



Figure 7.30 In terms of magnitude in remote operations, nothing compares to the Olympics. (Source: Chadwick Wachs)

The Winter Olympics

Fifteen Sports, 10 Venues

Although the Winter Olympics have about half the number of venues as the summer Olympics, televising the Winter Games is a massive undertaking. The 2002 Games in Salt Lake City involved coverage of 15 sports from 10 venues. This doesn't count the impressive spectacles at the opening and closing ceremonies, and a presence at the athletes' Olympic Village. To accomplish this, it takes approximately 4000 people and nearly 50 trucks. A large central media center in downtown Salt Lake City was constructed to house the 80 media rights holders from around the world and to receive incoming video and audio (dubbed VandA) from venues as far as 60 miles away and make them available to the world.

Qwest laid over 650 miles of fiber optic cable to tie the venues to the International Broadcast Center (IBC) located in the media center. Into the IBC funneled 388 trillion bits of data per second during the 17 days of the Games. The data carried VandA and communications traffic to and from the venues. Qwest deployed 600 technicians to support this network.

The host broadcaster makes every event available to any of the 80 rights holders around the world who wants them for live or delayed airing. The rights holders pay fees for the rights to broadcast the games in their country. While many countries have only one rights holding broadcaster (NBC in the United States through at least 2008), some have multiple rights holders. Japan has six; France and Korea have three; Germany, Mexico, New Zealand and Norway have two. Besides the IBC in the media center, the host broadcaster rents space to rights holders that want a presence at the games. The space rented varies from a small office to the 65,000 square feet that NBC had. NBC used its space for editing, studios, control rooms and master control, which selected the studio or venue for release back to New York. For a couple of months their facility in the IBC was the third largest facility they had, only behind New York and Los Angeles.

Because NBC has the rights to a series of Olympic Games, it was able to take a long-term outlook as to how it would construct its facilities inside the IBC. Starting with Sydney in 2000, they designed and built, in conjunction with Sony, a modular set of subcomponents to be assembled into a complete facility onsite. This concept was based on a number of racks for equipment that would be assembled together on a platform and wired together. Each set of racks generally comprised a complete sub-



Figure 7.31 IBC monitoring center. The IBC is run by the host broadcaster. Up until the mid-80s that was usually the host country's rights holding broadcaster. The Olympic committee then decided to make the host broadcaster a separate entity to ensure unbiased coverage of the Games. The host city's Olympic committee usually forms an organization to be the host broadcaster. In 1996 it was Atlanta Olympic Broadcasters; in 2000 it was the Sydney Olympic Broadcaster Organization; for the 2002 Games it was known as International Sports Broadcasting (ISB). These organizations have very close ties to the International Olympic Committee (IOC) and are usually run by the same group of people from one Olympics to the next. Starting with the 2008 Games in China, this group will be folded into the IOC. (Source: Chadwick Wachs)



system, such as signal routing and distribution, control room equipment, intercoms, etc. Each of these platforms, which measured 8 feet by 20 feet and held two rows of 10 racks, would ship in their own seagoing container. This concept is known as a Racks In a Box System (RIBS). Using technology developed for the military, each RIBS had shock isolation that could handle up to 40 Gs, along with overhead cable trays and a power panel. The individual RIBS would be interconnected onsite. Because most of the cities that will host the Olympics over the length of NBC's contract are in 220V countries, NBC used 220V power in Salt Lake instead of 120V.

Another key part of the modular approach was the two studios NBC used at Salt Lake. They had the interesting name of JAWS, for Just Add Water Studio. Besides power, all that was needed was chilled water to drive 180 tons of air conditioning in each studio. Each was 2000 square feet, with the main studio having a height of 25 feet and the other 18 feet. The studios are constructed of specially fabricated interlocking steel acoustical panels five inches thick. These 33 by 60 foot studios have a number of perimeter towers that support the walls and ceiling. Lighting grid, projectors, set and other studio scenery is secured to the ceiling and walls by special fasteners. These studios have been built with the strict earthquake codes they will meet when they are used in Athens in 2004.

