RESEARCH REPORT:

INVESTIGATING VIDEO CONFERENCING IN MUSEUM EDUCATION

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1. **Introduction**

The aims of this research paper are to identify:

- Offerings and pricing for video conferencing programs
- Best practices used for video conferencing delivery
- Video conferencing hardware and software solutions
- Configurations for distance learning rooms
- Staffing requirements
- Accessing video conferencing content
- Challenges for schools and remote sites
- Promotion of video conferencing programs
- Pre-flight Checklist

2. **Methodology**

The approach taken to the research was as follows:

- Consultations with a selection of museum education professionals in Canada and the United States (x 13) offering video-conferencing programs in 2014 and 2015;
- Observation of video-conferencing sessions held in 2014 (x 3);
- Literature reviews (x 4);
- Viewing of webcasts (x 3);
- Test drive of telepresence robot;
- Research and review of websites.

3. **Summary of Findings**

- The programming model dictates the equipment, room configuration, type of presentation and staff requirements.
- To participate in HD, real-time, video-conferencing programs far sites either require a formal video conferencing room with a H.323 VC system or a hardwired computer, webcam, microphone, speakers and a way to display the interaction (projector or television screen).
- The length of video-conferencing session is usually dependent on age group and topic. These are typically:
  - 30 minutes for early years
  - 45-60 minutes for middle years and high school
- Be flexible:
  - Offer a variety of connection types for potential far site clients
  - Offer customized programs to meet the needs of teachers and their classroom
  - Allow for a mixed schedule for booking arrangements. Prepare to offer programs early in the morning (east coast), the evening (west coast) and on weekends (public)
- Promotions / Advertising are primarily made via online booking hubs
- Working collaboratively with teachers increases success of programs
- Some museums are using telepresence robots to provide remote school tours and to offer accessible access to galleries for people with mobility issues.
4. **Findings**

Video conferencing is a proven vehicle for presenting Museum programs to national and international audiences. It is the vehicle that has the best potential to reach tens of thousands of new learners within a few years.

- Video conferencing is the widest used programming technology used by museums for distance outreach, education and training.
- New video conferencing software removes the need for far sites to purchase expensive equipment to participate in videoconferencing workshops and seminars. This has most recently contributed to increased accessibility and popularity across North America.
- Video conferencing is used by museums were geography is an obstacle to expand their reach.
- Promotion and technical support are crucial to ensure success of video conferencing programs.
- Offering in-service teachers free introductory video conferencing workshops and professional development training (i.e. Museum 101) increases demand for program bookings.
- The type of programming envisioned and developed drives the solutions for hardware, software, room size and required staffing.
- Many museums are collaborating to share resources and extend their audience reach and to increase their brand profile.
- Technical support from IT is a must have to guarantee success of a video conferencing program

Video conferencing is used by museums were geography is an obstacle to reach new audiences and expand their audience base. This is case for the Royal Tyrrell Museum, which is too far from Calgary and Edmonton for a field trip, and museums in Australia, located in cities dotted along the coast separated by the interior.

Virtual visits are commonly 30-60 minutes in length dependent on age, usually 30 minutes for early years, 45 for middle years and 60 for seniors. For middle and senior years, they are designed to fit in a class time slot. This is ideal for high school classes which have difficulty participating in field trips due to student-based schedules rather than classroom based schedules.

Video conferencing setup requires significant funding to support an H.323 video conferencing unit (Polycom, Cisco/Tandberg, LifeSize, Sony, Avaya), software (Zoom, Jabber, Lync, etc.), Chroma key (green screen), dedicated studio and staff training.

Telepresence robots are being used by some museums to:
- Conduct school programs and tours
- Provide remote school tours to underserved and remote classrooms
- Bring in experts and specialists to the museum
- Provide accessible tours provides museum access for the severely disabled and hospital patients
- Offer after hours tours for the public

Suitable Technologies offers a Museum Partnership Program which includes a BeamPro telepresence robot.

1. **National Museums of Canada**
<table>
<thead>
<tr>
<th>Museum Name</th>
<th>Programs Offered</th>
</tr>
</thead>
</table>
| **Canada Science and Technology Museums**  | • **3 program offerings**, 45-60 minutes in length, $125  
  o Offered in 2015, 2015/2016  
  • 2011-2012 Annual Report  
    o “A permanent videoconferencing system was installed in one of the classrooms, opening the door to future distance learning programming and making the classroom more suitable as a rental facility.” |
| **Canada Agriculture and Food Museum**     | • First webinar hosted, mentioned in 2013-2014 Annual Report  
  • [Webinar](#) offered again in 2015 on Google Hangouts |
| **Canada Aviation and Space Museum**       | • Started in VC programs in 2005, suspended in 2011 after organizational restructuring that lead to lack of dedicated IT support  
  • In discussion with Kim Reynolds, Education and Interpretation Officer on October 16, 2014 |
| **Canadian Museum of History**             | • No programs offered                                                                                     |
| **Canadian Museum Of Immigration At Pier 21** | • No programs offered                                                                                     |
| **Canadian Museum of Nature**              | • Pilot program run in 2011: 7 school districts (Alberta, Yukon, Ontario, Newfoundland), 225 students. External funding ($50,000) for target audience: High Schools students in Northern Communities  
  • Project programs offered in May to June 2012: 8 programs run in 7 school districts (Alberta, Quebec, Yukon, BC, Ontario), approximately 108 students. Program cancelled in 2012 due to technical issues and high cost per student (offered for free).  
  • VC currently used to bring in research experts from their research lab into the museum classrooms for educational workshops using iChat on iPads  
  • In discussion with Gilles Proulx, School Programs Project Leader on September 21, 2015 |
| **Canadian War Museum**                    | • No programs offered                                                                                     |
| **National Gallery of Canada**             | • Piloted 7 distance-learning programs in 2012/2013, using the University of Ottawa’s videoconferencing equipment and Adobe Connect software. Connected to 148 students in the Yukon, Saskatchewan, British Columbia and Southern Ontario. (From 2012/2013 Annual Report)  
  • **Online Programs:**  
    o Grades K-3 – 2 programs  
    o Grades 4-6 – 3 programs  
    o Grades 7-12/Sec I-V – 2 programs |
2. Other Canadian Museums and Institutions
Museums and cultural institutions in Canada currently offering video conferencing programs

| Redpath Museum                                                                 | Discussions with Ingrid Birker, Science Outreach Administrator / Public Education Program, October 23, 2014 & August 18, 2015  
|                                                                               | • Piloted in spring 2014, started offering programs in fall 2014  
|                                                                               | o Offers 3 Video Conferences for grades K-12  
|                                                                               | o Programs offered in English and French |
| Royal Botanical Gardens                                                      | Discussions with Karin Davidson-Taylor, Education Officer, July 15, 2015 & September 8, 2014  
|                                                                               | • Started in 2006  
|                                                                               | o Offers 20 Virtual Field Trips for grades K-12 and the general public (retirement homes, libraries, camps);  
|                                                                               | o Offers six programs in French;  
|                                                                               | o Delivers about 250 virtual field trips per year;  
|                                                                               | o Received start up seed funding to purchase hardware and hire educator |
| Royal Tyrrell Museum of Palaeontology                                        | Discussions with:  
|                                                                               | o Megan McLauchlin, Distance Learning Coordinator  
|                                                                               | o Jillian Steele, Distance Learning Educator  
|                                                                               | o Jason Martin, Director of Operations and Finance  
|                                                                               |  
|                                                                               | • Started in 2006  
|                                                                               | • Offers eight Virtual Visits for grades K-12 and the general public (retirement homes, libraries);  
|                                                                               | • Recently released three programs for homeschoolers;  
|                                                                               | • Delivered 335 programs at its peak in 2010. Currently delivers about 250 per year;  
|                                                                               | • Has presented to over 50,000 students in all provinces, Yukon and 34 states. |
| The Sheffield Museum of Rural Life                                           | Started in 1998  
|                                                                               | • H.323 VC unit |
| Sports Hall of Fame | • Piloting in 2015/16  
| Telus Spark Science Centre | New in 2015/16 |

