

RESEARCH STRATEGY





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1 SUMMARY

The Research Strategy presents a bird's-eye view of the research culture at Ingenium — Canada's Museums of Science and Innovation. The following pages outline the guiding strategies that will allow our organization to realize the following vision:

Over the next five years, Ingenium will continue to grow a thriving research culture that welcomes students, researchers, and scholars from around the world. Research at Ingenium will focus on its strengths in collections, exhibitions and products, and audiences, setting new standards for openness and public participation in the process.

The three museums that comprise Ingenium — the Canada Agriculture and Food Museum, the Canada Aviation and Space Museum, and the Canada Science and Technology Museum — care for over two million nationally-significant 2D and 3D artifacts, operate state-of-the-art collections and conservation facilities and digital labs, and reach millions of people globally through our initiatives, exhibitions, and travelling and digital products.



2 DEFINITION OF RESEARCH

We define research as systematic, critical, and collaborative investigation, experimentation, and study for the generation, synthesis, and communication of knowledge that benefits the public.¹

Research — and the sharing of findings with the public in Canada and globally — is essential to fulfilling Ingenium’s mandate: to preserve and promote the heritage of Canada and all its peoples, to contribute to the collective memory and sense of identity of all Canadians, to foster, through its collections, understanding of science and technology, and to demonstrate the products and processes of science and technology and their economic, social, and cultural relationships with society (*Museums Act*, 1990).



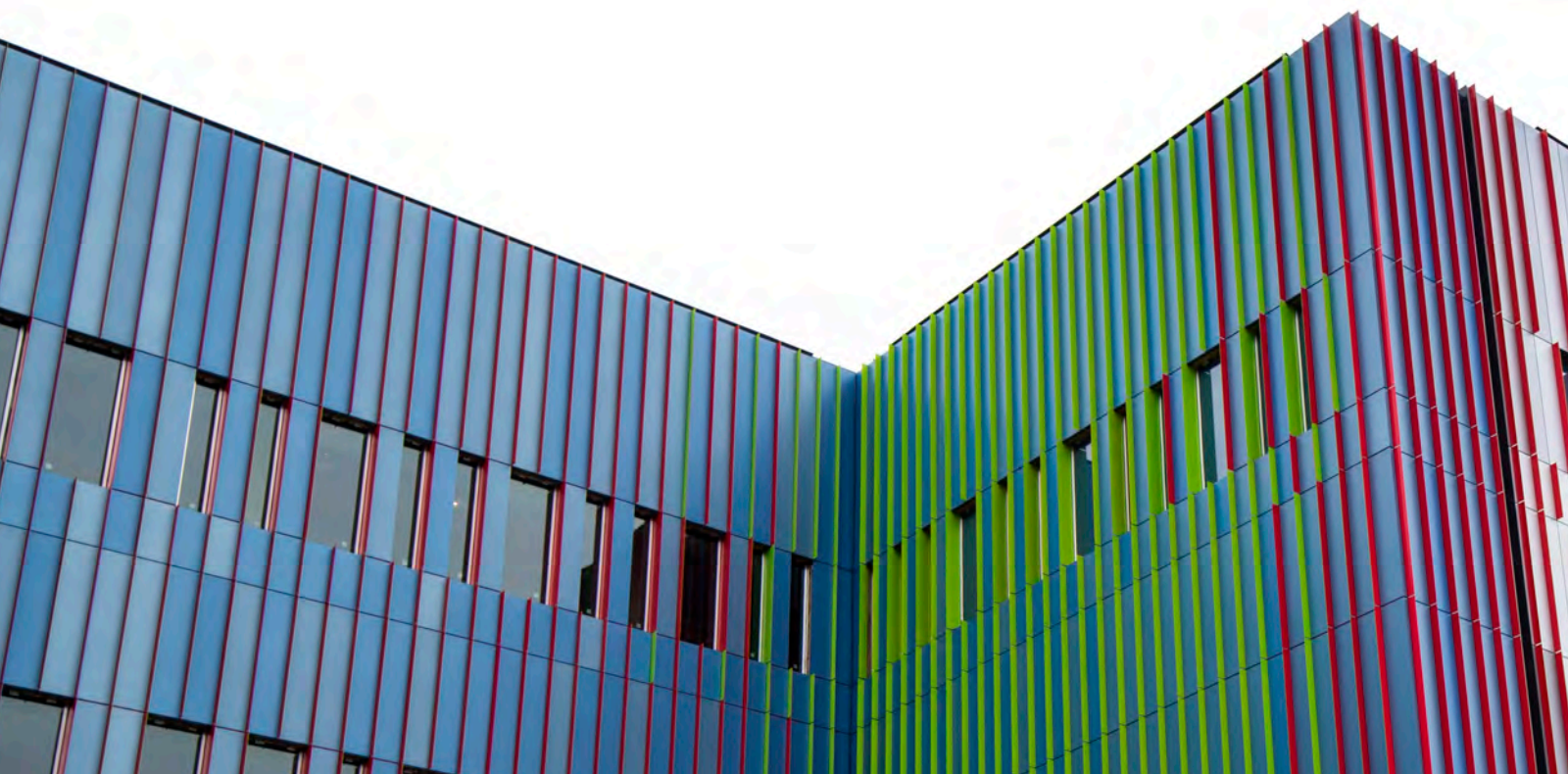
¹ This Research Strategy does not cover all forms of inquiry. Activities that fall outside of this strategy include: market research, day-to-day R&D for exhibitry, interactives, or programming, informal testing of mock-ups, public consultations, and routine information-gathering for internal operational purposes (e.g. procurement or cataloguing of collections).

