Eyes on the Skies: Managing Air Traffic in Canada
A Self-Guided Exhibition Tour

Introduction to this Guide

Eyes on the Skies is located centrally within the Museum's open-concept Main Exhibition Hall. You will pass through other exhibition areas on your way from the lobby to this exhibition. This exhibition is a self-directed experience without outer walls. While visitors can enter and explore the exhibition from many directions, this guide provides a directed path for clarity. Content within the exhibition is grouped by several key themes. The first section, titled Systems, examines the complex systems that make up Canada's air navigation network. The second section, People, explores how the workforce evolved with the rapid growth of this industry. The third section, Technologies, focuses more closely on tools and technical aspects of air traffic management.

This exhibition is unique in shape. A tall cylindrical structure, designed to look like an air traffic control tower, sits at the centre of the exhibition. Free-standing walls, each starting several feet away from the cylinder, radiate outward like spokes. Each set of facing walls creates an open wedge-shaped gallery. You will encounter an additional 2-wall wedge, before the spokes, if you approach from the main entrance. Angled content rails line each wall structure. Texts and graphics are featured along the walls and rails. Rails also house artifacts in display cases, videos, and interactives. Videos and digital interactives are housed in units with a standardized layout. All videos, and certain accessible interactives, include braille button and earphone labels. There are audio instructions to help visitors operate these units.

This guide includes all exhibition texts, from the main panels to the artifact details. Unless otherwise stated, texts in this guide are transcriptions of the exhibition panels. This guide also includes descriptions of artifacts and significant images, as indicated. We hope that you enjoy your visit.

Section 1: Introduction

Directions: Begin your visit at the Exhibition's introduction panel. This free-standing panel is the first element of this exhibition that you will encounter as you approach the centre of the Museum from the Main Lobby. This two-sided panel features the exhibition title, a brief introductory text, and the exhibition credit panel. The same content appears on both sides of the panel.

(panel)

Eyes on the Skies
Air traffic management keeps Canada's skies safe, thanks to a network of complex systems, highly trained people, and cutting-edge technologies.

(rail)

Eyes on the Skies: Managing Air Traffic in Canada
Exhibition developed and produced by the Canada Aviation and Space Museum in collaboration with NAV CANADA. (Partner logos, Canada wordmark).

Section 2: Systems

Directions: Turn 90 degrees to the right, walk a few paces, and turn another 90 degrees to the right. You will be facing the first wall in the Systems section. The panels in this section have a two-toned aqua (blue-green) design with deep red accents. Whimsical design elements include simplified airplane shapes that weave between texts, leaving a line trailing behind them (as an airplane leaves a cloudy vanishing line, called a contrail, in the sky). Content is presented from left to right as it appears along the wall and rail.

(wall)

Systems: More than Meets the Eye

A complex Air Navigation System (ANS) manages air traffic. Since 1996, Canada's ANS has been operated by NAV CANADA, a not-for-profit organization. Through a network of facilities criss-crossing the country, NAV CANADA provides air traffic control, shares vital information about weather and runway conditions, maintains navigation aids like beacons, and publishes important tools such as aeronautical charts.

Key Fact (these are featured throughout, in large circles marked with exclamation points): NAV CANADA was the world's first not-for-profit private air-navigation service.

Dividing Up the Air Space

Canada manages a vast air space—over 18 million square kilometres. Air space is divided into manageable zones called Flight Information Regions (FIRs). Canada has seven FIRs. They are managed by Area Control Centres in Vancouver, Edmonton, Winnipeg, Toronto, Montreal, Moncton and Gander. Each Centre coordinates flights through a portion of Canada's busy skies, and maintains equipment such as radar throughout its FIR. Gander also manages transatlantic flights, and Edmonton coordinates Northern air traffic, including trans-polar flights.

Graphic: Canada Flight Information Regions

This graphic shows a map of Canada, with provincial boundaries marked. A series of seven irregularly shaped areas are overlaid, indicating Canada's seven FIRs. Each of the cities where an FIR is managed is indicated. The Vancouver FIR generally occupies the lower two thirds of B.C. The Edmonton FIR is vast, including all of Alberta, northern B.C. and Saskatchewan, Yukon, the Northwest Territories, and much of Nunavut. The Winnipeg FIR includes the southern two thirds of Saskatchewan, nearly all of Manitoba, and north-western Ontario. The Toronto FIR includes the rest of Ontario. The Montreal FIR includes all of Quebec, and small portions of Nunavut and Labrador. The Moncton FIR includes New Brunswick, Nova Scotia, and P.E.I, while the Gander FIR includes Newfoundland, the majority of Labrador, and a great swath of space over the northern Atlantic Ocean.

(rail)

More than Control Towers

Canada's Air Navigation System includes many types of facilities. Control towers manage aircraft during take-off and landing at busy airports. Pilots connect with Area Control Centres along their route. Flight Service Stations share information about weather and runway conditions at less busy airports. In remote Northern communities, pilots get these details from Community Aerodrome Radio Stations.

AV Unit: Air Navigation System

This experience is accessible, with braille labels on the buttons and speaker. Visitors can navigate through an interactive version of the previously-described ANS Map. The experience features narrated audio, explaining different facets of this complex system. Visitors navigate a series of tabs that reveal the locations of different types of ANS installations across Canada. These installations are represented as icons, but their total numbers are included within the narration.

Directions: Turn 180 degrees, and step forward a few paces to encounter the next wall.

(wall)

Graphic: A simple outline drawing of a control tower. A caption, shaped like a luggage tag, indicates that YUL is the airport code for this tower, located in Montreal, Quebec. This treatment recurs throughout the exhibition.

Roger That!

In 1956, the International Civil Aviation Organization (ICAO) released a new phonetic alphabet. As English is the international language of aviation, an English word represents each letter. Air traffic controllers and pilots can

easily understand these words through the crackle of a radio.

Key Fact: ICAO headquarters is in Montreal. Could that be why "QUEBEC" is the word for Q?

Image: Three grouped images of ICAO headquarters: the inside of a large conference room with seated delegates, the exterior of the ICAO building, and ICAO's crest on the building's façade. Caption: Delegates from ICAO's 193 member states gather at the organization's headquarters. Montreal, Quebec, 2019.

Image: Headshot of a smiling man, wearing a tweed jacket and tie. Caption: Jean-Paul Vinay, a professor at the University of Montreal, helped ICAO develop its international phonetic alphabet.

A Canadian Controversy
Beginning in the 1960s, some Francophones at small Quebec airports wanted to communicate in French. This sparked a heated debate about safety, as English is the standard in aviation. This led to a pilot strike that grounded Canadian flights for over a week in 1976.

Key Fact: In 1980, Montreal became the world's first officially bilingual Flight Information Region.

Image: Empty flight check-in gates for international travel destinations. Caption: Empty gates at Toronto International Airport as airline pilots strike, opposing the use of French in air traffic control. Toronto, Ontario, 1976.

Image: Illustration of an aircraft cutting the map of Canada along the Ontario-Quebec border. Caption: Political cartoon depicting a country divided over language in air traffic control. An airplane cuts through Canada, with the acronyms for the airline pilots' and air traffic controllers' unions on its wings. Le Soleil, 30 June 1976.

(rail)

AV Unit: The Phonetic Alphabet
In the phonetic alphabet, each letter is represented by a word. This makes communication clearer between air traffic controllers and pilots. This experience invites visitors to listen to a series of words, and select the correct letter using an airplane-shaped slider device. It is modelled on the game hangman: the selected letters appear onscreen as the visitor attempts to decode secret messages (like "ready for landing"). The following are the words that make up the phonetic alphabet: A = Alpha, B = Bravo, C = Charlie, D = Delta, E = Echo, F = Foxtrot, G = Gold, H = Hotel, I = India, J = Juliet, K = Kilo, L = Lima, M = Mike, N = November, O = Oscar, P = Papa, Q = Quebec, R = Romeo, S = Sierra, T = Tango, U = Uniform, V = Victor, W = Whiskey, X = X-ray, Y = Yankee, Z = Zulu.