There are a number of Canadian museums and institutions that have cancelled or suspended their programs.

| Art Gallery of Ontario (AGO) | • Suspended in summer of 2014 for review by new Director  
| Biodôme de Montréal | Cancelled as reported by other museum professional. No programs found.  
| Royal Ontario Museum (ROM) | • Started in 2011 in partnership with Contact North | Contact Nord, Ontario’s Distance Education and Training Network  
| | • Google+ Hangout on Air In 2013  
| | • Offered in 2014/15.  
| | • Suspended in summer of 2015. Currently posting a position for an Instructional Designer responsible for all educational program development including video conferencing. Assume programs require redevelopment.  
| Ontario Science Centre | A web archive references VC programs offered in 2012  
| Glenbow Museum | A web archive references VC programs offered in 2012  
| Science North | No programs found |

3. American Museums

| Amon Carter Museum of American Art | • Started in 2001  
| | • 26 programs for grades K-12;  
| | • Offers customized programs;  
| | • Offers a limited number of Art-for-All Scholarships for free video conferences  
| | • From Distance Learning Summit: Amon Carter case study |

| Cleveland Museum of Art | • Started in 1999.  
| | o Offers dozens of programs for grades K-12;  
| | o Delivers 5 to 6 programs maximum per day;  
| | o Offers customized programs;  
| | o Offers programs in English, French, Spanish, Italian and German and has had support from a teacher who can speak Mandarin;  
| | • Database hosts 40,000 image objects for use in programs  
| | • In discussion with Dale Hilton Director, Teaching and Learning, July 21, 2015 |
• Offers two program streams: eight Virtual Science Academy programs for grades 1-8 and three for grades 4-8 and Scientists in Action connects grade 4-8 students directly with scientists during live broadcasts from field sites or research labs  
• Delivers 15 to 25 programs per week  
• Offers free Webinars for teacher professional development  
• Registration required three weeks prior to program delivery  
• Connection tests are scheduled two weeks prior  
• In discussion with Gianna Sullivan, Distance Learning Coordinator, August 14, 2015 |
| Smithsonian American Art Museum | • Started in 2001  
• 10 Artful Connections Tours offered for free for grades 3-12 and life long learners  
• Presented by a cadre of 20 docent volunteers and coordinated by a Scheduler  
• Investor funded  
• Three studios to deal with client demand  
• In discussion on July 31, 2015 with:  
  o Rebecca Fulcher, Videoconference Scheduler  
  o Peg Koetsch, Distance Learning Coordinator |

### 4. Human Rights education

VC programs are primarily offered by art and science (natural and technology) museums. There are very few museums offering human rights programming. The Museum of Tolerance recently launched a speaker’s series for grades 5-12 and offers conferences connecting students across the USA and the world. The National September 9/11 Memorial and Museum offers a series of recorded webcasts.

Scans of the 579 programs promoted on Centre for Interactive Learning and Collaboration’s (CILC) return very few results for human rights related content:

- Rights (127)
- Conflict (147)
- Slavery (90)
- Peace (36)
- Bullying (35)
- Social Justice (27)
- Discrimination (27)
- Holocaust (26)
- Gender (26)
- Human Rights (22)
- Racism (10)
- United Nations (9)
- Disabilities (9)
- Indigenous (8)
- Genocide (3)
- Media Literacy (2)

### 5. Far Site Learners

Grades K-12 classrooms are the primary far site clients of video conferencing programs but museums are extending their reach to new audiences that include pre- and in-service teachers, libraries, summer camps,
child care centres, community centres, homeschoolers, special needs groups, life long learner programs, retirement homes and prisons.

**Locales**

Royal Botanical Gardens and Royal Tyrrell Museum report that most of their client schools are in Alberta, Quebec and the US. Royal Tyrrell Museum reports that more than 50% of their clients come from the USA through CILC. The Royal Botanical Gardens reports that almost 80% of their clients come from the USA through CILC. Both Royal Botanical and Royal Tyrrell promote their programs in Australia.

There is an opportunity to connect to remote communities in the north.

### 6. Program offerings and pricing

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>LEARNERS</th>
<th>PROGRAMS</th>
<th>COST/PROGRAM</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Amon Carter Museum of American Art</strong></td>
<td>Grades K-12</td>
<td>26 programs</td>
<td>$100 USD per 30 students</td>
<td>60 minutes</td>
</tr>
<tr>
<td><strong>2. Canada Science and Technology Museum</strong></td>
<td>Grades 2-6</td>
<td>3 programs</td>
<td>$125</td>
<td>45-60 minutes in length</td>
</tr>
<tr>
<td><strong>3. Cleveland Museum of Art</strong></td>
<td>Early years</td>
<td>21 programs</td>
<td>$75 USD &amp; $135 USD</td>
<td>30-40 minutes</td>
</tr>
<tr>
<td></td>
<td>Middle years</td>
<td>23 &amp; 6 custom programs</td>
<td>$135 USD</td>
<td>40-60 minutes</td>
</tr>
<tr>
<td></td>
<td>High school</td>
<td>29 &amp; 6 custom programs</td>
<td>$135 USD</td>
<td>40-60 minutes</td>
</tr>
<tr>
<td></td>
<td>Adult Groups / Continuing Education / Lifelong learners</td>
<td>Seasonal Programs</td>
<td>$135 USD</td>
<td>40-60 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-English language or special presenter lesson</td>
<td>$165 USD</td>
<td>40-60 minutes</td>
</tr>
<tr>
<td><strong>2. Denver Museum of Nature and Science</strong></td>
<td>Grades 1-8</td>
<td>11 programs</td>
<td>$140 USD, $120 for additional program</td>
<td>45 minutes</td>
</tr>
<tr>
<td><strong>3. National Gallery of Canada</strong></td>
<td>Grades K-12</td>
<td>7 programs</td>
<td>Free</td>
<td>30-50 minutes in length</td>
</tr>
<tr>
<td><strong>4. Redpath Museum</strong></td>
<td>Grades K-1</td>
<td>3 programs</td>
<td>$155.22 (includes all taxes)</td>
<td>30 minutes</td>
</tr>
</tbody>
</table>
### Best practices used for video conferencing

#### 1. Teacher Packages

Every content provider sends a package as PDF files to teachers at remote sites they are to connect to prior to the actual presentation date. These materials also include:

- Introduction
- How to use the package
- Curriculum links
- Learning outcomes
- Suggested activities for pre-lesson, during lesson and post-lesson
- Images
- Glossary or vocabulary
- Suggested reading on selected websites and reference books

Amon Carter Museum of American Art provides videos for download prior to the conference to introduce the subject to students to allow for more time for discussion during the presentation.

