Document generated on 10/13/2026 6:30 p.m.

Newfoundland and Labrador Studies

A Brief History of Disaster Response and Recovery Efforts at the Newfoundland/Gander International Airport 1941-1985

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Volume 38, Number 1, 2023

Disasters, Pandemics and Crises in Newfoundland and Labrador: Past, Present and Future

URI: https://id.erudit.org/iderudit/1115687ar
DOI: https://doi.org/10.7202/1115687ar

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Publisher(s)

Faculty of Arts, Memorial University

ISSN

1719-1726 (print)
1715-1430 (digital)

Explore this journal

Cite this article

Mullaly-Moulton, B. & Doyle, E. (2023). A Brief History of Disaster Response and Recovery Efforts at the Newfoundland/Gander International Airport 1941-1985. *Newfoundland and Labrador Studies*, *38*(1), 1–57. https://doi.org/10.7202/1115687ar

Article abstract

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ARTICLE

A Brief History of Disaster Response and Recovery Efforts at the Newfoundland/ Gander International Airport 1941–1985

Betty Mullaly-Moulton & Emily M. Doyle

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The Newfoundland Airport, later renamed the Gander International Airport, was built in 1938–39 to deliver regular flight services that supported aircraft refueling stopovers for flights travelling from New York, United States to London, United Kingdom. It is also the site of significant aviation disaster and large-scale emergency events that have brought the world to Gander (and Gander to the world), including the Arrow Air Flight 1285 crash in 1985 and the accommodation of diverted aircraft, passengers, and crew on September 11, 2001. Since its inception, the Airport and the citizens of the subsequently developed Town of Gander have played an essential role in coordinating and delivering Disaster and Emergency Management (DEM) program services (preparedness, response, mitigation, and recovery) pertaining to aviation disaster and emergency events. Over the past century, the Town of Gander and the Gander International Airport have also been the site of accumulated experiences, learnings, and developed skills from these efforts, all of which have become part of Gander's unique history and have resulted in the establishment of

comprehensive and integrated municipal and airport DEM plans critical to future responses.

Introduction

This article details the disaster response and recovery efforts made by the Newfoundland/Gander International Airport and the Town of Gander pertaining to a variety of airplane crashes, including the Dr. Frederick Banting – Hudson Bomber Flight T-9449 in 1941, Sabena Airlines DC-4 Flight 00CBG in 1946, Czechoslovakian State Airlines IL-180 Flight 523 in 1967, and Arrow Air Flight 1285 in 1985. Throughout we consider the learnings gained from responding to and recovering from these events, and how each played a critical role in how the Gander International Airport and the Town of Gander (and the province of Newfoundland and Labrador) continue to support the development and maintenance of integrated airport Disaster and Emergency Management (DEM) plans today. We begin with a brief history of the Newfoundland Airport, later renamed the Gander International Airport, and the Town of Gander.

The Beginning of Aviation in Gander

Prior to the construction of the airport in Gander, NL, the coastal community of Botwood (located approximately 94 kilometers from Gander) was the only place on the island of Newfoundland supporting transatlantic crossings. Botwood's naturally deep fog-free harbour which was sheltered by low-lying hills made it an ideal location for a flying boat* base. While Botwood provided essential refueling flying boat-based services, it was not viewed as a suitable location for a land plane base as it did not have the requirements needed to support the development of large airport runways. Advancements in technology

* Flying Boat — A fixed-winged seaplane with a hull allowing it to land on water and no landing gear.

led to the demise of the flying boat and by 1945 they were obsolete as land-based planes were developed that could complete transatlantic trips faster and more efficiently.

During an air conference in Ottawa in 1935, an agreement was reached by the Canadian and British Governments to continue to support the flying boat-based services in Botwood in addition to permitting one British and one American company to carry out experimental flights across the North Atlantic, with a view to establish an airport suitable to deliver regular flight services that supported an aircraft-refueling stopover for flights from London to New York. Under the terms of the Agreement reached in Ottawa, the Canadian Government was to provide meteorological services, the British Government was to provide wireless services and five-sixths of the costs associated with construction, and the Newfoundland Government was to assume one-sixth the cost of construction and have ownership (*Gander Beacon*, 1981).

The British supported construction of a large airport as Newfoundland was part of the British Empire, and it enabled Imperial Airways to use NL to support its commercial transatlantic service. They also saw the airport's location as beneficial in the event that World War II (WWII) broke out (Nicklin, 2016).

In October 1939, construction of the Newfoundland Airport was officially completed. Support for airport operations included four paved runways, an aircraft hangar, radio and meteorological installations, a power plant, and administrative buildings. The airport site also contained dormitories, a post office, and a movie theatre. The location of these buildings was later referred to as the Old Army Side or Old Town Side. According to Carl Christi, at the time the Newfoundland Airport was finished in 1939, "it would be one of the largest airports and technically most modern airports in the world" (1995, p. 19).

Newfoundland's geographical location as the most easterly point in North America became a vital factor in the future development of island airports during WWII. Given the strategic importance and potential threat to Canada and the United States should German forces ever take control of the Newfoundland Airport, discussions took place

between the Newfoundland, British, and Canadian Governments, resulting in the 1946 Defense Agreement between the three countries. In this Agreement, all countries obtained significant benefits:

> Canada got assurance of freedom of action in the Newfoundland area in the event of another emergency; Newfoundland got assurance of immediate support from Canada in the event of a crisis, without loss of sovereignty; and the United Kingdom got assurance of the wartime partnership of Canada, the United Kingdom and Newfoundland for the maintenance of transatlantic sea and air communications (Department of External Affairs, 1974, p. 13).

The Airport remained under Canadian Government control until April 1, 1946, when the Newfoundland Commission Government regained ownership, paying Canada $1,000,000 for improvements made during the war (Warren, 1988).

Postwar and the Continued Development of the Newfoundland Airport and the Construction of the Town of Gander

During WWII, the control tower at the Newfoundland Airport was owned by the Royal Canadian Air Force. After the war, the airport airbase became a civilian airport, and the airport tower was removed, with all oceanic control occurring from Moncton, New Brunswick. Location of this control began to shift in 1949 when Newfoundland joined Confederation and became a province of Canada. When Newfoundland entered Confederation, the Newfoundland Airport came under the administration of the Canadian federal government's Department of Transport and it was at this time that the Newfoundland Airport was granted international status and was renamed the Gander International Airport.

Due to its strategic location, the Gander International Airport was established as a main refueling and service station, transfer point, and

layover for all air traffic in the North Atlantic, encompassing Bermuda, the Azores, Europe, Canada, and the United States. The number of commercial airlines around the world grew post war, offering travelers a widely expanded variety of routes and schedules. Because of the increased volume of airlines refueling and servicing their planes at the Gander International Airport, it became known as the "Crossroads of the World" (Goff, 2005, p. 3).

As the airport expanded, so did the needs of the population that surrounded it. After the Airport came under the Federal Department of Transport, a decision was made in 1951 between the new Province of Newfoundland and Gander International Airport officials to build a new townsite away from the four runways. Gander was Newfoundland's first "planned" town. Its streets were and continue to be named after famous aviators (Major, 2001). The Town of Gander was built (replacing the 'Old Army Side' or 'Old Town Site' that was adjacent to the Airport and later abandoned) to better accommodate the housing needs of military and civilian personnel living in barracks, and to welcome families wanting to make their homes in Gander. In 1959, a new international terminal was constructed, and an Air Traffic Control (ATC) Centre (later Nav Canada) and a new radar system was established. When the new international terminal was constructed, the airport handled 13,000 aircraft annually and a quarter of a million passengers, making the Gander International Airport one of the largest and busiest airports in the world at the time.

While the Gander International Airport has seen a significant reduction in aircraft landings since the late 1980s, the airport continues to operate and offer domestic and international airline services for Air Canada, charter flights, medical evacuation rerouting/flights, and private/executive aircraft. Humanitarian cargo flights have had stopovers for services at the Gander International Airport, including a Russian cargo plane transporting 600 children (who were impacted by the Chernobyl nuclear plant disaster that took place on April 26, 1986) from Ukraine to Cuba for medical assessment and treatment, as well as some 100 cargo plane flights from around the world travelling to

Haiti to deliver critical disaster relief supplies after the devastating earthquake on January 12, 2010. During both Middle East Gulf Wars as well as the war in Afghanistan, Gander Airport saw an increase in military aircraft stopping over for services. This continues to be a practice for many military aircraft who require refueling services while travelling to a theatre of war or transporting humanitarian relief supplies (Brian Hicks, Personal Interview, October 20, 2020).

The international importance of the Town of Gander and the Gander International Airport continues today due to its strategic position as one of the most easterly international airports in North America. The Gander International Airport maintains a tower to oversee local air traffic as well as two active runways designated as emergency landing options for large aircraft in transatlantic operations. One of the runways is designated as an emergency landing for NASA's Space Shuttle Obiter as it measures 10,500 ft × 200 ft (3,200 m × 61 m). The Gander International Airport also houses Environment Canada's meteorological weather center for Newfoundland. The 103 Search and Rescue Squadron and the Canadian Forces Base 9 Wing Gander is likewise adjacent to the airport.

Approaches to Disaster and Emergency Management

The field of Disaster and Emergency Management (DEM) is ever evolving. Over the past 75 years it has emerged from a program of civil defense grounded in tactical/task-oriented response operations to a generalist practice or discipline that emphasizes strategic concepts of skills enhancement, networking and coordination, leadership, and team building/collaborative approaches (Canton, 2007; Public Safety Canada, 2017). As an evolving field, DEM faces complex and challenging problems and emerging issues that require holistic and integrated approaches to attaining successful outcomes. To that end, focusing less on a problem-solving approach that centers around what is not working and how to fix it, and more on an appreciating and discovering approach that examines what is working and how to further influence it

(Vogt et al., 2003) supports collaborative decision-making that will ultimately serve response and recovery efforts well. These approaches are highlighted in the specific crash events discussed below, presenting information on how the acceptance of an appreciating and discovering approach and collaborative decision-making model amongst responders and leadership at the Newfoundland/Gander International Airport contributed to effective and efficient response and recovery efforts. A lack of buy-in or a lack of understanding of the benefits of utilizing these best practices can cause disruption, tension, and miscommunication, all of which interfere with the ability to coordinate efforts in Emergency Operations Centres (EOC) and at disaster sites.

Disaster and Emergency Managers and emergency response organizational leaders must ensure that fair, legitimate, and equitable decisions are made during all phases of DEM (preparedness/planning, response, mitigation, and recovery). To achieve this goal, professionals must promote and engage in practices that are participatory, transparent, and open. The inclusion of forward and analytical thinking in the practice of DEM produces many rewards as it enables individuals to apply lessons learned and become well-informed, flexible, organized, and strategic in making decisions. This is particularly important when responding to a large-scale, multi-agency emergency as it is imperative that decision-makers and responders be fair-minded in evaluating exercises and responses, diligent in seeking relevant information, and unbiased when addressing ethical issues (Facione, 2007).