Biography Panel: Chris Rieken
(Biography panels appear throughout the exhibition, featuring people past and present working in different areas of air traffic management. Each panel includes a photo of the person, a personal quotation, and a short biography.) National Manager, Airspace Development and Standards, NAV CANADA. "We have the opportunity to modernize our airspace, taking advantage of today's technologies. This gets me out of bed in the morning" (2020). Chris Rieken started his career as an air traffic controller in the late 1990s. He has worked in Australia, the United Kingdom, and Canada. Chris joined NAV CANADA in 2004, and has been working in airspace design since 2017.

Artifact: Vinyl Recording of the Phonetic Alphabet, International Civil Aviation Organization, Montreal, Quebec, 1956 (Loan: International Civil Aviation Organization). Caption: The International Civil Aviation Organization sent copies of this vinyl record to all member states in 1956. The recording helped ensure that everyone working in aviation knew the proper pronunciations for the new international phonetic alphabet.

Artifact: Political Buttons, Makers unknown, ca 1976 (Loan: Canadian Museum of History). Caption: These buttons were worn by air traffic control staff and pilots who supported and opposed the use of French in air traffic control. The French button reads "There is French in the air." The English button reads "English is the international

language of aviation."

Artifact: Model of the Control Area Surrounding Montreal Airport, Plastics of Canada, ca 1977 (Loan: Library and Archives Canada). Description: A detailed regional map with several plastic cylindrical and rectangular shapes sitting on top, each meant to represent a section of the airspace above. Caption: During 1977 and 1979, the Commission of Inquiry into Bilingual Air Traffic Services in Quebec held hearings in Montreal to explore the potential risks of using French in air traffic control. This model was exhibited during the hearings.

Section 3: People

Directions: From the right end of this wall, turn 90 degrees to the right and step forward several paces. You will encounter the next exhibition wall to their right. The panels in this section have a sky-blue design with deep orange accents.

(wall)

People: Aviation's Greatest Asset
People are essential to keeping our skies safe. A variety of staff handle unique challenges every day—from maintaining technologies to managing air traffic through our southern domestic, transatlantic and northern airspace. Their work has evolved to keep pace with Canada's ever-increasing air traffic.

Video: Runway Timelapse
A silent video, played on continual loop, shows commercial airplanes taking off and landing at a busy international airport. Footage courtesy of Jordi Blumberg.

Taking to the Skies
After the Second World War, air travel became more affordable. Since 1946, air traffic in Canada has increased by more than 18,000%. This dramatic growth put pressure on air traffic services, particularly along Canada's southern domestic corridor. New staff in a variety of roles were needed to keep the system running smoothly. In Canada, a formal system for air traffic control emerged in the 1940s, and the need for controllers steadily increased into the 1960s and 1970s.

Image: Passengers bustling though Vancouver International Airport. Vancouver, British Columbia, ca 2010.

(rail)

Graphic: Outline drawing of a control tower. Toronto, Ontario. Airport Code YYZ.

Infographic: Passenger Volume in Canada
A bar graph illustrates the steady increase in passenger volume over time; from 880 000 passengers in 1946, to 159 000 000 passengers in 2019. The bars in the graph are comprised of stacked luggage icons. A stylized aircraft flies above the bars, highlighting the increase with a line tracing its upward path.

Image: A young boy walks up stairs to board an airplane, followed by adult passengers. Caption: Boarding an aircraft at Malton Airport. Malton, Ontario, 1947.

Image: An airport terminal with hangars and aircraft visible. Caption: Aerial image of Dorval Airport, showing its rapid growth following the Second World War. Montreal, Quebec, 1950s.

Directions: From the right end of this wall, turn 180 degrees and step forward a few paces. You will encounter the next exhibition wall.

(wall)

Laying the Groundwork

Air traffic increased during the Second World War. This created an urgent need for skilled people to coordinate aircraft movements. In 1940, the Department of Transport established a training program for air traffic controllers. This laid the groundwork for the system we use today.

Image: A group of four men stand on the porch of a small building. Caption: Curt Bogart (right) poses with colleagues. St-Hubert, Quebec, 1940s.

Image: A control tower with a flag and radio antennae frosted with snow and ice. Caption: The control tower at St-Hubert Airport was Canada's main training centre for air traffic control during the Second World War. St-Hubert, Quebec, ca 1930s.

Artifact: Telegram to Peter Casey, 1940. Caption: This telegram asks Peter Casey to report for training at the St-Hubert Airport control tower.

Artifact: Air Traffic Control Licence, Department of Transport, 1940. Description: A folded licence, which includes a man's photo and signature. Caption: Peter Casey held this early air traffic control licence. He trained at St-Hubert Airport, and was likely taught by Curt Bogart.

Now Hiring!

Commercial aviation grew by leaps and bounds, and more controllers were needed to keep our skies safe. Between 1966 and 1976, the number of Canadian air traffic controllers more than tripled. Workloads were heavy, and stress levels were high.

Image: Grouping of two images: the first is a waiting crowd, sitting on their luggage or standing in a busy airport terminal; the second is of busy staff at work stations. Caption: Busy terminal (above) and fully staffed tower (below) at Toronto International Airport. Air traffic control was quickly expanding to keep up with demand. Toronto, Ontario, 1976–1977.

Image: A man in sunglasses, holding a radio transmitter. Caption: Air traffic controller Chuck Freeland looks out the tower windows at Montreal-Mirabel International Airport. Mirabel, Quebec, Mid-1970s.

Key Fact: Toronto Pearson International Airport is the busiest in Canada, handling more than 1,200 flights each day.

Infographic: Getting Off the Ground

This labelled diagram illustrates how pilots communicate with different types of air traffic controllers as they progress from ground level to cruising altitude, and travel further away from the airport. The diagram illustrates that there are three types of controllers: First, tower controllers control the airspace around the airport. They issue instructions and clearances (such as permissions) to pilots, including for take-off and landing. Pilots communicate with tower controllers from ground level to 4,000 feet (1,219 m), and from their take-off point to a distance of 5.75 miles (9.26 km) from the airport. Secondly, terminal controllers help airplanes maintain separation, clearing them away from the airport as quickly as possible after take-off, and help arrange them into a straight line for landing. Pilots communicate with terminal controllers as they ascend to 12,500 feet (3,810 m), to a distance of 34.52 miles (55.56 km) from the airport. Finally, pilots communicate with enroute controllers who use surveillance displays, flight data processors, and communication systems to ensure separation as aircraft travel between airports. Pilots communicate with enroute controllers to a maximum of 60,000 feet (18,288 m).

(rail)

Biography Panel: Curt Bogart

Air Traffic Controller and Instructor, Federal Department of Transport. "Mr. Bogart, who established air traffic

control in Canada . . . was lauded . . . for his work in making [our] system . . . second to none among the nations." (The Ottawa Citizen, 1946). In 1939, Curtis "Curt" Bogart was Canada's first licenced controller. He established this country's training programs for tower control—and later, area control. Curt retired from Canada's Public Service as Chief of Air Traffic Services in 1957.

Artifact: Tower Controller's Headset, Danavox Technology Co Ltd, ca 1975 (Loan: Chuck Freedland). Caption: Tower controller Chuck Freedland used this headset while working at Montreal-Mirabel International Airport. Tower controllers only used headsets when heavy air traffic made it difficult to communicate by radio.

