



Olympic
Broadcasting
Services

MEDIA GUIDE

OLYMPIC WINTER GAMES

BEIJING 2022

February 2022



STORYTELLERS OF THE GAMES



As host broadcaster of the Olympic Games, Olympic Broadcasting Services (OBS) acts as the storytellers of the Games, delivering the images and sounds that captivate billions of viewers worldwide.

This media guide has been produced to provide an in-depth overview of who OBS is, what OBS does, and how OBS helps the Rights Holding Broadcasters (RHBs) deliver the best coverage of the Games possible to their audiences.

BEIJING'S OLYMPIC WINTER DREAM UNDERWAY

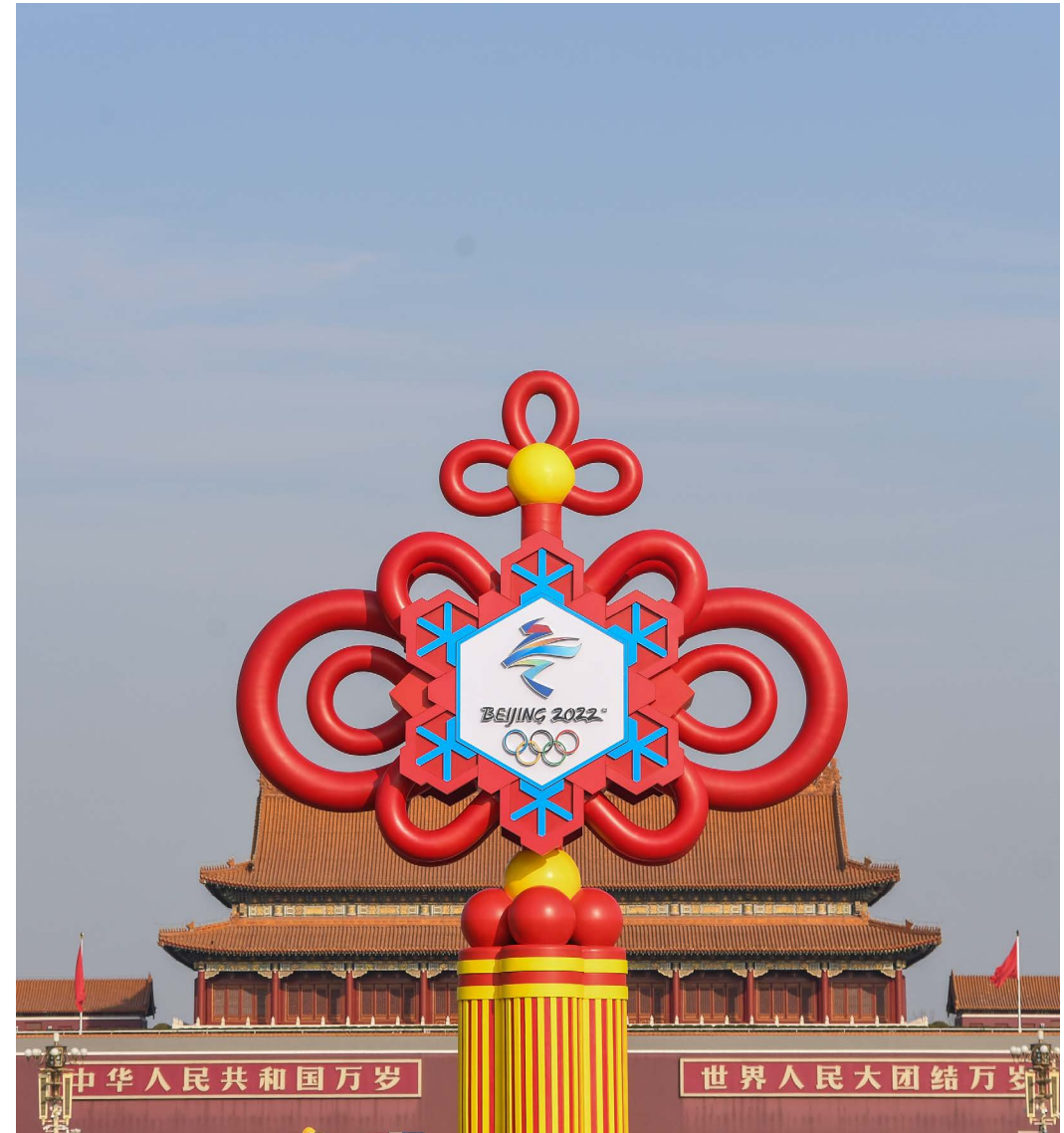
Welcome back to Beijing, and to another opportunity to experience the Chinese capital's unique Olympic spirit.

After successfully hosting an unforgettable Olympic Games in the summer of 2008, Beijing is set to become the first city to host both a summer and a winter Games. Over the course of 17 days of incredible sporting feats, athletic prowess, and raw emotions, Beijing will become the world's showcase of winter sport. Some of the iconic legacy venues from 2008 have been temporarily transformed, while the mountains surrounding the city are ready to serve as a spectacular backdrop to the snow events.

As host broadcaster, Olympic Broadcasting Services (OBS) is committed to providing the highest level of coverage and services to the Rights Holding Broadcasters (RHBs), allowing them to deliver an enhanced and more immersive viewing experience to their audiences, whichever platform they use to watch the Games. By making the delivery

of high-quality content an absolute priority, and pursuing the latest technologies and innovations, OBS enables broadcasters to serve their diverse audiences, keep them engaged with inspiring stories from the Games, and create memorable experiences.

It has been a unique build-up to a Games. The COVID-19 pandemic caused not only travel restrictions, but also forced the postponement of the Olympic Games Tokyo 2020 to the summer of 2021, disrupting the broadcast preparations for the Olympic Winter Games Beijing 2022. Planning has needed to be nimble and flexible, requiring a new way of thinking and constant adaptation to an ever-changing situation. However, the many lessons learnt from the safe organisation of the Tokyo 2020 Olympics have helped put in place everything required for a smooth and efficient broadcast operation. Moreover, the guidelines laid out in the Beijing 2022 Playbook mean everyone involved with the Games will be able to work in a safe and secure environment.



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Beijing will become the first city in the world to host both the summer and winter editions of the Olympic Games, making it the inaugural dual Olympic city. Having hosted the Summer Games in 2008, Beijing is now hosting the Winter Games, starting on 04 February 2022. Fourteen years ago, Beijing impressed the world with the outstanding delivery of the Olympics, which created numerous memorable moments not only for worldwide audiences but also the athletes, and the entire Olympic family.

From a broadcast perspective, Beijing 2022 will offer an exciting glimpse into the immersive and virtualised future of Olympic broadcasting, exploring new and innovative ways of producing the Games while engaging worldwide audiences further.

Beijing 2022 will again mark a leap forward in Olympic Games broadcast technology. The Olympic Games Beijing 2008 were the first to be produced and broadcast entirely in High Definition (HD). Fourteen years later, Beijing 2022 will represent the first time that an Olympic Winter Games is natively produced in Ultra High

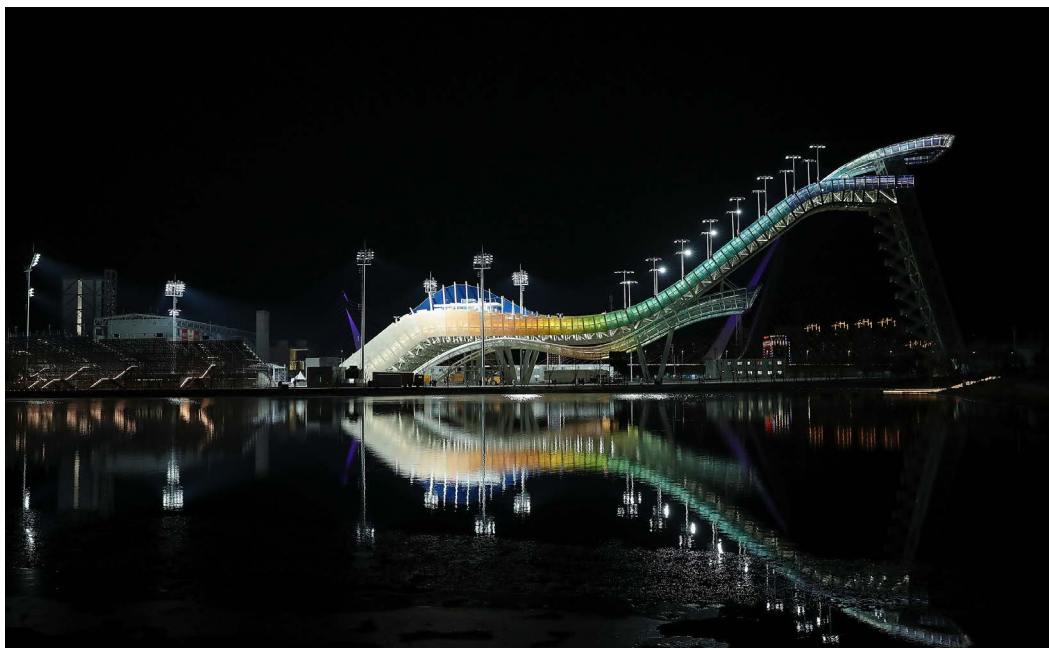
Definition (UHD) High Dynamic Range (HDR) with immersive audio. This new standard elevates the pictures and sounds, delivering life-like colour and breath-taking contrast while capturing the full atmosphere from the competition venues. OBS will achieve this level of coverage thanks to a brand-new, state-of-the-art IP-based core system that will allow for additional services, new formats and more flexibility, while dramatically reducing the carbon footprint of the broadcast operation in the host city.

To showcase Beijing 2022's celebration of winter sports, OBS will introduce a series of innovative technologies to improve the overall Olympic viewing experience and provide worldwide audiences with the genuine feeling of being at the Games. Working with Worldwide TOP Partners, Alibaba and Intel, OBS plans to use the latest technologies to deliver a far more immersive experience than in previous Games.



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An interior view of the reflective silver ceiling within the newly-built National Speed Skating Oval, also known as the Ice Ribbon.



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Shougang Big Air is the only outdoor snow event venue in the Beijing zone. Built on the site of a former steel mill, it will host the freestyle skiing and snowboard big air events, and is the world's first permanent venue for big air events.

Together with Intel, OBS will capture, produce and distribute the Olympic Winter Games in live 8K Virtual Reality (VR) for the first time. Through a much improved, smoother user experience, Olympic fans (via participating RHBs) will be able to watch the action in higher quality, true-to-life VR and feel like they're actually there alongside the athletes, while broadcasters will be able to use these VR feeds in 8K to create virtual backdrops for their television studios.

OBS will generate further engaging and dynamic viewing experiences in Beijing by deploying more multi-camera replay systems for frame-freeze 'bullet-time' slow motion replays. These systems will allow viewers to move around the athlete and capture an up-close look at the action from various angles. For curling and speed skating, OBS has joined with Alibaba to use its leading-edge cloud solution to seamlessly deliver unique replays to viewers around the world in mere seconds.

The wider adoption of cloud and 5G technologies in Beijing will reshape the way the Games are broadcast. The OBS Cloud will once again support the backend of Olympic broadcasting and play a key role in content distribution and post-production workflows. OBS will distribute the feeds in HD and UHD through the cloud for the first time to more than 20 broadcast organisations. Not only do the RHBs have a new means of receiving the live signals in their home countries, it offers them a more agile solution to choose which feeds they wish to receive.

The full 5G coverage implemented across all Olympic venues also provides new opportunities for live coverage, and for the first time, OBS will capitalise on super-fast 5G wireless connectivity to deliver live signals from several cameras, including those fitted on snowmobiles at cross-country skiing and also those used in the start and finish areas at alpine skiing.

Teaming up with Intel, OBS will also explore more flexible and modular production environments by designing a revolutionary virtualised Outside Broadcast (OB) van. With the full adoption of an IP-enabled infrastructure, certain functions of the in-venue production units can be moved away from the legacy broadcast components into using virtualised Commercial-Off-The-Shelf (COTS) Information and Communications Technology (ICT) servers and networking, opening up new opportunities that could lay the groundwork for producing the Olympic Games in an entirely new way in the near future. Virtualisation will redefine broadcast production requirements and allow for the possibility to scale services and greatly reduce the set-up time.

After proving so popular at the Tokyo 2020 Olympics, the Digital Fan Engagement initiative will return to Beijing 2022. Fans around the world will again have the chance to show their support for their favourite athletes and teams. Once again, athletes will be able to connect with their loved ones and share with them, live in the moment, all the emotions of participating in the Olympic Winter Games. Unlike in Tokyo, where it was available at selected sports only, OBS will offer these athlete moments from all Beijing competition venues, and incorporate them as much as possible into the live coverage to convey the athletes' emotions beyond the arena.

For Beijing 2022, OBS will produce more than 6,000 hours of content, including 900 hours of live sports and Ceremony coverage. RHBs will have access to more than double the amount of content from the sporting action compared to PyeongChang 2018.

All of us around the world have endured two difficult years, and everyone involved with the Olympic Winter Games Beijing 2022 has made a significant effort to make these Games happen. Now the time has come for athletes to compete, and for OBS and the broadcasters to share their stories to worldwide audiences, in new and inventive ways, so that the memories of Beijing 2022 live on as those of Beijing 2008.



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CHAPTER 1

OBS, STORYTELLERS OF THE GAMES

As host broadcaster, Olympic Broadcasting Services (OBS) is responsible for delivering the pictures and sounds of the Olympic Games to billions of viewers around the world. OBS produces and transmits unbiased live radio and television coverage of every sport from every venue. This feed is called the International Signal or the world feed.

In this role, OBS develops a consistent approach across all Olympic editions while at the same time optimising resources to continually improve the efficiency of the host broadcast operation. OBS does so to ensure that all IOC contractual obligations are fulfilled and the RHBs are offered the exceptionally high level of production that is associated with the Olympic Games.

