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INCORPORATED

Luc Montpellier csc Crafts a Dark Future

Kris Belchevski: *Jean of the Joneses*

Ray Dumas csc: *HORIZON*

YouTube: *The Creators*

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Credits: Ray Dumas csc

VR guru David Robinson, who provided the live stitching.

By Ray Dumas csc

At the Canadian World exposition in Montreal commemorating Canada's 100th birthday in 1967, a unique film called *Canada 67* was exhibited. It was commissioned by Walt Disney himself and shot by founding CSC member and legend Fritz Speiss. Shot in Circle-Vision 360 with multiple synchronized 35 mm cameras in a circular array, the film was projected onto nine screens in an enormous surround theatre at the Expo '67 Bell Telephone Pavilion. It took nine months to shoot and was a 22-minute soliloquy to Canada featuring footage of our great land from coast to coast. Afterwards it spent many years showcasing Canada to people from around the world at Disney's Epcot centre.

To commemorate Canada's Sesquicentennial, a new project called SESQUI was born as part of the Canada 150 Signature Initiative to showcase the best in Canadian culture and innovation. The centrepiece of this exhibit will be a new 20-minute, 360-degree cinematic experience called HORIZON of which I was very proud to be a part.

This new film was shot digitally and will feature a seamless 360-degree by 180-degree inverted dome projection. That is to say, the audience will be in the middle of a large inflatable dome and experience the film all around them including directly above.

The Team

The film, conceived and executive produced by Andrea Stewart and Joanne Lorton, is directed by Drew Lightfoot, someone with whom I have worked for a long time and respect immensely. With so much ground to cover, my director of photography duties were split with Toronto DP and REDLAB Digital co-founder Yinit Borrison, with each of us splitting the provinces up on different legs that covered the four seasons. Over the course of the shoot, we tapped the particular skill sets of Jeremy Benning-csc, Stephen Chung and associate member Duraid Munajim for additional

ZON

photography. The crew was handpicked for their ability to think on their feet and adapt to difficult situations, a real group of bonafide MacGyvers.

The Prep

Practically every aspect of this project from pre-production to final exhibition required heavily adapting existing technologies or creating entirely new systems from scratch. When camera prep began in late 2015, we started to look at existing off-the-shelf solutions and found ourselves travelling all the way to Silicon Valley to test several rigs in various stages of development. VR was already taking off by then and it seemed like new rigs were popping up on a weekly basis. In the end, none of them fully met our requirements for SESQUI. First and foremost, we needed resolution because of our large projection format. Our final image is 12868 pixels wide at the base and 4096 pixels from horizon-top-horizon with an equivalent resolution of approximately 9K.

Secondly, we needed our camera system to be robust enough to handle harsh conditions. All of our gear had to be tested in California in a cold room at temperatures of up to -40 degrees Celsius. Many of the off-the-shelf systems were failing in cold temperatures or were simply not robust enough for what we were going to subject them to.

Thirdly, the array had to be compact. We were travelling to some very inaccessible locations and weight was obviously going to be an issue. More importantly, the cardinal rule for good VR is keeping the lenses and sensors as close together as possible to maintain a stitchable image when objects get close to camera. Large, multiple camera arrays are great for shooting ultra high-def images of landscapes, but when a subject gets too close, parts of them literally disappear when they surpass the coverage area between lenses. Drew wanted to allow

our subjects to get very close to the camera to keep things dramatic and immersive. We were therefore faced with the task of designing our own camera mounts that perfectly aligned multiple cameras as close as physically possible to allow for the image overlap necessary for stitching. After testing 6 and 5 camera arrays that allowed for subjects to get within 8 or 9 feet of camera before falling apart, we settled on a very elegant 3 RED EPIC camera array. REDs were chosen for their high-resolution, compact size and dependability in the field.

The CAD-designed body mounts were machined in aluminum and custom made for us by a team at Réalisations Inc. in Montreal. At around 30 pounds fully built, our three stripped down RED bodies were squished together in a pattern that practically had them touching each other. So tight was the formation that custom cables and touch screen mounts had to be designed.