Successful disaster response and recovery efforts are dependent on more than plans and procedures being in place. They also require individuals to be ready, skilled, adaptable, and imaginative. Since the responsibility of managing a disaster in Newfoundland and Labrador may require support from municipal, provincial, and national governments — as well as emergency management organizations' employees and community-based volunteers — it is important that responding agencies/governments undertake preparedness initiatives in advance of an emergency or disaster to enhance communal readiness and promote an effective response (Coppola, 2015). Some preparedness activities

that can be undertaken prior to an emergency or disaster event include participation in joint education, training, and exercise opportunities; obtaining input in updating emergency plans to include lessons learned and processes developed; and the sharing of approved DEM plans (Canadian Standards Association, 2017).

In adapting a comprehensive approach to DEM, community-based government and volunteer-based agency leaders must build on its strengths to include a community resilience methodology that incorporates social, cultural, and psychological factors (McEntire, 2002). Collaborative initiatives (training, simulation exercises, sharing of DEM plans) between community partners and stakeholders, including government and non-government organizations, in all DEM phases will reduce the impact of a major event and increase community resilience (Public Safety Canada, 2019). Willingness by the Town of Gander, the Gander International Airport, and partner response agencies and volunteer organizations such as the Canadian Red Cross and the Salvation Army to adopt an integrated approach of DEM has over time bolstered its disaster and emergency response efforts. Furthermore, the development, review, and updating of integrated and sustainable DEM plans within agencies in the Town of Gander is a DEM practice that has evolved over several decades.

Dr. Frederick Banting Airplane Crash – 1941

Dr. Frederick Banting was a Canadian physician best known for his 1922 co-discovery of how insulin could be used in the successful treatment of diabetes. In 1923 Dr. Banting became the first Canadian to win the Nobel Prize, and in 1934 he was made a Knight of the British Empire (Harris, 1946). When Canada entered World War II in September 1939, Dr. Banting enlisted as a medical officer with a base hospital unit, and as the war continued, he took on an important role in wartime medical research. On February 17, 1941, Banting and crew boarded Hudson Bomber Flight T-9449 from Dorval Airport, Montreal, Quebec enroute to London via Gander, Newfoundland where

they were scheduled to make a routine stopover at the Newfoundland Airport (Bliss, 1984). Upon arriving in Gander, Banting learned that there was a blizzard forecasted and that he and his crew would not be able to take off as planned that evening. He would be grounded in Gander for several days.

On February 20, 1941, at 19:58 hours, Hudson Bomber Flight T-9449 and crew members Captain Joseph Mackey, Navigator William Bird, and Radio Operator William Snailham took off from the Newfoundland Airport on route to London, England. Less than an hour after takeoff, the plane experienced engine trouble and Mr. Snailham contacted the radio operator requesting a radio bearing to return to Gander. Although the bearing was promptly provided by the radio operator in Gander, it was never acknowledged. With a failed radio and engine trouble Captain Mackey was forced to turn and head back over Newfoundland towards Gander.

Given the night's darkness, falling snow, and the lack of radio support, Captain Mackey lost his bearings and crash-landed in an isolated, heavily-wooded area with about six feet of snow, some 16 kilometers/10 miles south of Musgrave Harbour (approximately one hour outside Gander). Both William Bird and William Snailham died upon impact of the crash. Dr. Banting and Captain Mackey survived the crash and suffered head injuries and broken bones. Despite these injuries Captain Mackey made crude snowshoes and attempted to seek help on several occasions. He was not successful given the freezing temperatures and heavy snow. During one of these times when Captain Mackey left to find help, Dr. Banting exited the plane, fell face down in the snow, and died from his injuries (Christie, 1995).

Search and Rescue Response and Recovery Efforts

When there was no radio response received from Captain Mackey and/or his flight crew, the radio operator at the Newfoundland Airport suspected a crash and alerted the Royal Canadian Air Force (as the Newfoundland Airport was under the control of the Government

of Canada during World War II, from 1939–1945) to commence with a search of a suspected missing aircraft. Due to the snowy conditions in Gander and its surrounding area, air crews could not get their search planes up until midafternoon on February 21, 1941. Included in the air search were Hudson Bombers and other military forces aircraft out of Gander. When the people of Musgrave Harbour heard on the radio that Dr. Banting's plane had gone down, local community residents came together to join the search efforts (Warren, 1988). Although there was now an intense search underway, the area was a vast expanse of sea and wilderness covered in six feet of snow. This coupled with the plane going missing far from its flight path posed grave concerns.

On February 23, 1941, a low-flying searching Hudson Bomber found the crash wreckage and saw Captain Mackey frantically waving a piece of cloth and next to him, traced in the snow, the message: "Three dead. Joe" (Harris, 1946, p. 230). While the pilot could not land the rescue plane, he was able to drop some food to Captain Mackey and a note saying that help would be coming soon. Only two kilometers (1.2 miles) away from the crash site, the search plane crew spotted three hunters. The search plane crew was able to successfully drop a package to the men that contained a message asking them to go to the

Figure 1. Site of Dr. Banting's Airplane Crash. February 20, 1941 (Courtesy Gander Airport Historical Society).

aid of the survivors. It also contained a map showing the position of the crash site. Upon arriving at the crash site (Figure 1), the hunters were able to put Captain Mackey on their wooden sled and, travelling on foot, they pulled him to Musgrave Harbour, 16 kilometers/10 miles away (Harris, 1946). There he was cared for by a local nurse until a doctor arrived from Gander. Soon other people arrived at the crash site with their sleds and recovered the three bodies. Once the bodies were in Musgrave Harbour they were sewn in white sheets and "laid out" in the Orange Lodge for several days until ski-equipped planes came to retrieve them.

DEM Learnings from the Banting Airplane Crash

It was the persistent and innovative response efforts to locate the remote, snow-scaped, wooded crash site by the radio operators at the Newfoundland Airport in Gander, military search plane operators, and local community responders that ultimately resulted in the pilot's survival. While a three-day search and rescue operation might seem like a lengthy time frame by today's standards, we must consider the location of the crash site and the equipment available at the time. The ingenuity of the coordination efforts of the search plane crew — who were able to locate the crash site and drop essential supplies and a note to the sole survivor, as well as dropping a note to the three hunters advising them of the location of the crash site and how there was one survivor — was impressive as it demonstrates a resourcefulness and ability to effectively respond to an unfolding event. The successful efforts pertaining to the coordination of having a search plane pick up essential supplies at the airport in Gander and drop them off at the crash site provided a lesson learned to the coordination team arranging the response to the 1946 Sabena Airlines crash. The Sabena crash, also taking place in a remote wilderness area, presented challenges in accessing and treating survivors as well as getting essential medical and transportation supplies to the crash site (Gander Airport Historical Society, n.d.).

The fact that the pilot was not able to land the rescue plane yet was able to effectively communicate and secure a successful response effort so that the survivor could be transported to a community to receive essential medical assistance shows an understanding of the importance of effectively communicating pertinent information during an emergency event. The ability of the three civilian responders to provide care and support to the surviving pilot and to carry him by wooden sled over snowy rough terrain for 16 kilometers to receive medical attention is also notable. The ground rescue efforts as well as medical support provided by a local nurse (until a doctor arrived) demonstrates the importance of utilizing informal resources (local community residents) and highlights the value of a DEM approach to building local "social capital." When a community takes this approach to responding to emergency events, it creates an ability to address and solve its own internal problems, allowing for more efficient and effective results to materialize (Kapucu, 2007, p. 23).

Sabena Airlines DC-4 Flight 00CBG Airplane Crash – 1946

Sabena Airlines DC-4 Flight 00CBG carrying 44 passengers and crew was scheduled to arrive for refueling at the Newfoundland Airport on September 18, 1946 at 07:20 hours. Weather conditions reported at the time included a brisk wind blowing north-northeast, light fog, rain, and drizzle, one-mile visibility and a temperature of 45°F (Tibbo, 1993). The flight had departed from Rinsanna, Belgium the day before, on route to New York City, United States. As the aircraft approached, it overflew the airport and began to descend on the southern side of the airfield rather than the north. This resulted in the plane striking the tops of birch trees, ripping pieces of number-four engine cover away and crashing 100 yards through the heavily-wooded hill approximately 35 kilometers/22 miles southwest of Gander.

The tremendous force of the sudden stop resulted in the floor bolts, which were meant to hold the seats in place, fracturing, causing passengers to be forced ahead into the back of the seats in front of

them, some into the cockpit, and others thrown outside of the aircraft. Within seconds of the crash there was an explosion and a huge fireball blasted upwards from one of the wings. The fire burned for six hours. The crash and subsequent fire killed 26 of the 44 occupants. Though most of the 18 survivors had serious injuries, three came through the ordeal with only a few scratches. The passengers who were unhurt assisted the other surviving passengers in getting away from the searing heat of the aircraft to only find themselves stranded in the thick, cold, wet Newfoundland woods (Warren, 1988).

Search and Rescue Response and Recovery Efforts

When the Control Tower Operator at Newfoundland Airport lost communication with the Sabena Airlines flight he initially requested the Radio Operator try to reach the flight crew by Morse Code and to contact the US Harmon Airforce Base /Airport, Stephenville, Newfoundland and the Air Traffic Control Tower, Moncton, NB to determine if they had heard anything on the flight being diverted to another airport. The US MacAndrew Navy Base, Argentia, and the US Harmon Airforce Base, Stephenville were put on alert in the event that air rescue support was required. Argentia is situated on the southeast coast of Newfoundland, some 282 kilometers/175 miles from Gander whereas Stephenville is on the west coast of Newfoundland, some 438 kilometers/272 miles from Gander. By 14:30 hours no contact was made between the Control Tower and the Sabena flight crew, and a determination was made that Flight 00CBG was not diverted to another airport.

At 15:00 hours the weather, which had deteriorated earlier in the day, had improved enough to allow Lieutenant Commander Schrader, US Coast Guard Services/US Naval Base, Argentia and his PBY5A aircraft to depart Argentia to conduct a search in the area where it was now assumed the Sabena Airlines flight crashed. Lieutenant Commander Schrader searched the area for 2.5 hours. Due to poor visibility and the onset of darkness he returned to Argentia at approximately

19:00 hours. At this point, the crash survivors had been on the ground for approximately 12 hours in cold, wet, and windy weather conditions.