Artifact: Diorama of the Uplands Airport Control Tower, Maker and date unknown. Caption: This diorama depicts controllers at work inside the tower cabin at Uplands Airport (Ottawa International Airport) during the early 1970s.

Artifact: Flight Computer, Cessna Aircraft Company, 1976 (Loan: Pat Ulicki). Description: A thin metal rectangle, inscribed with complex lines and numbers, with a spinning metal disc featuring further lines and numbers. Caption: Pat Ulicki used this flight computer while working as a tower controller in Saskatchewan. She calculated the rate of climb and descent for airplanes in her area, ensuring their separation during take-off and landing.

Artifact: Air Traffic Control Manual of Operations, Transport Canada, 1977 (Loan: Pat Ulicki). Caption: Pat Ulicki used this reference manual, which laid out the processes and procedures that allowed air traffic controllers to do their jobs safely and efficiently.

Biography Panel: Pat Ulicki
Tower Controller, Transport Canada. "It's challenging [for] a girl **or** a fellow. It's a relatively new field, and you can go nowhere but up" (1971). Patricia "Pat" Ulicki became an air traffic controller in 1968. She was the first female tower controller in Saskatoon when she was posted there in 1971. At that time, Pat was one of only 13 female controllers in Canada.

Directions: Proceed to the right and around the corner to the opposite side of the wall.

(wall)

Crossing the Atlantic
The small town of Gander, Newfoundland, was once an important stopover for transatlantic flights. When Gander's airport was built in the late 1930s, it was the largest in the world. Gander was a key refuelling point for airplanes crossing the Atlantic. Staff at Gander, working in a variety of roles, managed flights in and out of this bustling hub. Today, far fewer flights need to stop at Gander, but its staff continues to manage air traffic over the North Atlantic.

Key Fact: Marilyn Monroe, Frank Sinatra and The Beatles were just some of the famous people who touched down in Gander.

Image: Passengers climbing outdoor stairs to board a passenger aircraft, which has a British flag clearly visible on the tail. Caption: Passengers board a British airplane after refuelling. Gander, Newfoundland, 1948.

Image: Cartoon illustration of two geese, facing opposite directions, with a phrase underneath each reading "No Goose" and "No Gander." Caption: By the late 1950s, jetliners could fly greater distances without stopovers. Airlines advertised that their fleets no longer stopped in Goose Bay, Labrador or Gander, Newfoundland, 1957.

Image: A control room with people working at various consoles; a Newfoundland flag on the far wall. Caption: Inside the Gander Area Control Centre. Gander, Newfoundland, 1990s.

Key Fact: The town of Gander, Newfoundland, was nearly named "Airlandia."

Oceanic Control
It takes a team to manage flights over the ocean. Oceanic controllers track aircraft flying a great distance away—beyond the range of radar. Other professionals, such as radio operators and meteorologists, also play key roles.

Image: Men wearing headsets work at a row of desks set along a wall of radio communication equipment. Caption: Radio operators working at Gander's International Flight Service Station. Gander, Newfoundland, ca 1960s.

Image: A worker seated at a very large computer screen with several information windows visible. These windows overlay an onscreen map dotted with reference points. Caption: Today, oceanic controllers have a suite of modern technology at their disposal, including a custom software program called GAATS+. Gander, Newfoundland, 2016.

(rail)

Image: People comfortably seated in a mezzanine lounge area. A mural appears above the open view to another seating area below. Caption: When the new terminal at Gander International Airport first opened, it was noted for its modernist style and incredible art. Gander, Newfoundland, 1959.

Artifact: Suitcase, Samsonite of Canada Ltd., ca 1960s. Description: Suitcase dotted with destination stickers from Canada and around the world. Caption: A suitcase belonging to Anita Cole. Her travels to Europe in the 1960s would have taken her through Gander.

Artifact: Boarding Pass, Trans-Canada Air Lines, 1954. Description: A ticket with the silhouette of an aircraft showing seating locations. Caption: A boarding pass for a flight to London, England, aboard a Lockheed Super Constellation. This transatlantic trip would have involved a refuelling stop in Gander.

Infographic: Highways in the Sky
This graphic includes a map of the North Atlantic Ocean. Canada is presented on the left, while Ireland and the United Kingdom are on the right. Gander, Prestwick (Scotland), and Shannon (Ireland) are indicated. The ocean between is divided into two Oceanic Control Areas called Gander and Shanwick. Five lines of aircraft are shown travelling East from the Gander area across the Shanwick area to Europe—each line is called a skyway. An inset image shows a cross-section of a skyway, highlighting how airplanes are stacked at regular 1,000 foot altitude intervals: 34,000 feet, 35,000 feet, 36,000 feet, and 37,000 feet. Text boxes on the graphic read as follows: When airplanes cross the Atlantic Ocean, they follow a series of "skyways" called the North Atlantic Organized Track System. Every morning, an oceanic planner in Gander decides where to shift these skyways, based on factors like weather conditions and the jet stream—a fast-flowing air current that can reach speeds of about 320 km/h (200 mph). Eastbound flights to Europe are coordinated in part by NAV CANADA. There are typically five eastbound tracks crossing the Atlantic. Westbound flights to North America are coordinated in part by an organization called NATS. Every evening, an oceanic planner in Prestwick, Scotland, decides where to place the westbound tracks. Along each skyway, airplanes are stacked vertically, each separated by 1,000 ft. (or roughly 305 m).

Directions: Standing at the right-hand edge of this wall, turn 45 degrees to the right and step forward a few paces. You will encounter another exhibition wall (the back side of a previously explored panel). As this wall includes two separate themes, they are presented sequentially in this guide.

(wall)

The Right Stuff
Surprisingly, many of the skills that air traffic controllers need come naturally, including a strong memory, good listening and communication skills, quick decision-making, effective multitasking, and excellent spatial visualization. With special training, controllers learn the rules of the air and further develop their natural skills.

Graphic: Outline drawing of a control tower. Edmonton, Alberta. Airport Code YEG.

(rail)

AV Unit: Controller Skills Challenge
This experience includes three games that assess key skills required by air traffic controllers. These games, based on recruitment quizzes created by NATS, test visitors' visual acuity and reflexes.

The first game, Rapid Recall, challenges visitors to view and recall a sequence of flashing icons onscreen, and then tap on the screen to repeat the sequence from memory. The viewer is given several attempts to succeed and progress to greater levels of difficulty: more icons and longer sequences.

The second game, Spatial Savvy, challenges visitors to use their fingers to move a circle onscreen. They need to protect the circle from colliding with rectangular shapes that move within the playing field. As well as avoiding collisions, the player must keep the circle in the "safe zone" (it cannot cross the borders of the playing area). Keeping the circle safe for the prescribed time allows the visitor to progress to levels of greater difficulty.

The third game, Landing Airplanes invites visitors to control the direction of aircraft passing over single-runway airport. The aim is to direct aircraft to land at the correct end of the runway (which changes depending on the wind direction). Tapping arrows surrounding an airplane adjusts its direction. Visitors watch a windsock icon at the bottom of the screen to monitor the wind direction. Aircraft must navigate through the space without coming too close to each other. The visitor gets points for each landed airplane, but loses points for each error. As with the other games, there are three levels of difficulty.

(wall)

Women in Control
Women began working in control towers during the Second World War. Originally, women were only hired as assistants, but by the 1950s they could become licensed controllers. Still, women remained a small minority within the workforce. In the early 1970s there were only 13 female controllers in Canada. As of 2019, only 17% of all Canadian controllers were women.

Headline: Air Traffic Control Is Latest Occupation To Be Womanized. *Winnipeg Free Press*, March 29, 1943.