ISB contracted with remote truck vendors to provide the international coverage at each venue, also known as the host feeds. The host feed was non-biased, full event coverage with minimal graphics overlaid. Feeds that are intended for any of the rights holders are known as multilateral feeds. Many rights holders that use the host feeds use the video as sent and only add voice commentary to the audio using the "natural sound" (crowd and event noise) that is provided on two of the audio channels.

Some rights holders augment

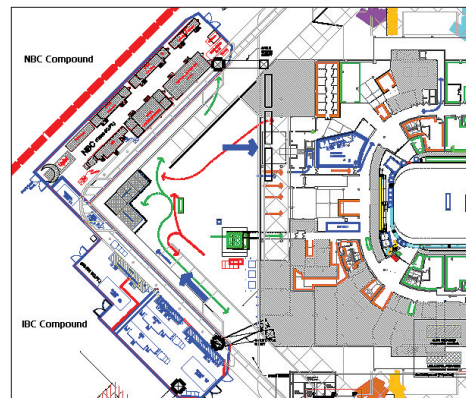


Figure 7.32 This drawing shows two truck compounds at the Salt Lake Ice Center venue, where the figure skating events were held. The IBC compound had the host broadcaster's trucks while NBC had its own fleet of production trucks, utility trailers and even a satellite truck that provided a backup feed to New York. (Source: NBC)

some events coverage with facilities of their own. They take the multilateral feed, and cut in a few of their own cameras to tailor the coverage for them. Some, such as NBC, go even further by having their own trucks at most venues with many of their own cameras, and using the host feed on occasion to augment their own coverage. These feeds are known as unilateral feeds. Almost all venues have multilateral and one or more unilateral feed(s) back to the IBC.

Often, countries with expertise in a sport produce that coverage with host gear and crew. As an example, Norway produced the cross-country coverage at Salt Lake. In Sydney, NBC produced the host's world feed for gymnastics and basketball, along with their own unilateral coverage. NBC produced figure skating for the host at Salt Lake. Separate directors, separate trucks and separate crews were used for the host and NBC unilateral coverage, even though both were produced by NBC.



Figure 7.34 Most venues become small towns or fortresses onto themselves. (Source: Chadwick Wachs)

NBC designated various levels of coverage at each venue, with some presence at every venue at Salt Lake:

- The A venues are the obvious stars when it comes to coverage. For the Summer Games, it's track and field, aquatics, and gymnastics. For the Winter Games, it's figure skating and downhill skiing. Plus, the Opening and Closing Ceremonies for both winter and summer games are considered A venues.
- B venues are events such as hockey, basketball and speed skating.
- C venues were usually flight packs (equipment housed in traveling cases), they had no onsite editing. Or instead of flight packs, a very basic small truck with two or three cameras, graphics and replays.
- C-World is a truck in a suitcase, an even smaller version of the flight pack setup. This approach has a small switcher that can cut between host's clean (video without any graphics overlaid) and dirty feeds (video with

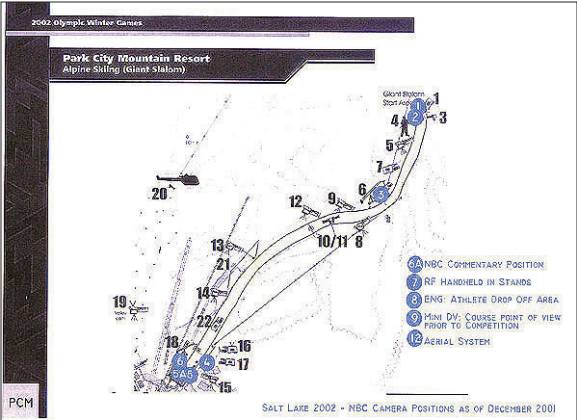


Figure 7.33 Camera placement schematic for a winter games event. Black numbers represent host cameras, blue represent cameras that NBC added. (Source: NBC)

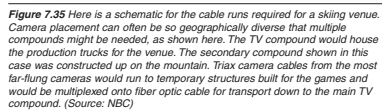


Figure 7.35 Here is a schematic for the cable runs required for a skiing venue. Camera placement can often be so geographically diverse that multiple compounds might be needed, as shown here. The TV compound would house the production trucks for the venue. The secondary compound shown in this case was constructed up on the mountain. Triax camera cables from the most far-flung cameras would run to temporary structures built for the games and would be multiplexed onto fiber optic cable for transport down to the main TV compound. (Source: NBC)

- Pure World - NBC announcers voiced over the host's feed back at NBC's IBC facilities.

