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A Timeline of Practical Experiments at the NASA CoLab Island

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Abstract

Personnel at the Second Life NASA CoLab island have been experimenting with providing live, virtual world broadcast events for the benefit of the space and technology community. The broadcasts range from simple one-way stream feeds to more complex two-way interactive events. This paper will provide background information about the NASA CoLab, sketch an evolutionary timeline of experimental events held at the NASA CoLab island, and compare a couple of similar two-way mixed reality events.

Keywords: NASA, Second Life, virtual communities.

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Second Life Mixed Reality Broadcasts: *A Timeline of Practical Experiments at the NASA CoLab Island*

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The NASA CoLab island in Second Life (SL) is a NASA-sponsored project incubator for NASA and the entrepreneurial space technology community. It is a virtual world complementary to the physical CoLab office in San Francisco. The original charter of the SL CoLab incubator in November 2006 was to provide a Second Life location where NASA could leverage the entrepreneurial technology talent of the virtual community and work with the non-traditional space business sector to support NASA's Vision for Space Exploration. Currently the SL NASA CoLab facilitates collaborative efforts between NASA and the public/private sectors by providing a place where anyone can participate or volunteer their talent. Examples of the space community groups that have developed projects at the incubator include the L-5 Society, the National Space Society, and the Mars Society. NASA groups such as the Lunar Reconnaissance Orbiter Education/Public Outreach (LRO E/PO) and NASA Learning Technologies (NLT) have established interactive exhibits and tools for residents to use. In addition to space community participants and NASA personnel there is a strong volunteer support contingent at NASA CoLab that contributes to projects, island maintenance, orientation, and security. This combination of talent has led to a variety of live broadcast events of interest to the space and technology community.

In May of 2007 the International Space Development Conference (ISDC) keynote speech was presented from both the virtual NASA CoLab island and the "real-world" Dallas conference room. The keynote speech was given by General S. Pete Wordon and his avatar Simon Pete Raymaker. General Wordon, the Director of the NASA Ames Research Center in Northern California, spoke from SL NASA CoLab about future opportunities for all citizens to be involved in the participatory exploration of space through virtual worlds.



Figure 1: NASA Ames Director General Pete Wordon gave the 2007 ISDC Keynote at NASA CoLab

Two views of the SL environment were projected into the conference room: one of Simon Pete Raymaker giving his talk and the other of the SL audience that assembled for the event. The two views came from feeds provided by CoLab members at the conference who were logged into SL for the event. The SL audience had an audio feed of the talk but did not see or interact with the Dallas audience. During the course of the talk General Wordon's avatar crashed a couple of times which hastened the General's real-life entrance at the conference to conclude his speech.

The NASA community gathered at two events held at the neighborhood JPL Explorer Island before holding another CoLab event, the Virtual Worlds and Immersive Environments Workshop originating from NASA Ames in January of 2008. In a last minute effort to include NASA CoLab in the workshop, one conference participant logged into SL and tried feeding the room audio to Second Life using a microphone and a laptop from the back of the room. Only every third or fourth word was heard in SL so avatars were off topic within an hour and had disbanded by the middle of the first day. While the CoLab avatars thought it was worth trying to participate in future presentations, it was agreed that any follow-up effort would require more up-front preparation.



Figure 2: Virtual Worlds and Immersive Environments Workshop at the NASA CoLab Island

Not long after this event, the NASA Learning Technologies (LT) team established a media center at the CoLab Platform Arroyo. The media center was equipped with various information and broadcast tools for RSS feeds, vodcasts, streaming tv, video, and blog feeds. The motivation for the media center was to provide a central NASA multimedia location for use

by new NASA e-Education groups in the virtual SL environment. The Platform would also serve as a testbed for mixed reality events.

The first mixed reality broadcast test occurred during the Next Generation Explorers Conference (NGEC-2) held on February 12-15, 2008 at the NASA Ames Research Center. The conference was attended by young engineers who are emerging global space leaders and planners. The goal of the conference was to gather design momentum for future elements of space exploration focused on “Entrepreneurial Opportunities in Lunar Development.” The format was a mix of speeches, presentations, and working-group sessions. The idea for a mixed reality broadcast was initiated by CoLabbers to provide a window into the NGEC event for those who could not attend the conference in person. The goal was for SL participants to attend the presentations and working-group sessions via a real-time video/audio stream and participate in Q/A (Questions and Answers) with the Ames speakers and participants. The broadcast team was a loose band of dispersed volunteers with no budget and very little time. The availability of hardware, software, and broadcast equipment was unknown. The configuration and support system within the conference room was also unknown. Each volunteer had a good amount of experience in specific areas but little experience with this set of variables for a total solution.