On September 19, 1946, the weather conditions in the Gander area greatly improved (sunny and 70°F) which allowed for three US Coast Guard aircraft with rescue teams on board to depart from the US Naval Base, Argentia and three aircraft from the US Airforce Base, Stephenville to commence with the search for the lost Sabena Airlines DC-4 plane. Three civilian aircraft that were in Gander doing survey work were also chartered by the Newfoundland Government to assist in the search (Tibbo, 1993). At 10:00 hours the Control Tower,

Figure 2. Sabena Crash Site (Courtesy Gander Airport Historical Society).

Newfoundland Airport received a call from Captain Wells, from a Trans World Airlines flight that was destined for Gander from New York City, stating that he had spotted a crashed DC-4 aircraft some 35 kilometers/22 miles west of the Newfoundland Airport. After receiving an update from the Control Tower of a possible crash sighting, Lieutenant Commander Davis, US Coast Guard, who along with other aircraft were searching east for the crash site, diverted west and confirmed the crash site earlier identified by Captain Wells (Figure 2). Lieutenant Commander Davis was also able to confirm that there were at least three survivors.

Upon finding the crash site, Lieutenant Commander Davis's crew dropped essential supplies from the air, including sleeping bags, pots, pans, tins of food, matches, medical supplies, and a message asking the survivors to stay where they were, and that help was on the way. As Lieutenant Commander Davis returned to the Newfoundland Airport to help with the coordination of a rescue plan, his co-pilot was contacting the US Naval Base, Argentia to inform them to gather the huge number of supplies needed to support the rescue efforts. The other aircraft also returned to the Newfoundland Airport to await further response directions. As one of the rescue aircraft was returning to the airport the crew spotted two caribou hunters not far from the crash site. The flight crew were able to fly low enough to provide hand signals to the hunters to travel towards the crash site. Upon arriving at the crash site, the hunters provided as much assistance as possible to the survivors (using the supplies that were dropped by the US Navy Coast Guard) until additional help arrived. They also gathered sticks and stones and printed out, only a short distance from the crash site, the number 18 followed by the letters SURVIVORS (Tibbo, 1993, p. 91).

In the meantime, at the Newfoundland Airport (which became the headquarters site for search and rescue coordination, referred to as Rescue Headquarters), a detailed search and rescue plan was being developed by a team comprised of the Airport Manager and personnel, Lieutenant Commander Davis, and officials from the US Navy Coast Guard (from Argentia) and US Army (from Stephenville), and the

Newfoundland Government. Rescue plan logistics were developed, and a radio communications antenna and receiver were set up near Runway 36 to ensure communications between the radio station and ground search and rescue teams. This was in addition to the handi-talkies that were provided to the team leads. Two key outcomes of the plan included getting Captain Dr. Samuel Martin, US Naval Base into the crash site as a member of the first rescue team and contacting the Newfoundland Ranger Force, Glenwood (located 30 kilometers west of Gander) to assist with the search and rescue efforts. The US Navy Coast Guard was put in charge of the overall rescue operation (Gander Airport Historical Society, n.d.).

The first part of the ground search and rescue mission took the teams as far as they could by boat (Figure 3). The route taken by Rescue 1 required them to cross rapids and rough waters resulting in team members getting very wet as the boats would turn over. Once the boat

Figure 3. Sabena Crash Rescuers (Courtesy Gander Airport Historical Society).

trip ended the teams had to then make the trek through bog and underbrush, and then up a rough, thick-forested steep incline filled with mosquitoes for which they had no insect repellent to help them deal with the discomfort. At approximately 20:15 hours on September 19, 1946, ground Rescue 1 reached the crash site and then gave the prearranged signal of three long flashes of light to the aircraft support (led by Lieutenant Commanders Schrader and MacDowell) indicating that they had reached the crash site. This was now some 39 hours after the crash (Gander Airport Historical Society, n.d.).

After receiving this signal, Lieutenant Commander MacDowell reported back this information to the Control Tower who in turn passed it on to Rescue Headquarters, Newfoundland Airport. The two Search and Rescue aircraft then returned to Argentia where they would spend the night and gather emergency supplies and equipment that would be dropped at the crash site on the following day. In addition to the critical supplies and equipment provided by the Naval Base, Argentia, requests put forward by Rescue Headquarters secured medical supplies from the Banting Memorial Hospital, Gander, as well as tents, sleeping bags, and other essential supplies from the US Air Force Base, Stephenville and the US Army Air Force Base, St. John's, located on the east coast of Newfoundland, some 335 kilometers/208 miles from Gander (Gander Airport Historical Society, n.d.).

When Dr. Martin and his team reached the crash site, they immediately took stock of what action was required. Upon assessment of immediate priorities, direction was provided to rescue team members to help provide immediate care to individuals who were severely burned and who had major injuries. Dr. Martin continued to provide care and support to the survivors with basic medical supplies until the following day (day two after the initial crash) when medicine, medical supplies, and equipment such as sleeping bags, tents, and stretchers were dropped at the crash site via parachutes. Unfortunately, the supplies and equipment could not be dropped until early afternoon when the weather cleared. Over 15 parachute drops were made to the crash site before nightfall (Gander Historical Society, n.d.).

Dr. Martin and his ground search and rescue team continued to provide care to the crash survivors and communicate messages to the Search and Rescue Coordination Team located at their headquarters site at the Newfoundland Airport. In addition to these message updates, the headquarters coordination team continued to receive updates on the progress of ground Rescue Teams 2 and 3 who were delayed in reaching the crash site due to trouble travelling by boat and land due to wet and windy weather conditions. These updates, as well as advice and recommendations from the air search and rescue aircraft teams, supported the development of a comprehensive response to prepare and transport crash survivors from the crash site to the Banting Memorial Hospital, located near the Newfoundland Airport (Tibbo, 1993).

Given the impossibility of transporting the critically-injured survivors from the crash site by land, the Search and Rescue Coordination Team contacted the American Coast Guard Commander from Argentia, Newfoundland and secured approval for two Sikorsky helicopters to be disassembled in New York City and flown by military aircraft to Gander where they would be reassembled and used to assist with the transporting of survivors to the Banting Memorial Hospital, Gander. Three days and three hours after the initial crash, two C54 planes carrying two unassembled helicopters arrived at the Newfoundland Airport. The arrival of the aircraft in Gander made history as never before had helicopters been in Newfoundland. While the helicopters were being assembled, two Search and Rescue aircraft as well as an Army aircraft loaded with carpenters, wooden planks, and other building materials left the Newfoundland Airport to make suitable platform areas for the helicopters to land and take off. One platform was constructed at Shank's Bog (1.6 kilometers/1 mile from the crash site) and the other at Caribou Lake (8 kilometers/5 miles from Shank's Bog). Also dropped at these sites were containers of gasoline needed to refuel the helicopters (Tibbo, 1993).

The first survivors to be transported from the crash site were in critical condition. These survivors were initially carried on stretchers (by foot) from the crash site by the rescuers to the Shank's Bog platform.

From the platform the survivors were strapped to helicopter pontoons so they could be transported to the other helicopter platform at Caribou Lake. Once they arrived at this platform the survivors were moved to a small water raft that transported them to a waiting amphibian airplane. This airplane would then take off and land at the Newfoundland Airport where the survivors would then be taken by ambulance to the Banting Memorial Hospital, only a short distance away. The less severely injured passengers were transported from the crash site by rescuers and boats. All survivors were transported to the Banting Memorial Hospital for treatment and care. Given the severity of the injuries of the crash survivors, a medical doctor and several nurses were sent from St. John's, Newfoundland to assist the medical professional at the hospital in Gander.

Dr. Samuel Martin (a member of the initial ground rescue team at the crash site) remained at the crash site until all survivors were safely transported out. He and his team were at the site a total of three days and three nights and cared for the survivors who had to remain at the crash site until they were transported to hospital on September 22, 1946 — a total of four days and six hours since the plane crashed. It was Dr. Martin's splinting of broken bones, treating of major head wounds, and administering of morphine and antibiotics that is credited with saving the lives of many of the critically injured passengers. Of the 18 survivors, one died from heart failure while recovering from burn injuries at the hospital in Gander, while the others made remarkable physical recoveries (Gander Airport Historical Society, n.d.).

DEM Learnings from the Sabina Airline Crash

The Sabena airplane tragedy was the largest commercial airliner crash in the world at the time. The prompt establishment and ongoing involvement of a multi-agency response team whose Rescue Headquarters was centred in the Newfoundland Airport was integral to the complex planning and coordination efforts of both air and ground response teams in searching for, rescuing, and ultimately transporting survivors

to the Banting Memorial Hospital. The incorporation of many resources and skillsets including communications (technical and verbal), ground and air search and rescue crews, procurement of helicopters, building of helicopter landing platforms in a remote area, and on-site critical emergency medical services were successful in large part due to the sound planning and leadership demonstrated by Rescue Headquarters and ground and air responders.

The aptitude and leadership demonstrated by Rescue Headquarters personnel during this tragedy in 1946 was quite remarkable given that there had been no formal training provided to team members on how to manage a large-scale multi-agency remote response and recovery effort. That said, having the involvement of the US military service at all levels of the search and rescue as well as recovery efforts brought a skillset that supported leadership and a respect for a Chain of Command or a Command-and-Control operation. The effective communication and coordination efforts between the Newfoundland Airport, US Coast Guard Commander, Argentia, and the New York City base (from where the two helicopters were transported to Gander) is notable given the ingenuity and timeframe from which Rescue Headquarters had to develop and implement this initiative. Moreover, the learnings from the coordination and overall management of response and recovery efforts that took place during the Sabena crash were a foundation for a more formalized Emergency Command Centre (ECC) that was to be operationalized in future large-scale airplane crash events.

The recognition by Airport personnel to identify early on the magnitude of the logistics and also the urgency involved in the response and rescue efforts demonstrated how critical thinking about their strengths (medical support, ground search and rescue teams) as well as their limitations (survivor safe extraction and transportation from crash site to the hospital) provided a need for practical solutions. The ability to recognize barriers and identify solutions within Newfoundland and on an international level (US) provides a lesson learned on how the inclusion of multi-agencies in a disaster event is crucial for a positive outcome. The coordinated approach that took place during the Sabena crash

highlights how the building of formal or informal partnerships, drawing upon individual and community strengths, and adapting to emergent challenges is essential to the creation of a resilient workplace and community (Kapucu, 2007; Public Safety Canada, 2019). These best practices in DEM are identified not only in the Sabena and Banting crashes but also in the Czechoslovakian State Airlines and Arrow Air crashes discussed below.