- Pure World - NBC announcers voiced over the host's feed back at NBC's IBC facilities.

The effort to pull off an Olympics actually starts before the previous one has ended. Planning for Salt Lake commenced

The effort to pull off an Olympics actually starts before the previous one has ended. Planning for Salt Lake commenced almost immediately after the Sydney coverage facility had been decommissioned. All television productions are team efforts in several disciplines. While various organizations may use different names for these functions, they are basically:

Production – defines the style and approach to coverage of each event. Determines camera locations, graphics looks and other creative elements.

Logistics – transportation, housing, catering, credentials, security, clothing, office trailers and furniture, copiers, and phones – the glue that holds it all together.

Sales and finance – predicts and generates revenues from advertising and any other sales, and monitors and controls expenses.

Operations – coordinates the relationships between the above groups.

For events as complex as the Olympics, this team works together for many years leading up to the actual Games. Planning for the Games begins between six and ten years before Opening Ceremonies. Organizations seeking to present the games in the United States and other countries must submit a detailed bid offer to the Olympic Committee to be awarded exclusive rights to show the Olympic events in their country. In order to submit a responsive and financially feasible bid, all the disci-

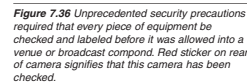


Figure 7.36 Unprecedented security precautions required that every piece of equipment be checked and labeled before it was allowed into a venue or broadcast compound. Red sticker on rear of camera signifies that this camera has been checked.



Figure 7.37 Camera control units and camera remote control panels in a secondary compound up on a mountain. From here, camera feeds are multiplexed onto fiber and sent down to the production trucks in the main compound. (Source: Chadwick Wachs)

plines work together to build a prototype of a game coverage plan with as much detail as is humanly possible. That plan defines coverage and associated costs — along with projected revenues. That information is absolutely necessary in order to submit a bid that ensures a sound financial plan with a good chance of being awarded the games, and turning a profit.

In an unprecedented move, following the 1996 Games in Atlanta NBC was awarded the rights for the 2000 Sydney Australia Summer Olympics through the 2008 Summer Games in Beijing, China. At the time of the

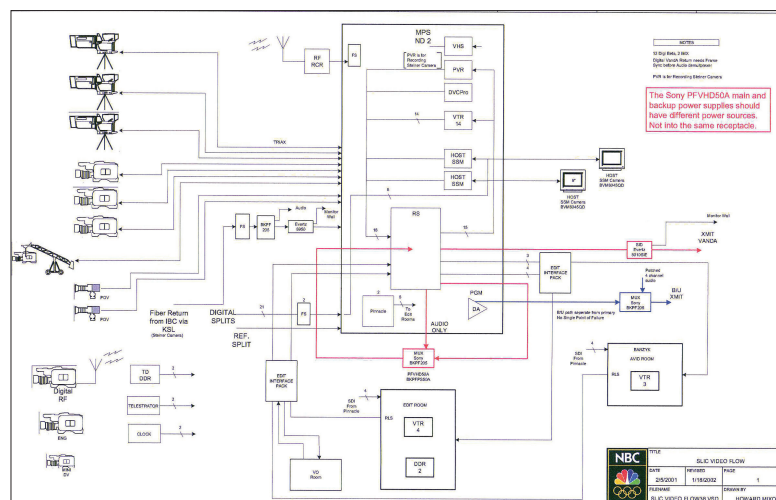


Figure 7.38 Venue schematic of Salt Lake Ice Center. The box in the center represents the production truck. (Source: NBC)