After testing many lenses, we opted for Canon ultra-wide-angle -15 mm zooms. These still camera lenses set to 8 mm were just wide enough to cover the full 360, including the zenith

point and provide a bit of additional coverage beyond the 180-degree horizon point for breathing room. Being zooms, they were much slower (T4) than I had hoped for, but the faster film primes we tested were either too large or not sharp enough on the edges to give us a uniform stitch.

Another issue was that we could not filter in front of the lens to control the stop by using NDs in bright daylight situations. Closing down the iris was not an option because even the slightest amount of dust on such a wide-angle lens becomes a huge black dot at higher stops, especially on such a large projection format. We therefore set our limit to F5.6 to avoid the problem. Dropping the ASA on the RED wouldn't work because it adversely affected the curve and we needed maximum dynamic range. Manipulating the shutter angle also wasn't an option because of strobing issues, although we did opt to shoot at 90 degrees when possible to reduce motion



Ray Dumas csc during the shoot of the choir scene in Prince Edward County. Background photo: Northern Lights, Yukon



The team in Whitehorse assembles the "minimalist" package. (Standing) Soundman Ian McGettigan celebrates the crew's arrival while director Drew Lightfoot takes a nap.



Director Drew Lightfoot wearing snow "camouflage" in order to hide from the all-seeing camera rig. Ghost Lake, Alberta.

blur. Motion mounts between the lens and camera body seemed like an obvious solution and did a good job of controlling the stop, but we discovered that they were causing serious polarization issues on the edges of frame that included sky and made stitching very difficult. In the end we went old school and took advantage of the Canons' built-in rear filter slot. Colin, our assistant, sourced out some vintage Kodak Wratten ND gel and we used it to control exposure without affecting depth of field or shutter angle.

In our prep phase we also discovered that no one rig was going to cover all of our needs and that specialized setups would be required. In the end, we travelled with five separate camera arrays that each suited a purpose: the 3 RED array was utilized for the majority of the film in any situation that was scripted and shot in a controllable, well-lit environment. For situations where exposure was a concern, we also had a separate Sony A7-S array. Even though we used the same T4 Canon zooms on the Sonys, we took advantage of the higher ASA capabilities of the camera to shoot certain night scenes. For time lapse, such as the Northern lights in the Yukon, we had a Canon 5D DSLR array and a custom-built electronic trigger system also designed by the team at Réalisations Inc. Underwater shots were done with an Abyss housing with five GoPro Hero4 cameras. This housing features curved optical glass lenses that correct the aberrations associated with flat optics underwater.

Finally, for off-the-cuff or dangerous situations, we had some simple 360 GoPro arrays that we could whip out at a moment's notice or put in harm's way. Unscripted shots in the film like one where we encountered big horn sheep on the side of the highway while travelling through the Northwest Territories could not have been captured otherwise.

The Shoot and its Challenges

Shooting in 360 forces you to rethink all of the basic methods of filming you take for granted. Where do you hide lights if the camera can see everything? How do you move the camera when you can be nowhere near it when it is rolling? How do you monitor your image to set up and execute

your shot? Even something as simple as slating required some serious trial and error. (In the end, for the rigs that did not have a synch box, covering the camera array with a bucket and setting off a camera flash inside did the trick.)

For the most part, lighting for exteriors took the form of detailed scouting and scheduling for best light. Many shots were executed in early light or sunset. Weather was always a factor but we were incredibly lucky throughout the shooting and never got rained out. One of the prettiest shots opens the film and is a direct homage to the famous Canadian film *Helicopter Canada*. In the shot, we watch a helicopter approach until it positions itself directly over a group of aerialists suspended on a circular truss. We set up for sunrise but we awoke to heavy cloud cover. Our set was in an airfield near Hamilton, Ontario, but our chopper was flying out of Toronto and would take a half hour to reach our location. We came close to calling the day but decided to take a chance. The sky opened up just as we could see the helicopter appear on the horizon.