Czechoslovakian State Airlines IL-180 Airplane Crash – 1967

On September 4, 1967, Czechoslovakian State Airlines Ilyuhin IL-180 Flight 523 departed from Prague, Czechoslovakia bound for Havana, Cuba, with scheduled technical and refueling stops at Shannon, Ireland and Gander, Newfoundland. There were 69 passengers and crew on board. The flight departed from Shannon that evening and landed on Runway 14 (now Runway 13) at the Gander International Airport on September 5, 1967, at 03:26 hours. The aircraft was refueled, and the crew was changed. The flight crew that flew the aircraft to Gander deplaned and remained in Gander and was replaced by a crew that had been off duty and stationed in Gander. Due to the number of regularly scheduled technical and refueling stopover flights that Cubana, Interflug, Aeroflot, and Czech State Airlines made at the Gander International Airport, it was common practice for flight crews to be stationed in the town so that the on-duty crew could be replaced by an off-duty crew to continue the final leg of their transatlantic flight to Cuba, East Germany, Russia, or Czechoslovakia.

At 05:10 hours the pilot called the Airport Control Tower and advised that the aircraft was airborne from Runway 14. The aircraft lifted off routinely near the end of the runway, but then engaged in a climb in altitude that was shallower than normal. As a result, the aircraft's right wing struck the guy wire (a support structure) radar reflector mast that was located 4,500 feet from the end of the runway and the plane began to descend. 100 feet later, numbers 2, 3 and 4 propellers started to nick the ground shrubs and 20 feet later the belly of the

Figure 4. Czech Airlines Crash Site (Courtesy of Gander Airport Historical Society).

aircraft hit the ground. Shortly afterwards, the plane struck the railway track embankment and rails, skipped 400 feet over a depression in the ground and crashed into the boggy terrain, the wings breaking into several sections and the fuselage into seven large parts. This caused the 6,100 gallons of fuel onboard to catch fire, and it continued to burn for approximately six hours. The plane's wreckage was strewn over an area of 550 feet in seven different directions (Figure 4). Of the 69 passengers and crew, 32 died immediately, and three died later at the local James Paton Memorial Hospital (previously Banting Memorial Hospital). 34 passengers survived the crash, most having suffered critical burns and injuries (*The Evening Telegram*, 1967).

Disaster Response Efforts

Air Traffic Controller Jack Pinsent, who worked alone from midnight until 08:00 hours at the Airport Control Tower, was the first employee to respond to the Czech Airlines crash. Upon seeing the plane crash at the end of Runway 14, Mr. Pinsent immediately hit the crash notification button that was linked to the Airport Fire Department and contacted James Paton Memorial Hospital, Allied Aviation, and the Chief Control Tower Air Traffic Controller at home.

The Airport Fire Department was the first to arrive at the crash site as it was located at the airport at the end of Runway 14. Upon arrival at the crash site, they notified the Airport Control Tower of the devastation of the wreckage, and that there were survivors requiring immediate medical assistance. In response to the call from the Gander International Airport, Nurse Nolan, the Nurse in Charge at the James Paton Memorial Hospital, notified staff working the midnight shift of the plane crash and telephoned off-duty doctors and nurses and asked them to report immediately to the hospital. Within minutes of being notified of the crash, the on-duty nurse (Josephine Cashin) along with an ambulance and driver obtained medical supplies (basic first aid and morphine, stretchers, blankets, and flashlights) and headed to the crash site. To reach the crash site, medical staff had to park on the side of the road and travel knee-deep in bog, as did the other first responders.

Despite being wet and cold (having left the hospital wearing only sandals, dress pants and a knit sweater), Nurse Cashin came to the aid of injured passengers roaming through the smoldering wreckage and located severely injured and burned passengers, providing them with vital medical care until their seat belts were cut off and they were transported to the hospital. Nurse Cashin's partial knowledge of the German language, which she learned while deployed overseas as a nurse with the Canadian military, was beneficial to the rescue efforts as it allowed her to glean from the injured passengers she was treating where other potential passengers could be located at or near the crash site. It was also Nurse Cashin's care and instructions to the on-site

responders on how to prepare the injured for transport from the crash site that is credited for saving lives (*The Evening Telegram*, 1967).

In total there were six nurses and four doctors from James Paton Memorial Hospital dispatched to the crash site. Dr. Neil Harvey, like Nurse Cashin, also provided critical medical care to the shocked and shivering passengers who were both inside the plane wreckage or thrown some distance from it. He recalls being up to his waist in muck as he approached the crash site and coming upon a family of three surviving passengers who were still strapped in their seats, and other survivors who were wandering around and calling out for help, many calling out in foreign languages. Dr. Harvey, who spoke only English, tried to communicate by motioning that he would send help. As he moved forward towards the wreckage, he would inform emergency medical responders (EMRs) about these passengers, and they would immediately go with stretchers and rescue them (Personal Interview, September 30, 2020). The doctors and nurses remained at the crash site triaging and treating passengers by the light of flashlights and the glow of flames from the wreckage until all survivors were transported to hospital. When they completed their medical response efforts at the crash site, the medical staff then proceeded back to the hospital to provide care for the survivors. The responders included employees from the Airport, Town of Gander Fire Rescue, RCMP, and medical staff from James Paton Memorial Hospital.

In addition to the hazardous bog conditions (several fire rescue workers needed to be pulled out by other rescuers), the darkness (no lights at the end of the runway) and smoky fires from the crash also presented impediments to the response efforts. Since the remains of the aircraft were approximately 2000 feet from the nearest road, the issue of travelling on the dangerous bog made it impossible to get rescue vehicles across the bog to the crash site. Airport personnel including the Chief Air Traffic Controller, Airport Manager, and Allied Aviation coordinated the crash logistical response and recovery efforts with support from the RCMP and Airport and Town of Gander Fire Departments, along with medical staff. Given the urgent need of

hospital medical care for many of the passengers with severe burns and broken bones, the on-site rescue officials recognized that a rescue helicopter was required for the timely transport of injured passengers to life-saving medical help.

Once this essential transportation requirement was identified, a request was then put forward to Allied Aviation to obtain this service. Since the closest Royal Canadian Rescue Air Force Unit was in Halifax, an emergency call went out to Eastern Provincial Airways (EPA) requesting their assistance. Coordinated efforts by EPA officials soon identified and contacted Austin Garrett, a local veteran helicopter pilot employed with the Department of Mines and Resources, and requested his immediate assistance in transporting by helicopter the injured passengers from the crash site to the airport terminal where they could then be transported to the James Paton Memorial Hospital by ambulance.

Within 40 minutes of the crash, Austin Garrett arrived at the burning airplane wreckage site. As he arrived before daybreak and the helicopter he operated did not fly at night, the only light available to guide him to the crash site was the light from the burning plane (which was hindered by the smoke from the burning fuel) and flashlights used by the rescue workers who were on the ground trying to direct the helicopter. Between 04:09 hours when Garrett first had the helicopter airborne and 05:50 hours he made 18 round trip flights from the crash site to the Airport Terminal where the injured were transferred to ambulances. Each round trip was approximately 4 miles in distance and took between 4 and 11 minutes. By 05:50 hours all thirty-nine injured passengers and crew had been removed from the scene.

Mr. Garrett's efforts in the rescue operations not only greatly reduced the time required to evacuate the injured from the scene but also provided the delivery of essential medical supplies and equipment needed at the crash site. Mr. Garrett completed his mission during adverse and unusual circumstances. The lack of wind that night also complicated matters, as the smoke from the burning wreckage blanketed the crash site and drifted slowly toward the airport. As Mr. Garrett approached the scene, he had to fly over the smoke and occasionally

had to fly through it. Dr. Neil Harvey stated: "The most impressive thing I ever saw was Mr. Garrett angling and landing the helicopter, that would not even ruffle a sheet, pick up two casualties and an EMR and transport them to the Airport" (Personal Interview, September 30, 2020).

While Mr. Garrett provided transportation of the injured passengers to the airport terminal, another helicopter operated by volunteer Herb Johnson from Universal Helicopters assisted with the response efforts and provided a valuable service in searching for passengers who wandered from the crash site. Keeping a safe distance from the flight path Mr. Garrett was using, Johnson patrolled the perimeter of the crash area and upon spotting a survivor(s) he would relay this information back to the ground rescue workers. The challenging flying conditions that Mr. Garrett experienced were also a presenting hazard for Mr. Johnson.

Once all surviving passengers were transported to the James Paton Memorial Hospital for assessment and treatment, the medical team received assistance from several hospitals throughout the province, including the Central Newfoundland Hospital, Grand Falls; General Hospital, St. John's; St. Clare's Mercy Hospital, St. John's; and the US Naval Base Hospital, Argentia. Additionally, blood donations were received from the residents of Gander and essential medical supplies were provided by the Red Cross, St. John's; US Base, Argentia; and hospitals in St. John's and Toronto.

Of the 34 surviving passengers, 31 were critically injured. Passengers who required treatment for fractures were either treated at the James Paton Memorial Hospital or were transferred to an Orthopedic Surgeon at the General Hospital in St. John's. One of the passengers who required orthopedic surgery was a woman who had been in the bathroom (located in the tail section of the plane) at the time of the crash. This woman was initially rendered unconscious by the crash and sustained multiple fractures in both legs, remaining in the airplane lavatory until 09:00 hours when she remarkably got the door of the bathroom open and crawled out of the wreckage to reach out and touch an RCMP officer who was standing nearby. Dr. Harvey recalled

that the RCMP officer she approached at the crash site also required follow-up treatment at the hospital for shock after being surprised by the lavatory survivor in this manner, well after he thought all surviving passengers had been accounted for and transported to hospital (Dr. Neil Harvey, Personal Interview, September 30, 2020).

Twelve passengers required advanced medical care for extensive burns. These individuals were transferred later that afternoon to the Victoria General Hospital, Halifax, Nova Scotia. The burn unit at that hospital had a bacteriologist on staff to manage patient care, thereby reducing the risk of infection. Dr. Harvey recalled one passenger who was so severely burned that the only part of her body that was not burned was the area around her waist where she had her seatbelt on. This passenger was transferred to the burn unit in Halifax, along with two family members, however she later succumbed to her injuries.

On September 6, 1967, an additional eight surviving passengers were transferred from the James Paton Memorial Hospital to the Victoria General Hospital and seven were transferred to Montreal, Quebec for specialized medical treatment. Transportation to medical facilities located outside the province was provided by the Royal Canadian Airforce, US Navy, and Eastern Provincial Airlines (*The Evening Telegram*, 1967). Dr. Neil Harvey coordinated the medical transfers and he, along with a doctor from the US Military Base, Argentia, accompanied survivors to the Victoria General Hospital. Given the severity of many of the survivors' injuries some would have to spend several months recovering in hospital.

Another remarkable story was recounted by Frank Tibbo, a former Air Traffic Controller and Aviation Historian (*Gander Beacon*, September 13, 1967) who told the story of Ariel King, a member of the Czechoslovakian State Airlines Flight 523 crew responsible for accounting for the passengers and crew on the crashed airplane. While the flight manifest indicated 69 people were on the flight, rescuers could only account for 68 people after the crash. At approximately 11:00 hours, some six hours after the crash (and two hours after the lavatory survivor presented herself), Mr. King found the 69th person while searching through the

crash debris when a hand reached out and grabbed his arm. The missing passenger was another woman who had been at the rear of the aircraft — she had been protected from the fire and structural damage by the material that had fallen and had rendered her unconscious. The woman was not seriously injured and was released from hospital as soon as the medical staff had completed an examination.