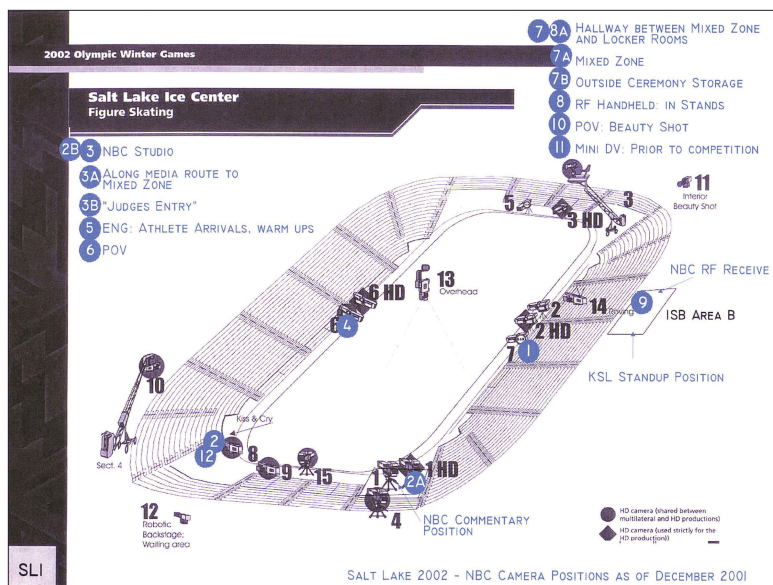




Figure 7.40 At each venue a broadcast compound is constructed a couple of months before the start of the games. Qwest, which provided the interconnectivity between the venues and the IBC, laid 650 miles of fiber optics through some of the most challenging terrain in the country. Up mountains and down valleys, the cable was laid to comprise six SONET rings that totaled 31,200 fiber miles. The SONET rings were designed so that if a break in any of the 48 fiber strands of the cable interrupted data (video, audio, communications, computer network traffic, etc.) flowing from one venue or node to another, the ring would automatically send the data the opposite direction around the ring to get the data where it needed to go. Each venue had the necessary multiplexing equipment to strip out data traveling in the ring destined for the venue, and insert outgoing data, most likely headed back to the IBC.

switcher and monitor wall. The need for cameramen has been identified, along with the need for credentials, hotel, transportation, meals and uniforms. All the costs associated are logged as well. These details keep being refined until the actual camera, lens, cable, cameraman, credential, hotel, airfare, meals and uniform have been identified, ordered and confirmed.

For the Winter Games, cable may be installed during warm weather

that is available to all rights holders. As we have mentioned, a rights holder's programming/sports department may choose to take the world feed, augment it or produce its own coverage. At the same time, plans are developed for the studio and coordination control rooms at the International Broadcast Center.

About a year before the games, mobile units are selected for the venues, equipment details are finalized, and crewing requirements determined, all in coordination with the various disciplines to ensure that the camera covering center ice is supplied with the right lens and cable and it has a place in the routing



Figure 7.41 Even before the broadcast compound takes shape most venues needed spectator facilities constructed. Here is some of the massive assemblage of scaffolding that was required for spectator seating at the Alpine skiing venue. (Source: Chadwick Wachs)

Figure 7.42 Depending on the complexity and difficulty of setup, mobile units start to arrive at the venues from four to 10 days before their events begin. Most venues had more than one production truck because, in addition to the host broadcaster's production capability, NBC added their own at most venues. Here are production trucks for the host. The host had three trucks at this venue; here are two side by side. NBC had its own production compound nearby. (Source: John Tomlinson - NEP/ Chadwick Wachs)





Figure 7.43 Most compounds became full of trucks and portable office trailers. The compounds mushroomed into small fenced-in communities camped just outside the spectator areas. Security started off tight and as the events neared even stricter security guidelines were put into place. Elaborate security procedures were used to determine not only who, but what, could be moved into or out of a compound. NBC had a central field shop that provided additional equipment and spares as necessary to the compounds. There was even a strict protocol as to how equipment moved into and out of the field shop. (Source: Chadwick Wachs and Jason Taubman)

before being snow covered. For Salt Lake, four tractor-trailer loads of cable were shipped to Salt Lake in late May 2001 for installation and remained buried until spring 2002.