THE STRENGTH OF EXPERIENCE

The experience and diversity that the OBS team possesses has been instrumental in the televised production of hundreds of the greatest sport events during the past 40 years.

The planning of the broadcast operation is the daily business of a team of more than 160 people, representing 30 nationalities, working from the offices in Madrid, who progressively relocate to the host city prior to the Games.

However, it is up to an international workforce comprised of between 4,000 and 8,000 personnel, depending on the edition of the Games, to deliver the Olympic live broadcast and support the RHBs' operations.

Members of the OBS management team have an average of nine Olympic Games experience each. Collectively, the entire OBS staff has worked across approximately 800 Games combined.



© 2018 Olympic Broadcasting Services / Owen Hammond

The successful coverage of the Olympic Games is the result of endless hours of work and know-how from an experienced and diverse broadcast team.

HOW OBS WAS CREATED

The International Olympic Committee (IOC) established OBS to serve as the permanent host broadcaster for the Games, eliminating the need to continually rebuild the broadcast operation for each edition, and as a result create a more efficient, streamlined operation. In 2003, the IOC registered the company in Madrid. Manolo Romero, a television pioneer, who had overseen the Olympic host broadcast organisations since Barcelona 1992 became the first Chief Executive Officer (CEO) of OBS.

At that time, agreements and structures were already in place for the broadcast of the Olympic Games Athens 2004 and the Olympic Winter Games Torino 2006, so the first official OBS operation was the broadcast of the Beijing 2008 Games. A joint venture was created between the Beijing Organising Committee and OBS. OBS supplied not only the equipment but, more importantly, the know-how of experienced personnel from previous Olympic broadcast operations as well as new personnel hired and trained through the Athens and Torino Games.

In November 2007, the OBS Board of Directors approved a plan to create a permanent central planning structure for OBS to work across

all Games. Previously, a full-blown planning operation had to be recruited and trained for each edition of the Games in each host city, while OBS in Madrid was working as a Management Company made up of a small group of employees looking after its central assets of equipment used across the Games. As a result, OBS has developed into a permanent team of more than 160 employees and has been completely independent from the Organising Committees since the Beijing Games. Yiannis Exarchos was appointed OBS CEO after the Olympic Games London 2012.

In March 2018, a Cooperation Agreement between the IOC and the International Paralympic Committee (IPC) was signed and established OBS as the Paralympic Games host broadcaster of all future editions.

OBS SL is nowadays supervised by an IOC-appointed board of seven directors, whose current chair is IOC member Gerardo Werthein from Argentina.

2001 The IOC establishes the need for a single host broadcast organisation and OBS is formed.

2003 The IOC registers OBS SA in Switzerland, as well as a subsidiary company, OBS SL, in Madrid, Spain.

2005 Television pioneer Manolo Romero establishes offices in Madrid, recognising the benefits of Spain's highly trained workforce and strategic location for global operations.

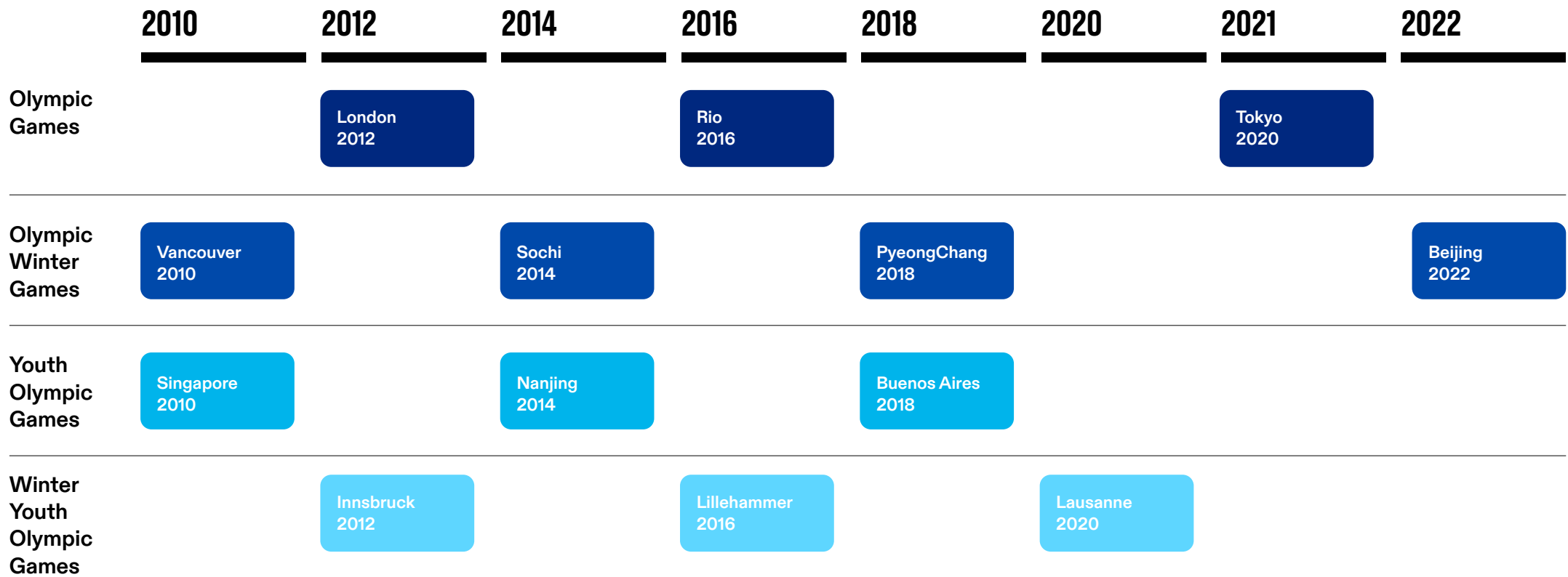
2007 OBS Board of Directors approves the plan to create a permanent central planning structure for OBS, working across all Games. The core team in Madrid expands from 18 employees to 146 broadcast professionals.

2010 The Olympic Winter Games Vancouver 2010 represents the first time the host broadcast operation is completely independent from the Organising Committee, and the sole responsibility of OBS.

2012 Yiannis Exarchos is appointed OBS CEO after the Olympic Games London 2012.

2018 A Cooperation Agreement between the IOC and the IPC is signed and established OBS as the Paralympic Games' host broadcaster of all future editions.

OBS AS HOST BROADCASTER



(includes Paralympics when applicable)

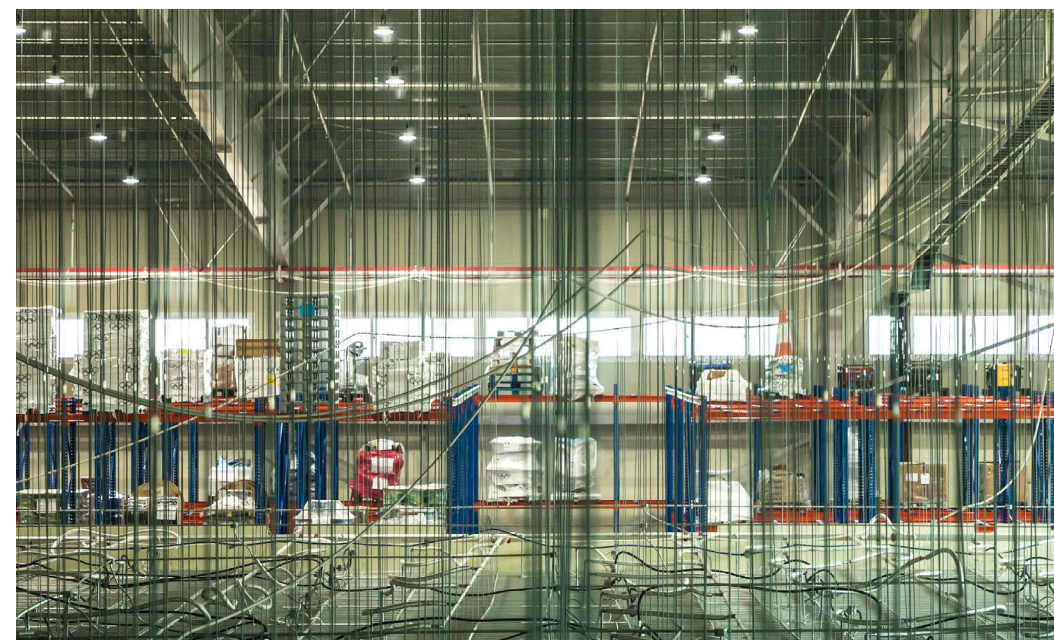
THE COMPLEXITY BEHIND THE HOST BROADCAST OF THE OLYMPIC GAMES

Behind each Olympic Games are years of detailed planning and preparation to ensure viewers can enjoy the world's largest sporting event on their screens.

The scale of the Games and the nature of the sports programme are two key features that set the Olympics apart from any other major sporting events.

A copious amount of detail and effort goes into the preparation of the broadcast of the Olympics. Successful planning requires identifying the right people, infrastructure and equipment to properly deliver the coverage from each competition venue, while working closely with all of the stakeholders, in particular the IOC, the local Organising Committee of the Games (OCOG), the International Federations and the RHBs.

Live broadcasting by its very nature requires being prepared for every eventuality – an enticing challenge that grips everyone at OBS. From the design of the coverage plan to the high-powered, back-end technical support required to make it happen and ensure proper delivery to the RHBs, to the offering of a plethora of services and facilities for the world's broadcasters to customise the signals for their home audiences, OBS can depend on a core team that offers a unique blend of technical expertise, practical experience and creativity. This know-how is key when it comes to planning, adapting, innovating, supporting and



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The OBS warehouse which is temporarily installed in the host city at each Games plays a key role in ensuring that all the broadcast equipment is dispatched to the Olympic venues and shipped back once the Games have come to an end.

delivering solutions across the various aspects of the operation.

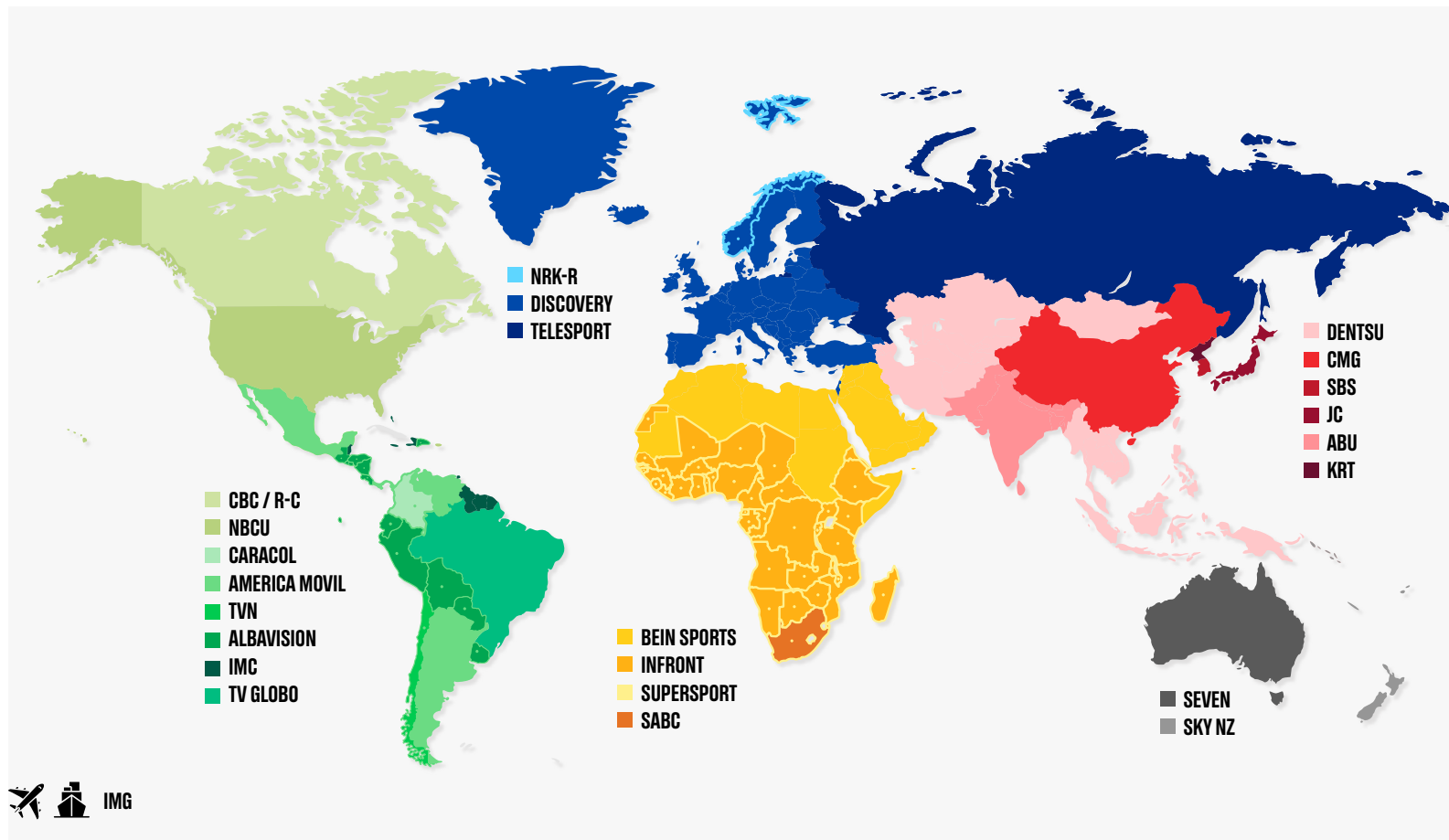
Setting up the host broadcast operation also entails a tremendous logistical challenge, which involves transporting tons of equipment to the host city(ies), ensuring its safe delivery and then providing the same service when it is time to pack up and leave. It also means recruiting thousands of broadcast professionals worldwide, across a broad range of positions, training local students through the Broadcast Training Programme (BTP) and managing the accreditation of the entire workforce. It also includes meeting the service level needs of the OBS team by providing air and ground transport, accommodation, uniforms and food, all the while, providing a high level of support whenever it is required during the Games.