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>PACKAGES &amp; RESOURCES</th>
</tr>
</thead>
</table>
| 1. Amon Carter Museum of American Art | • Teaching Guides  
  o Activities  
  o Lesson plans  
  • Introductory videos |
| 2. Cleveland Museum of Art | • Aligned with national /Common Core, Ohio, New York, and Michigan learning standards  
  • Lesson Plans available as PDF download:  
    o Teacher information guide  
      ▪ Objectives |
### Pre- and Post-Activities
- Selected Vocabulary
- Suggested Readings and websites
  - Selected images (4 images)

#### 3. Denver Museum of Natural History
- US National Education Standards
- Materials mailed to teachers prior after successful testing

#### 4. Redpath Museum
- Handouts
- Pre-, During & Post-Activities
- MELS curriculum expectations
- Achievements and Competencies based on Common Framework of Science Learning Outcomes (K-12)

#### 5. Royal Botanical Gardens
- Curriculum links for:
  - Alberta, Ontario, Quebec, UK, USA
- Brochure
- Introductory guide

#### 6. Royal Ontario Museum
- EduKits:
  - Teacher’s notes
  - Student activity cards
  - Resource material
  - Objects/artifacts
  - Reference material
  - Lesson plans and student activities

#### 7. Royal Tyrrell Museum
- Teacher Resource Guides:
  - Pre- and Post-activities (PDFs)
  - Curriculum connections
  - US National / Common Core Education Standards

#### 8. Smithsonian American Art Museum
- Tips for a Successful Videoconference
- Teacher Guides:
  - Overview
    - US National / Common Core Standards
    - Vocabulary
    - Topic related artworks
    - Additional resources (websites)
  - Pre-Visit Lesson: Activities and Questions
  - Post-Visit Lesson: Activities and Discussion

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### Museum educators recommended:
- The content needs to be relevant to the learner: engaging, interactive and fun
- Don’t keep to the script! Be aware of the needs of teachers and students. The content needs to be flexible and adapt to learner’s questions.
- Focus on interaction and discussion not on content
- Learn to understand your audience quickly by asking questions
- Animated presenters work best. Video requires more movement and energy than presenting in person in gallery. Several recommended hiring someone with a theatre background.
• Collaborate with teachers to develop a better product
• Create connections with remote communities, which opens up the possibility of cultural exchange.
• Run a maximum of 5-6 programs per day
• Present to class sizes with a maximum of 30-35 students. In cases of multi-point connections, keep the number of classes to 2-3 tops while still adhering to a cap of 30-35 students.
• Customizations to programs require two weeks notice to prepare
• Send out email / package with link to test connection
• Test 2-3 days before video conference
  o Images

Cleveland Museum of Art reports that development time of educational resources takes a significant amount of time.

3. Program Customization
Most organizations customize video conferencing programs to work with teachers and their curriculum needs, adjusting content and developing new workshops to suit the teacher’s objectives for their classes. Providers may charge clients additional charges for development of customized programs.

4. Clothing
Most museum educators wear golf style shirts while presenting, while at other museums presenters wear work attire.

Bright colors transmit well, with the exception of red, which tends to bleed. Pastels or darker-brighter colors are best. Black, white and grey colours do not work very well. Black can cast shadows without the correct lighting. Do not wear the same colour as the Chroma key or those parts of you will be replaced by the presentation. Solid colours are the best. Stripes, dots, and patterns do not work. They come “alive” and distract the viewers.

Royal Botanical Gardens and Royal Tyrrell Museum recommend wearing golf style shirts in solid colours that help build brand. Royal Botanical Gardens uses light green. Royal Tyrrell Museum uses maroon/burgundy. Denver Museum of Natural History uses light blue and black. They all recommended testing a variety of colours to arrive at a colour that will work well.

Logos on shirts are fine but shouldn’t be the same colour as the Chroma Key or they will disappear.

5. Name Tags
Name tags are not required as they cannot be read in either direction. Students at far sites cannot read the presenter’s name tag and, in turn, the presenter cannot read students’ name tags.

6. Login
It is recommended that client classrooms login to video conferencing to avoid interrupting the classroom. Login to the classroom only if the far site’s teacher requests it.
7. Scheduling and Program Bookings
Be flexible by allowing for a mixed schedule for booking arrangements. Canada has six time zones from Newfoundland and Labrador (NT) to the Pacific (PT). Be prepared to offer programs early in the morning (east coast), the evening (west coast) and on weekends (public)

8. Maximum Number of Program Offerings per Day

Single Studio
Cleveland Museum of Art runs a maximum of five to six programs per day using two Presenters. Several years ago they ran 14 programs in a single day, but found that it was non-sustainable model that was leading to program and presenter burn out.

Royal Tyrrell Museum runs a maximum of five programs per day. The Presenters and Technician will swap places on a busy day to share presentation duties.

Multiple studios
Some museums are using multiple studios to meet the high demand for their programs. Smithsonian American Art Museum has three video conferencing studios. Denver Museum of Natural History is moving from a small studio to two larger studios set to open in October 2015.

9. Games
Royal Tyrrell Museum is the only museum in this report to offer interactive games. Flash based games are served to remote sites to allow students to interact with the games.

10. Technical Issues

H.323 VC units
Technical issues will occur with H.323 units, connections, video, audio, etc. Test connections are required prior to the presentation to decrease the possibilities of issues. Museums test connections with far sites in advance to identify any connectivity issues.

Cloud Software
Cloud based software drops video quality first, followed by video and audio is last to ensure presentations can still occur.

Resolving Issues
Presenters should have some technical skill to be able to identify and resolve issues on the fly. IT support is crucial to the success of programs.

If you experience audio issues on your end ask the far site can hear you by giving the thumbs up. If they can hear you, continue presenting.

8. School Requirements and Preferences

Requirements
Video conferencing programs are best accessed by classrooms using either:
1. **For connections to H.323 devices:**

   A dedicated H.323 video conferencing device with a smart board, TV screen or projector

   — OR —

2. **For cloud based software connections:**

   Computer, laptop, or, in some cases, tablet device with:
   - Wide-angle USB camera or webcam to show the entire classroom
   - Microphone (not built in, quality is not high enough)
   - External speakers
   - Smart board, TV screen or projector

Royal Botanical Gardens reports that most of the schools booking their programs use H.323 video conferencing devices. Cleveland Museum of Art and Smithsonian American Art Museum report the same. Smithsonian has found that quite a few of their recent client schools have made recent H.323 VC unit purchases and are eager to use them.