After all the injured passengers were rescued, Mr. Garrett and Mr. Johnson continued to operate their helicopters as part of the response effort and assumed responsibility for transporting the bodies of the deceased passengers from the crash site to a temporary morgue set up at the Allied Aviation hangar located at the Airport, approximately one mile from the site. It was at this temporary morgue that doctors began the gruesome work of photographing and trying to identify the bodies. Many of the passengers were so severely burned that their identities were only confirmed after they were examined by medical officials in Prague. By 08:08 hours Mr. Garrett had completed 36 round trips to the scene. He ended his effort at 01:04 hours after completing a total of 45 round trips. While the bodies were being transported to the morgue and the Department of Transportation commenced with their investigation into the crash, the RCMP Superintendent from the Gander Detachment acquired support from detachments in St. John's, Glovertown, Botwood, and Grand Falls to help guard the crash site evidence.

DEM Learnings from the Czechoslovakian Airlines Crash

The Czechoslovakian Airlines crash occurred on airport property and within the Town of Gander. As a result, the response and recovery efforts were carried out with more formalized, community-based agencies than informal ground-based volunteer efforts, as occurred with the Dr. Banting and Sabena Airplane crashes. That said, the compassion, determination, and ingenuity of the responders in the Banting and Sabena crashes are also characteristic of the Czechoslovakian Airlines crash responders.

The timeline of the response and recovery efforts of the Czechoslovakian Airlines crash differed from the previously discussed crashes, being hours, not days. However, the horrific discoveries at the crash sites involving loss of life, seriously injured passengers, large-scale burning debris, and challenging conditions to conduct rescue and response efforts were similar. The physical terrain of the crash site presented harsh conditions for conducting response efforts. Still, Dr. Neil Harvey believed that many of the passengers survived the Czechoslovakian Airlines crash because the airplane crashed in a soft wet bog as opposed to a hard landing surface (Dr. Harvey, Personal Interview, September 30, 2020).

The story shared about the missing passenger highlights the importance of airlines maintaining accurate passenger and crew manifests that account for all individuals on each flight. If not for the levelheadedness and persistence of one of the Czechoslovakian Airlines crew survivors, the 69th passenger (who was trapped under wreckage debris) might not have been found alive. Following protocols to check the passenger and crew manifest list numbers during a disaster such as a plane crash is essential for the success of the response and recovery efforts.

The literature reviewed on the Czechoslovakian Airlines crash indicates that some survivors and responders experienced post-disaster psychological trauma such as nightmares, fear of flying, and shock of seeing such devastation. But, like the Sabena Airlines crash, there was no reference in the literature about survivors and responders receiving psychological support services following the disaster. According to Dr. Neil Harvey (Personal Interview, September 30, 2020), no psychological follow-up services (informal or formal) were provided to the survivors or medical staff following the crash. In fact, the medical team who responded to the crash returned to the hospital and went directly back to their duties once they left the crash site. Staff continued to work as scheduled. When Dr. Harvey returned to Gander on September 6, 1967, he immediately went home to change his clothes and remembers throwing away his shoes and new sports jacket as he could not get the smell of burning flesh and kerosene out of them (Dr. Neil Harvey,

Personal Interview, September 30, 2020). The importance of providing psychological services during and after a disaster or crisis event was not yet widely recognized. These services would be developed and included in emergency response plans after the Arrow Air crash in 1985 (Ellsworth, 2023).

Prior to the Czechoslovakian Airlines crash, the James Paton Memorial Hospital did not have a developed disaster response plan. In fact, they were in the process of organizing a mock disaster exercise to formalize and document their emergency response procedures when the Czechoslovakian Airlines crash occurred. According to Dr. Neil Harvey, it was the experiences of the coordinated response efforts at the crash site and of passenger care while in hospital that informed the development of the Hospital's first formal emergency response plan, specific to how an airplane crash at the Gander International Airport would be addressed. This plan highlighted protocols for the rapid response of staff, stockpiling of emergency medical supplies, and training requirements of emergency medical responders. This plan would serve as a basis for the development of best practices for the hospital's future response to disasters at the Gander International Airport as well as in the community, including large-scale motor vehicle accidents, the devastating impact of hurricanes, and other natural disasters.

Following the Czechoslovakian Airlines crash, the Airport, Canadian Forces Base, RCMP, James Paton Memorial Hospital, and Town of Gander began to formalize their disaster plans. These plans, which would have only been tested in simulation exercises, were activated on December 12, 1985, when an Arrow Airlines airplane crashed shortly after taking off from Gander International Airport. According to the Emergency Communications Research Unit Report (1987), "not only was Gander prepared with co-ordinated emergency plans, but it had also exercised them regularly. A major disaster simulation had been held on November 15, 1985, only 27 days before the crash" (p. 11).

The Banting, Sabena, and Czechoslovakian Airlines crashes all resulted in teams of investigators being brought into Gander from their airline's respective countries of origin to investigate and determine

the cause of each crash (*The Telegram*, 2017; Christi, 1995; Tibbo, 1993). Ensuring that Airport management and staff, response teams, and police and military officials are available to support and work cooperatively with national and international investigation teams is key to completing comprehensive investigations. The experiences and lessons learned from these crash events were significant during the recovery and investigation stages of the Arrow Air crash when international military chain of command and national security (US) became a factor in conducting the crash investigation (Findlay, 2022).

Arrow Air Flight 1285 Crash – 1985

Arrow Air Flight 1285 was a DC-8 jetliner chartered by the Multinational Force Observers to transport American soldiers from the 3rd Battalion, 502nd Infantry of the 101st Airborne Division, back to their home base of Fort Campbell, Kentucky. The soldiers were on a six-month multi-national peacekeeping mission in the Sinai Peninsula in the Middle East. Arrow Air Flight 1285 originated in Cairo, Egypt, with one stop in Cologne, West Germany, and landed at Gander International Airport for a scheduled refueling stopover on December 12, 1985 at 05:34 hours local time (Findlay, 2022).

At 06:45 hours, 51 seconds after taking off from runway 22, Arrow Air Flight 1285 suddenly faltered and fell from the sky. The plane's tail first struck trees, then rolled to the right, smashing its wings into more trees as it disintegrated piece by piece, bouncing down a small sloping incline towards the shore of Gander Lake. The cockpit broke away, and parts of the undercarriage landed to the far right of the wreckage. The tail section also separated from the body of the plane. The plane's 46,000 kilos of fuel ignited upon impact with the ground. Passengers not killed on impact died in the intense fire from the aircraft debris and burning terrain. The crash site spread across 350 meters and claimed the lives of all 256 people onboard (248 passengers, all soldiers, and eight crew). Locating the bodies of the passengers and crew was a difficult process. Access to the crash site was limited to a series

of narrow roads and paths at various points along the edges. Some had been ejected from the plane, and the remaining passengers still in the aircraft were thrown to the front of the cabin as it crashed (Emergency Communications Research Unit Report, 1987). On December 12, 1985, the shoreline of Gander Lake bore witness to the largest loss of life on Canadian soil and in Canadian aviation history. It was also ranked as one of the worse military air disasters in US history (US Army Quartermaster Foundation, 2011).

Overview of Agency-Specific Emergency Response Plans (1985)

The Gander International Airport and community emergency response agencies had coordinated emergency response plans in the past, so they were prepared for the crash of December 1985. The Gander International Airport's Control Tower plan included procedures for two potential disasters: on-site and off-site emergencies. When an emergency happens at the Airport, the Airport Control Tower uses a crash alarm that activates a series of automatic actions, much like a domino effect. The on-site crash alarm activates the Crash Fire Rescue Department's response. At the same time, the on-duty Control Tower Operator uses a hotline to call the airport detachment of the RCMP and the James Paton Memorial Hospital. The Airport Control Tower Operator is responsible for immediately contacting the RCMP. Eventually, the Operator transfers the continued responsibilities to the RCMP and the Airport Fire Chief.

When an emergency occurs off airport property, the on-duty Airport Control Tower Operator contacts the Crash Fire Rescue Department and the RCMP by telephone. As the emergency occurred off airport property, the Airport Control Tower's role is limited to controlling any vehicles on airport property. If the Crash Fire Rescue Department is required at the site, it would be dispatched from the airport property. Then, the Airport Control Tower must advise incoming flights that the status of the Airport has changed. If the Airport has no crash and fire rescue capabilities, incoming aircraft must assume all

risks to be accepted to land. Both emergency scenarios require the Airport Control Tower to complete follow-up contact with the Area Control Centre (ACC) (formally named Air Traffic Control Centre, now called Nav Canada, located off the Gander International Airport site), Canadian Forces Base (CFB) 9 Wing Gander, the Airport Control Tower manager, and the telephone company.

Upon notification of an airplane crash, each organization initiates a 'fan-out' system to follow organizational protocols and inform the necessary individuals/organizations. A fan-out is a system of notification whereby designated individuals call a list of individuals. This saves valuable time responders would lose if one individual had to call every single person in every agency. The ACC's emergency response plan is activated when they receive the Airport Control Tower's telephone call. At this point, the ACC assumes control of alerting the other agencies (RCMP, CFB Gander, Canadian Aviation Safety Board, Environment Canada, and Town of Gander officials). The ACC officer checks whether the appropriate calls were made per response protocols. ACC deals with any traffic and maintenance checks and is responsible for reliable and working navigational aids. The ACC plan also includes accessing maintenance vehicles with radio capability in case they are used as ambulances.

Once the RCMP is notified, their plan coordinates the overall on-site operations of all emergency response units. Therefore, the RCMP takes control of the response and the site. The RCMP works with the Airport Crash Fire Rescue Department Chief to coordinate the response of all agencies. The RCMP's response is sequenced. First, they cordon off the crash area and establish traffic control. Then they set up a restricted area and perimeter around the crash site. Next, they establish rescue, first aid, and casualty stations and ensure only essential and designated individuals are accessing the restricted zone. The RCMP then establishes the command post, arranges for a temporary morgue, if needed, and schedules an executive meeting to determine the objectives and responsibilities of the agencies involved in the response. The RCMP then begins the investigation. This includes

arrangements for placing and identifying any bodies in the temporary morgue. The final part of the RCMP plan is to prepare full reports, provide evidence, and carry out any other requests as directed by the Minister of Justice, Government of Canada.