3 VISION FOR RESEARCH AT INGENIUM

Over the next five years, Ingenium will continue to grow a thriving research culture that welcomes students, researchers, and scholars from around the world. Research at Ingenium will focus on its strengths in collections, exhibitions and products, and audiences, setting new standards for openness and public participation in the process.

By 2024, Ingenium will be recognized for its:

- Rich and diverse collections and expertise in the material culture of science and technology;
- Research into the history of science and technology ecosystems;
- Inclusive and respectful research relationships with diverse communities, including Indigenous peoples;
- Strong ties to universities and research organizations;
- Expertise in conservation;
- Supporting scientific research and citizen science initiatives;
- Strong visitor studies program;
- Expertise in digital heritage;
- Leadership in public history research; and
- Ground-breaking work in Open Heritage, Open Data, and Open Archives initiatives.



4 KEY STRATEGIES

A.

Building on areas of strength;

B.

Providing a thematic framework;

C.

Expanding partnerships and networks;

There are six key strategies that foster a thriving research culture at Ingenium.

Together, these strategies represent a commitment to:

- A.** Recognizing fields of expertise among Ingenium research staff, identifying areas of strength within the collections, and using these as the building blocks for new research;
- B.** Identifying a set of themes to guide Ingenium researchers and research partners;
- C.** Expanding partnerships and networks to provide more research opportunities for graduate students and colleagues at other research institutions, and fostering interdisciplinary research and the freedom to experiment;

D. Capitalizing on the physical and digital resources of the Collections Conservation Centre, making it a hub for research that fosters collaboration;

E. Making Ingenium's research findings openly available to staff, the academic community, and the general public through exhibitions and programs, digital channels, publications, and presentations; and

F. Coordinating Ingenium products and research priorities to ensure that exhibitions, programs, and digital products such as apps are based on Ingenium research and that the research plan responds to the needs across Ingenium. For example, building off the recent Historical Assessment as well as curatorial expertise, the Canada Aviation and Space Museum recently engaged in a major exhibition project with NAV CANADA.

D.

Leveraging
Ingenium
facilities;

E.

Sharing
resources
through multiple
channels; and

F.

Aligning Ingenium
products and
research priorities.

5 OUR RESEARCH PRINCIPLES

The seven pillars behind Ingenium's research include:

1. Engagement

Stimulating inquiry and dialogue among scholars and the general public, through collaboration and by sharing new knowledge and new research approaches that are relevant to Canadians;

2. Inclusiveness

Learning from diverse ways of knowing, including perspectives of groups whose knowledge and expertise is underrepresented in current scholarship;

3. Access

Identifying and documenting collections to make them accessible to students, researchers, and scholars, and setting standards for open access to our collection data and research products;

4. Openness

Sharing research findings through access to the national collections, exhibitions and programs, evaluations, publications, presentations, teaching, and digital media products;

5. Excellence in Collecting

Setting standards and identifying priorities for collection acquisitions and disposals;

6. Accuracy

Ensuring information in public offerings is factually correct and accurately presents scientific and historical consensus or debate; and

7. Stewardship

Determining and implementing appropriate care and treatment of collections that reflect their significance and value.