An exceptional layer of complexity was added to the Tokyo 2020 and Beijing 2022 Games operations with the two Games back-to-back, due to the postponement of the Tokyo 2020 Olympics and the impact of the COVID-19 pandemic.

Planning for two Games at a time has been a massive undertaking, but OBS has been able to count on the incredible commitment of the Beijing 2022 Organising Committee and the support of all its partners to deliver successful Winter Games in February 2022.

OBS has been working closely with the IOC, the Chinese authorities and the OCOG to implement COVID-19 countermeasures and to ensure a safe environment for all involved.

OBS IS AT THE SERVICE OF THE RIGHTS HOLDING BROADCASTERS



To date, 24 RHB organisations have reached agreement and purchased the rights to broadcast the Olympic Winter Games Beijing 2022, alongside the Olympic Channel.

The IOC is responsible for managing the global broadcast rights for the Olympic Games across all media platforms, including free-to-air television, paid television, radio, internet and mobile, and allocating exclusive rights for a certain territory to broadcast partners through the negotiation of rights agreements.

Through their partnership agreements, the RHBs are given access to the International Signal produced by OBS and may book the required facilities at the Olympic venues, the International Broadcast Centre (IBC) and the Zhangjiakou Mountain Broadcast Centre (ZBC) in order to produce their own coverage.

While OBS is responsible for producing the multilateral coverage of the Games, the RHBs personalise the programming for their respective audiences. They are uniquely positioned to provide detailed commentary on the competition, interview athletes and cover the news of the Games in their native languages.

THE RHB JOURNEY

Whether a broadcast organisation has only recently acquired the rights to the Games, or has had a long-standing relationship with the Olympics, OBS will assist and guide the RHB through the entire planning process. While no two Games are the same, OBS has built upon many years of experience to deliver the most efficient and streamlined approach to planning and delivering all the services and facilities required to bring the Games to the world.



RHB as official broadcaster

A broadcast organisation enters into agreement with the IOC to purchase the rights to broadcast the Olympic Games in their home territory (television, digital, radio or some combination).



Start of the relationship with OBS

OBS will assist each RHB during the planning phase and provide access to a broad range of resources to support and enhance their production plans.



Annual broadcaster meetings

Beginning three years prior to the Games, OBS will hold annual meetings in the host city(ies), together with the OCOG, to update the RHBs on the preparations for each Games.



Catalogues of services available for booking

Two years out, OBS distributes the Directory of Services (DOS) that details all broadcast-related services and facilities available for the Games. Additional services such as vehicle rental will need to be booked through the OCOG's Rate Card.



Coordination with the Organising Committee

RHBs will work directly with the OCOG to establish their needs for accreditation and visas; arrivals and departures; accommodation; transportation etc.



OBS booking deadline

Each RHB must submit to OBS all of their requests for services and facilities that will be deployed for their exclusive use during the Games during the specific booking window set in the DOS.



Venue surveys

OBS, in conjunction with the OCOG, will offer RHBs the opportunity to visit select competition venues to observe the status of construction and preparation, as well as better identify their needs within each venue.



Move to the host city(ies)

RHBs who have chosen to have all or some portion of their operations in the host city(ies) begin moving equipment and personnel, including occupying space in the IBC, if booked.



Set-up and testing

Installations, testing of signals and systems, rehearsals and all preparations commence prior to the start of the Games.



Games-time

RHBs, OBS, the IOC and the OCOG conduct Games-time operations.

RHBs' unconventional journey to Beijing 2022

The impact of the global COVID-19 crisis and the back-to-back operational challenges of the Tokyo 2020 and Beijing 2022 Games have been significant to the broadcasters' preparations.

Not only did the pandemic affect their daily operations and planning activities, but broadcasters were also prevented from travelling to China and visiting the venues prior to the Games, due to the restrictions put in place.

Further, holding two editions of the Games less than six months apart has presented several logistical obstacles in their staffing and operational plans. Conducting Games-time activities, while concurrently planning the rapidly-approaching Winter Olympics, has been a challenge unlike any other.

The Playbook for stakeholders, developed jointly by the IOC, the IPC, the Beijing 2022 Organising Committee and the Chinese authorities, has provided key guidelines for the RHBs' on-site operations and COVID-19 countermeasure implementation.

Additionally, OBS has been at their side along this unique journey, holding remote briefings, providing guidance and adapting its services to best support their efforts.

INTERVIEW WITH YIANNIS EXARCHOS

“The most immersive Olympic Winter Games yet”

OBS Chief Executive Officer Yiannis Exarchos talks about the unusual planning of the Beijing 2022 Games and the key broadcast innovations.

Welcome back to China. This will be your second Olympics in Beijing. What first comes to mind when remembering the 2008 Games, from a personal and a broadcast standpoint?

It is great to be back in Beijing and China. I lived here for three and a half years before Beijing 2008, and I am extremely fond of the city. In 2008, I had the pleasure of experiencing the most spectacular change of a city there has ever been. It was fascinating to see, but so was getting to know the Chinese people and their culture.

The Games of 2008 were China's welcoming party to the world, and we all witnessed what China and Beijing were capable of when organising a worldwide event. Now, China is an established power, and will become the first to host a Summer and a Winter Games.

From a broadcasting perspective, Beijing 2008 was the first time that the Games were

distributed in High Definition (HD), and the first time we produced a little bit of digital content, at a time when most of the platforms we now use didn't exist. Now, we have transitioned to Ultra High Definition (UHD) High Dynamic Range (HDR) and are equally focused on traditional television and digital broadcasting.

The preparations for Beijing 2022 haven't been conventional, considering that the past two years encompassed a global pandemic, travel restrictions and the postponement of Tokyo 2020, leaving only six months between Games.

How has OBS remained agile in adapting to a constantly changing environment and been able to deliver and plan back-to-back Games?

Obviously, it has been a highly complex environment from a planning and execution point of view. As host broadcaster, OBS had to deal with two Olympic Games and two Paralympic Games happening within seven months of each other. So it means four huge



YIANNIS EXARCHOS

Yiannis Exarchos is the CEO of Olympic Broadcasting Services (OBS), the organisation created by the International Olympic Committee (IOC) to serve as the permanent host broadcaster for all Olympic Games and Youth Olympic Games. He was appointed to this position following the Olympic Games London 2012, after having served as a top executive for all Olympic host broadcasting organisations since Athens 2004.

In 2015 he was also named Executive Director of Olympic Channel Services (OCS), the corporate entity charged with creating and operating the IOC's Olympic Channel, which was successfully launched in 2016 and is now the core hub for content creation, technology and digital development, as well as data analysis for Olympics.com and the wider Olympic digital ecosystem. He is also a member of the OCS SL Board of Directors.

Specialising in the management and coverage of global sporting events, his background in radio, television, music and film brings a comprehensive perspective to the planning and management of the broadcast of major events.

His in-depth media experience and leadership have earned him numerous nominations and recognitions, including, among many others, five Emmy Awards, five Webby Awards and more than ten Telly Awards. He also received an award from the Greek National Olympic Committee for his long-term contribution to the Olympic Movement, and the Great Wall Friendship Award in acknowledgment of his contribution to Beijing's progress and development.



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Yiannis Exarchos was born in Athens in 1964 and studied Law and Film directing. During his earlier career, he produced and presented cultural and art programmes on Greek TV and Radio and held several management and senior executive positions in a number of broadcast organisations, including Executive Director of the Greek national broadcaster ERT. He has lectured at numerous conferences and collaborated with several public and private organisations such as the European Broadcasting Union (EBU) and the United Nations Educational, Scientific and Cultural Organisation (UNESCO). He is also a regular speaker at international conferences and events on broadcast, new technologies and digital media.

He lives in Madrid with his wife Vana; his native language is Greek and he is also fluent in English, French and Spanish.

 @YiannisExarchos

Games operations happening in a concentrated period of time.

Planning has not been straightforward because our teams couldn't travel to Japan or China for a long time. China has pursued a successful zero COVID-19 policy, but that meant gaining access and entry was difficult. We weren't able to do some of the usual things we do when you can travel, but we were able to get a few people on the ground to work alongside the Beijing 2022 Organising Committee. We also fast-tracked our remote planning tool, and then it was a case of planning properly for the entire implementation of the Games, both Tokyo 2020 and Beijing 2022.

We began work on the fit-out of the Beijing 2022 International Broadcast Centre (IBC) three weeks before the start of Tokyo 2020.

Preparing for these Games has been a unique challenge, but I'm happy to say that we are in very good shape ahead of the Beijing 2022 Opening Ceremony.

Tokyo 2020 proved that delivering a safe and successful large-scale event is possible, thanks to the principles laid out in the Playbook. How have the principles in the Beijing 2022 Playbook evolved to meet the zero COVID-19 strategy in China?

We know now that Tokyo 2020 was not just extremely successful, but extremely safe with 33 positive cases among the 11,300 athletes, and 464 among tens of thousands of accredited stakeholders. That success can be attributed to the implementation of the Playbook and the countermeasures that were put in place, notably those introduced by OBS for the Rights Holding Broadcasters (RHBs) activities at the venues.

For Beijing 2022, the greater build-up time means that we have refined some of those measures, to provide better working conditions for the broadcasters. However, we have also had to consider the conditions laid out by the Chinese government.

It has been a highly complex environment from a planning and execution point of view

The Playbooks have been developed jointly by Beijing 2022, the IOC and the IPC, in close collaboration with the Chinese Government and other relevant authorities. They are based on the extensive work of an international working group and collaboration with scientific experts and organisations from across the world. They include sport-specific regulations, which build upon the experience of the International Federations, other sports organisers and the measures implemented during the Tokyo 2020 Olympic Games.

The Chinese have been able to create a loop system which houses all the resources in a very safe Olympic environment. It has been in operation for a few weeks, and it is working very well. It is easy to follow, so everyone can have confidence that they will be able to perform their job while at the Games.

What challenges and opportunities in your planning come from having three competition zones?

We are accustomed to working with numerous competition zones, especially at the Winter Games, and what really helps bridge the distance from Beijing to the Yanqing and Zhangjiakou zones is the new high-speed rail system, which has brought the mountains so much closer to Beijing. Whereas it was a three-to four-hour car journey, now it is a fraction of the time by train. The mountain venues have been built for the Games and have already hosted highly successful test events. I expect the spectacular locations – from the space-age looking ski jumping facility to the

beauty of the ski runs to the revitalised industrial Shougang Park – will wow a global audience and create images that will be remembered around the world.

Beijing will become the first city to host both an Olympic Winter Games and Olympic Games, with an ambitious goal of engaging 300 million Chinese in winter sport. How will the coverage by OBS support this effort?

In each host city, the Olympic Games have the unique power to create a narrative and imagery for the whole nation, and they draw in people who aren't regular followers of sport.

Beijing is ready to host the Olympic Winter Games. All of the competition venues are ready and successful test events were held. Learnings from these test events are incorporated into Games planning to ensure excellent conditions for the athletes to perform at the highest level.

The Winter Games will help the Chinese people engage more with winter sports. Over 200 million Chinese have begun playing these sports and that is a great thing. China now has more than 650 ice rinks across the country, an increase of more than 300 percent since 2015. The number of indoor and outdoor ski resorts in the country has almost doubled, and over 2,000 primary and secondary schools across China included winter sports in their curriculum by the end of 2020.

The Organising Committee has also emphasised the need to make the Games as sustainable as possible. Five of the seven competition venues in the Beijing 2022 competition zone will be legacy venues from Beijing 2008, including the "Bird's Nest" National Stadium, which will host the Opening and Closing Ceremonies; the Water Cube, which has been transformed from the Beijing 2008 swimming venue to host the curling competitions; and the Wukesong Sports Centre, which hosted basketball in 2008 and will host ice hockey in 2022.

Beijing 2022's innovative Shougang Park was created by using and renovating discarded factories in the Shougang industrial area and the Big Air Shougang venue is set to become an iconic venue of the Beijing 2022 Games, with its giant chimneys from the former steel plant as a background.

The other legacy from the Beijing 2008 Olympics is the programme that was put in place to ensure Beijing's air is far cleaner. It means that today we can enjoy brilliant blue skies, over an eco-friendly city from where you can see the surrounding mountains. Many back

then didn't even realise that Beijing was situated on a plateau surround by mountains.

The Olympic Games have the unique power to create a narrative and imagery for the whole nation, and they draw in people who aren't regular followers of sport



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The Chinese government's ambitious goal to engage more than 300 million Chinese in winter sports thanks to the Olympic Winter Games Beijing 2022 is about to become reality.

A new standard was set in Tokyo 2020 with the broadcast of the Games as a native UHD HDR production with immersive audio. What were the key learnings and how have they affected the direction OBS will take in Beijing and future Games?

At Beijing 2022, we plan on consolidating the way we now produce our coverage in UHD HDR, and the Beijing 2022 Games will become the first Olympic Winter Games natively produced in this new standard.

To achieve this level of production, we had to develop a technical workflow that would allow us to shoot in UHD, while at the same time ensuring the delivery of our outputs in both UHD and HD as per Olympic standards.

The way this new production standard has developed, with audiences demanding for more content to be delivered in 4K as all TV screens are nowadays fully UHD 4K compliant, has helped accelerate the transition to live production and content distribution of the Olympic Games in this new standard.

Further, OBS has also created its own set of look-up tables in-house, enabling a better interoperability between the two co-existing HD SDR and UHD HDR workflows.