The Crash Fire Rescue Department represents Transport Canada at the Gander International Airport. When a crash is off airport property, a decision to respond impacts the status of the airport. If the Crash Fire Rescue Department decides to attend an off-site crash, they must notify the Airport Control Tower. They will then advise incoming aircraft and proceed with the notification procedure as outlined in the Tower plan. The Crash Fire Rescue Department supervisor retains command until the Airport Fire Chief arrives. The fire chief sits as Transport Canada's representative and is an assistant to the RCMP-designated site commander. The Crash Fire Rescue Department Chief is also the communication liaison between the site and the Airport Control Tower and Emergency Coordination Centre (ECC). While the Crash Fire Rescue Department is responding, the duty manager or airport manager opens the ECC located at the Airport. Personnel from the RCMP, CFB Gander, and airport operations are notified of the activation of the ECC. Another site is secured for airport staff placed on standby. After the opening of the ECC, telephone calls are made to the James Paton Memorial Hospital, the Town of Gander Fire Department, and regional headquarters. If needed, tenants in cottages on airport property are also notified.

CFB 9 Wing Gander is located off airport property but within one kilometer of the airport. 'The base,' as it is locally called, also has its own emergency response plan. Once a call is received, the information is relayed to the Base Commander, whose approval is required to notify units on the base. The emergency response plan calls all personnel to report to their place of work. There, some are selected for a Base Defense Force. A Base Defense Force Commander and on-site commander are designated. The on-site commander controls all things military at the crash site and reports to the base's command post. In turn, the Base Commander reports to the ECC.

The James Paton Memorial Hospital emergency plan is activated when the senior person on duty is notified and advises the administrator. The senior person then notifies staff to report to the hospital. During this time, other designated personnel are securing the perimeter of the hospital to control traffic routes for emergency vehicles, set up their own command post, and prepare a triage unit to go to the crash site. The hospital reviews its patient list to identify which patients they can discharge to allow for accident victims. Ham radio operators are identified to provide communication links between the hospital and the crash site.

At the time of the Arrow Air Flight crash, Terra Nova Tel was the local telephone company. The telephone company's role was to assist the Gander International Airport in notifying town agencies, such as Town of Gander officials and the Town of Gander Fire Department, of an incident occurring. It is then up to these individual agencies to activate their plan. The Town of Gander's Fire Department phone, at the time of the crash, was staffed 24 hours per day at a local hotel. This phone line was linked to the home phones of all fire personnel. Once the hotel staff were notified of the emergency, the relevant staff member repeated the emergency message until that person could hear the firefighters hanging up their phones. If there was an airport emergency, the fire personnel went to the station first, then to the Airport, then to the scene. Any out-of-town emergencies were responded to first by fire personnel stationed at the Town of Gander's fire station.

The Arrow Air Flight 1285 crash was an off-site airport emergency. The account of what happened during the period from the initial call regarding this flight to the completion of the response and recovery efforts revealed the strengths and challenges of working within individual and integrated emergency response and recovery protocols. The initial response to the Arrow Air Flight 1285 crash involved the mobilization of several local emergency response community agencies and organizations, including the Gander International Airport, Airport Control Tower, RCMP, CFB 9 Wing Gander, James Paton Memorial Hospital, Terra Nova Tel, Town of Gander Fire Department,

and Area Control Centre. The ECC was activated at the Gander International Airport, and the integrated response and recovery efforts unfolded.

Response and Recovery Efforts

Upon realizing Arrow Air Flight Number 1285 had disappeared from the radar within a minute after take-off, the Air Traffic Controller on duty in the Airport Control Tower made the manual call to the Airport Crash Fire Rescue Department, the Airport detachment of the RCMP, the Air Traffic Area Control Centre, the CFB 9 Wing Gander, the local telephone company, and his manager. The Airport Control Tower operator did not know the exact location of the crash, as the crash did not occur on airport property. As this was occurring, two other planes were preparing to land at the Gander International Airport. The Airport Control Tower operator asked one of the pilots to circle the estimated area of the crash to identify its exact location.

Following the initial notification of the crash, the Airport Control Tower operator activated the response protocols to engage other resources. The operator notified the James Paton Memorial Hospital, Town of Gander officials, and the Town of Gander Fire Department. While the response was comprehensive and immediate, it was challenging. For example, the answering operator of the telephone company could not locate the protocol checklist when initially contacted. The operator contacted the telephone supervisor, who directed the operator to call the Town of Gander Fire Department. According to protocol, however, the telephone company operator should have called the Town of Gander Fire Department's Fire Chief directly. Fortunately, this did not delay the response, as the Fire Department was already en route to the crash site by the time the operator contacted them. Organizations were mobilized, with each following their emergency response protocols (Emergency Communications Research Unit Report, 1987).

As per the Gander International Airport's Disaster plan, the ECC was activated and was initially staffed by the Airport Manager,

representatives from Transport Canada, the RCMP Superintendent, and a meeting of RCMP, Airport Representatives, and CFB 9 Wing Gander's Base Commander. Additional agency representatives (James Paton Memorial Hospital, Terra Nova Tel, Town of Gander) provided updates. The crash site command structure included the Airport Fire Rescue Department Fire Chief as the person in charge, working closely with the RCMP Inspector. As the crash site incident commander, the Airport Fire Chief was responsible for containing the wreckage fires and searching for survivors. Upon arrival at the crash site, the Airport Fire Chief directed the Town of Gander's Fire Department Chief and crew to set up three search parties. They were to check for potential survivors up the inclined slope where the plane first hit trees, away from the main fire (Figure 5). The Town of Gander's Fire Department determined there were no survivors and brought the main crash site fire under control. The Airport Fire Chief and his crew continued to extinguish smaller flare-up fires for another three hours and flashback fires for several more hours.

Figure 5. Crash Site (Courtesy of Kent Penton, Gander Airport Historical Society).

Upon determining that the wreckage fires were under control and that there were no crash survivors, the Airport Fire Chief transferred over command and control of the crash site to the RCMP Inspector. With the fires under control, they tried to deal with the oil spill at the wreckage site. The containment of the oil spill was a major concern as it could put the Town's water supply (Gander Lake) at risk. Measures had been taken to address the spill, including the arrival of an Atlantic Petroleum Agency truck with equipment and employees to deal with the issue. However, the Deputy Mayor did not know about this decision, only learning about the potential risk to the Town's drinking water when the RCMP mentioned it at a press conference held with the ECC (see Managing Unanticipated Equipment and Water Supply Concerns below).

One of the most challenging tasks associated with the recovery efforts of a plane crash with no survivors is the identification of human remains. This responsibility rested with the RCMP in the case of the Arrow Air disaster. Onsite RCMP developed a grid to mark the placement of the human remains and wreckage, and to identify the bodies. Soldiers from CFB 9 Wing Gander, Transport Canada, and Gander International Airport employees supported the RCMP in carrying out this time-consuming and gruesome work. They removed the bodies from the crash site and transported them to a temporary morgue at Hangar 21, next to Gander International Airport.

Finton St. Croix, a heavy equipment operator employed with Transport Canada, was one of the employees who visited the crash site and transported the bodies to the morgue. He recalls carrying out his responsibilities as very emotional and challenging. The magnitude of the crash site, volume of bodies, and the gruesome conditions that everyone worked under for a 10–12-hour shift left individuals feeling mentally and physically exhausted. The smell of burning wreckage and bodies, and the inhalation of smoke from the fire undoubtedly took a toll on many responders. Responders only had face masks. No other personal protective equipment (PPE) was available. The workers put aftershave on their face masks to try and reduce the horrific smells

from the site and continued the same practice when they arrived at the temporary morgue to transfer bodies for identification. Once at the morgue, the Medical Director from James Paton Memorial Hospital and representatives from the US military were then responsible for determining each passenger's identity (Finton St. Croix, Personal Interview, October 22, 2020).

After receiving notification of the airplane crash, the James Paton Memorial Hospital activated its emergency response plan. The Hospital recalled medical staff including physicians, surgeons, nurses, and anesthesiologists, and prepared for survivors and casualties. Simultaneously, two doctors, a nurse, and ambulances were dispatched to the crash site. When they arrived at the checkpoint on the Trans-Canada Highway (where the Highway intersected the road to access the crash site), officials informed them they could not access the site. The road was narrow and slippery, and conditions were icy. With the ambulances parked along the side of the Trans-Canada Highway, the hospital response team awaited further instruction from the RCMP. Within one hour of the crash, the RCMP notified the medical response team that there were no survivors. Upon hearing this devastating news, the team returned to James Paton Memorial Hospital.

While the initial response team dispatched from James Paton Memorial Hospital had no First Responder's role at the crash site as there were no survivors, the second team of doctors, laboratory technicians, and pathologists played a critical role in the recovery process at the site. They tagged bodies and body parts and prepared them for transport to the temporary morgue. At the temporary morgue, this medical team worked cooperatively with the US military morticians and the RCMP to identify and photograph the bodies and body parts. This work was arduous both at the crash site and the temporary morgue. The weather was cold and damp, and the terrain was wet and slick with fuel. Human remains were often scattered or hidden under brush. The temporary morgue was an unheated airport hangar with a concrete floor.

Within three to four hours of the crash, Canadian Aviation Safety Board (CASB) officials from Moncton, New Brunswick and Ottawa,

Ontario arrived on the scene. The purpose of the CASB's visit to Runway 22 and the aircraft crash was to conduct an independent investigation into the cause or contributing factors of the crash, make recommendations on eliminating or reducing deficiencies, and make public the investigation's findings. In conducting their investigation, the CASB received support from the RCMP and CFB 9 Wing Gander. A US military team also conducted their required crash investigation, including morticians, forensic experts, and the Federal Bureau of Investigation. The investigators had to find their evidence within 48 hours after the crash due to a forecasted winter snowstorm (Emergency Communications Research Unit Report, 1987).

Challenges to Response and Recovery Efforts

The responders that visited the crash site, temporary morgue, and ECC worked tirelessly, professionally, and collaboratively. More than 65 individuals visited the crash site during the first 48 hours. Problems were encountered, which is not surprising given the magnitude of the crash and the number of agencies involved in the response and recovery efforts. However, the efforts to address them speak to the innovativeness of these dedicated individuals.

The ECC was established to provide a central location for key senior commanders — the Gander Airport Manager, the RCMP Superintendent, and the Base Commander, 9 Wing Gander. The ECC received all information and made decisions based on prior planning and protocols. However, there were instances when challenges were not anticipated in prior simulation exercises. Those required designating tasks on the spot, such as dealing with the densely wooded terrain common in central Newfoundland, managing the media that descended upon Gander once the news of the crash became known, and ensuring all support equipment was available and in working order. Despite the challenges presented, the acquired experience of Gander's emergency response agencies ensured solutions to any unexpected issues.