Royal Tyrrell Museum has found that about half of their teacher clients use a computer or laptop within their classroom. This is true even if their school offers a H.323 video conferencing unit due to teachers having familiarity with their own equipment and the convenience of being able to host the program in their own classrooms. This removes the need to book the video conferencing room and disrupt their class by moving to a video conferencing room.

Denver reports a steady decline in schools using H.323 devices in the past three years and more schools preferring to conference via cloud software.

**Technical Issues**

Schools can encounter issues on their end. These are typically:

   - Firewalls: many schools
   - Physical downloads: software requiring
   - Lack of IT support: many teachers are unable to resolve technical issues and usually do not have IT support

9. **Video conferencing hardware and software solutions**

There are several hardware and software solutions that can be followed:

   a. H.3232 video conferencing unit alone
   b. H.3232 unit used in conjunction with video conferencing software (Zoom, FieldTrip Zoom, etc.)
   c. H.3232 unit used in conjunction with video conferencing software (Zoom, FieldTrip Zoom, etc.) and non-compatible H.323 software such as Google Hangouts, Skype, Adobe Connect
   d. Video conferencing software only

All museums contacted for this report use an H.323 device. Cleveland Museum of Art and Smithsonian American Art Museum offer H.323 connections only. The Smithsonian is looking at using VC software, such as BlueJeans or Zoom in conjunction with their H.323 units. They are also exploring using smart phones, iPads, laptops with webcams, and video conferencing robots.
Most museum content providers use additional video conferencing software, such as Zoom or FieldTrip Zoom, in conjunction with an H.323 device to deliver content to schools that have an H.323 VC unit and for schools that do not have one. Royal Botanical Gardens uses an H.323 in conjunction with FieldTrip Zoom. Denver Museum of Natural History uses an H.323 VC unit with Zoom. Royal Tyrrell Museum uses an H.323 VC unit with Zoom. They are considering moving to a software only delivery model as their H.323 units are failing. Using video conferencing software only requires a good quality web camera, microphone and external speakers.

Some offer further solutions, such as Google Hangouts or Skype for Business. The common theme expressed by everyone was that you have to be flexible by offering a variety of connection options to accommodate clients.

### 1. H.323 Devices

There are a large number of H.323 devices offered by a variety of vendors. The major brands include Cisco, Tandberg (bought recently by Cisco), Polycom, Lifesize, Sony, Radviso and ClearOne.

A base H.323 VC unit from Cisco and Polycom costs between $8,000 to $10,000, plus an additional $1100 per year service agreement for software firmware upgrades and service repairs.

ClearOne offers a base unit for $7000. ClearOne also offers an End-of-Life service agreement. Royal Tyrrell Museum reports that Canada Sports Hall of Fame recently purchased a ClearOne unit.

<table>
<thead>
<tr>
<th>VENDOR</th>
<th>BASE UNIT COST + FEES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco / Tandberg</strong></td>
<td>• $8-$10,000 + annual service fees&lt;br&gt;• Service agreement extends beyond EOL</td>
</tr>
<tr>
<td><strong>Polycom</strong></td>
<td>• $8-$10,000+ annual service fees&lt;br&gt;• Service agreement extends beyond EOL</td>
</tr>
<tr>
<td><strong>ClearOne</strong></td>
<td>• $7,000+ annual service fees&lt;br&gt;• EOL service agreement</td>
</tr>
</tbody>
</table>

There are a large variety of H.323 units available on the market. When choosing a H.323 unit, ensure the unit has the correct and enough plugins for our equipment, this includes:

- USB for web cams
- HDS cameras
- HDMI cameras

### Issues

H.3232 VC units are costly to purchase, maintain heavy and have an annual service cost. They are also bandwidth heavy. A large number of schools do not have H.323 devices either due to high cost of purchase or access to technical support.

Royal Tyrrell Museum’s H.323 units are at end of life. Their devices are unsupported and parts are unavailable for repairs. They are currently exploring using a software only delivery model as half of their far site bookings are not using H.323 devices.
Cleveland Museum of Art’s H.323 device is also end of life. They are exploring replacement options. The majority of their bookings are from far sites with H.323 units. Smithsonian also has legacy H.323 units that it wants to replace with new units to meet increasing demand from far sites with H.3232 devices.

2. Cameras and Camera Presets
Many museum content providers use additional cameras plugged into their H.323 VC units to allow presenters to move seamlessly throughout the studio, such as moving from a presentation desk to in front a Chroma key. Web Cams and PTZ (Pan/Tilt/Zoom) cameras are both frequently used.

Document cameras are used to zoom in on artifacts or to display hands on activities. Royal Botanical Gardens uses a digital presenter for displaying insects and plants. Royal Tyrrell Museum uses a second H.323 VC unit positioned above their presentation desk as a document camera to display artifacts.

Camera presets can be defined and controlled by a Presenter at a presentation desk with a VC remote control or touch screen to allow quick transition between cameras in presentations that require multiple camera views and AV feeds without a Technician.

3. AV Mixing Stations
Some museum content providers use Audio Video mixing stations to serve out and mix audio or video media files to a Chroma Key. AV mixing stations require an operator or technician to serve out media during the presentation. Royal Tyrrell Museum uses Roland VR 50HD to serve out audio, video, animation and interactives.

4. Chroma Key
Chroma keys allow presentations to be displayed behind a presenter, much like a weather person on the news. Most museums use Chroma keys to display images, video, interactives, games and slides during presentations. Some museums use screens, curtains, paper, painted walls or a false, painted wall.

A Chroma key will increase the interactive options for presenting, but they are an additional cost and require the room to be configured to allow for its setup.

Royal Botanical Gardens and Smithsonian display PowerPoint slide shows and images on their Chroma keys, while Royal Tyrrell uses images, video, animation and other interactives.

Most museums use green screens. Denver uses a green screen, Smithsonian uses green painted walls and Cleveland Museum of Art uses green curtains. Royal Botanical Gardens and Royal Tyrrell Museum are the exception; they use blue screens. Royal Botanical Gardens uses a blue curtain. Royal Tyrrell Museum used a green screen up to quite recently but found issues with green Chroma. Green Chroma causes greenish tints in blonde hair and light skin tones. They use a false, blue painted wall.

H.323 devices do not always display on Smartboards. Royal Botanical Gardens found that this was true in 50% of the cases. The use of Chroma Key will prevent this but will cause a minor delay.
5. **Tricaster**

In discussions with Justin Funke, he recommended a Tricaster as an alternative replacement for a Chroma Key. A Tricaster merges live video switching, broadcast graphics, virtual sets, special effects, audio mixing, recording, social media publishing and web streaming.

For video conferencing, a Tricaster can be used with an AV mixing desk, high quality cameras and microphones to incorporate things like, seamless switching between presentation images, video and third party video feeds.

Museums would need either the Tricaster 460 or the Tricaster Mini. These would allow mixing up to 4 digital/analogue camera sources, 2 laptops, and mix video or audio directly from the Tricaster. The Tricaster will allow you to mix, record & stream VC events via the web or via traditional H.323 VC equipment.

Denver Museum of Natural History is the only museum found to use a Tricaster. But they only use it to serve out a single video conferencing stream and do not take advantage of its other features.