Artifact: Job Advertisement, Public Service Commission, 1943. Description: A yellowed poster, printed on paper and repaired with tape. The poster reads: "Civil Service Examinations, Airport Traffic Control Officer, male— throughout Canada Department of Transport—$1920 per annum, plus cost of living bonus as provided, less usual deductions." Caption: In 1943, as this job advertisement states, only men could apply for positions as air traffic controllers.

Girl Power in the Tower
In Canada, there are a number of organizations that encourage girls and women to explore careers in aviation, such as air traffic control. Groups such Elevate Aviation and the Northern Lights Aero Foundation conduct hands-on workshops, and highlight women's contributions to the field.

Image: Three young women, with a small dog, sit on the floor examining the forward landing gear of a small airplane. One is lying directly behind the wheel, pointing to the assembly. Caption: Students with Elevate Aviation examine an airplane's landing gear at the Edmonton Flying Club. Edmonton, Alberta, 2019.

Image: Four young women excitedly look out from a control tower. One uses binoculars. Caption: Explore Aviation week-long summer camp, hosted by NAV CANADA, 2019.

Artifact: Handmade Keychain, Elevate Aviation, ca 2018 (Loan: Elevate Aviation). Caption: Students at Elevate Aviation take part in many hands-on activities, such as riveting metal to make keychains like this.

Image: (On the rail, but directly below this artifact) A woman smiling proudly, wearing a t-shirt bearing Elevate Aviation's logo. Caption: Kendra Kincade, Founder and Chief Executive Officer of Elevate Aviation.

(rail)

Image: An office with a wall sized, slotted filing bureau on the left, and two smaller desks on the right. Two men in the foreground work at the bureau, while two women are seated at the desks. Caption: Assistants (right) performing clerical work and reporting information to controllers (left). Winnipeg, Manitoba, 1940s.

Image: A woman using a telephone at a work station within a control tower. Caption: Vivian Fuller Corran working in the tower as an air traffic control assistant. Winnipeg, Manitoba, 1941.

Biography Panel: Margaret Dunseith
Tower Controller, Transport Canada. "They put me there to find out how the [pilots] would relate to a female traffic controller, which was kind of silly, because . . . during the war, [women] had been working as controllers in the States" (1980). Margaret Dunseith began working as an air traffic control assistant during the Second World War. She was one of the first women in Canada to become a fully licenced controller. Margaret worked at the Toronto's island airport (now Billy Bishop Airport) from its opening in 1953 until her retirement in 1980.

Directions: From the right end of this wall, turn 135 degrees to the left and steps forward several paces. You will encounter a display case. You will be facing the side of the case, where the artifact caption text is located (on a rail).

Artifact: Precision Approach Radar Display Console, Bendix Aviation Corp., 1958. Description: A large, electronic terminal with controls and two, round display screens used to monitor aircraft in flight. Caption: Installed at Gander Airport in 1959, this was the first Precision Approach Radar display console ever used in Canada. The system allowed controllers to guide aircraft landing in poor weather conditions.

Directions:
Proceed to the right to face the front of the display case, then turn 45 degrees to the right and steps forward a few paces. The next exhibition wall will be on your right.

(wall)

9/11: Responding to Crisis
On September 11, 2001, four American airliners were hijacked by terrorists. Nearly 3,000 people were killed in the 9/11 attacks. American airspace was immediately closed to non-military traffic, and 239 flights were forced to land in Canada. Of these, 38 touched down at Gander's small airport.

Image: Image of the World Trade Centre's two principal office towers, against the New York City skyline. The first tower has a massive, burning hole in the top third of its façade. A low-flying passenger jet is seen approaching from the opposite direction, about to strike the second tower. Caption: Moments before a hijacked airplane struck the second tower at the World Trade Center. New York City, New York, September 11, 2001.

Image: Two photos of aircraft parked abnormally close together at an airport. The image on the left shows a line of aircraft parked along a main runway, while the one on the right shows idle aircraft in a staging area. Caption: Airplanes parked all over the grounds at Gander International Airport. When American airspace was closed on September 11, 38 airplanes were ordered to land at Gander. Gander, Newfoundland, September 11, 2001.

Image: Two photos of airplane passengers. The photo above shows passengers resting in a church's pews. The photo below shows a man resting on a low stage, below works of art, with peoples' belongings scattered about. Caption: Gander's population nearly doubled overnight. The "plane people" were housed in many public buildings. Gander, Newfoundland, September 2001.

Image: A large group of passengers and staff pose together, standing on a staircase and boarding ramp that leads onto an airliner. "Gander" is clearly written on the building in the background. Caption: The last group of stranded "plane people" to fly out of Gander after the 9/11 attacks. Gander, Newfoundland, September 15, 2001.

Key Fact: People from Gander and surrounding communities provided food, shelter, clothing, and emotional support to more than 6,000 stranded passengers for five days.

Graphic: Outline drawing of a control tower. Gander, Newfoundland. Airport Code YQX.

Artifact: Poster for the Broadway Musical Come From Away. Description: the poster has a blue background with the words "Come From Away" in large orange print. There are no other images. Caption: The hit Broadway musical, *Come from Away*, is based on the extraordinary response of Gander and the surrounding communities to the "plane people" who unexpectedly arrived on September 11, 2001.

Video: Come From Away Promotional Reel
A video, played on loop, shows clips from the Broadway casts' performance of Come From Away.

(rail)

Video: Gander Air Traffic Controller
Interview with an air traffic controller who worked at Gander International Airport on September 11th, 2001. This experience is accessible, with braille labels on the buttons and speaker. Images within the video are not necessary for comprehension or enjoyment of the interview.

Artifact: Wallet and Contents, Recovered 2001 (Loan: 9/11 Memorial Museum). Description: A damaged wallet, a torn British 20-pound note, a frayed British driver's licence, and a customer reward card from a store called Sainbury's. Caption: Anthony Dawson, a 32-year-old from Great Britain, was attending a conference at the World Trade Center when the towers collapsed. His wallet and its contents were later recovered at "Ground Zero." The Canada Aviation and Space Museum thanks the 9/11 Memorial Museum and the family of Anthony Dawson for helping us to present the impact and significance of the tragic events that took place on September 11, 2001.

Artifact: Piece of Steel from the World Trade Center, Recovered 2001 (Loan: 9/11 Memorial Museum). Caption: A piece of warped steel, once part of the World Trade Center in New York City.

Artifact: Fragment of Airplane Wreckage, Recovered 2001. (Loan: 9/11 Memorial Museum) Caption: A fragment of airplane wreckage recovered at "Ground Zero," site of the former World Trade Center in New York City.

Biography Panel: Patrick Woodford
Tower Controller, NAV CANADA. "We don't like to talk about September 11th around here. We prefer to talk about September 12th" (2019). Patrick Woodford became a civilian air traffic controller in 1988. He was on shift in Gander the evening of September 11, 2001, and spent much of his time as a volunteer helping the "plane people." He even loaned his truck to Beverly Bass, one of the pilots "from away." Patrick retired in 2018.

Directions: Proceed to the right and around the corner to the opposite side of the wall.

(wall)

Flying North
Airplanes began flying to Canada's North in the 1920s, profoundly changing the lives of the people who lived there. Aviation has become a critical service, providing remote communities with greater access to medical care and consumer goods. Staff working in a variety of roles ensure the safe travel of aircraft across Canada's northern and polar regions.

Image: An art piece following thematic conventions and styles from Inuit culture. It depicts a man with a whip and a dog riding atop a musk ox. All of the figures are in the centre, and peer towards an airplane in flight seen in the upper, left corner. A mountainous landscape is in the background. Caption: In this work, Inuit artist Pudlat Pudlo shows the impact of aviation on traditional life in the North. Citation: Vision of Two Worlds, 1983, Pudlat Pudlo (1916–1992). Lithograph and stencil, 56 x 78.5 cm (22 x 31 in.).