For those watching the Games at home, the fact that our entire coverage is now produced in native UHD HDR makes a huge difference, when it comes to the quality of the pictures and the sounds. We have moved from a 5.1 to 5.1.4 audio configuration, which makes the viewers feel enveloped by the atmosphere of the event.

In Tokyo, this immersive audio set-up also helped mitigate the absence of spectators. However, in Beijing, there will be limited spectators in the venues and their presence will certainly enhance our coverage.

We are confident these first Winter Games in UHD HDR with immersive audio will provide an



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Virtual Reality helps bring viewers at the heart of the Olympic venues and offers an enhanced viewing experience.

unmatched viewing experience.

Fans want to feel closer to the action, as if they were there in person. How does OBS innovate and deliver on fans' new needs and digital habits to enhance the viewing experience?

OBS has always had the objective of making the fan's experience feel as close as possible to being at the arena. As well as satisfying core fans of the sports, we also need to cater to people who only follow those sports during an Olympic Winter Games. Historically, the Olympic Games has a much higher number of first-time viewers than other sporting events.

We need to provide an opportunity for a sport

to attract an audience that doesn't normally follow the sport closely, and to do that you have to immerse them in the sport. You have to make them feel as close to the athletes as possible, and make them see, listen, understand all the passion and the emotion that goes into practicing their sport.

As such, we have always pursued the directive of immersive coverage, and that is helped by improvements in technology. Nowadays, we have more tools, whether audio or visual, such as the increased use of multi-camera replay systems, greater data on our digital streams and immersive audio, that really give viewers that sense of being part of the Games. For example,

in Beijing 2022 we will be producing 8K live Virtual Reality (VR) coverage for the first time.

We will be able to expand our traditional coverage at these Games because of the more widespread coverage of 5G technology. 5G's greater bandwidth gives more mobility and flexibility and allows for a seamless transfer of high-resolution video with the ultra-low latency required. With 5G, you can have cameras in places you weren't able to have them before, providing new angles and more immersion.

Our digital output will also allow worldwide audiences to come together and share their experiences of the Games, and engage with the Olympics, no matter where they are in the world.

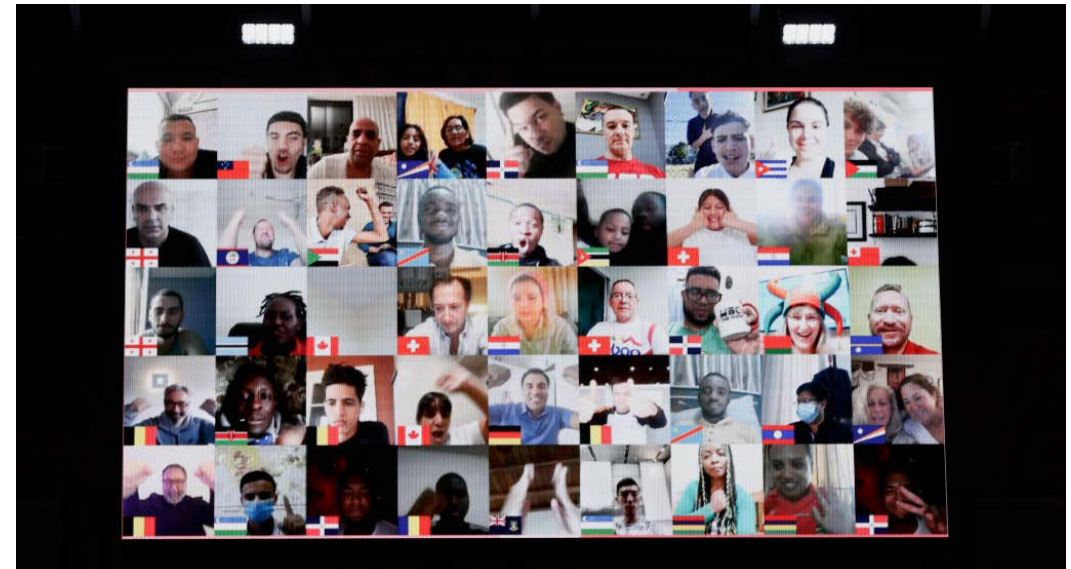
In that sense, compared to previous Games, Beijing 2022 will be much more immersive and interactive, and we will make the fans feel much closer and take them onto the field of play itself.

When it was announced that Tokyo 2020

would be held without spectators, OBS quickly developed an innovative Digital Fan Engagement initiative. Will this project be expanded for Beijing 2022, and do you foresee this becoming a permanent fixture for future Games?

One of Tokyo 2020's biggest legacies is the Digital Fan Engagement initiative, which was made up of three elements: the Fan Video Wall, the Virtual Cheer Map and the Athlete Moments. We had this project in mind for a while but had to fast-track it for Tokyo 2020.

Despite putting it together in two months, it proved a huge success and was widely popular. Athletes loved it, spectators loved it, fans back home loved it, and broadcasters loved the Athlete Moments, because it shared the emotion of an athlete's connection with their family to those watching. We had over 250 million cheers coming from every single country of the world, supporting every single nation that participated in the Games and more than 200 Athlete Moments connecting Olympians in the venues with friends and families back home.



© 2021 Getty Images / Steph Chambers
The Fan Video Wall allows Sport Presentation to share the fans' selfie videos as they cheer for their favourite athletes and teams on the big screens inside the Olympic venues.

After Tokyo 2020, we held discussions with athletes, broadcasters and International Federations who all expressed a desire to continue with the initiative, regardless of whether there would be spectators present or not at the venues.

We will be hosting Athlete Moments from every single venue, for every single sport, something we didn't have the capacity for in Tokyo. We will incorporate these special moments into our multilateral coverage as much as possible.

The digital fan engagement initiative proved a huge success and will return for Beijing 2022

The Digital Fan Engagement tools will also be available to Beijing 2022's Sports Presentation

to allow global fans to cheer on their favourite athletes, and in doing so enhance the atmosphere and sense of global fan inclusion in the Games, which will further enrich the athletes' experience.

It has become clear over the past two years that remote operations and production is rapidly becoming the new normal. What's next for digital transformation when it comes to Olympic broadcasting?

Two pillars have underpinned our planning for the greater introduction of remote and virtual workflows for the RHBs. The first was the change from a system that relied on traditional broadcast hardware infrastructure into one that is fully IP-based. We completed that change a couple of years ago. The second was the launch of OBS Cloud, which is our broadcast-specific cloud-based platform that we created in partnership with Worldwide TOP

sponsor Alibaba. With OBS Cloud, content delivery, signal processing, post-production and many other elements are now based in the cloud. At the Olympic Games, where there is a huge amount of content and the challenge for broadcasters is to manage that content, by providing them with efficient cloud-based solutions that can allow them to streamline their operations, we facilitate their workflows.

For Beijing 2022, we have continued to invest in cloud-based services. For the first time, OBS will distribute the multilateral signals in HD and UHD via the Cloud, and it will also be the first time that RHBs will have the ability to edit the content available on our online distribution platform, Content+, remotely. It means a more efficient way of working and addresses the RHBs' huge demand for content to share on their digital platforms, without having to multiply their resources.

Over the last two years, the global pandemic has forced broadcast organisations around the world to speed up their transformation, and they made more changes in these two years than they had in the previous decade. We introduced OBS Cloud in 2019, then in 2020 when the pandemic began RHB bookings increased seven-fold. The challenge of the pandemic made us all more creative in our thinking about how to work in a more efficient, remote, and virtual way.

An important project for Beijing 2022 is a virtualised Outside Broadcast (OB) van, whose control room will be based on virtualised, cloud-ready technologies, done in collaboration with our partners, Alibaba and Intel. We are trying to replicate the way an OB functions with reducing the physical broadcast footprint to the minimum. This pilot programme will be based at the curling venue. Depending on the results, we could use such a set-up at future Games. Not only does it offer greater flexibility and scalability, but the OB operations could be performed in a much more sustainable way than having a huge number of trucks coming from all around the world.

You've been outspoken in the past regarding the need for more equitable portrayal in sports broadcasting. How can OBS serve as an example for furthering athlete representation in terms of gender equity and diversity?

Beijing 2022 will feature the closest ratio of female to male participation at an Olympic Winter Games, with female athletes making up about 45 percent of those competing.

We are constantly updating our narratives in order to make sure that there is no stereotyping in the way we cover sports, because that has happened in the past across all sports. OBS needed to address this and drive the change, by being aware of unconscious bias in society where viewers expect sports to be presented differently for women and men. It is important that we keep on striving to strike the right balance and focus on what truly matters – athletes' sporting prowess. We have also been discussing with the broadcasters to ensure there is a more gender balance in the prime-time viewing Games slots.

At Beijing 2022, new mixed gender events will be introduced – snowboard cross mixed team, ski jumping mixed team event, short track mixed team relay, freestyle skiing mixed team aerials. Furthermore, the term 'women' will now be used across all sports, rather than 'ladies.'

Sport media has traditionally been male dominated and we will continue to keep up our efforts to open new avenues and opportunities for females to work in sports broadcasting so that eventually we have a 50-50 split between women and men.

We are not there yet, but we are on the right path and would encourage our fellow broadcasters to follow our example. Then we will have the natural balance in the way we tell stories and produce images that reflect that balance. It is something close to my heart and, while we have definitely made progress, we still have a long way to go.



CREATING A LASTING LEGACY BY TRAINING THE NEXT GENERATION

“Our production and technical managers who trained students back in 2008 were looking forward to repeating the experience, given the students' great work performance and motivation. Despite the challenging circumstances, all BTP students joining our team for the Beijing 2022 operation have been living up to their predecessors, and are brilliant recruits.”



Luana Florentino
Training and
BTP manager



© 2018 Olympic Broadcasting Services / Owen Hammond
The OBS BTP provides local student the opportunity to gain valuable work experience, with placements varying from a couple of weeks to several months.

Forming an important part of the legacy of OBS for each Games, the Broadcast Training Programme (BTP) provides undergraduate and graduate students from local universities an unparalleled broadcast experience. They are offered exciting training opportunities under the guidance of OBS broadcast experts, combined with hands-on skills and valuable work experience during the Olympic Games. **With this programme, OBS aims to empower a new generation of broadcast professionals in each Games' host country, equipping graduates with a wide range of skills required to enter the industry.** The students are given extensive hand-on experience in a real working environment and develop a solid understanding of broadcast workflow and operations, which provides them with a real advantage over the competition when starting their career.

For Beijing 2022, approximately 650 students will be part of the host broadcast operation, working alongside OBS crews in a variety of paid positions. They will be given training and on-the-job experience in key areas of broadcast such as archives,

production, commentary, venue technical operations, Games-time services, broadcast support and office support.

More than 900 participants took part in intense training workshops during the fall / winter of 2021, then the successful candidates were provided access to OBS's e-learning platform to get fully prepared for their Olympic job.

The OBS BTP began at Los Angeles 1984 and, since then, more than 11,000 students have benefitted from the programme's training and gone on to find jobs both within and outside the broadcasting industry. Students report that they mostly enjoy the unique integrated learning approach of the BTP that arms them with a wide range of skills including an increased sense of responsibility and confidence.



© 2018 Olympic Broadcasting Services / Owen Hammond
The BTP is often qualified by the participants as a once-in-a-lifetime experience.

When the lights go down on the Beijing 2022 Games, a strong human legacy will be left in the host country for years to come. **OBS takes much pride in enabling young people, leaving them eager to put into practice the lessons they have learned during their Olympic experience and inspired to pursue their career ambitions.**

CHAPTER 2

DIGITAL TECHNOLOGY IS TRANSFORMING OLYMPIC BROADCASTING

With tech innovation as one of its core values, OBS takes each Olympic Games as an opportunity to embrace change and elevate its coverage and service offering to the Rights Holding Broadcasters, allowing them to streamline their operations and provide their audiences with the best possible viewing experience.

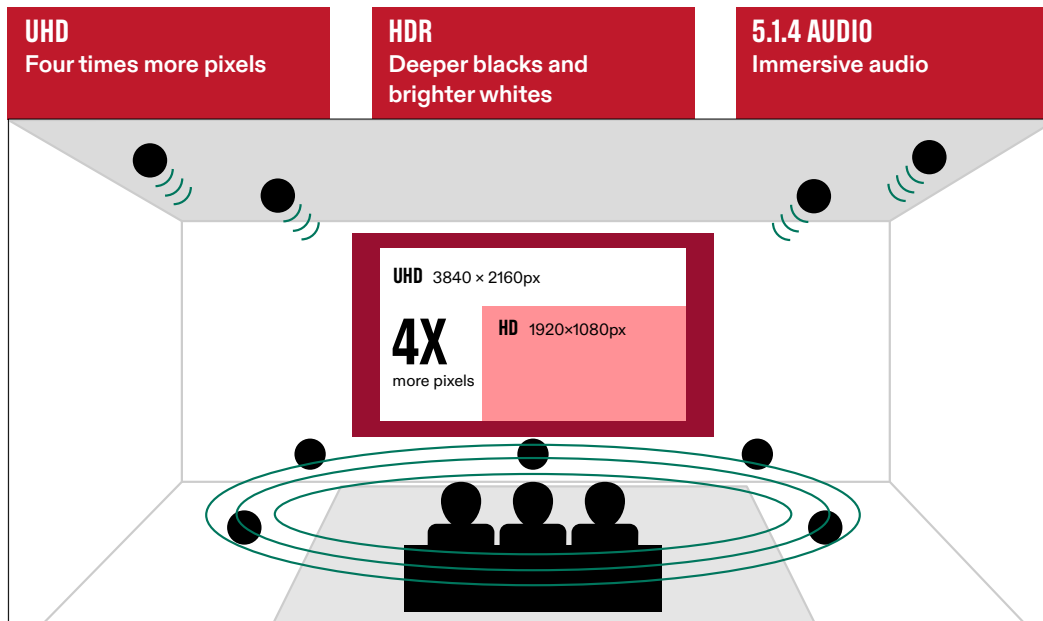
From the newly-established Ultra High Definition High Dynamic Range production standard to live cloud delivery, to virtualised broadcast workflows and 5G-powered live transmission, Beijing 2022 will be an innovation accelerator.