6. **Software Solutions**

There are a large variety of software solutions available that include Zoom, Skype, iChat, FieldTrip Zoom, Vidyo, Jabber, BlueJeans, Lync, etc. All the video conferencing is cloud based allowing for easy connections to far sites, do not require a physical download and work across multiple devices.

Some software, such Google Hangouts on Air, Skype for Business, etc. allows for far sites to chat with the presenter. Some software also offers booking services, such as FieldTrip Zoom and BlueJeans.

There are two types of software solutions: those that connect with H.323 devices and those that do not.

<table>
<thead>
<tr>
<th>SOFTWARE TYPES</th>
<th>SOFTWARE SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connects to H.323 devices</td>
<td>Zoom, Field Trip Zoom, Cisco Jabber, BlueJeans, Vidyo, etc.</td>
</tr>
<tr>
<td>Connects with most devices but not H.323</td>
<td>Google Hangouts on Air, Skype for Business, Adobe Connect, iChat, etc.</td>
</tr>
</tbody>
</table>

BlueJeans is the highest end videoconferencing software providing HD quality video but at a high cost. Zoom and FieldTrip Zoom are the most commonly used and available at a lower cost than BlueJeans. Both provide lower video quality than BlueJeans, but Royal Botanical Gardens and Royal Tyrrell Museum found them to be acceptable quality equivalent to H.323 devices. The Smithsonian is looking at using VC software, such as BlueJeans or Zoom in conjunction with their H.323 units. Redpath Museum uses BlueJeans, licenced by Teaching and Learning Services at McGill University.

Royal Botanical Gardens, Royal Tyrrell Museum and Redpath Museum tested a variety of VC software before arriving at using Zoom or FieldTrip Zoom. All three reported dissatisfaction with Jabber and Lync (now Skype for Business).
Denver Museum of Natural History also uses Zoom after testing Jabber, BlueJeans and Vidyo. Denver finds Zoom is user friendly, manages bandwidth and provides the best price point and quality. They found BlueJeans to be excellent but cost prohibitive.

<table>
<thead>
<tr>
<th>SOFTWARE</th>
<th>BlueJeans</th>
<th>ZOOM</th>
<th>FieldTrip Zoom</th>
</tr>
</thead>
</table>
| TYPE     | • Cloud Based  
          • No physical download  
          • Desktop app available | • Integrated cloud-based video conferencing 
          • No physical download | • Integrated cloud-based video conferencing 
          • Small software download |
| FEATURES | • HD screen sharing, up to 1080p resolution  
          • Real-time video  
          • Chat | • HD video and voice  
          • Chat | • HD video and voice |
| FEES     | MCU bridged:  
          • Point to point  
          • Assigned to room  
          • $250 USD per port per month  
          • Minimum of 4 ports required  
          • $12,000 USD per year USD | PRO:  
          • $10 USD per month licence  
          • $49 USD per month for room connector  
          BUSINESS:  
          • $149 USD per month  
          • 10 licences | MONTHLY:  
          • $99.95 USD/15% per transaction  
          • $949.95 USD/15% per transaction  
          — OR —  
          • $0/30% per transaction |
| COST FOR FAR SITES | • No costs for far sites | • No costs for far sites | • No costs for far sites |
| INVITATION | • Uses meeting invitations  
          • Permanent Room ID | • Uses meeting invitations  
          • Permanent Room ID | • Uses single web address |
| CONNECTS TO | • H.323/SIP devices  
          • Web browsers: Laptops, computers  
          • Tablets (iPads)  
          • Smart phones  
          • Skype | • H.323/SIP devices  
          • Web browsers: Laptops, computers  
          • Tablets (iPads)  
          • Smart phones | • H.323/SIP devices  
          • Web browsers: Laptops, computers  
          • Tablets (iPads)  
          • Smart phones |
| PROMOTION HUB / BOOKING SERVICE | • YES | • NO | • YES  
          • Program directory |
| SUPPORT | • 24/7 | PRO:  
          • Account Rep and onboarding  
          BUSINESS: | • |
### SERVICE FEATURES

| • 24/7 Help desk |
| • Phone and email |
| • Scheduling engine |
| • Order and payment engine |
| • Customer support |

### MUSEUMS

| Redpath Museum |
| Royal Tyrrell Museum |
| Denver Museum of Natural History |
| Royal Botanical Gardens |
| Telus Spark Science Centre |

### TYPE

<table>
<thead>
<tr>
<th>H.323 VC Device</th>
<th>ZOOM</th>
<th>FieldTrip Zoom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud Based software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No physical download</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud based software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No physical download</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FEATURES

| • HD video and voice |
| • Back channel chat |
| • Bundled price. Approximately $900 per year |

### FEES

| • $8-10,000 for a base unit |
| • Annual service fees |
| • Fees charged for Zoom to Zoom connections |
| • $700 per year |

### INVITATION

| Uses meeting invitations |
| Uses single web address |

### Connects to

| H.323/SIP devices |
| Variety of devices |
| Variety of devices |
| • H.323/SIP devices |
| • Mac, Windows |
| • Mobile |
| • Tablet |
| • Android, iOS |
| • H.323/SIP devices |
| • Mac, Windows |
| • Mobile |
| • Tablet |
| • Android, iOS |

### Promotion hub / Booking Service

| NO |
| NO |
| YES |

### TV Screens

In a simple setup, such as Royal Botanical Gardens’ studio, one TV screen is used with the Presenter facing the screen to view and interact with the far site audience. Most museums use two screens one to display the presentation and the other to view the far site audience. Royal Tyrrell Museum uses multiple screens: for viewing and interacting with the far site audience and viewing upcoming media being presented by the Technician.

### Lighting
Ceiling mounted lighting arrays are ideal for videoconferencing studios, especially those with Chroma keys to remove unwanted shadows. If the ceilings are too low for lighting arrays, a series of placed floor lamps can be used instead.

9. **Clocks**
A large clock is usually placed on the opposite wall near the LCD screen viewing the far site audience to allow the presenter to keep track of time. A series of clocks can be used to represent the range of North American time zones.

10. **Telepresence Robots**

Telepresence robots let users interact with remote locations through high end video and audio.

**Uses:**
- Conduct school programs and tours
- Provide remote school tours to underserved and remote classrooms
- Bring in experts and specialists to the museum
- Provide accessible tours provides museum access for the severely disabled and hospital patients
- Offer after hours tours for the public

The After Dark\(^1\) program at Tate ran over five nights in August 2014. Random users could control in gallery robots using a web app.

Some museums are providing remote access to galleries using self-roaming telepresence robots. The National Museum of Australia has offered Robotic Tours\(^2\) since 2013 using two prototype robots following a guide.

**Double Robotics** offers the Double telepresence robot which incorporates an iPad on a mobile platform that is essentially a Segway. The University of Alaska Museum of the North\(^3\) purchased a Double telepresence robot in 2013. The costs is $2500 USD. The iPad is purchased separately.