For night scenes and interiors we only used lighting that both provided source illumination and also worked practically for artistic effect. For example, our choir scene in Prince Edward County took place inside a beautiful barn. To create a warm soft atmospheric light, we suspended large China balls in the rafters, which, besides providing light, gave the viewer a visual treat when looking above. Another scene involved skateboarders at night underneath a highway overpass. We underlit their skateboards with LED strips and simple battery packs to great effect. For a scene with dragon boaters on the Rideau Canal, we sourced 40' long waterproof LED rope lights that we were able to affix directly to the hulls and power with battery packs equipped with inverters.

Moving the camera was a particular challenge. In our tests, we knew that the camera generally had to be very low to the ground whenever we had subjects close to camera, otherwise we would be losing the lower parts of their body. This made traditional dollies impossible as we had nowhere to hide the grip.

One rig that we used extensively was a specialized RC camera car from Freefly. The suspension had to be modified to handle the extra weight, and we needed to find an alternate power source for the three cameras as

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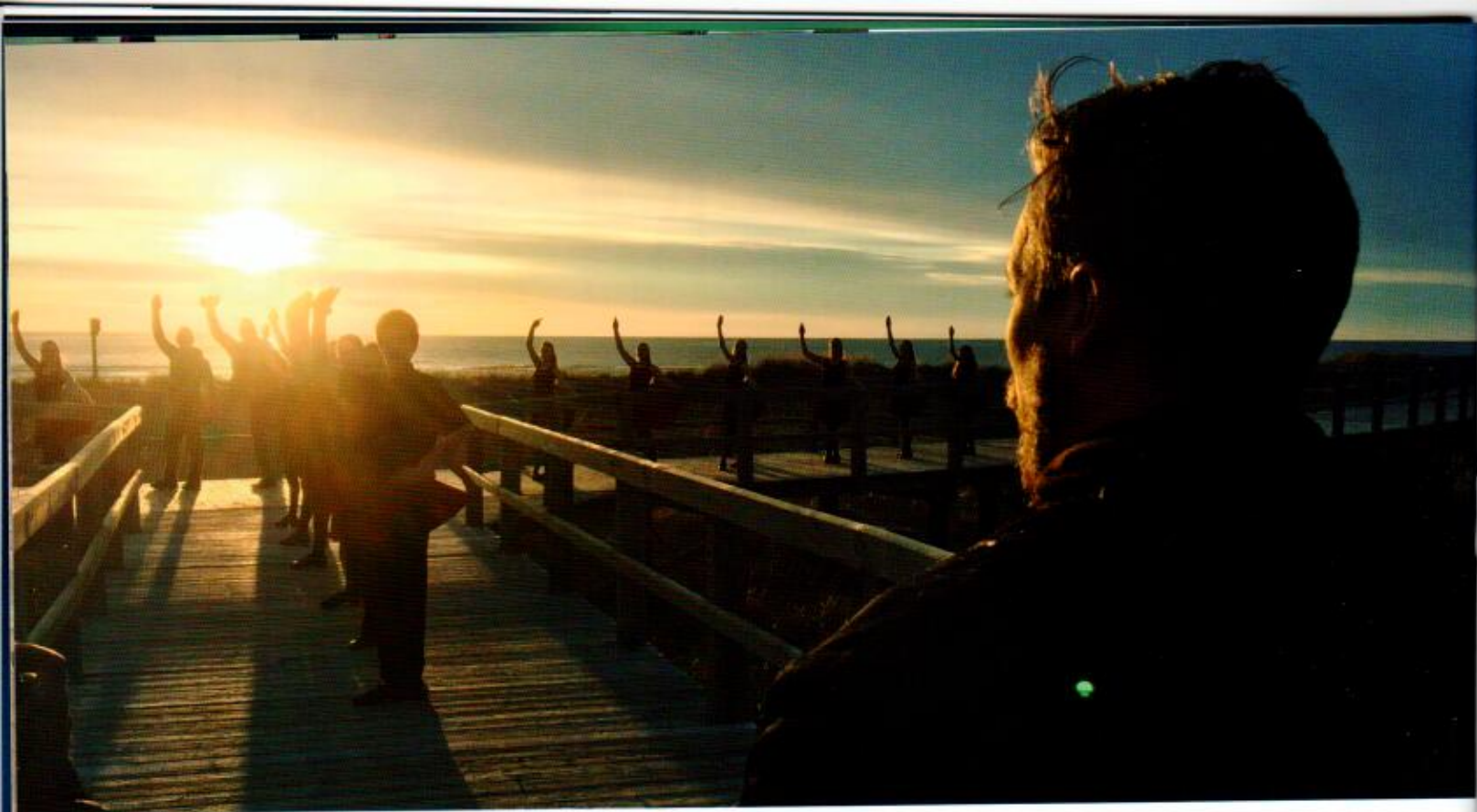
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Drew Lightfoot surveys the sunrise to shoot the Baie En Joie Acadian dancers in La Dune de Bouctouche, New Brunswick.