DELIVERING FIRST WINTER GAMES IN UHD HDR

OBS adopted a new production standard that captures content containing four times as many pixels as previous High Definition (HD) for the coverage of the Olympic Games Tokyo 2020.

Beijing 2022 will see the consolidation of this newly established standard.

For worldwide audiences, this transition translates into more life-like details; realistic and richer colours; greater contrast and sharpness, all of which will seemingly bring the audience right into the heart of the action and give them that feeling of actually being there.



Ultra High Definition resolution brings eight times more detail than 1080i and four times more than 1080p, allowing viewers to enjoy a more immersive experience

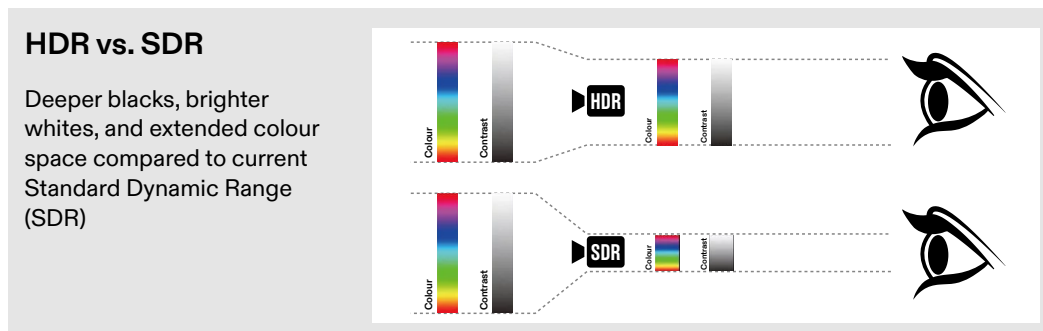
- Sharper, life-like images
- Better contrast and richer colours

High Dynamic Range delivers better brightness, contrast and colour accuracy for a more natural picture overall

- More vibrant, vivid and realistic colours
- Greater detail and textures in high-contrasting images

The 5.1.4 configuration offers a fully three-dimensional audio experience that is similar to actually sitting in the stands

- Better spatial audio rendering with a new sensation of height
- More depth and closer to reality



HDR vs. SDR

Deeper blacks, brighter whites, and extended colour space compared to current Standard Dynamic Range (SDR)

Heightened viewing experience

UHD HDR is not only a case of more pixels, but also better pixels and richer colours. Through these technologies, OBS can create a more immersive experience including more realistic pictures and a new sound approach – an entirely new level of production that helps deliver an enhanced Olympic viewing experience.

For Beijing 2022, all the sports sessions, the Opening and Closing Ceremonies and the Medals Plaza Victory Ceremonies will be natively produced in UHD HDR, with immersive audio. Delivering UHD HDR content requires customised production units and workflows. Overall, OBS will utilise a total of 15 Outside Broadcast (OB) vans, together with nine field datacentre production units, a fly-away system and a virtualised OB van – all that have been specifically configured and fitted-out to meet OBS's new production and distribution requirements.

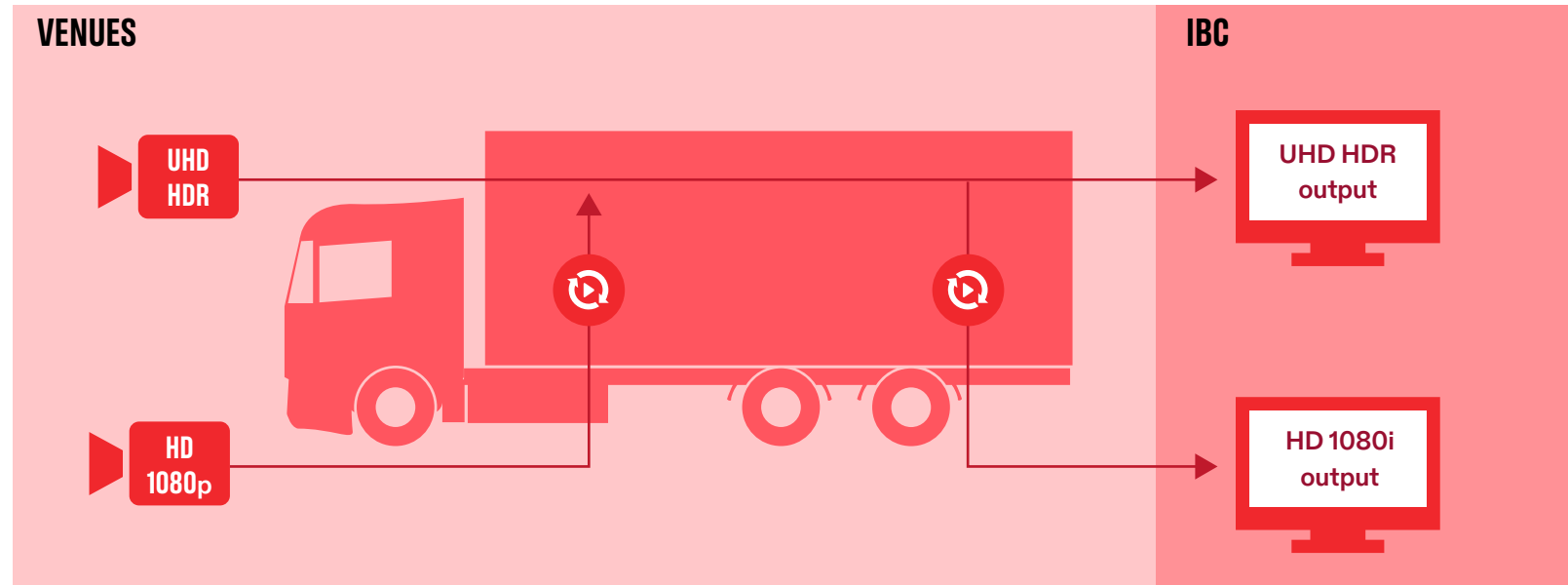
It will be the first time in an Olympic Winter Games that OBS will capture the sounds of the Games through an immersive 5.1.4 audio set-up that enables viewers to have a more realistic audio experience, with sound appearing to come from every direction – even from above. OBS will expand upon 5.1 surround sound by adding an overhead sound layer, and thus a third audio dimension with the addition of four hanging ceiling microphones with heights that will be adjustable. Two new microphones were specifically designed for this immersive sound production. In total, OBS will be using more than 1,600 microphones (40 different models). Two immersive audio quality control rooms installed inside the IBC will support the venue production and guarantee quality consistency across all sports.

INSIDE THE END-TO-END UHD HDR PRODUCTION WORKFLOW

“Building upon our experience from Tokyo, we have consolidated our production capabilities to simultaneously deliver both UHD and HD outputs in the highest possible quality for Beijing 2022. Although our production workflow is greatly simplified by having a single workflow model, achieving consistency across all HDR and SDR sources remains quite a complex undertaking on a job of this scale.”



Isidoro Moreno
Head of
Engineering



All RHBs will receive the output in HD 1080i SDR as per Olympic standards. OBS has created a single HDR to SDR production workflow model that will allow the trucks to generate an HD 1080i output via high-quality conversion from the primary UHD HDR signal.

Almost all of the content will be produced natively in UHD HDR; however, OBS will also rely on several specialty cameras that at this time can only operate in HD 1080p SDR. The video source of these cameras must be up-converted to UHD HDR in order to be seamlessly integrated into the main production so that there are no perceived colour or brightness differences.

A full Internet Protocol (IP) infrastructure has been built to support the transport of the UHD HDR signals for the contribution network. The OBS Venue Technical Operations (VTO) team has developed a set of look-up tables (LUT) in-house to maximise the quality between

all cross-conversions (from/to UHD-HD and HDR-SDR).



© 2018 Olympic Broadcasting Services / Owen Hammond
Inside the OB van during the Opening Ceremony of the Olympic Winter Games PyeongChang 2018.

By having natively captured the content in UHD HDR or up-converted to UHD HDR, then down-converted again, the final HD 1080i signal delivered to the RHBs will offer higher quality across all platforms than if produced in a standard HD production.

Technical specifications

All RHBs will receive the International Signal in the host city's HD standards. For Beijing, the SMPTE 292 standard is used for the production of the 1080i/50 HD-SDI signal. OBS will follow the 50 Hz specification. RHBs can also receive the international signal in UHD HDR. The UHD production will adhere to the SMPTE 2036-1 standard and follow the 50 Hz specification. The HDR standard will be Hybrid-Log Gamma (HLG). The 5.1.4 audio configuration will be provided for both standards.

TOWARDS MORE FLEXIBLE AND CLOUD-BASED WORKFLOWS

“The move to remote production has translated into a wider adoption of cloud-based services from broadcasters, and with it new ways of producing the Olympic Games. This major digital transformation is truly redefining Olympic broadcasting. OBS will continue to seek agility, customisable workflows, cost effectiveness and scalable capacity in the delivery of the broadcast of the Games to keep pace with broadcasters' evolving needs.”



Raquel Rozados
Director of
Broadcaster
Services



The digital transformation initiated by OBS ahead of the Olympic Games Tokyo 2020 will continue to accelerate at Beijing 2022.

The focus has been on expanding on IP-based remote production capabilities, together with a cloud-based approach to content delivery, post-production and distribution.

Broadcast transmission over IP

Presently, not only can RHBs receive all the live content produced during the Games over IP, they can now also send back their live interviews with the athletes from the mixed zone directly to their home headquarters, with ultra low latency and extremely high definition. This highly-reliable point-to-point distribution from the mixed zone is now available at all competition venues, as well as the Olympic

© 2021 Olympic Broadcasting Services / Silvio Avila
Yiannis Exarchos and Sotiris Salamouris with Kevin Li, in charge of Alibaba Cloud's Olympic projects at Tokyo 2020's Alibaba IBC showcase. With OBS Cloud, OBS can offer broadcasters new models for content delivery, post-production and distribution, driving further operational efficiency and agility.

Villages.

OBS Cloud

Additionally, OBS Cloud, the suite of cloud services specifically designed for data-heavy broadcast workflows in collaboration with Worldwide TOP Partner Alibaba, has proven key in streamlining many of the Olympic broadcast workflows. Cloud technology allows broadcasters to address media management workflows from processing to editing to distribution operations in a better, easier, and faster way. If most broadcast organisations were still in the early stages of deployment and integration of cloud-based systems in the beginning of 2020, the COVID-19 pandemic has clearly pushed forward the adoption of such solutions. Most organisations have been forced to carry out production and distribution workflows from home and, during the crisis, rely on cloud services to support their newly remote production. In that sense, workflows have dramatically changed over the course of the last two years.

Thanks to OBS Cloud, OBS can accommodate tailored, fully-fledged cloud-based front and back-end solutions for the RHBs to help them more easily set up all or part of their processes in the cloud. For broadcasters, this is a dramatic inflection point in the cost structure of their on-site production as they reduce up-front investments. Also, they can significantly keep their set-up time to the minimum and have their equipment all prepared for their Olympic coverage before even setting foot in the host city.

For Beijing 2022, the majority of the RHBs have established remote production capabilities and will run all or part of their production outside of China.

Driven in part by the necessities of the COVID-19 pandemic, but also the shift to

For the first time in Olympic broadcasting, the distribution of live signals over the cloud will be of equal volume as through standard delivery models.

remote production workflows, the size of broadcast teams being sent out to the Games has fallen dramatically. There will be nearly 40 percent fewer RHB broadcast personnel on-site in Beijing compared to the Olympic Winter Games PyeongChang 2018.

For the first time, more than 20 broadcast organisations will receive the feeds in real-time at their centralised production house back home through the Cloud, in either UHD or HD. The fact that broadcasters have shown significant interest for this new service is indicative of the growing integration of cloud-based workflows and how RHBs are offloading more of their traditional video infrastructure to the cloud.

It is also the first time that the Multi-channel Distribution Service (MDS) will not only be distributed via satellite, but will also be available

via the cloud.

OBS has also moved part of its broadcast workflows to the cloud, consolidating many of the services offered to the RHBs. The OBS Video Server, which is now fully hosted in the cloud, provides a more efficient and scalable system, while reducing on-site hardware and all costs associated. RHBs can now access all the content produced during the Games, including the live coverage, through Content+, OBS's content delivery platform, that provides great ease of use and remote accessibility.

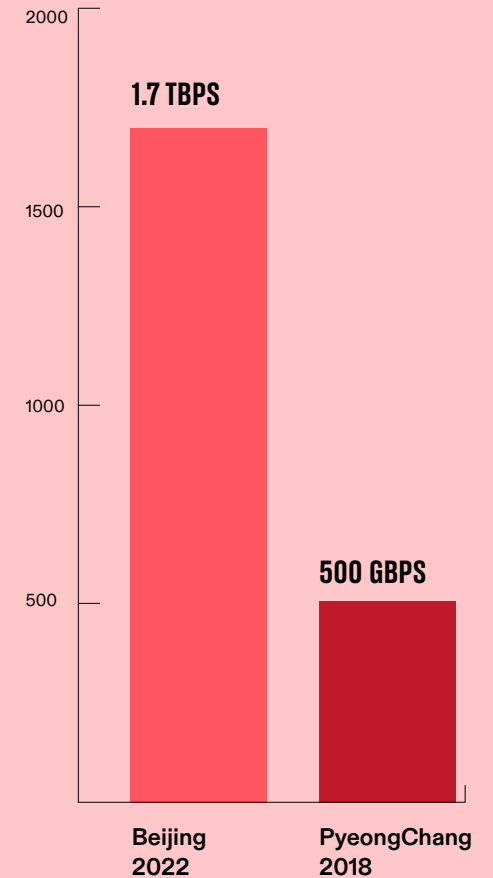
The flexibility, scalability and security of the cloud are proving to be a tremendous asset and opening up newfound technological and operational freedom as well as cost savings.



