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Defending the Diefenbunker's Murals: Conservation and Protection of Two Murals Displayed Three Stories Underground

THE HISTORIC SITE AND MUSEUM

In August 1958, at one of the highest tension points during the Cold War, Canadian Prime Minister John Diefenbaker announced his government's proposed construction of contingency bunkers across the country as part of a continuity of government program. This ensured that governments from a municipal to a federal level would be able to, theoretically, run the country in the event of a significantly destructive event in Canada, such as a coordinated nuclear attack. The term *Diefenbunker* was actually a political jab that was made by the opposition parties to refer to the structures, but the name was quickly picked up by the media at the time and has stuck ever since.

The official term for the site is the *Central Emergency Government Headquarters*, as it was meant to be the hub of all nationwide emergency bunker sites. It was constructed between 1959 and 1961 and was completed on time and on budget using the "Critical Path Method" in its engineering: each floor was planned while the foundations below them were already being built.

Workers labored around the clock to construct the 100,000 sq. ft. structure, all of which was made with hand-poured concrete (fig. 1). Once buried, the structure was 75 ft. underground from top to bottom and could withstand the blast of a 5 megaton (mt) nuclear bomb at a distance of 1.8 km (1.1 mi.). To put that into perspective, it is the explosive equivalent of five million metric tons of dynamite and is 250 times more powerful than the bombs that were dropped on Hiroshima and Nagasaki in 1945.

On the surface, the Diefenbunker was an active military facility for 32 years, from 1962 until it was decommissioned in 1994. For that period, there was a staff of 100 to 150 soldiers stationed on a rotational basis for mainly communications purposes (fig. 2). At its height in the 1980s, this site would process up to 100,000 messages per month, each one having



Fig. 1. Construction of the bunker, ca. 1960–1961. Courtesy of Diefenbunker: Canada's Cold War Museum.

to go through the lengthy process of decryption and encryption before entering and leaving the site.

Civilian personnel from Emergency Preparedness Canada would also participate in annual drills on-site in mock lock-down situations. Their role would be to assess the damage and needs of civil infrastructure and civilian population after a nuclear attack in Canada (fig. 3). The bunker was equipped to receive information from Emergency Preparedness Canada sites across the country to track fallout patterns and provide briefs to the government.

Underneath these routine operations, there was the true purpose of the site that was meant to be a secret. This true purpose was essentially an open secret before construction was completed. In 1961, toward the end of the Diefenbunker's construction, an intrepid reporter from the Toronto *Telegram* took aerial photographs of the site. The true scope of the project was revealed by one crucial detail in the photographs: 78 bathroom stalls were set up on the site for construction workers. The headline to this reporter's story was "Seventy-eight bathrooms—and the army still

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Fig. 2. Teletype operators at work in Canadian Forces Station Carp, ca. 1980. This is a staged photograph from inside the Bunker of military teletype operators who would write and relay messages through the Bunker to various military bases across the country. Courtesy of Diefenbunker: Canada's Cold War Museum.

won't admit that...This is the Diefenbunker." Even then, public speculations ran wild from joke suggestions that the site was where the government would bury tax dollars to the outlandish claim that the site would hoard the country's stockpile of bananas, to be sold at an exorbitant price once the country returned to normal.

Although many news stories and claims were published, the true purpose of the site was later revealed. At the first threat of a nuclear attack, the goal was to have 500 to 600 military and civilian personnel rushed to the bunker to direct the country's emergency procedures for the next 30 days. Each person was personally selected and was sworn to secrecy, never to reveal

their work to anyone. Of these, 10 to 12 government ministers would be in the bunker ideally, but in an emergency situation, only five people were needed to make up a complete government. In the War Cabinet Room on the bunker's second floor underground, the emergency government would meet to discuss and take actions based on information from Emergency Preparedness Canada and the military. This is where the country would be run. At the same time, relevant government departments and ministries would have had offices on this floor to run their mandates during a domestic conflict.