From the time of bid award until about six months before the games, the various disciplines make frequent trips to the host city to secure everything from camera positions to hotel rooms and warehouse space. Eight months before game time, a skeleton crew of full-time staff begins to work onsite, comprised of representatives from each of the disciplines. This office, or bureau, irons out all the final details requiring onsite coordination. Six months out, a field shop is established to serve as a central receiving and distribution facility for everything from cameras to napkins. Equipment to be installed in the IBC arrives here and is staged for installation. Typically, the IBC is set to be fully operational one month before Opening Ceremonies, ready to rehearse and check in the venues.

The potential for snow delays disrupting outdoor events, and potentially knocking holes in Olympic programming, prompted more background packages to be produced in case they were needed to fill gaps in the competition. Thus a fairly heavy editing contingent to support the



Figure 7.44 Appearing much like a small fortress in many respects, the compound had a lot of the infrastructure that a fort would have, from office and other utility space to the cafeteria trailer and cantina truck shown here. Each venue required massive amounts of power, upwards of half a megawatt, about what a town of 2000 people would consume. Most venues had two generators that shared this load.



Figure 7.45 Besides the sheer scale of doing the Olympics, the biggest challenge at Salt Lake was the snow and ice. At the Summer Games there is usually more competition available than the available airtime to show it. At the Winter Games almost all of the competition was covered to fill the required airtime. Where NBC had a unilateral presence at about 60 percent of the 2000 Summer Games, they had their own technical presence at every venue at Salt Lake. Above is a photo of the host compound at the men's and women's downhill skiing venue weathering the elements. (Source: Chadwick Wachs)



Figure 7.46 A key technical part of every venue was the technical operations center (TOC). All video, audio, communications and computer data at the venue funneled through the equipment in this office trailer. Half the production trucks used at Salt Lake produced and processed the video as digital data. A few of the trucks also processed the audio as digital data. Trucks that still worked in the analog domain temporarily installed equipment that converted their analog outputs to digital. The trucks also installed equipment that would embed up to eight channels of audio into the horizontal interval of the video data. Thus Vanda went from the trucks to the TOC as digital data. Inside the TOC the combined Vanda, now a 270Mb/s data stream (SMPTE 259A) was wrapped in OC-48 SONET frames and put onto the SONET ring that the venue was connected to. Each ring could handle nine full bit rate digital Vandas. Another important function of the TOC is to monitor the quality of the signals leaving its venue. (Source: Jason Taubman)



Figure 7.47 Once the venue's technical facilities were up and operating as a system, facilities check (fax) could begin. Fax ensures that all sources can be seen wherever they are needed, that all sources work correctly by themselves and as part of the overall system. This is done every day from this point until the games are complete. (Source: Chadwick Wachs)

dered and coordinated by the host broadcaster.

After a few days of setup cameras are powered up. While cameras were being hauled into position and built, the truck's EIC programmed the television routing and intercom equipment to operate the way the client specified. Meanwhile the TD was programming the video switcher and digital effects, as many of the elaborate transitions between sources needed to be programmed ahead of time.

The engineering effort at most venues is often complex. Here the host's or a unilateral (such as NBC) technical manager works with the truck's EIC and other

necessary pre-production was installed at the IBC and at most venues. NBC also used Sony IMX VTRs at Salt Lake. These machines store video and audio as MPEG data on tape. Since MPEG data is an internationally defined data stream, a common tape format now can be used between 625-line format (generally European) and 525-line systems (United States, Japan). This will greatly simplify tape exchange between 50Hz and 60Hz broadcasters, such as between most European and North American rights holders at the 2004 games in Greece.

Many rights holders from around the world also had announcers at venues where they had no other technical support facilities. In addition, they might have had a camera or two they wanted to send straight back to the IBC. These feeds would come straight from the announcers' booth in the case of audio, or from the desired camera, into the TOC (see Figure 7.46). These audio only or VandaAs would be digitized and also placed on the SONET ring. Often cameras or audio feeds are needed as sources at more than one location; for example, at one of the venues' production trucks and the IBC.