The Ames conference center provides only basic equipment such as microphones and limited network access. The facility does not provide computer equipment so the team set about lining up the suitable hardware and software to capture and broadcast the event. Through numerous e-mails and telecons between volunteers a broadcast system was pieced together from contacts within the Ames community. In a concurrent discovery process, a mobile networked Polycom broadcast system was discovered at the conference center that could also provide a solution for broadcasting the event. The team took the approach of working both options, the stand-alone computer and the Polycom system, to see which one was viable and could be made to work in the amount of time available.

To get the stand-alone solution going we requested a computer from Odin, the IT contractor at Ames. Odin would not provide a computer so the network administrator assigned to the conference room found a Mac G5 Tower for our use. There was a substantial time sink upgrading the Mac OS and installing Wirecast, the encoding software. Once the machine was upgraded and we tried to connect to SL it was discovered that additional firewall permissions were needed. Network access was granted Monday night, the evening before the conference began. Once the firewall restrictions were lifted on the correct ports we were able to plug in and go. We got video streamed immediately but it took some time to configure the audio. The National Oceanographic and Atmospheric Administration (NOAA) streamhoster account we borrowed was preconfigured for Wirecast so we had installed a demo copy of Wirecast encoder since it was the preset streamhoster configuration and it was free. It turns out the demo Wirecast does not broadcast audio on the codec required by the streamhoster. We switched to the free Apple Broadcaster encoder, ran the audio with FireWire, reconfigured the streamhoster, and finally got both video and audio.



Figure 3: NGEC Mixed Reality Broadcast at the NASA CoLab Island

In a parallel activity, the mobile Polycom system that runs a video/audio feed from the Ames conference room to a broadcast studio via H.323 connection was fed to the streamhoster in two ways. The videoconference unit can run through both an WindowsXP system (loaded with the demo Wirecast) and also through a Mac OS 10.4 system running Apple Broadcaster. Both the Wirecast and Broadcaster solutions sent the Quicktime stream to the NOAA streamhoster account. Again, the demo copy of Wirecast did not produce an audio signal and so the test stream was sent through the Mac using Apple Broadcaster.

In addition to the hardware and software required, a Quicktime streamhoster was needed on less than a week's notice. A Quicktime (or compatible) stream is a hard requirement, as that is the accepted streaming format in Second Life. CoLab called upon a SciLands member, the NOAA, for the use of their streamhoster account. SciLands is a loose network of science agencies and organizations in Second Life. NOAA graciously made the streamhoster account available to the CoLab for this event. The appropriate land permissions were granted to load the Quicktime stream on the CoLab parcels. Other inworld preparations at the SL sim included upgrading the viewing screen, texturing it with a media texture, and providing conference overview and schedule information panels and real-time updates to the event board.

The Second Life venue was set to load the media stream from the hoster and given to each individual avatar as requested. The streamhoster account accommodates 100 streams. The SL CoLab island accommodates 50 to 68 avatars at any given time, so there were plenty of streams available. The final broadcast solution the team used was the stand-alone computer system that was a combination of equipment from the conference center, NGEC staff, and our camera technician's personal inventory. The Polycom system could have also been used but that system had one more hop for the stream to make on its way to Second Life so we decided to use the stand-alone computer to reduce latency and streamline the data transfer. Within four days the

team came up with two viable solutions to broadcast the event. The tech team was on the phone, logged in to Second Life and broadcasting video to each, when all at once both systems were running within minutes of each other.

In the end, the resources required to broadcast the NGEC event into Second Life included a broadband internet connection with firewall access on the right ports, a MAC G5 Tower, Apple Broadcaster, a Quicktime streaming server account, a video camera with a firewire port, a long firewire cable, headphones, microphones, a mixing board, a PA system, a camera tripod, a tripod dolly, microphone stands, wireless microphones, microphone cables, support cables, and various other camera support devices and lighting. It also required an additional PC with the latest Quicktime to monitor the SL session and a PC with an operator/avatar to upload and display powerpoint slides in SL. It is important not to run the monitoring and upload functions on the same computer, as this causes lag and performance problems.



Figure 4: NASA Learning Technologies presents from NASA CoLab to Eduverse in Amsterdam

Later in February 2008, the NASA LT team gave an invited mixed reality presentation at the Eduverse symposium held in both Second Life and Amsterdam, Holland. The LT presentation was given from SL at CoLab Platform Arroyo and consisted of a two-way feed provided by the Eduverse conference team between SL and the real-life (RL) conference room using Skype voice for communication. The entire technical set-up was handled by the conference provider which made for a relatively simple presentation from Second Life. There was another simple one-way stream feed into the CoLab island of the Stephen Hawkings talk at NASA in April 2008.