During a lockdown, the facility was equipped with all of the amenities required to stay underground for 30 days. Air



Fig. 3. Simulated exercise in the Emergency Government Situation Centre, ca. 1986. Courtesy of Diefenbunker: Canada's Cold War Museum.

was filtered into the bunker through a five-stage system that removed radioactive air particles while water was pumped from two deep wells. The country could be notified of ongoing public service information from a Canadian Broadcasting Corporation studio that broadcast from the site nationwide. For eating, the site had a sizable cafeteria that contained a regular supply of fresh food that would last for 10 days before switching to packaged rations. Soldiers and civilians could exercise at a fitness room in the hallway to the former Bank of Canada vault.

For sleeping, bunk beds were provided for other ranks and civilians on a rotational basis, whereas officers and directors were given private quarters. Only the prime minister and the governor general were given a private suite, attached to their offices and containing a bathroom with its own shower. One of the most telling features of these two suites are two single beds, highlighting the order that only chosen individuals came underground and not their families, whose fate would be unknown.

These dual purposes, one surface and one secret, dictated life in the bunker from 1962 to 1994. After the dissolution of the Soviet Union in 1991 and the presumed end of the Cold War, Canada began to decommission its line of emergency government buildings. Some of the bunkers were sealed off

with concrete or otherwise destroyed to prevent others from using them for their own purposes, some were sold in private auctions, and some are still located on existing military bases. The site closed in June 1994, in the same year it was designated a National Historic Site by the federal government. Over the course of three years, a group of dedicated volunteers were permitted to do fundraising tours of the site, which generated local interest. By 1998, the museum was founded and continues to give tours of the structure. The museum's mandate is "to increase throughout Canada and the world, interest in and a critical understanding of the Cold War, by preserving the Diefenbunker as a national historic site, and operating a Cold War museum." Through this, the museum intends to use the period as a lesson in de-escalation, diplomacy, and peace building. Prior to the COVID-19 pandemic, the museum received its highest visitor numbers at 80,000 in 2019. Although it has been a difficult period for the museum, the lessons taught to the public have been a learning experience in trusting resiliency and calm for moving forward in a time of crisis (fig. 4).

The stresses of underground confinement coupled with the stress of a conflict above ground and uncertainty



Fig. 4. Tour being given to the public, 2003. Courtesy of Diefenbunker: Canada's Cold War Museum.

over family and friends could be overwhelming. When the bunker was being constructed, planners partnered with psychologists to design the spaces people would be working in continuously. Because of its confinement, psychologists were inspired by submarine psychology and the extended periods underwater. Striped columns and floors were used, which were intended to trick the mind into thinking the space was wider than it actually was. Desks and chairs were fabricated in cheerful colors like bright orange, yellow, and blue. And finally, starting in the early 1980s, these “windows” were placed in the recreational areas of the bunker to simulate life above ground. Wide open scenes of nature were intended to stave off the monotony of the work and the confinement of space.

Although no evidence has yet been found, it is speculated that at one point there were four seasons on display, judging by the scenes currently known: spring or summer at the Bow River Valley in Alberta and waterfall at Yosemite, and another documented but now removed autumn scene of a wooden mill on a river.

The Bow River scene is found in the cafeteria, and the Yosemite waterfall is found in the Spy HQ Youth Room, which was once the senior officer's exercise area (figs. 5, 6). Over the years, they were exposed to functions and education programs, as well as the outside elements seeping in through the concrete. In 2020, it was decided someone needed to

come in to bring some tender love and care to the museum's scenes of nature.

THE MURALS AND THEIR CONDITION

These two “windows” had suffered from the usual culprits of damage witnessed in every historic site: people and climate. Both murals are composed of eight sheets of heavy-weight paper mounted to the walls with a rubber-based adhesive. The images are printed using half-tone, offset lithography. The Bow River mural measures 3.3×2.6 m, and the Yosemite mural measures 2.5×4.3 m. The works are posters mounted in a marouflage style; however, due to their large size, they will be referred to as murals, despite that they are not painted directly onto the wall. Both works are found on the second level of the building, or three stories below ground. There is no protective covering, making them vulnerable to mechanical damage. The Bow River mural is found in the cafeteria, where it has suffered from abrasions, scratches, and losses. Sixteen areas of mechanical damage were noted on this mural, ranging from less than an inch to 6 in., including areas with scratching. Most of the damage was from the center down, where people had likely abraded against the print and accidentally snagged it. Four areas of damage had been previously infilled with “printer paper” and inpainted with felt-tipped marker. Four areas of damage, oddly located at the top of the



Fig. 5. Yosemite mural in the programming room.