**Suitable Technologies** produce the Beam telepresence robots. ran an accessibility project to bring guests with mobility issues into museums using BeamPro telepresence robots. Museums in the Beam accessibility pilot project included:
- de Young Fine Arts Museum
- Detroit Institute of Arts
- Computer History Museum Seattle Art Museum
- National Music Museum
- San Diego Air and Space Museum
- San Diego Museum of Man
- University of South Dakota’s Natural History Museum

The Confluences Museum in Lyon used Beam telepresence robots to bring in remote disabled

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1. After Dark
2. National Museum of Australia Robot Tours
3. The University of Alaska Museum of the North
guests for their inauguration. 4

Suitable Technologies offers a Museum Partnership Program. 5 Museums who participate in the partnership program will receive BeamPro SPS with assisted driving, charging dock, unlimited software licenses, and an annual service package that includes ongoing maintenance and program support for remote visitors who are physically unable to visit the site.

The cost is $4999 USD per year over three years with the option to purchase.

| Suitable Technologies Museum Partnership Program | Christa Cliver  
Director of Education & Museum  
+1.206.369.7786  
ccliver@suitabletech.com |

11. Staffing Requirements

There are two basic presentation models and variations on these models:

   a. A Presenter using a laptop with a single H.323 unit.
   b. A Presenter supported by a Technician who serves out media using an AV mixer.

The minimum staffing requirement for video conferencing programs is one presenter. Many museums also use a technician or operator who can serve out media files for a more interactive experience.

   a. One Presenter

Karin Davidson-Taylor, Education Officer, at Royal Botanical Gardens is responsible for all aspects of video conferencing including presenting, program development, support, bookings and promotion and marketing. A second educator has been hired to provide program presentations in French and Spanish. Their presentations are PowerPoint slide shows presented on a Chroma key.

Redpath Museum follows a similar model to Royal Botanical Gardens. Ingrid Birker, Administrator, is responsible for all aspects of video conferencing. But rather than using a studio, Redpath presents from within gallery using a mobile VC unit on a cart to highlight artifacts in their exhibits.

Smithsonian American Art Museum and Denver Museum of Natural History have atypical models. Denver has a Distance Learning Coordinator and 20 Educators who are responsible for all Onsite, Outreach (offsite) & Distance Learning programming. 5 of the Educators re used consistently for video conferencing programs. Programs are delivered by a single Educator using a laptop to display a PowerPoint slideshow with some video on a Chroma key. Smithsonian’s programs are coordinated by Rebecca Fulcher, Videoconference Scheduler, and presented by 20 volunteer

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4 Confluences Museum in Lyon  
5 Suitable Technologies Museum Partnership Program
Programs are presented by a single volunteer docent using a PowerPoint slideshow with 10 images per program on a laptop displayed on a Chroma key.

b. **One Presenter and a Technician**
Royal Tyrrell Museum has two full time staff, Megan McLaughlin, Distance Education Coordinator and Jillian Steele, Distance Education Educator. Megan is the primary Presenter and Jillian is the Technician and Developer. They are both trained present the programs and deliver media from the AV mixing station so that they can swap roles. The Technician is responsible for serving out media to the Chroma key (images, animation, video, games), serving games to the far site, controlling cameras, interactive content development (video, animation and games), troubleshooting and focuses on the technology so the Presenter can focus on the presentation. An IT staff person is available for technical support.

At the Cleveland Museum of Art, Dale Hilton, Director of Teaching and Learning, is responsible for managing, presenting and script development. She shares presentation duties with Arielle Levine, Master Teacher, Distance Learning. Technical production is provided by a Technical Producer and a Technician who operate the AV mixer and the cameras and serve out images from a database containing over 40,000 images. One IT staff person is available on a 50% part time basis. And a Scheduler coordinates the program bookings.

**Scheduler / Coordinator**
Larger museums with multiple presenters have a fulltime scheduler to handle bookings and coordinate staff. In the case of smaller museums, the presenter handles scheduling.

**IT Support**
IT support is crucial to the success of video conferencing programs.

Canadian Aviation and Space Museum suspended their programs in 2011 due to lack of IT support after an organizational restructuring.

<table>
<thead>
<tr>
<th>MUSEUM</th>
<th>STAFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cleveland Museum of Art</td>
<td>• Scheduler</td>
</tr>
<tr>
<td></td>
<td>• Presenter</td>
</tr>
<tr>
<td></td>
<td>• Director (Manager, Presenter and Script Developer: half time)</td>
</tr>
<tr>
<td></td>
<td>• Technical Producer</td>
</tr>
<tr>
<td></td>
<td>• Technician</td>
</tr>
<tr>
<td></td>
<td>• IT support (part time)</td>
</tr>
<tr>
<td>2. Denver Museum of Natural History</td>
<td>• Distance Learning Coordinator</td>
</tr>
<tr>
<td></td>
<td>• 20 Educators</td>
</tr>
<tr>
<td>3. Royal Botanical Gardens</td>
<td>• Educator, English</td>
</tr>
<tr>
<td></td>
<td>• Educator, French and Spanish</td>
</tr>
<tr>
<td></td>
<td>• Occasional guest speakers</td>
</tr>
<tr>
<td>4. Royal Tyrrell Museum</td>
<td>• Educator, Technician</td>
</tr>
<tr>
<td></td>
<td>• Technician / Educator</td>
</tr>
<tr>
<td></td>
<td>• Guest speakers and lab visits (scientists)</td>
</tr>
</tbody>
</table>
12. Rooms and Room Configuration

There are three ways museums deliver video conferencing:

a. In gallery
b. Shared use Studio
c. Dedicated Studio

a. In Gallery
All the museums contacted for this report have a dedicated a studio space with the exception of Redpath Museum and Amon Carter Museum of American Art both who provide in gallery presentations. Redpath uses a mobile H.323 unit, a laptop, and a large TV screen. Amon Carter has a similar model using a mobile cart with a mobile H.323 unit, a laptop, and two small TV screens.

b. Shared Use
The Denver Museum for Natural History used a shared studio for five years but moved to a small, dedicated studio. The shared studio space was also used for webinars for teachers and peer-to-peer video conferencing for museum professionals in other states and in Europe or for presenting at a conference at a distance.

c. Dedicated Studios
The room setup is dependent on whether a Chroma key and AV mixing station are in operations.

Studios with a Chroma key
The Royal Botanical Gardens uses a small 10’x10’ room dedicated to video conferencing. The Studio has a blue screen, a presenting desk with a document camera to the left for presenting insects and plants, an H.323 VC unit facing the desk and a TV screen to view the far site. The Presenter stands in place at the presentation desk with a laptop using PowerPoint slides in front of the Chroma key with the H.323 VC unit and TV screen positioned directly in front of them. This position allows access to the document camera, props and a VC remote.

Smithsonian American Art Museum has three video conferencing studios to handle the high demand for their programs. Their setup is similar to Royal Botanical Gardens. A volunteer docent presents at a presentation desk with a laptop using PowerPoint slides in front of a H.323 VC unit with a Chroma key behind.