Image: Photo of a truck encrusted with snow and ice, backed up to a transport airplane. Figures are seen unloading items from the airplane onto the truck and ground below. Caption: Cargo being off-loaded from a Pacific Western Airlines DC-4 at Inuvik Airport. Inuvik, Northwest Territories, December 1959.

Image: Photo of a man leaning against the open doorway of a small aircraft, facing the camera with a smile. Two sled dogs are visible in the doorway. The tail section of the airplane reads Yellowknife Airways. Caption: Max Ward, a well-known bush pilot, stands next to a cargo plane with two sled dogs. Max went on to found his own airline, Wardair. Location unknown, 1948.

Navigating the North
In Canada's North, many isolated communities rely on aviation. The region also supports military and large commercial airplanes. A variety of specialized staff work in this harsh environment, managing air traffic and maintaining navigation aids and communication systems.

Artifact: Maintenance Schedule, Transport Canada, 1984 (Loan: NAV CANADA). Caption: This complex schedule outlined maintenance requirements for all navigation aids located around Resolute Bay.

(rail)

Artifacts: Shipping Materials and Medical Supplies, Various makers, ca 2019 (Courtesy of Air Inuit and the Cree Board of Health and Social Services). Description: A variety of shipping materials, and medical equipment including catheter tubes. Caption: Shipping materials are important for people flying household goods into and between northern communities. Medical supplies are commonly used on MEDEVAC flights.

A Medical Lifeline
Local clinics provide healthcare in Canada's North, but often patients must travel south for hospital treatment. Communities rely on MEDEVAC aircraft to transport patients and treat them en route if required.

Image: Photo of the interior of a small transport aircraft. Dr. David Saint-Jacques is in the foreground. In the middle ground a female medical practitioner monitors a patient lying bundled on a stretcher (their face obscured for privacy). The pilot and co-pilot are behind, looking in from the cockpit. Caption: Dr. David Saint-Jacques accompanies a northern patient on a MEDEVAC flight. David went on to join Canada's Astronaut Corps., ca 2009.

Image: An artwork following thematic conventions and styles from Inuit culture. In a large room several children and adults surround a seated man who cradles a sleeping infant. Most figures wear colourful western-style winter clothing. One female figure wears an Inuit skin coat. Most are smiling and facing towards the infant. Caption: In The Homecoming, Inuit artist Annie Pootoogook shows family and friends gathered at the airport to welcome a newborn home for the first time. The Homecoming, 2006, Annie Pootoogook (1969–2016). Ink on paper, 80.5 x 93 cm (31 ½ x 36 ½ in).

Video: Air Inuit Pilot
Interview with Melissa Haney, a pilot with Air Inuit. This experience is accessible, with braille labels on the buttons and speaker. Images within the video are not necessary for comprehension or enjoyment of the interview.

Biography Panel: Melissa Haney
Pilot, Air Inuit. "As a pilot…you play a role in connecting these communities to the south and to each other. You

look at yourself as a tiny part of this great big northern territory and you're humbled" (2019). Melissa Haney was born in Inukjuak, Quebec. Her community relies on aircraft as a regular means of transportation. Melissa began her career in 2001 as a flight attendant for Air Inuit, later becoming a pilot for the airline. She became Air Inuit's first female Inuk captain in 2016.

Directions: From the right end of this wall, turn 180 degrees and step forward a few paces. You will encounter the next exhibition wall.

(wall)

Graphic: Outline drawing of a control tower. Iqaluit, Nunavut. Airport Code YFB.

Video: Eric Staples at Work
A silent video, played on continual loop, showing footage captured by Eric Staples, who was an air traffic controller in Frobisher Bay (now Iqualuit) in 1957-1958. Scenes include aircraft taking off from the remote runway, and people working in and around the control tower.

Community Aerodrome Radio Stations
In addition to larger airports in centres such as Yellowknife, there more than 50 Community Aerodrome Radio Stations across the North. They provide pilots with information on weather and runway conditions.

Image: A simple peak-roofed building with "Teslin" and "Elev 2313" on its façade. Pine trees and mountains are visible in the background. Caption: A Community Aerodrome Radio Station. These small stations are staffed primarily by local people. Teslin, Yukon, 2016.

Image: A desolate arctic landscape with a square shed and dirt road in the foreground. Centred on top of the shed is a large, metallic mesh disc and cone. Caption: A Very High Frequency Omni-Directional Range (VOR) navigation aid. Resolute Bay, Nunavut, ca 1970-1980.

Artifact: Parka, Maker Unknown, ca 1994 (Loan: Dave VanDorp) Caption: Transport Canada issued this parka to Dave VanDorp, who spent a year working as a technologist in Resolute Bay. Dave maintained critical navigation aids around the airport.

Northern Flights
The Edmonton flight information region is among the largest in the world. Its staff manages airspace over the Yukon, Northwest Territories, and Nunavut, as well as Alberta and portions of British Columbia and Saskatchewan. Edmonton handles an average of 50 transpolar flights per day.

Key Fact: Flying polar routes through Canadian airspace reduces greenhouse gas emissions by 600,000 tonnes every year.

Image: A man wearing a headset, seated facing a computer consol. Over his shoulder his screen visible, showing a map covered with lines, dots, and codes. Caption: A transpolar controller using specialized software called the Canadian Automated Air Traffic System (CAATS) at the Edmonton Area Control Centre. Edmonton, Alberta, 2014.

Image: A map of Earth as seen from above the North Pole. The globe is white, with countries outlined in black. A circle centred on the map indicates the most northerly polar region. Coloured lines connecting points on each continent criss-cross this inner circle. Caption: This graphic shows the many transpolar routes that airlines can take today.

(rail)

Biography Panel: Eric Staples

Air Traffic Controller, Transport Canada. "An igloo was built in Frobisher [by the local community] as a tourist site for... passengers who stopped there on their way from Los Angeles to Paris and London" (2012). Eric Staples began his career in 1953. He took on a number of special assignments, including several months in Frobisher Bay (now Iqaluit), during the winter of 1957-1958. Although Eric officially retired in 1988, he remained involved in the field into the 1990s.

Image: A man in a fur-lined parka and thick gloves stands on the balcony of a control tower. Caption: Eric Staples stands outside an air traffic control tower in the Far North. Frobisher Bay (now Iqaluit), Nunavut, December 1957.

Artifact: "Whiz Wheel" Mark VIII-C Computer, Pan Am & Weems System of Navigation, ca 1957 (Loan: The Staples Family). Description: A thin metal rectangle, inscribed with complex lines and numbers, with a spinning metal disc featuring further lines and numbers. Caption: Eric Staples used this "whiz wheel" to calculate the speed and altitude of the aircraft he was tracking.

Artifact: Radio Operator Certificate, Department of Transport, 1954 (Loan: The Staples Family). Caption: This radio operator certificate was issued to Eric Staples in 1954.

Artifact: Air Traffic Controller Licence, Department of Transport, 1955 (Loan: The Staples Family). Caption: Eric Staples' air traffic controller licence lists the places that he was qualified to work into the 1970s.

Artifact: Parka, Maker Unknown, ca 1994 (Loan: Dave VanDorp). Caption: Transport Canada issued this parka to Dave VanDorp, who spent a year working as a technologist in Resolute Bay. Davie maintained critical navigation aids around the airport.

Artifact: Tool Kit, Maker Unknown, ca 1980s (Loan: Dave VanDorp). Caption: Dave VanDorp used these tools throughout his career as a technologist in various locations, including Resolute Bay.