Fig. 6. Bow River mural in the cafeteria.

mural, had been inpainted without any infill paper beneath. Surprisingly, for a work of art in a cafeteria, there was only one stain, and that was way up above in the area depicting the sky.

As well as being subjected to mechanical damage, the Yosemite mural is mounted to an exterior wall and is suffering from climate fluctuations. Although the walls are thick poured concrete, and this room is three stories underground, moisture does seep through. No water or flooding has ever occurred; however, the author has previous experience with mold growth on artifacts stored at exterior walls in other areas of the museum. The moisture levels are high enough to cause minor and major bubbling of the paper. The largest area of bubbling was in the center, measuring $40 \times 43 \times 20$ cm, with a total of 50 bubbles found throughout the mural ranging from long narrow ridges to 1-in. round bulges. Bubbling in the wall paint alongside the mural confirms the source of the problem.

The Yosemite mural was also unprotected from the accidental abrasions, scratches, tears, and losses caused by visitors. About 30 spots of damage were documented, most of them likely due to the room's use as a children's educational programming space. This mural did have staining due to splashed liquid, as well as graffiti marks in the form of pen and marker streaks and a 3-in.-high "stick figure."

In addition, as with the Bow River mural, many areas of damage had been infilled with "printer paper" and colored with felt-tipped markers. These repairs were fairly well done, in the sense that they tricked the eye relatively well, and they are only noticeable when one closely examines the images.

TREATMENT

Treatment began with stain reduction. Since these murals are meant to be aesthetically pleasing, and their role within the site was as "windows" to the outside world from inside a Cold War bunker, the marks of wear caused by visitors were to be minimized as much as possible. The media was actually fairly friable when rubbed, as well as soluble in most solvents. Removing the sections for treatment and remounting was going to prove far too costly; therefore, a poultice was used to deal with the staining.

Neither gellan gum nor agarose gum was going to stay in place on a vertical wall, and methyl cellulose was too wet for most areas. The best solution was to apply Laponite RD to pull out the stains. A synthetic layered silicate product, Laponite RD is commonly used in book conservation to soften and draw out glues, as well as in object conservation for cleaning marble and alabaster. It is well known as a poultice for removing stains on stone. Commercially, it is used in toothpaste, paint, personal care products, and household cleaners (fig. 7).



Fig. 7. Laponite on a cotton swab showing products of staining absorbed by poultice.



Fig. 8. Before and after stain removal with Laponite.

Laponite is thick, stays in place, and is not as moist as methyl cellulose. It did a brilliant job of dissolving and wicking out the stains. It was applied with cotton swabs, left to sit for one to two minutes, then removed by a cotton swab, and the process was repeated until satisfactory results were achieved. The areas were given a final, light swabbing with slightly dampened paper towels to remove any possible residues (fig. 8).

This poultice also worked very well on the pen marks, although it left slightly white spots that had to be toned later on with watercolor pencils. Reduction of the stick figure took many applications of Laponite, followed by some blending of the area with watercolor pencils until there was only a slight hint left of the sightseer (fig. 9).

Once the stains had been addressed, removing the bubbles was the next challenge. The paper had actually expanded in these areas and required shrinking prior to re-adhesion. Evidence of the original rubber-based adhesive was visible at the seam lifts and at small areas along the edges of the printed paper. Rubber-based cement can be reactivated with heat, and heat would also dry and shrink the heavy-weight paper. This approach worked very well for the smaller bulges and the long thin bulges (fig. 10). A hair dryer was set on full blast, and full heat was held fairly close to the wall, and slowly but constantly moved over the bubbles while smoothing them with a Teflon folder. Due to the issues with moisture at the exterior wall, it is likely that this process will have to enter the