© 2021 Olympic Broadcasting Services / Silvio Avila
The International Transmission room in OBS Tech ensures worldwide delivery of the signals to the RHBs' home territories.

Beijing 2022 will be the most global Olympic Winter Games, with international connectivity to exceed 1.7 Tbps

INTERNATIONAL TRANSMISSION CAPACITY BOOKED BY RHBs



RE-IMAGINING THE OB VAN TO UPSCALE LIVE PRODUCTION WORKFLOW

“Flexibility and scalability, and especially the potential to maximise our production workflows, are behind OBS's cloud strategy and virtualisation efforts. Virtualised production set-ups will make our workflows a lot simpler, allowing us to deliver a very high quality production with greater agility, reduced footprint and cost efficiency. Making some OB van functions independent of physical infrastructure and moving them into the cloud will also help reduce our set-up time and broadcast footprint.”



John Pearce
Director of Venue
Technical Operations

When planning for the Outside Broadcast (OB) vans or fly-away systems that will be used for the coverage of the Olympic Games, as host broadcaster, OBS always faces the challenge of addressing three key factors: **footprint** that will be required in the broadcast compound at the venues, but also the actual space inside the production unit to fit both equipment and the dedicated production crew; **functionality** (ensuring all hardware resources are configured and up-to-date as to deliver the level of production required) and **logistics** (i.e. sourcing the production units, bringing them halfway across the world when not sourced locally, shipping specialised equipment, crewing the technical and production crews, setting up at the venue etc.)

Working closely with Worldwide TOP Partner Intel, OBS has been exploring more flexible and modular production environments with the goal of reducing logistical and operational complexity compared to traditional broadcast infrastructure, increasing flexibility and reducing the overall broadcast footprint at the venues and the IBC.

Since January 2021, OBS Advanced Technologies Manager Geert Heirbaut has collaborated with Intel teams to successfully design **a forward-looking virtualised OB van that is able to support agile production and provide the utmost in performance and with flexibility.**



© 2022 Olympic Broadcasting Services

The virtualised OB van has been set-up at National Aquatics Centre that will serve as the venue for the curling competitions.

In use as a proof of concept during the Olympic Winter Games Beijing 2022, OBS will be testing this new live production environment at the curling venue.

Based on a cloud-hosted, software-based architecture that mirrors the function of a traditional OB van, the venue production crew will perform their job from a production gallery in the compound, using Commercial Off-The-Shelf (COTS) solutions that offer a similar user experience as traditional broadcast appliances. An on-premise data centre will replicate the cloud-based architecture platform.

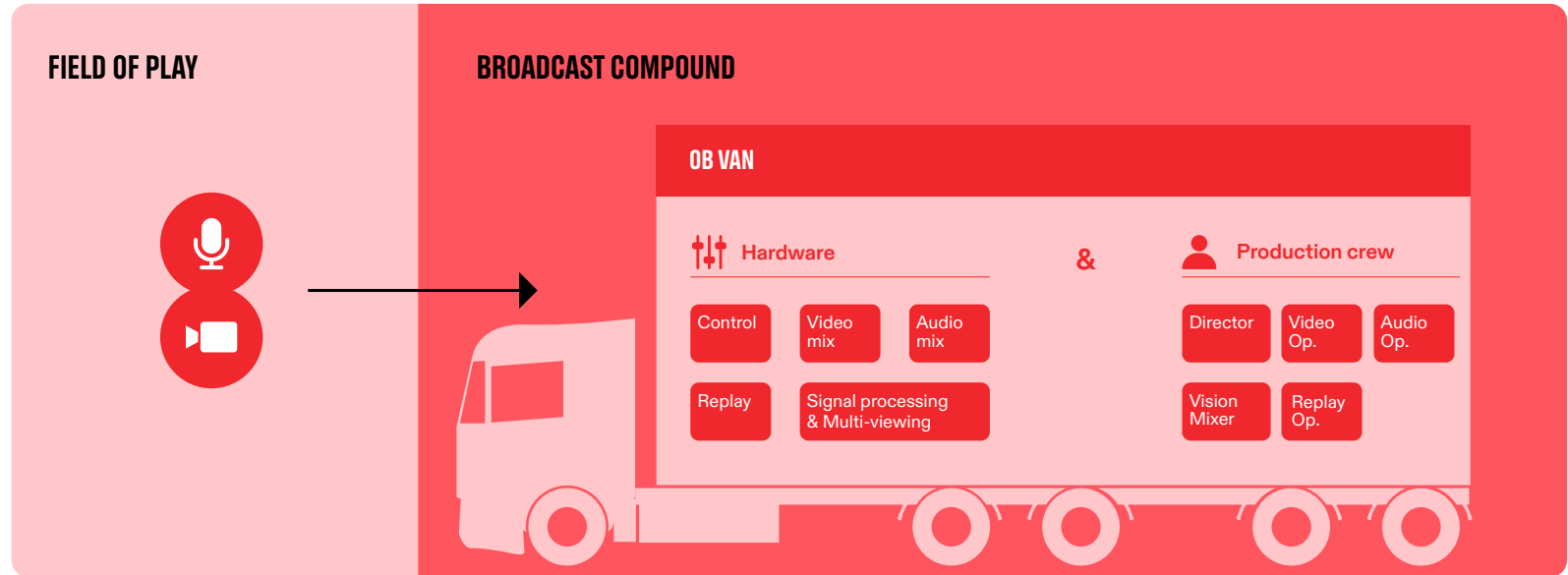
The first stage of this innovative project will give priority to functionality and interoperability, as well as ingesting and processing of the 1080p50 SDR video feeds coming from 18 cameras used for the coverage of one of the sheets at curling, alongside the audio feeds. Further, four additional native IP cameras, dedicated to the virtualised OB van project, will

be connected to the network stack, eliminating the need for camera control units.

Virtualisation will redefine broadcast production requirements and workflows and simplify them. This approach allows the broadcast production environment to be scaled to cater for changes in demand and workload, with production workflows that can be spun up and down as required in a matter of seconds. It will also reduce the set-up time to the minimum, given that the systems can be configured remotely before moving to the host city.

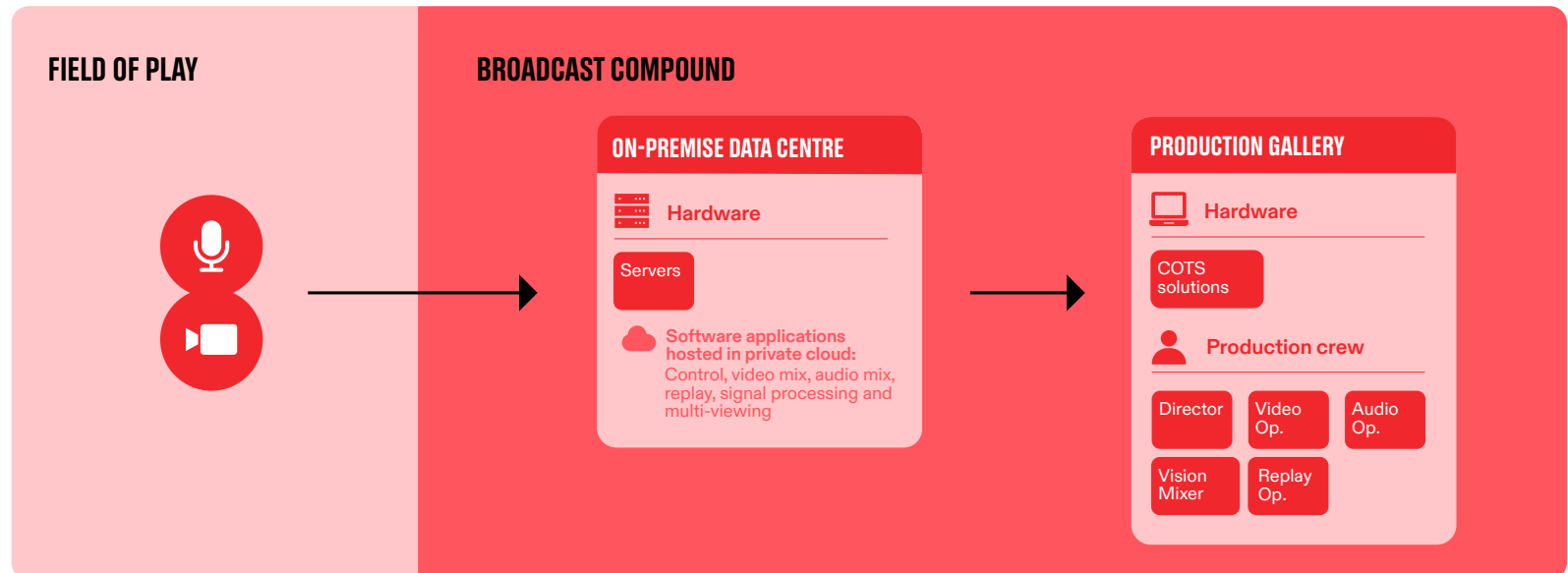
In the future, one could imagine having more flexible production crews, not necessarily based in the venue compounds, but perhaps operating from their own country premises, eliminating the need for dedicated full production crews on-site and avoiding the long-term rental of worldwide broadcast equipment for the live production of the Games.

From traditional, hardware-based production workflow



... to a virtualised, software-based model

With mature, cloud-based infrastructure now prevalent across the broadcast industry, helping to process and distribute content faster and more accurately than ever before, virtualisation opens new opportunities that could set the groundwork for producing the Olympic Games in an entirely new way in the near future. Virtualisation relies on software to simulate hardware functionality and create a virtual computing system in the cloud. The full adoption of an IP-enabled infrastructure, moving the functions of the in-venue production units away from the hardware traditionally on-premise will provide greater flexibility and scalability, while reducing the overall broadcast footprint.



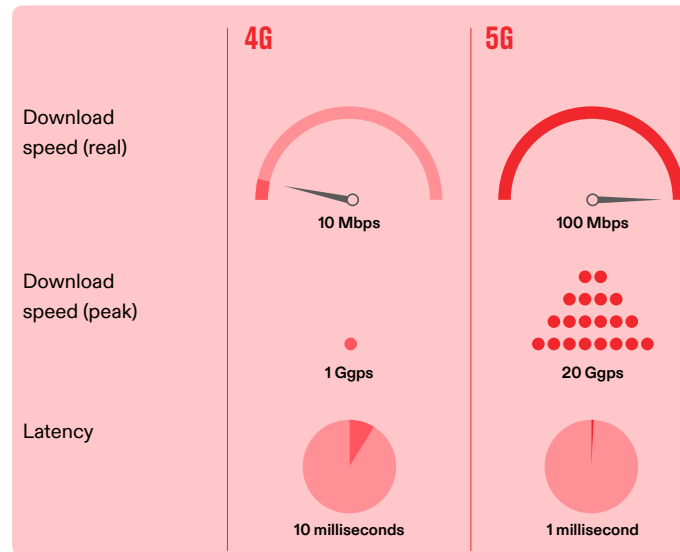
LIVE BROADCASTING WITH 5G

“5G has now reached a level of sophistication where it can be applied to production in earnest, and thanks to the full-scale implementation of a 5G network across all Beijing 2022 Olympic venues, we can now use its capabilities in our live coverage. It provides our production teams with greater flexibility than having to tether and plug in wired cameras, and the added mobility of camera positions will help OBS capture the action from unique angles.”



Mario Reis
Director of
Telecommunications

5G has the capacity of handling large volumes of data including UHD transport with ultra low latency and higher video quality



Latency: Time difference between the time when a particular video frame is captured by a device (camera, playout, encoder, etc.) and the time when this frame is played on the display of an end-user

The roll-out of 5G technology will permanently change the broadcast production and distribution.

5G offers a wireless contribution solution with enough bandwidth to carry high-demand UHD signals, enabling IP video from broadcast cameras to be transported with ultra-low latency in a reliable way. It also offers alternatives to traditional wireless equipment, offering new camera positions, and requires less frequency coordination with the authorities.

OBS conducted several field tests of network performance and quality from the end-user perspective on 5G networks at PyeongChang 2018 and Tokyo 2020, with excellent results

in terms of picture quality. OBS will now take full advantage of Beijing 2022's solid network architecture to transmit live content during the Winter Games via 5G for the first time.

OBS will capitalise on super-fast 5G wireless connectivity to deliver signals from more than 30 live and near-live cameras, including those fitted on snowmobiles at cross-country skiing and also those used in the start and finish areas at alpine skiing.

5G-connected cameras will also be used as part of the virtualised OB van project to capture the action from curling.

Artificial Intelligence (AI) and machine learning behind new auto highlights tool

For Beijing 2022, OBS plans to use AI technology to create clips from figure skating and ice hockey, letting AI do the repetitive and time-consuming work of video analysis and highlight production. These clips will then be shared with OBS producers to edit highlights packages and music pieces.

AI technology makes it possible to automatically search and identify any specific event, such as a goal or a penalty shot or a jump, and produce a clip corresponding to that event. AI speeds and simplifies the video highlights process thanks to its computer capabilities that can analyse and compile footage in mere seconds.

At a time when there is an increasing appetite for more content and faster delivery across multiple platforms, in different formats, automation is proving its mettle as a key driver in helping broadcasters optimise the content production and delivery workflows and enhance efficiencies.

OBS will continue exploring the best automation opportunities offered by AI technology to improve its workflows and services to the RHBs.