These sources are fed to either a distribution amplifier (DA) or video/audio router, where a single signal is turned into multiple feeds. This is known as a split. At some venues, many splits were needed between the unilateral and multilateral players. These are all or-



Figure 7.48 Pre-production continues up to and into the games themselves. Before the games, the crew will cover the trials, often as if it was the real thing to rehearse, but also to capture material that might be used by the folks producing background packages for possible use on-air. (Source: Jason Taubman)



Figure 7.49 A handheld camera nearly in the course, a few thousand feet from its truck. Notice the mic with a big windshield mounted on top of the camera. Catching the sounds of the games is as important as the video. For Salt Lake, NBC developed an elaborate audio "auto-fade" system that was temporarily installed on the trucks it was using at downhill venues. This system would gracefully fade from one camera's mic source to the next, as cameras were selected for air or recording for replay as the skier made their way down the course. This was used so that replays had smooth coherent natural sound. (Source: Chadwick Wachs)

based on equipment from Pinnacle Systems, treated graphics as a bunch of objects instead of one composite picture. Objects, such as a banner or picture, that are part of a composite graphic could be changed centrally and shipped via the inter-venue LAN/WAN over the Qwest fiber to where it was needed. As an example, the medal counts of each country would each be an individual object. As a country won a medal, say a gold, only the object representing the country's gold count would be changed and shipped out to the venues. If a venue then called up a graphic that had that particular object in it, the correct count would now be displayed. The local graphics people wouldn't have to keep track of and manually input medal counts, or



Figure 7.50 Even as setup begins for the actual games and airtime, pre-production coverage of the trials continues. (Source: Chadwick Wachs)

truck vendor engineers to integrate the vendor's truck into the overall Olympic coverage. Often, additional communications, graphics, editing, and video and audio gear must be installed and integrated into the truck in a few days. NBC used an engineering staff of 30 to design its coverage of the games. Often there are multiple technical managers for the multilateral and multiple unilateral feeds. At such venues there is a broadcast venue manager (BVM) who works for the IBC. The BVM's job is to coordinate the efforts of the various technical managers.

NBC took a radically different approach to graphics at Salt Lake. It used an object-oriented system based at its facilities in the IBC. NBC's system,



Figure 7.51 It's show time! In the photo on the left the director looks at the monitor wall displaying his available sources and "calls" the show. The person to his left is the TD, who turns the director's commands into the video portion of the show. All the control panels on the console in front of the director are for communications, either with the local truck crew, local talent in the booth or with the IBC. (Source: Chadwick Wachs)



Figure 7.52 Besides the cameras on triax supporting the multilateral and unilateral feeds, a sea of local stations and national networks converged on the various venues (left) to conduct interviews with hometown favorites. The videotape is then driven back to the IBC or fed back via the venue's TOC. (Source: Chadwick Wachs)

any other scores or constantly changing information.

From here it's pretty much a bunch of remotes, or as a wise person once said, "It's like doing a bunch of Super Bowls everyday for two weeks!!!!" After the games are over it's the normal drill — teardown and pack up. Mobile units take a day or two, the IBC a week or so and the field shop is usually gone 60 days after the Closing Ceremonies. ■



Figure 7.53 Like most sports today, the Olympics has a massive graphics effort. Here a producer and graphics operator confer over ever-changing graphics. (Source: Jason Taubman)



Figure 7.54 Here is a super slow-motion (known as super "slo-mo" in industry slang) instant replay operator during a break in the action. This replay is "super" because it records at 90 frames a second instead of the 30 frames normal for NTSC. This allows for much smoother motion from frame to frame upon playback. This "table-top" remote was in addition to the production truck's usual complement of equipment and was therefore set up in an office trailer in the compound and interconnected into the truck as an integral part of the system.



Figure 8.1 Early on the networks, and there were only three at the time — ABC, CBS and NBC — didn't provide full schedules. They slowly ramped up offerings, like FOX did throughout the late '80s, and a couple of the newer networks are still doing today. In addition there were only two types of sources, and both involved television cameras — the studio camera and the film chain (film projectors into a specialized television camera). So early television stations were in a constant search for programming. Early equipment was clumsy and disaster prone. But broadcasters soon discovered that venturing out into the community made for more viewers and more programming, which meant more advertising time that could be sold. The early trucks didn't carry many cameras, but the early television viewer was content, in many cases, with a couple static shots of the action, be it a ballgame, parade or city council.