Denver Museum of Natural History uses the same model: a single presenter in front of an H.323 unit with a green screen behind. They use PowerPoint slideshows with some embedded video. The distance learning program started by using a small shared studio used also for teacher development webinars and videoconferencing for staff to connect to peers world wide.
interdepartmental use helped to build support for funding. They are currently building two larger studios set to open in October 2015.

**Studios with a Chroma key and AV Mixer**

At the Cleveland Museum of Art The Presenter stands in front of a green screen in front of a desk or lectern facing a TV screen. A legacy AV mixing station staffed by a Technician to serve out images from a database during the presentation.

The Royal Tyrrell Museum has a large dedicated studio which combines the use of a blue screen with an H.323 VC unit, a presenting desk with a VC camera, and document camera on the ceiling to the left of the presenter for presenting artifacts. From this setup the presenter can transition seamlessly between the blue screen and a presentation desk. The presenting desk has drawers with available materials to present with. There a number of screens that the educator could see during the conference to show the classroom and to display which pre-recorded slide or animation are coming up next. The blue screen is a painted wall that allows the presenter to enter and exit from either side.

The Technician supports the lesson by serving out media files from the AV mixing stations. This can be dynamic and interactive as media files can be shared out in response to questions posed by students. The technician has a good knowledge of the programs, so they can swap places with the presenter as needed, especially during busy presentation days or when the presenter is feeling ill. The technician also has development skills for the development of interactives and games delivered to far sites during the presentation.

**13. Firewall**

Royal Botanical Gardens recommends being outside of the Enterprise firewall to ensure connections to far sites can occur while using a H.323 VC device. Cloud software sits outside of the Enterprise firewall.

**14. Promoting Video Conferencing Programs**

Museum professionals interviewed for this report indicated using several methods for promoting videoconferencing programs:

- Working collaboratively with teachers
- Identifying champions
- Offering free VC and PD workshops for teachers
- Using a booking hub system
- Advertising on a booking system (i.e. web banner)

Offering in-service teachers free introductory video conferencing workshops and professional development training (i.e. Museum 101, Introduction to video conferencing, how to use video conferencing in your classroom) increases demand for program bookings.
There are booking hubs that act as brokers for virtual field trips linking schools to museum content providers. Both charge a fee for hosting content provider programs.

1) Centre for Interactive Learning and Collaboration’s (CILC) database lists 104 North American museum content providers offering 579 video conferencing programs. Cost is based on number of programs being promoted on an annual basis. Banner ads are available at an additional cost and anecdotal evidence suggests they are worth the cost. CILC also handles evaluations. Requires membership.

2) FieldTrip Zoom offers a booking system with the software.

3) CAPspace’s database lists 75 North American museum content providers, as well as those from Australia and UK, offering 486 video conferencing programs.

4) DART Connections is an Australian database that also includes Royal Botanical Gardens and Royal Tyrrell Museum.

15. Broadcasting in other Languages

The Royal Botanical Gardens broadcasts in English, French and now in Spanish. French programs are provided for primary and junior schools with clients primarily from Quebec, the Maritimes and French Immersion schools in Alberta. Spanish is provided for schools in the United States.

Redpath Museum offers programs in both English and French.

The Cleveland Museum of Art broadcasts in English, French, Spanish, Italian and German and has had support from a teacher who can speak Mandarin. They report a recent drop off in requests for non-English languages.

Denver Museum of Natural History offers Spanish-speaking educators by request.

16. Accessibility

The Royal Tyrrell Museum researched providing programming services to deaf and hard of hearing students but found the cost to provide signers to be too high. They report that teachers and schools provide ASL services for their students. The Cleveland Museum of Art recommends teachers or schools provide signers.

17. Recommendations

1. Video Conferencing Programs

Phase I
Configuration: A Presenter using a laptop with a single H.323 unit
• A dedicated studio would be preferable to allow for programming to occur at anytime
and to ensure equipment is in place. In the absence of such, video conferencing equipment can be placed on trolleys.

- Purchase a H.323 video conferencing device for connecting to far sites with H.323 devices
- Licence Zoom Videoconferencing software to connect to far sites without an H.3232 unit
  - No physical download
  - No firewall issues
- Chroma key (blue or green screen?)
- Two TV screens: one for viewing learners at far site, the other to view the presentation
- Lights and reflectors
  - Array for high ceiling
  - Floor lamps for low ceiling
- Involve Design Team to:
  - Configure and setup studio equipment
  - Provide hardware training for presenters
  - Record and archive programs and presentations for webcasts and Video on Demand (VoD)
- IT Support on-call to provide support
- A series of clocks on the wall behind the TV screens to cover all North American time zones
- Pilot a single VC program: What are Human Rights?
- Provide training for presenters:
  - Hardware use
  - Software use
  - Program
- Conduct 20 pilot presentations with a variety of classrooms in different locales

**Phase II**

- Test and rollout our further video conferencing programs
- Provide workshops for teachers
  - How to use video conferencing in your classroom
  - Museum 101
  - Professional Development
- Presentations by Museum experts

**Phase III**

**Outfit MTS Classrooms for video conferencing:**

- Video conferencing for visiting classrooms to connect to international classrooms or remote guest speakers
- Video conferencing for visiting teachers to connect to international teachers or remote guest speakers
- Conferences and AGMs
- Teacher Professional Development
- Guest speakers and presentations
• Symposia
• School programs and tours
• Provide remote school tours to underserved and remote classrooms
• Bring in experts and specialists to the museum
• Accessible tours provides museum access for the severely disabled and hospital patients
• After hours tours for the public

2. Telepresence Robot Tours

Phase I
Purchase a BeamPro telepresence robot through Suitable Technologies’ Museum Partnership
Program to prototype and test:
• Provide school tours to underserved and remote classrooms
• Bring in experts and specialists to the Museum
• Accessible tours provides museum access for the severely disabled and hospital patients
## Appendix A: Summary Table

<table>
<thead>
<tr>
<th>MUSEUM</th>
<th>TYPE</th>
<th>DETAILS</th>
</tr>
</thead>
</table>
| **Cleveland Museum of Art** | Staff| • Scheduler  
  • Presenter  
  • Director (Manager, Presenter and Script Developer: half time)  
  • Technical Producer  
  • IT support (part time)  

  **Hardware** • H.323 video conferencing unit  
  • AV mixer  

  **Software** NA  

  **Location** Dedicated studio with Chroma key (green screen) |
| **Denver Museum of Nature and Science** | Staff| • Distance Learning Coordinator  
  • 20 Educators (Onsite, Outreach & Distance Learning)  

  **Hardware** • Polycom H.323  
  • Tricaster  

  **Software** Zoom  

  **Location** Initially, 1 small shared studio with Chroma key (green screen)  
  • Constructing 2 dedicated studios |
| **Redpath Museum** | Staff| • 1 Educator  

  **Hardware** • Cisco/Tandberg mobile H.323 video conferencing unit  
  • Laptop  

  **Software** Zoom  

  **Location** Mobile unit on a cart used in gallery |
| **Royal Botanical Gardens** | Staff| • 1 Educator  

  **Hardware** • Polycom H.323 video conferencing system  
  • Laptop  
  • Digital Presenter (document camera)  
  • TV Screen  
  • Lights  