INTERVIEW WITH SOTIRIS SALAMOURIS

“Reaching the next level”

OBS Chief Technology Officer Sotiris Salamouris talks about some of the new technologies that will be used for the broadcast of the Olympic Winter Games Beijing 2022 and the future of Olympic broadcasting.

What is your role with OBS during the Planning phase and Games-time?

My title is Chief Technology Officer of OBS and the Olympic Channel. At an Olympic Games, OBS has a double mission. One is as a production company, which means having all the people needed to cover and produce coverage of the Olympics. The other is as a technical company to support the requirements of the Rights Holding Broadcasters (RHBs) and provide a large number of technical facilities and services to them. Because we relocate to the host city for a much longer period than they do, it means we are able to build and put in place technical systems that RHBs are either unable to do by themselves or too costly.

Therefore, the responsibilities of the OBS technical teams are twofold: on one hand, providing support for OBS to successfully deliver the coverage of the Games; on another hand, providing RHBs with all the required facilities and infrastructure for their production objectives. We build a lot of technical systems for the RHBs, from

their technical facilities inside the International Broadcast Centre (IBC) and/or the Zhangjiakou Mountain Broadcast Centre (ZBC) to TV studios, to specific technical areas in all venues. We even provide specialised cabling and technical storage services. Additionally, we deliver essentially all their broadcast telecommunications and connectivity needs to connect between the venue and the IBC and from the IBC to practically everywhere in the world. Our Directory of Services is a very thick catalogue of virtually hundreds of technical facilities and services that every RHB can select from, all made available by OBS to facilitate their production workflows for the Games. Increasingly, many of these services are also built and made available in the cloud.

What effect has the short turnaround from Tokyo 2020 and the pandemic had on your preparations?

The people who work for OBS have several Games behind them so know what is involved in a cycle where we start preparing at least four years before. Soon after the host city is



SOTIRIS SALAMOURIS



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Sotiris Salamouris oversees all the technical operations of OBS, including managing the planning group responsible for the design and delivery of the technical facilities and services of the host broadcasting operations for the Olympic Games. Sotiris is also responsible for introducing the technological roadmap for OBS and the mid- to long-term planning regarding the adoption of new technologies. He manages the international team of broadcast engineers and operational personnel that has planned and operated the broadcast technical facilities for the past five Olympic and Paralympic Games, as well as all editions of the Youth Olympic Games. Prior to joining OBS in Madrid, Sotiris was the Head of Engineering at Beijing Olympic Broadcasting, the host broadcaster of the 2008 Olympic Games, a joint venture between OBS and the Beijing Organising Committee.

announced, we start preparing the large projects, most notably the telecommunication network that links the venues to the IBC and the IBC itself. Of course, as we are constantly getting closer to the Games, the preparations become more intense.

The situation in Beijing is different. We followed the standard pattern, but the postponement of the Tokyo 2020 Olympics was a big disruption. Normally, we would have a year and half from the end of the Olympic Games to the Olympic Winter Games when the final preparations take place. This time, it was just a few months, which made our activation plans much more complex and dense. We were still working on Tokyo 2020 when under normal circumstances we would have exclusively been focusing on Beijing 2022.

The pandemic has been a big challenge since we were also not able to visit Beijing, except in a few exceptional cases, which meant we were working almost blind in situations when we would normally be on-site and visiting the venues. Because of the deep experience of our teams, but also using effectively all the remote planning tools available, we are at the point where one way or the other, we have managed to overcome the vast majority of the difficulties we faced. We are extremely confident about our level of readiness going into these Games.

OBS made a successful transition to UHD HDR and immersive audio to offer a new level of picture and audio quality in Tokyo. How satisfying is that to see and how will this be carried out and consolidated in Beijing?

Tokyo 2020 were definitely ground-breaking Games in terms of broadcast technology as we offered a large number of firsts. The major change that we introduced at Tokyo 2020 was the full introduction of live coverage in UHD HDR, which was a breakthrough in format delivery for the Games' live signal. Introducing UHD and HDR was much more challenging from when we introduced HD for



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For the first time, the Opening Ceremony was captured in UHD HDR in Tokyo.

the Beijing 2008 Olympics. UHD isn't a small increase in data flow, it is eight times more than HD 1080i, which has been the standard of video delivery before Tokyo. This means a big change in all of the back-end systems and the technical infrastructure that can support such mega large bitrates. In addition, there is the HDR factor, which by itself is extremely complex, because HDR is a totally different way of presenting colours and levels of luminance and that requires a completely different kind of live production workflow.

On parallel, you also need to keep the system consistent with the SDR HD signal that is still our main content distribution format and the one that most of the broadcasters still use, so the introduction of UHD HDR in Tokyo had to also take this constraint into account.

In the end, we have developed one single live production workflow that was able to

simultaneously deliver both UHD HDR and HD SDR, with exactly the same visual content and the only difference being the significantly enhancement in picture quality that comes from UHD together with HDR.

UHD isn't a small increase in data, it is eight times more than 1080i. This means a big change in all of the back-end systems and technical infrastructure that can support such mega large bitrates.

Surprisingly, our unified new UHD-HD workflow had one unexpected but extremely welcomed side-effect: It also contributed to improve the HD picture quality, due to the way that video content was converted from the much higher quality levels of UHD HDR to those of HD.

The picture quality in HD that we managed to achieve for the Tokyo 2020 Games could not have been possible if we had followed the traditional, HD-only, live production workflows from the past.

We are glad that the transition to UHD HDR went so well, and now, of course, we can count on that first experience in Tokyo when going into the Beijing 2022 Games. Not that our journey did not have its tough moments. Debugging a totally new live production workflow in a new and demanding format like UHD HDR would always have its hurdles. What is however important is that the broadcasters who took our feeds in UHD HDR were very satisfied.

How has OBS further moved its workflows to the cloud, and how will it benefit OBS and RHBs?

Alibaba is one of the four major public cloud providers in the world and they have created a very powerful cloud, upon which we have built specialised services and tools for the RHBs.

We have partnered with Alibaba and used their excellent support to build what we call the OBS Cloud. The OBS Cloud is essentially a framework of tools and services that we package together and offer to the RHBs to support their production and distribution workflows over public cloud.

OBS also uses it to support its own production workflows. Our content delivery platform, Content+, for instance, is fully hosted in the cloud and it is part of the OBS Cloud. RHBs can access our content, including the live sessions as they are happening, from wherever they are in the world, which helps simplify their workflows.

They can create their own highlights from their home offices in a far shorter turnaround.

Another 'revolutionary' example is our Live Cloud service, also part of OBS Cloud. We successfully trialled such a live content delivery method in Tokyo, distributing live feeds to two RHBs on a pilot project basis. When we decided to offer it as a standard service for the Beijing 2022 Games, we were so excited to see RHBs' interest in the service. For these Games, more than 20 RHBs will be using Live Cloud to receive directly in their countries, over OBS Cloud, all the OBS multilateral live signals. What does our Live Cloud Video and Audio service achieve? Instead of highly expensive dedicated international telecommunication optical circuits, OBS is delivering all the live multilateral content, in contribution quality and in extra-high availability over public cloud. This is truly amazing and, just a few years ago, would have seemed simply impossible to ever happen. The more extraordinary aspects of this service, which also explains its increasing popularity, is that it can already meet the transmission qualities often related to satellite distribution, in terms of latency and resilience, while it is already able to outperform it when it comes to expandability, flexibility, and consequently, cost. Lastly, what really surprised us was the fact that we can use Live Cloud not only to transmit our multilateral signals in HD, but in UHD as well, with the same resilience levels.

At Beijing 2022, how much of a role will 5G technology play?

Where, in Tokyo, we only used 5G-connected cameras for ENG coverage at the Ceremonies, for the Beijing 2022 operations, OBS will have nearly 30 5G-enabled cameras that will be used as part of our live coverage. We will be using these cameras for several sports, such as alpine skiing, curling and cross-country skiing. All the tests that were performed have produced extremely positive results, offering us a lot of flexibility.

For the first time, OBS will have nearly 30 5G-enabled cameras that will be used as part of the live coverage

We have closely been working with Worldwide TOP Partner, Intel, who has helped us with the selection of the proper 5G Tx and Rx technology that goes with those cameras. Notably, the different encoders and modems that will be used for live transmission, as well as the receiving equipment.

China Unicom, Beijing 2022's telecom partner, has greatly supported this project as well, most importantly in establishing the telecom networks required to send the 5G signals back to the IBC, as well as tweaking the established network to allow us to do all this in real-time with low latency transmission from our cameras to the production units.

5G has great capacity to support low latency and high bandwidth live broadcast transmissions over a public infrastructure. This is certainly a key enabler for field production, especially considering the limitations of the legacy broadcast solutions that rely on dedicated radio frequencies that become scarcer and scarcer. However, there are several challenges for this approach to take off, since it requires certain network configurations that the carriers should adopt to secure the necessary availability levels that broadcast requires. In that front, China Unicom, in partnership with Intel, was really instrumental to help us engineer a solution that is appropriate for our quite demanding needs.

What progress has been made towards the use of AI technology in Olympic broadcasting?

We are moving closer to being able to integrate AI technology as part of our toolsets and





© 2021 Olympic Broadcasting Services / Owen Hammond
The immersive experiences offered by Virtual Reality offer tremendous opportunities for broadcasters to engage further with younger audiences.

using it for our video tagging workflow. The way AI-powered broadcast applications are evolving, we are confident that it will give us greater flexibility in managing our content.

For Beijing 2022, we will produce more than 6,000 hours of content. If this content isn't properly tagged, then it is very difficult to work with. For a long time, we have employed students through the OBS Broadcast Training Programme (BTP) to tag our live content. While we wouldn't replace those students with an algorithm, AI would allow us to tag far more content. Video tagging is not a closed requirement that sometime in the future will be fully covered. Tagging needs can be essentially open ended if we consider that tagging

always incorporates the particular interests and viewpoints behind the intended uses and applications. This is why AI is so promising for addressing the tagging or logging problem in video and audio as it will offer ultimate flexibility and expandability compared to the capabilities of human-only loggers.

We have our own technology, which we started developing ahead of Tokyo 2020, referred to as Automatic Media Description (AMD). It is becoming mature enough to be soon fully operational. We train the system to automatically search for specific content/video sequences, and once indexed, stitch this content together to produce quick highlights packages which are made available to OBS producers. Another

potential application is to use the same technology to search and find relevant content broadcasters are after such as clips with their NOC athletes, wherever they are and whatever they are performing within our videos. Although some athletes' tagging is currently achieved by our loggers, it is practically impossible to tag all athletes in all available video frames – but this is often what the RHBs require. AMD is also being developed to satisfy this demand.

The uses for AI and machine learning in broadcast are constantly expanding. After Beijing 2022, we will start experimenting with automatic switching, which would mean using AI in live broadcast operations.

OBS is planning to increase its use of 4D multi-camera replay systems. How does its growth help RHBs tell their stories?

I am very excited by it. There will be a large increase from how much we used it at PyeongChang 2018, where it was predominantly used in figure skating. Now it will be in place in the majority of the ice venues, but also used in Genting Snow Park.

Not only is there a huge increase of using these effects but also the different kinds of technology which are used to create the final effects.

In some cases, you need multiple cameras that are placed around an object and fly the cameras around, but you also have the volumetric technology that Intel has developed, which records and recreates a model of a solid object, which gives you much greater flexibility in terms of the flight camera trace that you can build around it.

In the first case, the flight camera pattern is more fixed, whereas in the second case, the flight path camera can take a wider variety of routes decided by the producer. While the volumetric approach is indeed much more flexible and richer in terms of produced results, it however comes with significant

computational complexity that also leads to much higher turnaround times, compared to the more simple “stitching-based” method.

At Beijing 2022, we will deploy both technologies, both of which are supported by Alibaba and will really add to OBS's overall production. They give the viewer far more information about how an athlete is performing and what the details around their movement are. They produce dynamic and thrilling images for the viewers.

OBS will provide 8K coverage in collaboration with China Media Group (CMG) and NHK of Japan. How will this collaboration work?

We have been developing 8K for a decade, having begun at London 2012, and we now produce it alongside standard HD and UHD. Since the start of the project, we have been partnering with Japanese public broadcaster, NHK, that has been pivotal in the development of the whole eco-system of technologies and tools that support 8K live production. Of course, in the early years, the coverage was rather simplistic in that we were only using a few cameras, and only one type of production unit. Now the whole 8K production has really matured.

For these Games, OBS has collaborated with NHK and CMG as partners and content providers. We will be providing 8K coverage from selected competition venues and the National Stadium for Ceremonies, with OBS organising the consolidation to create a unified 8K multilateral feed.

We have found that 8K coverage has matured and the technology around it is moving quickly so that it will eventually become an option for more and more broadcasters. However, for now, 4K remains more viable as the current premium content format for live coverage, with 8K being used for specific high-end cases.

Virtual Reality in 8K is transforming viewers' experiences, how much has OBS's plans for VR evolved?

We began producing VR at the Lillehammer 2016 Youth Olympic Games and we have continued developing VR together with the RHBs. We have seen a maturation of the process in how production planning is key, while technology has developed in such a way that it can produce a much better experience for the end-user.

In the past, there wasn't a good enough resolution from the device that VR was played on. The introduction of 8K resolution has helped sharpen the pictures VR can produce. It makes the experience as life-like as possible and much more immersive. We are excited to pursue our efforts with VR. It is one of the technologies with high potential for growth in the coming years.

The development of 5G technology can also provide very interesting scenarios for the evolution of VR. Its promise for high downstream bandwidth will "free" consumption of such content to be happening anywhere desired, and not just where Wi-Fi is available.

With VR 8K live streaming, 5G has considerably helped with the problem of resolution. A few years ago, it would have been hard to discern faces and other details while using VR, but now with 8K resolution the experience is far more lifelike. However, that increased resolution can only be available to the user if they have the network to support it. With 5G you have the necessary quality to transmit to final users, be it on a 5G enabled VR device, a mobile phone, tablet, or laptop. They can play back this content in real time, and not have to worry about the quality of the resolution.