6 SCOPE OF RESEARCH AT INGENIUM

Research activities at Ingenium are guided by its vision, key strategies, and values. Our research examines how people envision, make, and use technologies and goods — those on which we build our society and create scientific knowledge. In addition, our research examines how we manage the material life of museum objects, and expands our understanding of museum audiences and the public’s interaction with science and technology in the museum context.

At Ingenium, staff conduct:

1. Material culture and historical research

Identifying and authenticating objects in the collections, inquiring into the production, use, and provenance of artifacts and archival collections, and investigating the broader social, cultural, and historical context of collections in order to understand their significance;

2. Conservation research

Studying the material composition of objects, their properties, and physical deterioration, discovering measures to conserve these objects, and understanding the effects of visitor interactions with collections on preservation and conservation of artifacts;

3. Visitor studies

Evaluating the museums’ exhibitions, programs, and products, learning about our audiences, exploring social science research methods in the museum context, and contributing knowledge to the fields of informal learning and critical museum studies; and

4. Scientific research

Developing and executing inquiries including visitors and the general public in the citizen science process, and demonstrating and communicating the process of scientific inquiries to museum audiences.



7 RESEARCH COLLABORATION

To develop innovative research programs with reach and impact, we engage in effective research collaborations and create cross-national networks. The two-way sharing of knowledge between individuals and organizations within diverse knowledge communities is essential to all research activities at Ingenium. Our researchers explore questions, challenges, and methodologies that are shared with — or proposed by — knowledge communities that extend beyond our walls and Canada's borders.

Beyond disciplines like evaluation and informal learning, which are typically associated with museum visitor studies, Ingenium's exhibitions, programs, and digital environments are also fertile grounds for researchers working in many other fields, such as child development, historical thinking, disability studies, or human computer interaction. Ingenium's three very different museums provide ample opportunities to experiment and collaborate.

Opened in 2017, the Living Lab is a partnership between Ingenium and the University of Ottawa, where museum visitors can take part in cutting-edge child development studies in a custom-built lab nestled in the ZOOM - Children's Innovation Zone at the Canada Science and Technology Museum.





8 AREAS OF RESEARCH STRENGTH AT INGENIUM

We build on our strengths to develop a thriving research culture, forge partnerships with research communities that share our interests and values, and extend our activities into emerging fields of inquiry.

Our areas of strength are:

1. Curatorial and Archival Research Practices

- Material culture, public history, oral history, and history of technology research methodologies
- Museum collections, teaching with artifacts and 2D collections
- Collecting contemporary science and dealing with born-digital objects
- Archival research to describe and understand provenance and creators of archival collections

2. Conservation Expertise

- Accessibility versus risk to artifacts and risk management of hazardous artifacts
- Plastics, modern materials, and chemical products management
- 3D imaging of artifacts
- Study and assembly of decommissioned working artifacts
- Aircraft mechanical engineer expertise for the conservation and restoration of aviation artifacts

3. Visitor Studies Expertise

- Evaluation of exhibitions and programs
- Research into audiences and how they use and relate to museums

- Working with targeted groups to understand their needs and provide best access and inclusion
- Informal learning in museum contexts
- Exhibition evaluation methodologies, in particular, self-reporting methods
- Participatory exhibition development practices
- Accessibility standards and practices for museum exhibitions

4. Science Expertise

- Scientific and applied research in the museum context
- Citizen science initiatives, and Living Labs where researchers carry out projects in a public space
- Including visitors in the process of scientific inquiry
- Network of contacts among scientists in academia, industry, and government
- Dissemination of complex science to the general public
- Science communication training

5. Digital Innovation Lab

- Applying new and emerging technologies to cultural heritage to make collections more accessible
- Generating new forms of knowledge and disseminating this knowledge through innovative exploitation of digital media