Biography Panel: Dave Vandorp
Quality Assurance Manager, NAV CANADA. "Working in the High Arctic is an opportunity like no other. My motto was to go with the right attitude, and get the most out of my limited time there" (2020). Dave VanDorp began working with Transport Canada as a technologist in 1991. In 1996, he spent a year on assignment, maintaining navigation aids in Resolute Bay, now part of Nunavut. Dave remained on staff when NAV CANADA took over the country's air navigation system in 1996.

Image: A smiling man stands in a sunny arctic landscape and wearing a thick, fur-lined parka. Buildings atop snowy hills are visible in the background. Caption: Dave VanDorp stands outside in the High Arctic cold, wearing his Transport Canada parka. Resolute Bay, Nunavut, 1996.

Directions: You have reached the end of the "People" section. If you proceed to the right and around the corner, you will enter a small section titled "Families in Flight." This section includes activities for very young children, including books. We ask that the visitors proceed cautiously through this area, as low chairs and books on the floor can pose tripping hazards. If you would like to bypass this section, walk straight ahead rather than turning the corner and proceed to the edge of the next wall.

Section 4: Families in Flight

Turning the corner, you will find a children's activity area. The first wall you will encounter to your left is lined with benches, a bookshelf, and a large video monitor. Note that you will find USB outlets near the benches, should you need to take a break and recharge a device. The facing wall, to your right, also features benches and a large monitor. At the far end of this wedge-shaped area is a low counter area with hand-on activities for very young children. That area is designed to look like the control panels and windows of a control tower. The panels in this section have a navy-blue design with yellow accents.

(wall)

Families in Flight
From reunions in the arrivals area, to a child's first flight, air travel has played a memorable role in the lives of many Canadians. Behind the scenes, Canada's complex air navigation system keeps families flying. This selection of images, from people across the country, captures some of these special moments.

Video: Families in Flight
A large monitor displays a series of photographs shared with the Museum by families across Canada. Images include families waiting for loved ones at the airport, children getting to sit in the cockpit or looking out of airplane windows, people flying recreational aircraft, etc. The video includes about 50 images, played on continual loop.

Directions: From the right side of this wall, turn 180 degrees and step forward several paces. You will encounter the next exhibition wall to the right. This is where you are most likely to encounter tripping hazards. Note that the children's play area is to your left as you make your way to the next wall.

(wall)

Key Fact: In 2019, commercial air traffic worldwide was expected to nearly double, reaching 8.2 billion passengers by 2038.

Video: Busy Skies: Flying in the Future
This animated short explores what the future may hold for aviation, highlighting the challenge that busy skies can pose. It is just over a minute long, and plays on a constant loop with music. The animated sequence unfolds as follows: A two-dimensional cityscape is visible in the background, with an airport to the right. A single helicopter takes off from a city rooftop. As dawn breaks, the city comes to life. Passenger jets begin to take off from the airport and fly over the city. Various other flying vehicles appear around and over the city, in constant motion. The perspective zooms in to focus on a delivery drones as it collects a parcel from a rooftop and delivers it to another rooftop across the city. Upon delivery, the focus shifts to a couple of office workers on another rooftop boarding an air taxi. The air taxi shuttles them to another rooftop across the city, where it picks up woman with a suitcase and brings her to the airport. At the airport, the focus now shifts to a jet plane as it ascends over the city, other passenger jets, helicopters and air taxis seen throughout the sky. The focus then falls back on the cityscape. A single helicopter returns to a rooftop as the sun sets on the city and airport.

The Future is Now
Canada's air traffic continues to grow, putting pressure on our air navigation system. Different types of aircraft, such as drones and air taxis, could complicate things even more. New technologies and surveillance systems will aim to make air traffic management even more efficient—keeping Canada's skies safe.

Directions: Proceed to the right and around the corner to the opposite side of the wall. You are now progressing into the Technologies section of the exhibition. The navy-blue colour scheme continues through this area.

Section 4: Technologies

(wall)

Technologies: Finding Better Ways to Work
Air traffic management has changed a lot since the late 1930s. Computers and automation have streamlined the way that air traffic employees gather and apply information. New types of software have simplified complex tasks, like tracking the position of aircraft. All of this has increased safety in the sky while reducing stress levels for staff.

Data is Everything
There is no such thing as too much information when managing air traffic. Air traffic employees use a variety of

different technologies, ensuring that they have access to as much data as possible. Information which once required hands-on collection and complex calculations is now mainly processed by computers. Staff can easily access the information they need directly at their workstations.

Beyond the Line of Sight
Surveillance technologies make it possible for air traffic employees to "see" beyond their physical line of sight. Using radar, and more recently satellites, they can pinpoint an aircraft's position quickly and accurately.

Image: A man, wearing bulky earphones with a connected microphone, is seated at a radar consols. The console has a round screen in the centre, surrounded by knobs and dials. Lines and circles are visible onscreen, generally radiating from a central point. Caption: An enroute controller at the Toronto Area Control Centre, tracking airplanes with a Raytheon AASR-1 radar display console. Malton, Ontario, 1971.

Revolutionary Radar
During the 1950s, there was no radar coverage between Canada's airports. Controllers didn't know the real-time positions of aircraft under their watch. Mid-air collisions in the 1950s made the need for broader coverage clear. A radar network was installed across southern Canada in 1959.

Image: Front page of a newspaper, above the fold, with a headline reading: "38 Die at Moose Jaw as 2 Planes Collide." A lower headline reads "TCA North Star, Trainer Crash," with pictures of each type of aircraft. Caption: The mid-air collision of a Trans-Canada Air Lines passenger aircraft and an RCAF trainer made headlines across Canada. Moose Jaw, Saskatchewan, April 8, 1954.

Image: A painting of two passenger aircraft in flight, with one's wing colliding with the other's tail. Both are headed in roughly the same direction. Debris is visible at the point of impact. Caption: An artist's reconstruction of a mid-air collision over the Grand Canyon in 1956. This tragedy claimed 128 lives. Untitled, ca 1957, Mel Hunter (1927–2004). Gouache on board, 48 x 44.5 cm (19 x 17 ½ in.).

(rail)

Infographic: Circles of Coverage
This graphic illustrates how, from 1959 to present, layers of radar coverage have expanded to cover Canada's airspace. Five sequential maps show the expanding coverage as areas of yellow, which gradually take over the full map. In each map, dark yellow marks the new expansion, while light yellow indicates the area previously covered to that date. Graphic text reads as follows: Surveillance coverage has increased over time, helping controllers track airplanes with greater precision. 1959: (Coverage focussed along the Canada-US boarder) Primary Surveillance Radar bounces radio waves off aircraft to determine their positions. A network of Airport and Airways Surveillance Radar (AASR) enabled Canada's first enroute surveillance system. 1996: (Coverage expands to cover the full lower half of Canada) Secondary Surveillance Radar (SSR) increased coverage for Canada's southern regions. SSR communicates with aircraft that have specialized transponders, sharing both location and flight information with controllers. 2004: (Coverage expands though Northern Quebec, parts of Iqaluit, and the central Northwest Territories) Northern Radar Expansion Program had NAV CANADA built six new SSR sites, and upgraded one existing facility, to increase surveillance coverage in Canada's North. 2011: (Coverage expands over nearly all of Northern Canada) Automatic Dependent Surveillance-Broadcast (ADS-B) installations further broadened coverage in Canada's North. ADS-B uses GPS to determine and report an aircraft's precise position. Today: (The whole map is dark yellow) Space-Based ADS-B currently enables surveillance of all airspace in Canada and around the world. Aircraft broadcast flight data to satellites, which is then transmitted to air traffic controllers on Earth.

Video: How Radar Works
Animated video explaining how radar works. This experience is accessible, with braille labels on the buttons and speaker. Images within the video are not necessary for comprehension or enjoyment of the interview, the narration explains all action as it occurs.