Securing the Crash Site

In any disaster, it is important to secure the area surrounding the accident scene. This means setting up a perimeter and only allowing authorized personnel to access the accident site. The experienced RCMP and soldiers from CFB 9 Wing Gander knew that such an event inevitably brings high-level investigations. All potential evidence from the site — for example, the way a tree was hit, the path of the fire burn (the direction of any fire created by the crash, the intensity of the fire, the origin of the fire), the scatter pattern of debris, the location of victims — needed to be protected to ensure a full and valid investigation. The RCMP was responsible for maintaining records of all aspects of the response, including protecting any potential evidence, recording who did what and when, what equipment was used, and any issues and challenges. The RCMP would be ultimately accountable for how the response and recovery efforts were managed.

Access to the crash site was hampered by the condition of the terrain. Central Newfoundland is known for its forests and thick brush. The land area surrounding the Gander International Airport is no exception. A narrow access road did not provide easy access for cars or small trucks. The icy slope descending to the crash site further hindered some emergency response vehicles' access to the site but a local company with suitable equipment was employed to salt the road. CFB 9 Wing Gander also provided vehicles that could access the rough terrain.

Upon arriving at the crash site, the RCMP and soldiers from CFB 9 Wing Gander determined that securing the site perimeter was paramount to ensure that the crash site was not contaminated by unauthorized people walking around, physically handling items, unintentionally moving physical terrain, taking unauthorized photos, or otherwise interfering with the recovery efforts. Public safety was also a major concern. The US Military contracted the Arrow Air Flight, so military weapons, shell casings, and ammunition were scattered about the crash site. Given the importance of securing the crash site, the

RCMP tasked soldiers from CFB 9 Wing Gander to establish a perimeter, including the roads leading to the crash site and the pump house. The Base Defense Force Commander approved this tasking. The perimeter area required the presence of over 50 soldiers. Those guarding the perimeter area of the crash site were not permitted to leave, so a bus was brought in to allow soldiers to take turns warming up after standing for hours in the cold and miserable weather (Emergency Communications Research Unit Report, 1987).

Managing Telecommunications and the Media

Managing communications between agencies also presented its challenges, as it became difficult to locate key individuals. In addition, communication equipment that had been identified in a prior simulation exercise of an airport disaster was not viable for this incident. In 1985 there were no cell phones or public internet. Also, the service range of the two-way radios used by Airport Crash Fire Rescue did not extend to the crash site, which was some 3,500 feet from the end of the runway. This was quickly resolved by the ECC accessing radio communication equipment from the RCMP and CFB 9 Wing Gander, who were already on site. Ham radio operators were available, but this was not an initially preferred option due to security concerns. Eventually, the ham radio operators were approved by coordinating military personnel and were used as an additional reliable source of communication.

Within moments after the crash, a local radio station received a news tip that a plane had crashed in Gander. 48 hours later, the news had reached national and international news agencies. Some 300 media outlets from around the world descended upon Gander. A protocol for media relations had not yet been established, so the Airport Manager gave the local media (who were there before any other media outlets) access to the crash site before it was completely secured and searched. The RCMP site commander immediately reversed this decision, and the local media were denied access to the crash site. Nevertheless, they were permitted to take pictures from the access road close enough to

see the crash scene. If any unauthorized individual had access to the site before the completion of the investigation, it could have negatively affected the investigation's integrity. It was important to the RCMP to ensure the crash site was intact as they gathered information and evidence. In time, arrangements were made by CASB, RCMP, and Transport Canada to take media personnel to the site.

Despite the steps taken, news media tried to access the disaster crash site to take pictures and interview first responders. News crews also staked out at the James Paton Memorial Hospital to take pictures of the bodies should they be transported to the hospital morgue from the crash site. One media reporter was seen taking pictures of the hospital morgue and was later caught looking inside the morgue and trying to pry open the window. A US camera crew gained access to the roof of a temporary morgue and took blurred photos of rows of bodies (Emergency Communications Research Unit, 1987).

It was important to control the information provided to the media. Initially, many of the victims' families had not been officially notified by military personnel of the crash. Concern was high that families would learn of the tragedy through a special news bulletin rather than with the dignity and respect they deserved. The early presence and persistence of the media to distribute information about the Arrow Air crash gave rise to legitimate and immediate concerns that information would find its way to the victims' families without respect or accuracy. ECC had not yet established how official notifications would occur. The passengers were military personnel, and strict protocols were in place to notify family members of the loss of a serving member of the US military. However, Gander, Newfoundland, and Fort Campbell, Kentucky, are some distance apart. The ECC needed time to communicate with the appropriate US Military chain of command and for US Military representatives to arrive in Gander. When Canadian Border Service Agency (CBSA) officials arrived in Gander on the afternoon of the crash, they took over communications with the media. The CBSA and the RCMP managed when and how media personnel would be granted access to the crash site.

Managing Unanticipated Equipment Requirements and Water Supply Concerns

CFB 9 Wing Gander became the primary source for necessary items for accessing the crash site, securing the site, and allowing personnel to monitor the site overnight and in inclement weather. The terrain, the weather, and the square footage of the crash site required specialized machinery and equipment. The RCMP or Transport Canada did not usually have such items within easy access. They needed appropriate vehicles, cold weather clothing, lanterns, tents, generators, and night lighting to preserve the crash site as the recovery mission continued and the investigation began. Prior simulation training exercises or agency-specific plans did not consider the ease of acquisition of such equipment.

The ECC quickly identified the availability of these items through CFB 9 Wing Gander. The CFB 9 Wing Gander response plan and the efficiency of its military precision was a vital contribution to the overall management of the community response. However, before the Arrow Air crash, CFB 9 Wing Gander's ability to provide logistics, equipment, security, and liaison support with another military command structure, such as the US military, was not identified as a key resource-based emergency response (Emergency Communications Research Unit Report, 1987).

During the response and recovery efforts, the Town of Gander became aware of a potential concern of jet fuel leaking into Gander Lake. Although the ECC had not informed officials with the Town, they apparently had everything under control. As the Mayor was out of town on business, the Deputy Mayor was satisfied with the ECC response that she received to her questions and there was no negative impact to the water supply. However, not having a key stakeholder such as the Town of Gander participate in the ECC was a serious omission. This resulted in important information not being communicated and acted upon, as required. Subsequently, the Deputy Mayor participated in the ECC and acted as a link to the Town Hall. She

assisted in locating a surveyor and offered information that determined the location of a temporary morgue (Emergency Communications Research Unit Report, 1987).

The Town of Gander sent its Public Works employees to the crash site to assist the Atlantic Petroleum Agency and the Canadian Coast Guard in cleaning up the spill. They isolated and contained quantities of fuel to prevent it from reaching the shoreline and the Town's water supply. Public Works employees also visited the Gander Lake pump house to continuously monitor the Town's water intake for any signs of fuel or other contamination. These employees confirmed that there was no breach of the water supply system. The Town Engineer and the Public Health Inspector from the Department of Health also visited the pump house to monitor the situation. They did not report any concerns. Therefore, they did not deem it necessary to notify community residents. Two weeks after the crash, the Public Health Inspector visited the crash site and conducted a bacteriological analysis of the water supply. The results were negative for any toxins due to the crash (Emergency Communications Research Unit Report, 1987).

Essential Recovery Support Shortages

On the second night after the crash, the team (RCMP, CFB 9 Wing Gander soldiers, and medical professionals from James Paton Memorial Hospital) worked through the night. They wanted to account for all human remains before the forecasted snowstorm hit Gander early the next morning. The arduous work of locating, photographing, and tagging bodies and body parts required adequate lighting. A generator and a 1,000-watt tower light had to be obtained and erected at the crash site. With the support of the Town of Gander Public Works employees and Canadian and US soldiers, the required equipment was purchased and placed where needed.

Due to a miscommunication between Transport Canada and the RCMP in ordering body bags, there was a shortage available at the crash site. This shortage was resolved by securing additional body bags

supplied by CFB 9 Wing Gander, and by removing the inner liner of a body bag which could be used as a temporary body bag. The recovery team could then use the bags a second time (this practice continued until body bags arrived from St. John's). In addition, there were not enough white shroud sheets to use as both coverings and to lay bodies on; thus, the white shroud sheets were used as coverings for the bodies in the morgue, while plastic sheets were used as ground sheets to lay the bodies on the hangar floor. Given the outside temperature and poorly insulated hangar, the bodies could remain frozen, and thus did not require refrigeration equipment. This proved beneficial for the preservation of remains until repatriation to the United States. However, this also meant that the medical staff and employees handling the bodies during the transportation and identification processes were working in very cold conditions (Emergency Communications Research Unit Report, 1987).

Supporting First Responders, Security Officials, and Investigators

First responders, security officials, investigators, and other workers at the crash site received food during the five-day recovery period. The exact number of these essential workers is not known; however, according to the Emergency Communications Research Unit Report (1987), more than 65 individuals gained access to the crash site, including first responders, Town of Gander employees, Canadian Coast Guard members, US and Canadian soldiers, and an explosive disposal unit.

The Airport's ECC also ensured adequate food, transportation, and accommodations for personnel conducting various tasks at and around the crash site during the implementation of the response plan. The ECC contacted Mr. Des Dillon, Assistant Regional Director with the Department of Social Services, whose mandate included the provision of emergency social services during a disaster. Mr. Dillon assembled a team of departmental employees and volunteers from the community who delivered lunch and supper meals to emergency personnel as well as snacks and hot beverages for breaks.

Initially, they delivered 'fast food' to the crash site as an expedient and accessible option. While the food delivery was very much appreciated, upon reflection, this practice may not have been the best decision. First, the smell of cooked food and the crash site odors did not mix well, with responders associating the smells of cooked meat with the smells of charred bodies. Second, the Medical Officer of Health, Department of Health, raised concern about the food chain timeline and requested that no further hot food deliveries be made to the site. Mr. Dillon followed up with the local Salvation Army emergency response team lead to resolve the issue. Together, they coordinated the requirement to provide a hot meal service near the crash site. Local hotels provided soup, the Salvation Army provided sandwiches, and volunteers picked up and delivered tea, coffee, and donuts/muffins from local restaurants to the crash site. Deliveries were also made to the soldiers positioned along the Trans-Canada Highway, as they were not permitted to leave the perimeter area they were guarding. Since this response, the Municipal Plan includes the Salvation Army as taking the lead role in the provision of healthy and nutritious meals and snacks during emergency and disaster events. This need was evidenced during the September 11, 2001 (9/11) response when over 6,500 passengers and crew arrived at the Gander International Airport (Des Dillon, Personal Interview, August 2, 2020).

Psychological Impact on Responders

The psychological impact of working for extended periods in cold and damp conditions, fear of inhaling hazardous materials and toxic fumes, dealing with the smell of death and destruction, working where there was known military ordnance, and carrying out body recovery identification had to take a significant toll on the individuals working at the crash site. We do not directly address the physical or mental health outcomes of individuals who worked at the Arrow Air crash; however, it is important to note that individuals may present varying degrees of issues related to post-traumatic stress, depression, anxiety, insomnia,

and respiratory problems — no matter how well-trained they are or whether (or not) they had medical follow-up after such a devastating disaster. According to Finton St. Croix (Personal Interview, October 22, 2020), there was no follow-up (check-in by administration, medical or psychological) with Transport Canada employees upon completing their shifts at the crash site.