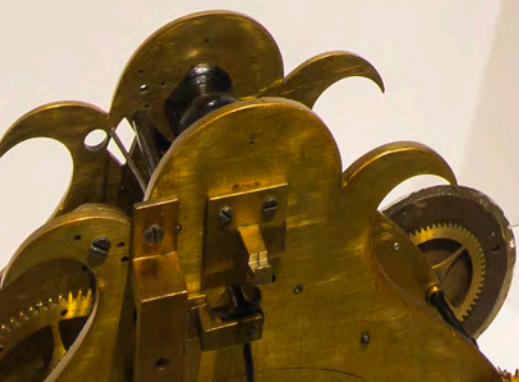
- Collaborating on new approaches for collection digitization, 3D modeling, gamification, immersive video, virtual and augmented reality, open data, big data analytics, and artificial intelligence
- Providing tools and expertise to study software-controlled technologies and help preserve meaningful evidence of their operation and use

While acknowledging our strengths, we also recognize that Ingenium’s expertise has limitations and that collaboration, both internal – between Ingenium’s staff – and external necessarily involves the sharing of authority over what we research, how we conduct it, and how we share knowledge. Defined by Michael Frisch, who coined the term, “shared authority” is a dialogue that defines processes and methodologies and leads to more democratic and inclusive cultural practices. In planning and carrying out research, we seek a dialogue with experts beyond our walls, both informally through our professional networks and through formal consultation and the creation of advisory groups.





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LOOKING AHEAD: POTENTIAL RESEARCH THEMES FOR 2019-2024

We live in an evolving social, scientific, technological, and intellectual environment that influences the questions that we — and the Canadian public — ask about the material culture of science and technology, past and present. In this context, we identify the emerging research themes. The goal is not to restrict flexibility in research topics but to suggest areas of commonality among seemingly disparate areas of inquiry and collaboration with students, researchers, and scholars who share these interests.

Theme A. Ways of Knowing, Ways of Doing: Diversifying Perspectives

Science, technology, and innovation are shaped by socio-economic, political, and cultural forces, just as we are shaped by the technologies and objects in our daily lives. Our research will examine the diverse ways people envision, make, and use the tools and goods on which our society is built. We will also explore themes, social groups, and knowledge that have been excluded from traditional national narratives.

Possible research topics:

- Gender and technology
- Indigenous knowledge and ways of knowing
- Technology and global perspectives
- Women in science, technology, engineering, and math (STEM) fields
- Gender dynamics in the agriculture, aviation, and aerospace industries
- Adaptive and assistive technologies
- Makers, making, and practice
- Art and technology



Theme B. Contemporary Science and Technology: Binary, Black-boxed, and Borderless

At Ingenium, part of a researcher's work is to identify important trends in current scientific research and technological development and collect objects that represent these trends. But scientific and technological objects are increasingly "black-boxed" and software driven. This poses challenges for preservation and interpretation, especially with the speed of product development cycles and the continuous need for software updates. In addition, the increasingly borderless, global nature of contemporary science and technology poses a challenge for Ingenium, with its fundamental Canadian focus.

Possible research topics:

- Science and technology since 2000
- National and international collaboration in the aviation and aerospace industry
- Software, video games, digital sound and image making, and born-digital objects
- Public interaction with science and scientific learning in museums
- Citizen science and increasing the level of scientific and technological literacy
- Archiving digital records
- Digital museums and digital humanities

Theme C. Resources and Environment

Science and technology are very much part of the material world. From the extraction of natural resources to manufacturing and the use and disposal of goods, technology helps us fill our needs and wants. However, it also has critical material impacts on local, national, and global environments. The study of these impacts — and the development of technologies to remediate them — is an increasingly important part of scientific research and technological innovation.

Possible research topics:

- Climate change and the material culture of science and technology
- Agriculture and food science, post-1950
- Energy systems, post-1980
- Energy in the North/energy from the North
- Fisheries and aquaculture, introduced species
- Lighting and the human environment
- Mining and metallurgy
- Sustainability
- Water

Theme D. Living and Artificial: New Frontiers

Increasingly, scientific inquiry focuses on the fundamental workings of living things. Building on this knowledge, technological innovation targets how to emulate, augment, and modify these biological systems. Our research will explore how science and technology have blurred the boundaries between the living and the artificial, and how this is embodied in the objects we create.