Directions: From the right side of this wall, turn 135 degrees to your right and steps forward a few paces. You will encounter a large free-standing display case.

Artifact: ASR-5 Radar Console, Raytheon Company, ca 1959 (Loan: Montreal Aviation Museum). Caption: This style of display unit was used for the AASR-1 enroute radar system, as well as for local ASR-5 radars located around airports.

Directions: Facing the display case, turns 135 degrees to your right and steps forward a few paces. The next exhibition wall will be to your right.

(wall)

Biography Panel: Rudy Kellar
Executive Vice President, Service Delivery, NAV CANADA. "It's hard to fully express the unprecedented level of benefit that Aireon's surveillance provides from a global—and now a Canadian—perspective, in terms of safety" (2020). After a long career in aviation and airline management, Rudy Kellar joined NAV CANADA in 2005. He has been involved in Aireon from the early days of NAV CANADA's Space-based ADS-B initiative.

The New Revolution: ADS-B
Ground-based surveillance technologies like radar are tricky to install in remote areas. Enter Aireon, a company supported early on by NAV CANADA. Aireon's satellite-based Automatic Dependent Surveillance-Broadcast (ADS-B) system picks up signals from aircraft, and shares key information with air traffic employees in near-real time.

Image: An illustration of Earth surrounded by communication satellites set at regular intervals. Each satellite follows a linear North-South path. Caption: This graphic shows the constellation of Iridium NEXT satellites, carrying the ADS-B payload. ADS-B enables complete global coverage for aircraft surveillance.

Graphic: Outline drawing of a control tower. Fort Nelson, British Columbia. Airport Code YYE.

What's It Doing Out There?
Local weather data was traditionally collected outdoors by staff such as Flight Service Specialists. Increasingly, this data is being gathered by sensors. Special software adapted by NAV CANADA processes this information and feeds it directly to staff workstations.

Image: An individual on walking path approaches two raised structures. A blue building is located in the background, with a control tower. Caption: A Flight Service Specialist checks weather monitoring equipment, which recorded temperature and dewpoint. This information was collected hourly, and passed on to pilots. Location unknown, ca 1980s.

Image: Three men in a field, preparing to release a very large balloon. Caption: Staff from Canada's Department of Transport inflate a balloon used to measure the ceiling, or height of the lowest clouds, around an airport. Fort Nelson, British Columbia, ca 1940.

(rail)

Video: How ADS-B Works
Animated video explaining how ADS-B works. This experience is accessible, with braille labels on the buttons and speaker. Images within the video are not necessary for comprehension or enjoyment of the interview, the narration explains all action as it occurs.

Artifact: Satellite model (Loan: NAV CANADA). Caption: The Iridium NEXT satellite carries an ADS-B payload (the white box).

Artifacts: Weather Monitoring Tools, Various makers, 1950s–1960s (Loan: Thomas Murphy) Captions: Flight Service Specialists used these tools for weather monitoring at the airport in Nanaimo, British Columbia. Items include a notebook, an apparatus for inflating weather balloons, and a sling psychrometer to measure relative humidity.

Biography Panel: François Ouellet
Flight Service Specialist, NAV CANADA. "The job was evolving constantly. Equipment got better and better, and made weather reports so much more accurate" (2020). François Ouellet became a Flight Service Specialist with Transport Canada in 1982. He spent several years at northern Flight Service Stations in Quebec and Nunavut, before working at what became NAV CANADA's Quebec Flight Information Centre. François retired in 2013.

Directions: Proceed to the right and around the corner to the opposite side of the wall.

(wall)

Putting Data to Work
Once air traffic employees have all of the information they need, they use it to keep aircraft safely separated. As Canada's air traffic grew, it became harder to track the positions of aircraft in the sky. It also became more difficult for air traffic employees to communicate effectively amongst themselves and with pilots. To keep pace, modern technologies automated many time-consuming processes tied to tracking and communications. Today, the stereotype of the frazzled controller is far from reality!

Going Digital
Computers have been one of the most significant innovations in air traffic management. They have increased the speed of information-sharing, and revolutionized the way in which data is displayed. Without computers, it would be next to impossible to manage today's volume of air traffic.

Image: Two men seated in a control tower surrounded by their equipment. Through the tower window beyond, you can see an airplane on the runway. Caption: In this image, the tools used by early air traffic controllers are visible: a light gun, flare gun, communication radio, and telephone. Location unknown, 1940s.

Image: A man seated in front of a large angled surface covered in neatly slotted strips of white paper. He holds a "whiz wheel" calculator, while writing information on a strip of paper. Caption: Air traffic controller Cyril Rowsell uses a whiz wheel and records his calculations on flight progress strips. Gander, Newfoundland, 1950s.

Image: A woman wearing a slim headset seated in front of a round table-top monitor. Two figures to her left work at other work stations. Caption: Enroute controller Anne Gorman monitors a radar display, while her colleague records flight information. Radar and recording duties were split between controllers at busy times. Toronto, Ontario, ca 1960s.

Image: Several people working at a long table covered in large files, file organizers, and papers. Caption: Before flight plans were shared electronically, information centres like this one in Edmonton processed and shared information manually. Edmonton, Alberta, ca 1970s.

Image: A lone figure seated in a control tower facing his workstation, the tower windows, and the expansive airfield beyond on an overcast day. Caption: A controller, surrounded by screens, works in the tower at Vancouver International Airport. Technology has greatly decreased stress for controllers since the 1960s and 1970s. Vancouver, British Columbia, ca 2019.

Interactive Experience: Controllers' Screens
On rail below, visitors will find a dial surrounded by four round pictures of controllers' screen. Each image shows how a controller's screen would look using a different generation of equipment or software. Turning the dial, visitors select one of the images, revealing a number. The number corresponds to a text that appears on the wall

above. The text reads as follows: See how air traffic controllers' screens have evolved over time. 1. (A dark blue grainy background, covered with lighter blue lines and dots. There are some irregular light blue speckles). In use since the 1940s, Primary Surveillance Radar sends out signals, and registers "blips" onscreen whenever they are reflected back. Radar picks up rain drops, birds, and landscape features, which can be challenging to distinguish from airplanes. 2. (A darker blue background. Light blue lines are more clearly defined. A larger definitive white mark appears near the centre). Available since the early 1960s, Secondary Surveillance Radar is more precise. It communicates with an airplane's transponder to confirm its identity, then displays its location with a clear symbol. 3. (A warm black background intersected by light green lines and dots. Certain dots include numbers or short codes like "BA263"). Introduced in the early 1980s, the Joint Enroute and Terminal System (JETS) displayed a "tag" for each airplane onscreen. This software used data gathered by Secondary Surveillance Radar, but included more details such as flight numbers, altitude, and speed. JETS is no longer in use. 4. (A dark black background, with fine precise light blue lines. White dots are highly visible, with clear tags). NAV CANADA launched the Canadian Automated Air Traffic System (CAATS) in 2001. This cutting-edge software draws data from many sources, and allows controllers to filter the content they view onscreen.

(rail)

Biography Panel: Steve Doherty
Enroute Controller, NAV CANADA. "The equipment is so good and so much data is presented to you. . . . With the right tools, you can do a masterful job" (2020). Steve Doherty started working in air traffic control in 1971. He has worked as both a terminal and enroute controller. Steve has witnessed extraordinary changes during his career, due to the expanded use of computers and automation.