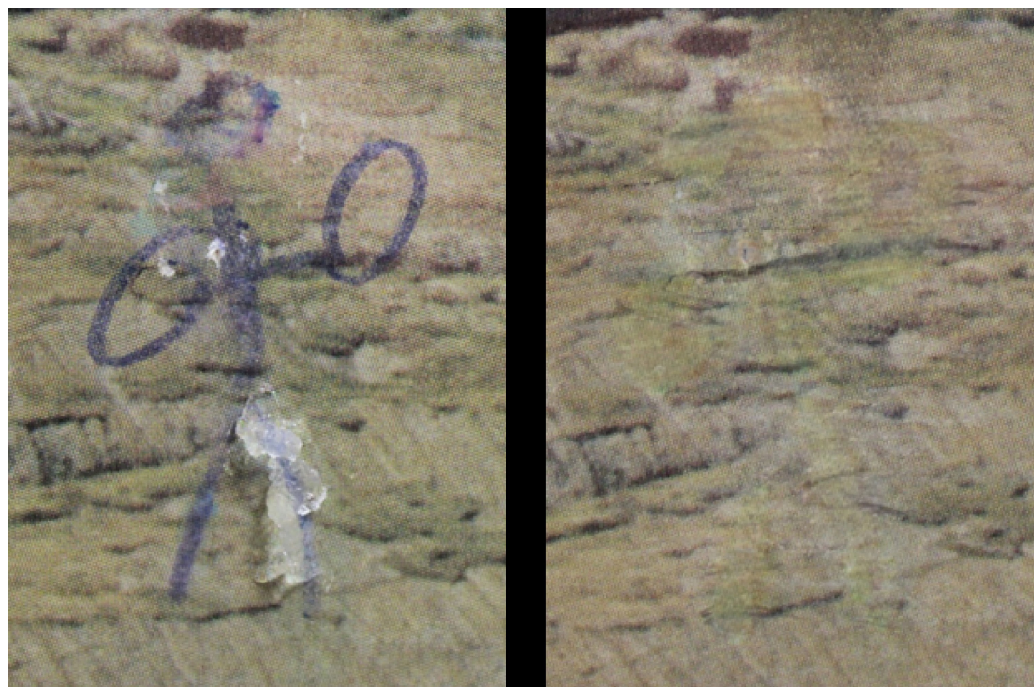


Fig. 9. Before and after removal of stick-figure graffiti.



Fig. 10. Using heat from a hair dryer and Teflon folder to remove minor bubbling.

museum's regular maintenance plan and be repeated every few years.

The larger bubbles required more than just heat to shrink the paper back and reactivate the adhesive. To ensure that the bulged paper stayed in place once shrunk, Jade 403 PVA adhesive was injected with a syringe at the top of the bubbles and spread out with a Teflon folder. Jade was selected for its instant stick, low reaction to moisture once set, and low moisture content. However, because of these desirable characteristics, the paper had to be shrunk with heat before the glue set and smoothed while it was cooled. The palm of the hand worked best for smoothing as the paper cooled, allowing for the detection of any voids that could be attended to immediately (fig. 11). Should the rubber-based adhesive get to a point where it fails all over, and the mural requires dismounting, isopropyl alcohol can be employed to soften the Jade 403 PVA adhesive enough to remove the panels.

Once the bubbles were taken care of, the lifting paper at the seams of the mural were secured and the losses infilled with Japanese paper. Kitikata cream was chosen for its weight and dual surfaces, one face being smooth to match the mural paper and the other being rough, providing grab for the adhesive. Jade 403 PVA was employed again for its low moisture

content, nonreaction to high-moisture environments, and instant stick. The losses were then colored using Faber-Castelle and Winsor & Newton watercolor pencils. These could be blended beautifully to mimic the half-tone printing process and applied in a variety of ways to produce the right sheen. Using a combination of wet pencils, blending with wet cotton swabs, and dry pencils ovetop, layers of coloring could be built up, creating the illusion of tiny multicolor dots (fig. 12). The watercolor pencils were also employed to smooth out the old inpainting, whose infills were left in place.

After the challenges of the Yosemite mural, the Bow River mural seemed easy. The losses were infilled in the same manner, coloring them with the watercolor pencils, and the previous inpainting was blended.