Possible research topics:

- Artificial intelligence
- Autonomous vehicles
- Biotechnology and genetic modification
- Human-computer interaction
- Material culture of the senses
- Robotics
- Wearable technologies

Theme E. Mobility: A World on the Go

Scholars of technology are increasingly studying the concept of mobility. This includes the movement of people, things, and information — on a global scale or on a local or personal one. The mobility theme crosses over many disciplines in science, technology, agriculture, and aviation, lending itself to broad partnerships. For example, the Canadian Aero/Space Skills Network, created at the Canada Aviation and Space Museum, aims to inspire the next generation of leaders and innovators in the aerospace and mobility fields.

Possible research topics:

- Automobility
- Aviation infrastructure
- Aviation and aerospace transportation networks
- Cycles and cycle culture, post-1990
- Culture of travel
- Mobile communications
- Private flying
- Public transportation
- Railways, post-1960

Theme F. Conserving Modern Technology

Conserving modern technologies — which often contain a variety of materials and software — with a goal of ensuring long-term care, preservation, and housing of the National Collections, is a focus of Ingenium's Conservation Department.

Possible research topics:

- Preserving plastics
- Hazardous artifacts awareness and management

- Preserving electronic and digital technology
- Keeping motorized artifacts running
- Using digitization technologies for artifact access and innovative preservation

Theme G. Understanding Audiences

Multi-disciplinary by nature, the field of visitor studies encompasses a wide variety of inquiries about museums' real and virtual audiences. These include questions about informal learning, visitors' expectations, and the evaluation of outcomes and impacts. Studies situated in our museums can also explore the construction of meaning and public understandings around science, technology, and different ways of knowing. The range of settings and subjects afforded by our three very different museums also provide ample opportunities for collaboration and experimentation, by researchers from across the arts and the social sciences. Understanding audiences ultimately leads to a better dissemination of knowledge, which in turn reaches a larger number of people.

Possible research topics:

- Research methods for evaluation exhibitions and programs
- Inclusive practices in museum research and evaluation
- Digital museum products and their audiences
- Representations of marginalized communities in national museums
- Public understanding of science in science museums



10

INDIGENOUS RESEARCH RELATIONS

Ingenium is particularly committed to meaningful engagement and research collaborations with Indigenous communities, organizations, and experts. This research must be conducted in full partnership with Indigenous peoples to ensure their perspectives, priorities, and historical experiences are central to the work, and must inform practices across Ingenium.

The Truth and Reconciliation Commission recognizes that museums have a key role to play in national reconciliation.

Like other heritage institutions, Ingenium's museums have historically interpreted the past in ways that have excluded and marginalized Indigenous peoples' cultural perspectives and historical experiences. It is our responsibility to address this by studying the scientific and technological achievements of Indigenous people, and researching the employment of science and technology for the construction of colonial systems that have marginalized and controlled Indigenous people.



11 FOSTERING A RESEARCH CULTURE



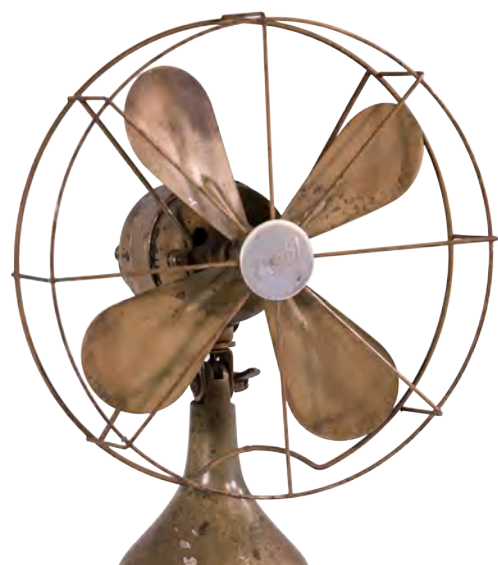
Research at Ingenium rests on a spirit of critical inquiry, collaboration, openness, and creativity. To foster a thriving research culture where these qualities are upheld, we provide physical spaces and financial resources for research, and create a working environment that offers time and encourages exploration. Ingenium's research culture aims to include:

- **Time for research:** Dedicated research time to allow staff to prepare publications, conference presentations, and other forms of knowledge sharing;
- **An emphasis on building relationships and networks, and contributing to knowledge communities:** Time and funding for staff to build research relationships, sit on advisory committees and boards of scholarly societies, and assume editorial roles with journals;
- **Fellowships at Ingenium:** Funds to support research fellowships for graduate students and post-docs;
- **Cross-appointments with universities:** Provision for staff to take adjunct professor appointments at universities, and for university faculty to assume adjunct curator positions with Ingenium;
- **Staff exchanges:** Provision for staff exchanges with universities, research organizations, and museums in Canada and abroad;



- **Continuing education:** Continued support for education leave and self-funded leave (e.g. deferred salary plan), to enable staff to pursue further education, professional development, or long-term research projects;
- **Training:** Training in cultural competency, consultation, and collaboration with diverse cultural communities;
- **In-house knowledge sharing:** Encouragement for staff to share their work with other employees through job shadowing, brown-bag sessions and all-staff meetings;
- **Conference participation:** Continued and secure funding for conference travel by staff to share knowledge;

- **Hosting conferences and workshops:** Physical facilities, support services, and funding to host small conferences, workshops, and symposia; and
- **Open Heritage:** Continued sharing of unpublished research through our Open Heritage portal.



12 THE INGENIUM RESEARCH INSTITUTE

The Ingenium Research Institute is the central initiative to achieving the goals of the Research Strategy. Housed in the new Collections Conservation Centre, this institute makes space for innovative and experimental research related to our extensive national collections, and for fostering collaboration among Ingenium research staff, students, visiting scholars, artists, scientists, and guest curators. The institute is the heart of a growing community of national and international researchers, who are dedicated to bold experimentation and knowledge creation.

The Ingenium Research Institute at the Collections Conservation Centre will provide:

- **Work spaces:** A mix of group spaces for working with other researchers, and quiet spaces for focused, individual study;
- **Library and Archives:** Access to materials in the Ingenium Library and Archives for internal and external researchers;
- **Access to artifacts:** Controlled access to the artifact storage spaces, by authorized researchers enabling in-situ examination of large and small artifacts;
- **Artifacts workroom:** In or next to the artifact storage spaces, a large collection workroom where staff and supervised visiting researchers can research objects or conduct classes with post-secondary students;
- **Collection online:** Digital, interactive, worldwide access to Ingenium's collections;





- **Imaging equipment:** Technical facilities for imaging artifacts, library, and archival materials for research and dissemination purposes;
- **Access to prototyping space:** In all three museums, a public exhibition prototyping space with reusable showcases and basic design and interpretive support, where curators, research partners, and students can experiment with new exhibition ideas based on their research;
- **Ingenium public portals:** A range of open, online tools for sharing Ingenium data with the public (e.g. Open Heritage, Open Archives, Open Data);
- **Virtual meeting space:** Facilities and spaces set up for voice and video teleconferencing to support virtual meetings, presentations, and lectures;
- **Digital training:** Training in the use of digital tools for research and knowledge sharing;
- **Digital support:** Technical support to present research via a variety of digital media and distribution channels; and
- **Dissemination of knowledge:** Sharing knowledge with our audiences, in both official languages.

APPENDIX A: LIST OF INGENIUM EXPERTISE BY SUBJECT AREAS

AVIATION

Bush flying
Cold War aviation
Early flight, including ballooning
First World War aviation
History of air traffic control in Canada
History of the Canadian aircraft industry
Interwar aviation in Canada
Second World War aviation

LAND AND MARINE TRANSPORTATION

Marine navigation
Cycles and cycling
Horse-drawn vehicles

SPACE

History of the Canadian Space program and technology
The International Space Station
Astrophysics
Space medicine
Living in Space

AGRICULTURE AND FOOD

Mechanization of agriculture
Food preservation
Home economics

INTERDISCIPLINARY FIELDS

Citizen science
Visitor studies
Born-digital objects and digital products
Collections conservation risk management
Consumer culture
Gender, science, and technology
Mobility studies
Environmental history of North America
Video games and gaming culture