Information Graphic: Seeing the Big Picture
This graphic show a computer screen at the top, surrounded by symbols that evoke the idea of data. A line downwards from the monitor is met by a series of icons, each connected to a text box. At the end of the line a passenger airplane is parked beside a control tower. A figure at the bottom, accompanied by a speech bubble, gives a "thumbs up." Text reads as follows: Computers and other technologies put more information at controllers' fingertips. Box 1, Weather: In the past, controllers would leave their workstations to check weather reports, or contact meteorologists directly. Today, weather data is delivered digitally, right to the controller's console. Box 2, Communication: In the past, controllers would mainly communicate by radio. Every message had to be repeated back to ensure its accuracy. Today, more and more communication is text-based. This prevents errors. Box 3, Information Updates: In the past, controllers had to leave their workstations to get the latest updates, such as closures of airports and airspace. Today, digital updates are sent right to the controller's console. Box 4, Aircraft Tracking: In the past, controllers talked with pilots to get their positions, altitudes and speeds. Today, controllers' screens automatically display aircraft positions, altitudes and speeds, and highlight potential collisions. Voice bubble: Automation saves me time, reduces my stress, and increases safety in the sky!

Directions:
The last item along the rail is the previously-described Controllers' Screens interactive. From the end of the wall, turn 180 degrees and step forward a few paces. The next wall will be to your right.

Flight Info at Your Fingertips
Since the 1950s, controllers have used flight data strips to track airplanes across the sky. Originally handwritten on strips of paper, flight details were later digitized, and the strips printed centrally or at a controller's workstation. Today, flight strips are viewed onscreen—no need for printing.

Image: Two men seated separately at a long, angled work surface, covered in neatly slotted strips of paper. The man in the foreground wears a headset while looking at the strips. Caption: A controller records flight information onto strips by hand. Gander, Newfoundland, ca 1950s.

Image: A woman sits at a smaller angled unit, moving a paper strip. Computer and radar equipment is visible nearby. Caption: An air traffic controller records updated information on a flight progress strip, ca 1990s.

Image: A man seated in front of a large angled touchscreen. Onscreen, information is organized into neat rows of boxes that resemble paper strips. Caption: A Flight Service Specialist at the Lethbridge Flight Service Station uses NAVCANstrips: an electronic flight strip program developed by NAV CANADA. Lethbridge, Alberta, 2016.

What Did You Say?
Strong communication is critical to managing air traffic. A flight can end in disaster if a key piece of data is misunderstood. Information is repeated multiple times to ensure accuracy. Technologies are streamlining communications as much as possible.

Images: Two photos of tower controllers at work. The first shows a man wearing aviator sunglasses. He has a pipe in his mouth as he holds a radio receiver and points a large cylindrical light gun. The second image is of a man looking out of the tower window, speaking into a radio receiver. Caption: Tower controllers using light guns and radios to communicate with pilots. Winnipeg, Manitoba, early 1940s.

Graphic: Outline drawing of a control tower. Winnipeg, Manitoba. Airport Code YWG.

(rail)

Infographic: Flight Data Strips
This graphic shows a paper flight strip, with its various printed codes. A cartoon hand hovers over the strip holding a pen, as if about to record something. Numbered boxes surrounding the strip explain each of its codes. Graphic text reads as follows: In the past, air traffic controllers used slips of paper to quickly access and record information about the aircraft they were tracking across the sky. Each of the codes on a flight strip has a specific meaning. 1. (box contains codes DHK972 and H/B763/WX) Airplane Details: DHK indicates the Airline (DHL Air Limited), and 972 indicates the Flight Number. H indicates the size of aircraft (H means "Heavy" or wide-body airplane). B763 indicates the make and model of airplane (Boeing 767, series 300), and WX indicates the type of navigation equipment on board. 2. (box contains M.80) Speed: M.80 indicates the airplane is travelling at Mach 0.80, 850 km/hr (530mph). Mach 1 is the speed of sound. 3. (a large box includes 0329, 360, and A/BOBSU) Where, When, And How High? A/BOBSU indicates a waypoint along the airplane's route that falls within the controller's area. 0329 indicates the estimated time at which the airplane will pass the waypoint—in this case, 3:29 a.m. 360 indicates the altitude at which the airplane will pass the waypoint—in this case, 36,000 ft. (approximately 11 km). 4. (box contains 0711) Transponder Code: Airplanes broadcast this code, along with information such as altitude and speed, to receivers on the ground. 5) (box contains EGNX, MT, BOBTA, YQA, APE, CINCE8, and KCVG) Points Along the Route: EGNX indicates the Departure Airport, and KCVG the Arrival Airport. The remaining groupings between them indicate navigation aids and waypoints within the controller's sector.

Artifact: Light Gun, Maker Unknown, ca 1955 (Loan: Glenn Clark) Description: (A large cylinder set into a rectangular base with a pistol grip). Caption: Light guns were one of the tools used by tower controllers to communicate with pilots. Different colours and pulse patterns carried different messages. This light gun was used at Brandon Airport in Manitoba.

Artifact: Communication Console, ATS Aerospace Inc., Mid 1990s (Loan: NAV CANADA) Caption: Communication consoles such as this were pre-programmed with common radio frequencies and telephone numbers. This saved controllers' time when communicating with pilots and other air traffic control staff. This console was used at NAV CANADA's training facility in Cornwall, Ontario.

AV Unit: Track the Airplanes
In this game, visitors act like area controllers, tracking the location of airplanes as they cross through a sector of the sky. This game tests visitors' spatial skills and reflexes. The player receives incoming calls from three pilots, sharing their locations on the map. The player quickly presses a button to quickly identify which airplane they are tracking, and then taps the touchscreen in the right place to mark the airplane's location. They need to ensure that two airplanes do not enter the same square, which represents a square kilometer of space. If two airplanes get too

close, they need to press a warning button. Should a player fail to mark an airplane's position within three seconds, or mark it incorrectly, they will receive a warning from their supervisor. After three errors, it's game over.

Directions: At this point, the Eyes on the Skies exhibition comes to a natural end. There is an additional wall of content, located closer to the beginning of the exhibition, that was bypassed in this tour for ease of circulation. This information is part of the People section of the exhibition, and relates to the rapid rise of commercial travel. If you would like to loop back to the beginning of the exhibition area to explore this material, please proceed as follows: From the right side of this wall, turn 45 degrees to the right and step forward several paces. You will encounter a previously visited wall. Proceed along the left-hand side of this wall, which features a large cloud scene and is lined with benches. From the end of this wall, turn 90 degrees to the right and steps forward a couple of paces to encounter the remaining exhibition content.

(rail)

Biography Panel: Billie Houseman
Flight Attendant, Trans-Canada Air Lines. "When I first joined the airline we flew on 10-passenger aircraft, now the North Stars carry 48 people, and even larger planes are just over the horizon!" (1953). Lillian "Billie" Houseman's career spanned 39 years, from 1944 to 1983. She worked for Trans-Canada Air Lines which later became Air Canada. Billie was a witness to the massive growth of the aviation industry following the Second World War.

Image: A row of women wearing light-coloured uniforms walk in unison, hand in hand, towards the camera. A passenger aircraft is in the background. Caption: Billie and eight fellow flight attendants, pictured here, were assigned to a new route from Toronto to Chicago. 1946.

Artifact: Trans-Canada Air Lines Flight Attendant Jacket, Tip Top Tailors Ltd., 1953. Description: a light-blue uniform including a long-sleeved jacket, white blouse, and knee-length skirt. Caption: Billie Houseman, a Trans-Canada Air Lines flight attendant, was issued this jacket in 1953. This style of uniform was worn from 1953 until 1963.

Artifacts: Board Games, Various makers, ca 1950 (Loan: Albert Wakarchuk). Description: Two small, portable table games meant to be used during travel. The game pieces are designed to stay in place if the board is disturbed. The first game is a Checkers and Chess board, while the second is a Tic-Tac-Toe board. Caption: Flight attendant Billie Houseman kept these small board games on hand to entertain passengers during flights.