traditional batteries would be much too big and heavy. We were able to modify the tiny lithium ion batteries used to power MōVI gimbals to power our cameras and transmitters. One particularly difficult shot had us driving the RC car on the frozen surface of Cold Lake Alberta, as ice boats whizzed by at high speed. The car could not maintain traction on the ice and kept spinning out of control. Our grip, [affiliate member] Justin Beattie, removed the rubber tires from their rims and pushed dozens of thumb tacks through the rubber. When he re-installed the tires and we ran it at top speed, it worked like a charm.

Other methods of moving the rigs were battery-operated sliders, pulley systems for vertical shots, and a motorized dolly that we devised using standard track, a skateboard dolly and a simple step motor we sourced from Laird FX. Our most complex setup was for aerial shots in the Northwest Territories. Drones were not an option for our A camera simply because of the weight factor nor were traditional helicopter mounts. We had to get the camera far enough from the helicopter that it wouldn't occupy the majority of the frame and be small enough to paint out. We ended up suspending the camera rig on a 50' tether attached to the belly of the aircraft. To prevent the camera from spinning uncontrollably, we used a torpedo shaped Klauscam system with internal Gyroscopes. For additional stabilizing, we attached a gimbalized stabilizing flight head by the folks at Russian Arm mounted directly beneath the Torpedo. This rig was used to do flyovers of figure skaters on a frozen mountain lake. My favourite move, however, was one of the easiest to achieve.

Credit: Frank Fisher

In the aforementioned opening shot with the aerialists, we needed a 60' dolly move that could be perfectly timed with the helicopter and end perfectly centered in the middle of the circular truss. We laid our track at a very slight downward incline so that gravity would propel the move. We set the cameras on a Western Doorway dolly with baby legs set just high enough to allow me to lie on my stomach just underneath. When the helicopter approached I was able to launch myself at the perfect moment and use my gloved hands directly on the rails to brake to a stop. With our miraculous break in the cloud cover, it worked on the very first try.

Monitoring was also a huge challenge. From the beginning we decided that we wanted to be able to properly visualize our shots in real time, full 360. Without that, we would never have the confidence that our cameras were functioning perfectly and that our shots were well positioned. This job fell to our only non-Canadian crew member, David Robinson, a charming Englishman who is a renowned live event broadcast guru working out of New York. He was able to create a portable live-streaming wireless system, rough stitch the multiple images and link it to an Oculus rift viewer. Without it, we would have been flying blind, and as far as I know, it was the first time it has been done in this fashion.

This is just a small sample of the challenges we faced daily. A remarkable amount of troubleshooting, creative problem-solving, gerrymandering and teamwork were necessary to make this project come to life. It also made for one of the most enjoyable professional experiences of my career. 🍷

For more information on *HORIZON* go to sesqui.ca