The second full, mixed reality broadcast occurred during the NASA Future Forum in May 2008. The NASA Future Forum is a monthly meeting held at different locations around the country where NASA, scientists, engineers and the commercial sector discuss the role of space exploration, advances in science, and economic benefits of the space program. The May Future Forum was held at the Tech Museum of Innovation in San Jose, California, near the NASA Ames Research Center. SL Colab had a good amount of notice for this event, the technical

support of the Tech Museum, some technical support from NASA, and some of the same CoLab volunteers that worked the NGEC event. The lead time plus the significantly improved support structure for the event positively impacted the broadcast as a whole. The keynote speaker for the Future Forum was Shana Dale, deputy administrator at NASA, so there was official technical, NASA media support provided for the event which included a multi-camera, HiDef video/satellite truck and a crew of six from NASA Ames. Other professional media support included lighting, trusses, and back lights, plus the technicians and machinery to assemble and disassemble those components. The Second Life video feed was taken from the satellite truck to a transcoder (analog to FireWire) and the audio feed was taken from the in-room audio mixer fed to the transcoder. The conference room feed captured by the FireWire was sent to a Mac which encoded and uploaded the stream to an SL Quicktime server. Second Life was fed onto plasma screens in the conference room through a Mac Powerbook with an attached cooling fan. The stream pulls were monitored on a separate laptop through a server admin website. There were some low audio volumes reported at the beginning of the event which were resolved. The feed was broadcast to five SL islands and, although one island experienced a rolling restart, there were no other major technical problems.



Figure 5: NASA CoLab as seen from the NASA Future Form held at The Tech Museum of Innovation

The differences between the two mixed reality broadcasts, NGEC and the Future Forum, fall into the areas of technical equipment, planning, and user experience. The NGEC conference was a first-time, brute force technical achievement in that the volunteers figured out how to do the broadcast in a very short amount of time with donated equipment. SL participant comments about the event were that mixed reality broadcasts are an innovative approach to sharing information and have great potential for the future. Almost all participants agreed it is a good way to share large group presentations but it was a little lacking during the working-group sessions because there were no hand-held microphones in the conference room and no clearly stated goals, objectives, or responsibilities given to the SL participants to create a work product.

This was due to the fact that there was no predetermined coordination between the conference planners and the technical SL team to provide context and structure during the working-group portion of the conference. The team accomplished the goal of providing the stream but realized after the broadcast that simply providing a stream does not ensure a meaningful participant experience, specifically in a break-out working-group session.

The Future Forum had the benefit of official NASA technical support and a team with some experience in mixed reality broadcasting. Additionally, with a generous lead time for the event, CoLabbers were able to plan space artifact and information displays to illustrate themes and topics featured in the day's event. There was also time to plan structured guidance for SL participants through the CoLab volunteer Welcomer's Group who were stationed at all the sims to provide information notecards, guidelines, and assistance. There was also a very discrete security team positioned at each sim to deal with any untoward avatar behavior, such as had occurred during the NGEC broadcast.

As we look to the future, CoLab and NASA Learning Technologies welcome the NASA Digital Learning Network (DLN) to the NASA CoLab island. DLN is a free, interactive program that allows participants to learn about our home planet and to journey into space using webcast and video-conferencing technology. DLN is in the process of bringing their live broadcast events and extensive catalog into Second Life. DLN will operate on the SL main grid to contribute to the professional development of all educators. NASA CoLab will also host a broadcast event for the Smithsonian Folklife Festival to be held in the summer of 2008. It will consist of two 45 minute sessions of SL panelists discussing education, outreach, and the NASA CoLab. The panelists will present from Second Life and take questions from festival visitors and SL avatars. The festival will be held on the mall in Washington, DC, so it is likely the technical specs will be limited to a portable computer, a wi-fi connection, and a projection screen.

With each event, the NASA CoLabbers become more adept at providing broadcast solutions for the Second Life environment. The events held so far have been different in nature, requirements, and availability of resources. As it stands, the volunteer team has to scope the broadcast in terms of these elements and devise the best combination in order to organize and execute the desired event. It is foreseeable that a standard methodology or "playbook" will emerge as a guideline for different types of events such as one-way RL to SL, one-way SL to RL, and SL/RL interactive. These event types and their various permutations will be codified in a way that the broadcast solution will soon be plug and play. Additionally, when the more organized structure of the agency makes its way into SL and other virtual worlds, the standard provision of tools and resources will be available and on-hand for any given event.

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