THE BARRIERS

Now that these windows were ready to be shown off again, a little protection was in order. However, being a historic building, no permanent alterations to the building's structure can be implemented. Nothing can be attached to the walls, the floor, or the ceiling. The barriers had to be free standing and yet sturdy and safe for the viewing visitors, including



Fig. 11. Before and after removal of larger bubbling.



Fig. 12. Before and after infilling loss and inpainting with watercolor pencils.

children. It is imperative that they avoid creating microclimates, especially with the Yosemite mural mounted on the exterior wall. The barriers also had to be visually unobtrusive, in keeping with the feel of the site, and constructed with a limited budget based on grant funding.

The first concept met almost all of these needs. Clear Plexiglas sheets, in an aluminum frame, were slightly angled backward for safety, with concrete slabs in the base for stability. This proposal was ideal, but it presented several complications. The barrier would have to be assembled on-site and required exact engineering. It also called for oversize, custom-made Plexiglas sheets, which during the height of COVID-barrier installations at grocery and retail outlets might as well have been called *unobtainium*. These barriers were also going to cost about \$4000 each, and that was with the labor of making the frame and installation being donated. A simpler solution was called for.

A barrier only half the height of the murals, constructed of three standard-size, 4 × 8 ft. sheets of Plexiglas, bent to create arms for stands, and bolted together became the ultimate solution (figs. 13, 14). Although this barrier would not fully cover the murals, they would keep people at almost arm's length away, protecting the works from abrasions and scratches and hopefully ward off any future

stick-figure artists. These barriers minimally obstruct the visual effect of the murals and are reminiscent of barriers found at national park sites. They are also easily moved for cleaning and do not create microclimates. A steel kick-plate and feet were added to the bottom, creating stability and durability. These cost less than \$1000 each to have constructed and installed.

WORKING UNDERGROUND

Visiting this unique site is always exciting; however, working alone three stories below ground is a challenge. Peace and quiet when conducting a treatment is usually welcome, but the presence of others, natural light, and the ambiance play a huge role in preventing mental strain. The museum's employees all work on the fourth level, which is the top level. They have modern offices, where they grow plants, they have lounges, and many people are milling about and conversing. Although there are no windows, it is not a far walk to take a break outside. These steps have produced a pleasant working space for staff. For a conservator, working in isolation, three stories underground, in an atmosphere that resembles the set of a 1960s horror film, in the midst of a pandemic, the morale is different (fig. 15).



Fig. 13. Barrier showing bent Plexiglas sheets, feet, and kick plate.



Fig. 14. Barrier solution.



Fig. 15. At work.

The project only lasted five days on site; however, it was mentally draining. The work itself required high concentration, making music or podcasts overly distracting. All of the equipment and tools had to be carried in and thus limited what could be brought to what was deemed essential. In hindsight, bringing in additional lights to fill in the flicker of the fluorescents was a requirement. Regular breaks were needed; however, the elevator required a key, and climbing the three flights of stairs every time seemed very wasteful of the limited time on-site.

At the end of each day, the long path was taken up the stairs and through the tunnel toward the exit. Coming out into the bright sun caused painful adjustment for the eyes. Visitors, of course, do not experience this, as they are only there for a few hours and generally are not alone. Working in this situation makes one realize the importance of those murals for the mental well-being of those who were in the bunker on a daily basis. Even with many colleagues around, reminders of the outside world would have been extremely important.

CONCLUSION

A historic site commemorating and illustrating Canada's Cold War experience, the Diefenbunker: Canada's Cold War Museum is enjoyed by visitors of all ages. The two

murals on the second level attest to the forethought put into the psychological well-being of the people who worked here and remind us of the hardships faced by the dedicated military personnel trusted with the continuity of our nation's leadership. The conservation challenges presented by years of exposure to the damage of visitor traffic and climate issues were mitigated through careful and exacting treatments. A simple barrier, meeting the needs of the museum, the historic structure, and the murals was brought to fruition. Likely, the Yosemite mural will require frequent attention to keep the bubbles at bay, but in the meantime, these "windows" are defended.

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