  **Software** FieldTrip Zoom  

  **Location** Dedicated studio with Chroma key (blue screen) |
| **Royal Tyrrell Museum** | Staff| • Educator  
  • Technician  
  • IT Support  

  **Hardware** • Cisco/Tandberg H.323 video conferencing unit  
  • Second overhead H.323 video conferencing unit used as a document camera  
  • Roland VR 50HD AV Mixer  
  • Desktop computer  
  • TV Screen |
<table>
<thead>
<tr>
<th>Smithsonian American Art Museum</th>
<th><strong>Software</strong></th>
<th>Lights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Location</strong></td>
<td>Zoom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dedicated studio with Chroma key (blue screen)</td>
</tr>
<tr>
<td><strong>Staff</strong></td>
<td><strong>Hardware</strong></td>
<td>Distance Learning Coordinator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Videoconference Scheduler</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 volunteer docents</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td></td>
<td>Polycom H.323 video conferencing units</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td>3 dedicated studios with Chroma keys (green screen)</td>
</tr>
</tbody>
</table>
# Appendix B: Video Conferencing Equipment

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| H.323 video conferencing system | • Incorporates a codec, microphone, camera & internet router  
|                               | • Large variety of units offered with different options                     |
| Television monitor or data projector | • To view the classroom  
|                               | • To view yourself                                                          |
| Workstation/laptop            | • Serves out digital media                                                  |
| Microphones                   | • Audio                                                                     |
| PTZ or Webcams                | • For providing different views                                            |
| AV Mixing Station             | • Serves out digital media to Chroma Key or Tricaster  
|                               | • Ability to mix audio and visual                                          |
| Chroma Key (green screen)     | • Connected H.323 device  
|                               | • Used with AV Mixing Station  
|                               | • Displays digital media                                                   |
| Lighting array                | • Configured for Chroma Key                                                |
| Tricaster                     | • Seamless switching between presentation images, video and third party video feeds |
| MCU server system             | • Multipoint control system for 4+ remote sites/points                      |
| Mini-bridge                   | • Provides support for 3 remote sites/points                                |
| Document Camera               | • For displaying props, artifacts and hands on activities                  |
| Second VC camera              | • Allows students to see themselves  
|                               | • Used as a document camera                                                |
Appendix C: Pre-Flight Checklist

The basic idea of a pre-flight check is to do technical checks on everything BEFORE you start the video conference. Granted most of us delivering video conferencing are not technical and very few of us have the luxury of having a technical person on standby to help with the set up. So it will pay you greatly to spend a few minutes before an event doing some basic checks on your equipment. Even if you know the state of your gear or your gear has not moved it is still a good idea to check everything is working just so you can eliminate your end as being the problem if an issue does crop up it’s ugly head during your event. Following is a checklist that has been implemented at the Powerhouse Museum, since we have started this process we have had very few technical problems and we have also found that our staff are more confident and know the equipment better as a result.

1. Check Your Network
Check that you have an IP address. On a Polycom unity The IP address is shown at the bottom of the display when the unit first boots up. On a Tandberg you will see the IP on the top left. An IP address has the form nnn.nnn.nnn.nnn, If you do not have or cannot see an IP address try switching to another network port or talk to your network administrator.

2. Check Your Primary Camera
Check that the primary camera is plugged into the correct port and you are getting a loopback image on the screen.

3. Check Your Secondary Camera
If you are using a secondary camera, switch over to it and check that you are getting a loopback image.

4. Check Your PC
If you are planning to use content sharing from an external PC, then you MUST check that it is working beforehand. There are several things that can go wrong here! Make sure you are familiar with the ins and outs of switching your computer from mirrored or extended display modes and check that you have all the right sort of connectors available to connect to your v/c codec. Exactly how this done is something that I can save for another article.

5. Lighting
This seems like an obvious one, but you should keep in mind that a camera does not perceive light exactly as the human eyes does and low light levels can translate into a fuzzy or graining looking image at the remote end. Conversely high light levels can cause the image to look grey or colourless. Critically review the lighting and check via camera loopback that the lighting is not too dark and not washed out. There should be a nice contrast between each half of the face and skin tones should look natural for onscreen talent.

6. Make a Test Call
Once you have tested the above make a test call to another v/c unit, and test everything again from steps 1-5.

7. Test the sound
Finally, while on the test call confirm that there is two way audio. The sound should be loud and clear and not distorted. Remember you can always have a v/c without the picture, but you can’t have one without the sound!

Another good idea is to use a service like VTC Call Back (http://vtctest.pointsofdata.com/) Using this you can make a test call and it will call you back and check your video and audio is working. Try to plan the time it takes to do this into your event schedule, I would recommend that you allow yourself at least 15 minutes for the basic checks written above, longer if you have a more complex setup. If you make a good habit of running through this before every event you will save yourself a lot of heartache in the long run.

Appendix D: References

Literature Reviews


Webcasts

Distance Learning Summit: Amon Carter case study (2013), Crystal Bridges Museum, Bentonville, Arkansas, USA. https://www.youtube.com/watch?v=hOtem25lhKc&index=3&list=PLgwvJx_aihhBDP7BSXPgsdJ449xFFYY_G

Distance Learning Summit: Smithsonian American Art Museum case study (2013), Crystal Bridges Museum, Bentonville, Arkansas, USA. https://www.youtube.com/watch?v=4trCgiWrFzl&index=7&list=PLgwvJx_aihhBDP7BSXPgsdJ449xFFYY_G&spfreload=10

Educational Video Conferencing Best Practice: OZeLIVE2015. Retrieved on September 21, 2015 from https://www.youtube.com/watch?v=7xiQi9zDM_g

Websites

Science outreach on the road. https://bennewsome.wordpress.com

### Appendix E: Professional Consultations

| 1. Canadian Aviation and Space Museum | • **Kim Reynolds**, Education and Interpretation Officer | • October 16, 2014 |
| 2. Canadian Museum of Nature | • Anne Botman, Head, Content Development  
  • Gilles Proulx, Nature School Programs Project Leader | • September 15, 2015  
  • September 21, 2015 |
| 3. Cleveland Museum of Art | • **Dale Hilton**, Director, Teaching and Learning | • July 21, 2015 |
| 5. National Gallery of Canada | • | • September 2015 |
| 6. Redpath Museum | • **Ingrid Birker**, Science Outreach Administrator / Public Education Program | • October 23, 2014  
  • August 18, 2015 |
| 7. Royal Botanical Gardens (RBG) | • **Karin Davidson-Taylor**, Education Officer | • July 15, 2015  
  • September 8, 2014 |
| 8. Royal Tyrrell Museum | • **Megan McLauchlin**, Distance Learning Coordinator  
  • **Jillian Steele**, Distance Learning Educator  
  • **Jason Martin**, Director of Operations and Finance | • September 15, 2014  
  • September 17, 2014  
  • July 14, 2015  
  • July 17, 2015 |
| 9. Smithsonian American Art Museum | • **Rebecca Fulcher**, Videoconference Scheduler  
  • **Peg Koetsch**, Distance Learning Coordinator | • July 31, 2015 |