However, after the investigation into the crash was completed, the conditions individuals encountered at the crash site were highlighted. For example, a nurse followed up with first responders and employees who worked at the crash and requested that they complete blood work. The test results were then provided to their personal physicians or family doctors. Responders were also encouraged to follow up with their physician or family doctor and/or seek psychological services should they be concerned about their physical or mental health (Emergency Communications Research Unit Report, 1987).

DEM Learnings from the Arrow Air Crash Response and Recovery Efforts

In addition to the developed DEM plans that each of the key responding agencies had in place in 1985, there was another important factor that supported the response and recovery effort: previous experience in responding to disaster crash events. According to the Emergency Communications Research Unit Report (1987), "a number of people still living in the community had been involved in the earlier incidents — the Belgian (Sabena) and Czechoslovakian air crashes. The town fire chief, for example, had been on one of the first airport fire vehicles to respond to the Czechoslovakian crash" (p. 11). Some Airport Fire Department staff also responded to the Czechoslovakian crash and brought the experience of that response to the Arrow Air crash site (Collins, 2010).

The 65-plus individuals who performed response and recovery at the Arrow Air crash site did a remarkable job under extraordinarily difficult and harsh conditions. The Town of Gander and Airport Fire

Departments, Canadian and US soldiers, service providers, medical personnel, investigators, Transport Canada employees, Town of Gander employees, volunteers providing meals, and ECC members diligently worked together for extended hours for five days. The experiences of previous crashes along with conducted exercises amongst the Airport, Town of Gander, and its noted community partners and stakeholders provided opportunities for responding agencies to have a developed mutual understanding and respect for all chains of command, investigation protocols, media involvement, and each other's roles and responsibilities. That said, there were still additional lessons to be learned. One lesson was the non-inclusion of a representative from the Town of Gander at the Airport's ECC. Recognizing this as a mistake, the ECC Incident Commander invited the Deputy Mayor to participate in ECC meetings. Since that crash event, a representative from the Town of Gander has been invited to participate in the activated Airport ECC, along with other community partner agencies. This inclusion has been evidenced through the mock disasters that are required to be held every two years, and tabletop every other year, as per Transport Canada requirements (Higgins, 2017), and during the 9/11 response in Gander (Scanlon, 2003).

The mock disaster exercises held at the Gander International Airport have provided opportunities not only for the Airport to test components of its DEM plan but have also supported its partner agencies to test their respective emergency plans. One example of an exercise that was held at the Airport that highlights the extent of community agency participation took place on September 29, 2017 when 13 agencies, including the Gander International Airport Authority, Air Canada, Allied Aviation, the Royal Canadian Mounted Police, Gander Flight Training, Gander Fire Rescue, the Town of Gander, Nav Canada, the James Paton Memorial Regional Health Centre, the Canadian Red Cross, the Department of National Defence, the Canadian Border Services Agency, and Fire and Emergency Services, participated in "Operation Smokey." According to Brian Hicks, participating in large-scale exercises enables agencies to examine what

was done well and to identify areas for improvement. Furthermore, he states that "it will be the participation and learnings taken from such exercises that will build confidence in those who will need to respond if something occurs some day" (Higgins, 2015, p. 2).

The Arrow Air crash also highlighted the importance of having appropriate safety measures in place to ensure Airport employees' physical health and well-being. Current regulations in Federal Government Occupational Health and Safety focus on hazard risk exposure and reduction. Employees who respond to potentially hazardous sites such as airplane crash sites are now required to have appropriate masks and protective clothing available to them (Government of Canada, 2023). Additionally, the Safety Management System (SMS) program, which is overseen by Transport Canada, is also in place and focuses on auditable and measurable safety processes that identify hazards to ensure a proactive approach to preventing incidents (Gander International Airport Authority, 2015).

Learnings from response and recovery efforts from the Arrow Air crash as well as previously noted crashes and subsequent simulation exercises have also contributed to the Health Emergency Management plan at the James Paton Memorial Hospital. According to Doug Ellsworth, Regional Director for the Paramedicine and Medical Transport Program, Central Health (retired), the Hospital Emergency Management Plan that was in place prior to the Arrow Air crash listed call-back protocols, physician and nurse triage at site, medical transport, and bed reallocation (Personal Interview, June 16, 2023). It was only after the Arrow Air crash that a more integrated Emergency Management plan was developed, which included: a greater focus on establishing EOC protocols and training for participants; having a list of interpreters maintained at the emergency department to assist with patient care for airplane passengers (and other individuals) whose flight got medically redirected to the Gander International Airport; public health regulations; the Regional Health Authority's coordination and resource sharing; and collaboration with the Department of Health and Community Services to access a 200-bed emergency

hospital. Furthermore, the Hospital plan over the past 10 years included a shift in practice from a physician and nursing model responding to triage at an emergency or disaster site to one where paramedics in their role as first responders can support nursing staff at a site. This practice was tested during a mock exercise held at the Gander International Airport on October 3, 2015. According to Sherry Freake, Chief Operating Officer for the James Paton Memorial Regional Hospital, hospital participation in the exercise provided an opportunity for paramedics to use their advanced skills as first responders to triage survivors at disaster sites, which in the past was the responsibility of nurses (Mock Disaster in Gander, 2015).

The learnings from the Arrow Air crash response and recovery efforts resulted in local and regional health care systems and government departments recognizing the importance and benefits of including Psychological First-Aid services in organization/agency DEM plans. Today, the James Paton Memorial Regional Health Centre and other hospitals throughout the Central Regional Health Authority have a well-developed, implemented, and exercised plan that includes Psychological First-Aid services. Psychosocial services and support are also available to survivors, families impacted by the event, responders, volunteers, and the community. Information on accessing these services is promoted throughout the Central Regional Health Authority's service provision area. The Central Regional Health Authority's employees often take the lead in delivering Psychological First-Aid services. However, other agencies such as the Canadian Red Cross, social workers from the provincial government departments, CFB 9 Wing Gander, and psychologists and social workers in private practice collaborate with these employees so that all individuals who require services have access to them.

In addition to recognizing the importance of developing local and regional Psychological First Aid, Bober et al. (2007) state that while grieving families and colleagues of the soldiers and crew who lost their lives were provided supportive services and counselling following the Arrow Air crash, reports began to emerge about the profound effect that

the crash had on recovery personnel. It was these reports from the Gander crash disaster as well as the impacts of the disaster recovery efforts pertaining to the June 1985 Air India crash into the Atlantic Ocean near Cork, Ireland that led to increased awareness amongst stakeholders that the needs of everyone involved with response and recovery efforts need to be addressed. Subsequently, legislative requirements pertaining to improvements in regulations and measures that carried higher expectations of airports and airline carriers across the country were put in place. One example is the establishment of multi-agency critical incident stress teams to assist emergency responders following a crash event. Over the years this service has developed from a single session debriefing model to a more inclusive model that supports resilience, providing services to individuals, family, and airport personnel (Bober et al., 2007).

The learnings from the Arrow Air crash also included the enhancement of DEM plans for the Gander International Airport, Town of Gander, and key emergency response agencies and community partners. Sharing agency-specific DEM plans, which included media response and coordination practices with these groups, promoted better response and recovery practices. By collaboratively working to prepare joint plans and participating in multi-agency disaster preparedness exercises, responding agencies will increase partnerships and local capacity which will "create communities that are likely to withstand any disaster they may happen to face" (Hoard, 2005, p. 122). The development of partnerships through the sharing of DEM plans, the inclusion of responding agencies in activated EOCs and ECCs, and the participation of multi-agencies in simulation exercises (Canadian Red Cross, Airport, Hospital, RCMP, Canadian Forces, Media Personnel) and other in-service training events contributed to the efficient and effective management of the largest emergency in NL's history — the arrival of 37 aircraft (with over 6,500 passengers and crew) in Gander on September 11, 2001.

A final lesson learned involves all the airlines associated with the Banting, Sabena, Czechoslovakian, and Arrow Air crashes operating outside of this province/country and how the impacted airlines, the

Gander International Airport, Transport Canada, and by extension the Town of Gander have demonstrated a willingness to cooperate during the response and recovery efforts. The international cooperation during the reporting of the crashes, extensive investigation phases, memorial services, and repatriation of the bodies to their homelands reaffirm the importance and benefits of working collaboratively. This level of cooperation is particularly important to crash survivors, family members who lost loved ones, as well as investigation outcomes for improved industry standards.

Conclusion

The Newfoundland Airport, constructed in 1938–39 and later renamed Gander Airport and Gander International Airport, has a unique history in the evolution of the global aviation industry. The Airport, along with the people of Gander, have had the distinctive experience of providing international flight service requirements during incidents such as the Banting airplane crash, Sabena Airlines crash, Czechoslovakian State Airlines crash, and the Arrow Air crash. The experiences garnered from these events have demonstrated heroism, ingenuity, and good will among responders. These events have also provided accumulative learnings which supported a heightened level of preparedness and more effective and efficient large-scale emergency and disaster response and recovery capabilities. According to Scanlon (2003), it was the developed partnerships, handling of tasks by the multi-agency activated EOCs and ECCs, along with an understanding of each agency's roles and responsibilities (that came from accumulative learnings from prior large-scale emergency responses) that contributed to the effective response in Gander during the 9/11 event.

Moreover, it was the DEM elements of having a shared vision, skilled leadership, collaborative partnerships, community participation, service coordination, and resourcefulness, developed and maintained when relationships and interorganizational partnerships are promoted and supported, that also contributed to the people of Gander's ability

to coordinate and integrate activities necessary to build, sustain, and improve the capability to prepare for, protect against, respond to, recover from, or mitigate against acts of terrorism and natural disasters. In order for the Gander International Airport and the Town of Gander to maintain the success it has experienced in responding to and recovering from large-scale emergency and disaster events, they must continue to: foster partnerships through education and training opportunities; develop integrated DEM plans; and advocate for maintaining human and financial resources associated with sustaining operational DEM capabilities. These practices and learning from past events will help maintain a disaster-resilient community.

The information garnered for this article includes several elements which helped the Gander International Airport and the people of Gander to respond effectively to the disasters discussed (Mullaly-Moulton, 2023). These events served as the basis for the development of comprehensive DEM plans for the Gander International Airport and its partner organizations, including the Town of Gander, the Canadian Forces Base 9 Wing Gander, RCMP, Central Health, and the Canadian Red Cross. It also provided the foundation for integrated DEM preparation which ensured partner agency employees and community volunteers participated in education sessions, training events, and simulation exercises.

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