COMMUNICATIONS

Sound studies
Media studies

MEDICINE

Material culture of medicine

SCIENCE

History of scientific instruments (nineteenth century and post-Second World War)
Material culture of science
Exploration and surveying
Astronomy

ENERGY AND NATURAL RESOURCES

Energy production in Canada
Canadian mining and metallurgy
Material sciences

FISHERIES

History of fish culture
Fisheries science
Fisheries exhibitions



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Small tag



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14 APPENDIX B: THE COLLECTIONS

Ingenium has an extensive collection of objects, photographs, trade literature, corporate and private papers, periodicals, and books. A strong collection provides material of sufficient breadth, depth, and quality to sustain a diverse range of internal and external researchers. Our collection is particularly strong in twentieth-century material reflecting Canadian social, economic, and cultural trends, as well as areas of focused Canadian research, innovation, and manufacturing.

ARTIFACT COLLECTION STRENGTHS

- Agriculture, 1880-1950
- Air travel
- Astronomy
- Canadian aircraft
- Canadian automobiles
- Canadian military aviation
- Canadian Space program
- Contemporary science
- Cycles and cycling, esp. 1890-1920
- Twentieth-century science and medicine
- Electrical domestic technologies, early to mid-twentieth century
- Electricity generation and distribution
- Exploration and surveying
- Film technology
- Forestry
- Horse-drawn vehicles
- Letterpress printing
- Lighting
- Military aviation
- Meteorology
- Mining technologies
- Navigation
- Personal computing

- Photography
- Precision measurement
- Radio communication and broadcasting
- Small watercraft
- Sound recording and reproduction
- Steam-powered transport in the twentieth century
- Telephony
- Television

LIBRARY AND ARCHIVAL STRENGTHS

- Agriculture
- Aircraft manufacturers — Canadair and Avro
- Canada air travel — Air Canada Collection
- Automobile advertising, 1920-1980
- Aviation history — books and technical manuals
- Aviation images, early to mid-twentieth century
- CN Images of Canada Collection — photographs
- Cycling
- Data management
- Firefighting
- Locomotive and rail engineering drawings
- Marine transportation — Canadian Pacific Steamships
- Open Data and Open Heritage
- Papermaking — DOMTAR, E.B. Eddy, J.R. Booth
- Radio communication — Canadian Marconi Co.
- Railway images, mid-twentieth century
- Steamships trade literature

APPENDIX C: THE COLLECTION DEVELOPMENT STRATEGY

The strategic document that currently guides curatorial research is the 2006 *Collection Development Strategy*, or CDS (for more detail, see Appendix A). In the CDS, the primary purpose of research is to provide an intellectual framework for deciding what to add to or remove from the collection. The CDS represents our ongoing commitment to responsible collection development, based on knowledge derived from research.

The CDS establishes a broad theme, “The Transformation of Canada,” and four sub-themes:

- Canadian Context
- Finding New Ways
- How Things Work
- People, Science, and Technology

These over-arching themes guide “all aspects of collection development, including research” (*Collection Development Strategy*, 2006).

The CDS channels research into two broad streams. Historical research provides necessary context and background about significant concepts, ideas, and issues in the history of a particular technology or scientific discipline in Canada. Collections research assesses current holdings, to determine how well these reflect the findings of the historical research.

In the CDS, historical research is directed toward producing Historical Assessments (HAs), which synthesize largely secondary sources to provide an overview of a particular subject area. All HAs undergo peer review and many have been published in the corporation’s book series, *Transformations*. As such, they make an important contribution to the history of science and technology in Canada.

Collections research is directed toward producing Collection Assessments (CAs), which analyze a particular subject area in the collection. Guided by the HA and curatorial philosophy, the CA identifies a general



approach to the collection, assesses how well the existing collection conforms to this approach, and establishes a plan for future development (and, by implication, related research activities).

A third form of collections research outlined in the CDS is the Acquisition Proposal. These proposals provide a rationale for acquiring an object for the collection, describing the object's physical attributes, function, provenance, and significance. Ideally, Acquisition Proposals are supported by an HA and a CA, but if these do not exist, curators will do their own research as needed. In many cases, acquisition research and the resulting proposal represent significant contributions to knowledge in their own right. They can form the basis for exhibition themes and texts, conference presentations, and publications of various kinds.





IngeniumCanada.org