There are plans to use a virtualised Outside Broadcast van at Beijing 2022. What are your expectations?

There is a lot of excitement around this pilot project that we are planning to use for our coverage of curling. Our entire broadcast



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The Contribution, Distribution and Unilateral (CDU) master control room serves as the technical hub of the broadcast operation.

workflow has transitioned to IP and is now working well. That means we have left behind the more traditional broadcast approaches to systems and technology. Further, technology has developed to the stage where we are developing the vast majority in digital format. With this development comes lots of opportunities that we have yet to explore, but which promise major changes as systems and technology continue to migrate to digital.

Due to the unique needs of broadcasting an Olympic Games, we have been planning our virtualised OB van in a thorough manner, along with our partners, and predominantly Intel which is our technology integrator, so we understand the technological requirements of each sport. It is not possible to use the same system for each sport with the traditional technological stack. With new technology, it is possible. We can use the same servers and systems in a standardised rack arrangement,

which are very common in Information Communication Technology (ICT) data centres. We use virtualisation technologies, along with ICT tools to allow us to configure the system for different sports. The broadcast equipment, such as the vision mixer, audio console, and replay server are turned into software that is placed in standardised hardware, which are then configured to the relevant sport. As such, it optimises planning and preparation for future Games.

It is not possible to use the same system for each sport with the traditional technological stack. With new technology, it is possible.

Our idea is that in the near future, we will be able to replace the use of typical OB vans or bespoke flight pack systems, with a standardised ICT architecture of Commercial-Off-The-Shelf (COTS) servers and IP switchers, where all standard broadcast applications for live production will be only software functions. This will offer us tremendous flexibility in order to address the major problem of having to deal with so many different systems, like individual production units with each one of them based on a different combination of broadcast boxes which themselves require specialised configurations and overall handling.

We are ready for this set-up. All the equipment was shipped to Beijing and set up at the curling venue before the end of 2021. We have tested the system on numerous occasions and are now excited about using the virtual OB van in a live Olympic environment.

As the person responsible for OBS' technical roadmap can you tell us where you see the future of Olympic broadcasting?

The honest answer is that we don't know for sure but we have to try our best to watch and review trends and developments, along with using our experience and imagination to make predictions. Then we need to take into account fast-changing technology and broadcasters' requirements. We are in close contact with them and listen to their advice and act on their requests. To this end we organise a number of workshops, and we will have further discussions and brainstorming sessions at Beijing 2022.

The main requirement is that RHBs have access to the best content delivery and remote broadcast options for both their operations on-site and in their home countries. Above all, broadcasters want flexibility and cost efficiency in their workflows, and the move to IP and the availability of the cloud, increasingly allows them to have such options. Each broadcaster, of course, is different, and they have different needs and concerns, but all of them expect this flexibility, and I think this is where we are going to invest more in the future.

No matter if a broadcaster wants their coverage to come from the host city or their home base, they expect two things from the host broadcaster. First of all, to keep producing more content in different variations and formats because this is work that they themselves do not have to do. Secondly, it is about giving them a good selection of tools to help them efficiently deliver their final, unilateral coverage to their audiences. OBS must keep on investing time and effort for producing more and higher quality content, and also developing technical tools that help RHBs ingest and manage this content in the most efficient manner.

How do you envision future IBCs? What do you think the most significant difference with the present ones will be?

RHBs will always need a base in the host city,

so no matter how more efficient and remote workloads are, the IBC will not shrink massively in size.

Quite often the issue affecting RHBs in the host city are the same as those in their home country, notably the number of extra personnel required. So, even for the domestic broadcaster of the host country, for instance in this case CMG, there is always the need for a big presence in the IBC, because it is not possible to find the increased space in their headquarters for their Games-time staff.

If the IBC was only needed to address the problem of distance from the host country, then the domestic RHB would not be needing space there; however, Games after Games, we have seen that the domestic broadcasters continue occupying one of the largest broadcast areas inside the IBC. It is not like 15 years ago when broadcasters had to be in the IBC to have access to all the content. However, there will always be the need for a large broadcast operations centre



© 2022 Olympic Broadcasting Services
Together with Intel, OBS has set up a virtualised OB van at the National Aquatics Centre to explore new ways of producing the coverage of the Olympic Games. In this new environment, all the standard broadcast hardware such as the video mixer have been replaced by software running in the cloud.

in the host city, as well as smaller hubs in remote venues like here at Beijing 2022. Elements of an IBC may be different in the future, but the IBC will still be a hugely important component in the broadcast of future Games.

How can the implementation of new technologies and new workflows help with the sustainability of future Games and RHBs' operations?

We have already mentioned the changing paradigm in broadcast technology, which is all about migrating all our applications and tools to IP, piggy backing on the ICT revolution. This same transition is the best path to tremendous overall efficiencies, and thus increase sustainability, which has been a key factor behind the adoption of virtualisation and, subsequently, the cloud. Both technological concepts are essentially all about high efficiency, that is one of the important ways to reduce waste and increase levels of sustainability.

By moving all broadcast workflows into the cloud, we can reduce our footprint further – it is one of the fantastic opportunities offered by virtualisation.

Virtualisation is the starting step when moving into the cloud and is all about how one can take advantage of a particular piece of hardware in the most efficient manner. Thanks to virtualisation, hardware is now utilised to levels up to or more than 90 percent, a level that was unthinkable with previous approaches that were only relying on physical servers for running the applications software.

The cloud is the next step as it holds the highest possible density in terms of virtualised assets, together with a highly sophisticated and rich set of tools that allow the just-in-time use and

management of this tremendous concentration of computational and networking capacity. There is not a more efficient manner to run applications of any sort. The data centres that house the cloud infrastructure are huge consumers of power and other resources. However, overall and for the total number of services that they are supporting, they do so in a far more efficient manner. They offer very high incentives for that efficiency to keep on improving, compared to running all these same services in stand-alone systems on-premise.

By moving all broadcast workflows into the cloud, we can reduce our footprint further – it is one of the fantastic opportunities offered by virtualisation. For example, in the past, to use a visual mixer in a conventional OB van, it would have required a huge frame consuming a large amount of power, even if we were to use a much smaller portion of its features and overall capacity. The typical OB vans are built as systems for hire, hence they normally carry infrastructure which has been designed with maximum capacities in mind, even if such capacities are not used that often. A virtual, purely software-based vision mixer running on the cloud will be a significantly more efficient, and hence sustainable, solution as it could be easily configured and its capacities scaled up or down depending on the real needs. We can expand this notion to almost all the technology systems that are required to support the broadcast of the Games. Moving to the cloud allows a rather inefficient consumption of technical resources, mostly power but as well HVAC, built enclosed areas etc. to be exchanged with a far more efficient one within the cloud.

We will always build our technology in such a way that it offers efficiency, sustainability, and reduces our footprint, while at the same time offering the broadcasters the chance to do the same.

CHAPTER 3

BEHIND-THE-SCENES AT THE INTERNATIONAL BROADCAST CENTRE

The International Broadcast Centre (IBC) acts as the main hub and nerve centre for all broadcast operations during the Olympic Winter Games. The feeds from all the various competition venues are sent to the OBS technical facilities at the IBC to be then accessed by the Rights Holding Broadcasters, many of whom have a physical base of operations in the IBC.

The IBC operates around the clock, with broadcasters producing and transmitting their Olympic television and radio programmes 24/7. Due to the size and complexity of the IBC, for the 17 days of the Games, the IBC serves as the largest broadcast centre in the world.

IBC LOCATION



Main Media Centre International Broadcast Centre
Main entrance Floors 1 & 2

For the coverage of the Olympic Winter Games Beijing 2022, OBS and broadcasters will operate from the Main Media Centre (MMC), under the same roof as accredited press and photographers. Located in the newly-built China National Convention Centre Phase II, in Olympic Green, they will find themselves at the heart of the Beijing Zone, one of the three Games clusters.



04 January
20 February



24
hours



30,000sqm
of functional space, housing a variety of technical and administrative facilities for both OBS and RHBs



144
incoming feeds

102
concurrent feeds at CDU at busiest point on Day 11 of the Games

Nearest venues

Bird's Nest National Stadium, National Aquatics Centre, National Indoor Stadium, National Speed Skating Oval, Beijing Medals Plaza, Beijing Olympic Village

ZBC LOCATION

• Zhangjiakou Mountain Broadcast Centre Floor 1



To facilitate RHB activities in the mountains, OBS will also operate a secondary broadcast centre in Zhangjiakou, referred to as Zhangjiakou Mountain Broadcast Centre (ZBC).



04 January
20 February



24
hours



5,000sqm
of functional space, housing a variety of technical and administrative facilities for both OBS and RHBs

Nearest venues

Zhangjiakou National Ski Jumping Stadium, Zhangjiakou National Biathlon Centre, Zhangjiakou National Cross-Country Skiing Centre, OBS Mountain TV Tower

SUPPORTING RHBS FROM PLANNING TO DELIVERY

“With new ways of broadcasting come more complex infrastructure and additional services required. As host broadcaster, our role is to understand the needs of the broadcasters and adapt our offerings to meet their expectations. We work together with the rights holding broadcasters from early on to find the best solutions to optimise their operations, either on-site or remotely.”



Tomoyo Sato
Broadcaster Services Senior
Manager



© 2021 Olympic Broadcasting Services
As the domestic broadcaster, CMG will have an important base of operations at the IBC.

Overall, eight RHBs will have a base of operations at the IBC for the Beijing 2022 Games, which represent 33 organisations when counting their sublicensees. In Zhangjiakou, eight RHBs will have facilities at the ZBC, which represent 16 organisations. As in Tokyo, an important part of the coverage of the Games will be done remotely from the RHBs' home premises.

At the IBC and ZBC, broadcaster offices range from small units with a few desks and computers to much larger broadcast spaces which can include several control rooms, TV studios, editing suites, commentary off-tube booths, news production areas and other office rooms.



© 2021 Olympic Broadcasting Services
Several broadcasters will install their TV studios within the OBS Mountain TV Tower.

OBS technical facilities mainly operate from an area called OBS Tech, located within the IBC, which is made up of the Contribution, Distribution and Unilateral (CDU) master control room (MCR), the International Transmission MCR, the Commentary Switching Centre (CSC), the Archive Video Logging Area and Mixed Zone Feed Area, and the Broadcast Data Feed (BDF) room.

Additionally, for Beijing 2022, OBS has also built two TV Towers to offer RHBs TV studios and stand-ups for their news reporting. The Beijing TV Tower is located in front of the Bird's Nest National Stadium and Beijing Medals Plazas. In Zhangjiakou, the TV Tower is adjacent to ZBC and facing the National Ski Jumping Centre.

A MORE EFFICIENT DESIGN

“Finding new efficiencies and procedures has been central to the successful delivery of the Beijing 2022 IBC and ZBC project. The unusual circumstances surrounding these Games have forced us to rethink the logistics of moving materials and people, which actually made us more efficient from a workflow perspective.”



Eugenia Sofia Fuenmayor
Director of Construction



© 2022 Getty Images / Lintao Zhang

Reducing broadcast footprint and increasing efficiencies have been key priorities in the design and fit-out of the IBC for the Olympic Winter Games Beijing 2022.

Following the delivery of the base construction from the Organising Committee (OCOG), the fit-out process begins under the direction of the OBS Construction team. During the fit-out period which may vary from six to nine months, the IBC space is transformed from an empty shell into a working environment where every detail has been designed to enable OBS and the RHBs to seamlessly deliver the broadcast of the Games.

Additionally, for the Winter Olympics, a secondary broadcast centre may be required to help facilitate OBS and RHB operations in the mountain venues. For Beijing 2022, this additional facility will be located in the Zhangjiakou cluster, known as the Zhangjiakou Mountain Broadcast Centre or ZBC.

As part of its long-term commitment to sustainability, OBS has been rethinking the design of the IBC, making the optimisation of space usage a priority.

For Beijing 2022, OBS has succeeded in reducing the overall net broadcast footprint from 36,000 square metres to 30,000 square metres by facilitating the integration of the IBC and the Main Press Centre (MPC) into a single venue where two were initially planned. By bringing together the IBC and the MPC under the same roof, a broad range of facilities and services that otherwise would have had to be duplicated will now be shared by press and broadcasters, reducing costs for the OCOG while optimising Games-time operations.

Fit-out process

The fit-out process is a complex task that involves the expertise and collaboration from a multi-disciplinary team and encompasses a multitude of activities carried out by many entities. It entails the planning, engineering, site layout, architectural development, project coordination and scheduling of all subcontractors, from the moment the first plans are drafted until the dismantlement phase. In addition, the teams interface with the local authorities and health and safety inspectors on a regular basis to ensure regulatory compliance throughout the entire period of occupancy.

For Beijing 2022, taking into account RHBs' space requirements, OBS has built 12 fitted-out compartments, six on each level, at the IBC, and an additional 12 at the ZBC distributed on one floor.

An enhanced modular and prefabricated system helped reduce the fit-out timelines significantly. With an innovative, completely clean-and-dry fit-out system, OBS was able to reduce the timeline by a month and half (20 percent). The prefabricated fit-out system, based on steel sheet panels, will be reused for the next three Games editions, resulting in a significant reduction of construction waste.

OBS has also integrated a series of enhancements, looking towards future Games editions, to facilitate fit-out construction with little to virtually no impact on pre-existing structures and legacy buildings.

In order to optimise the broadcast operation, and for the first time in an Olympic Winter Games, OBS has designed a series of Centralised Technical Areas (CTAs) strategically placed within the IBC and ZBC.

These areas provide 'data centre' type of services and infrastructure to both OBS and the RHBs, enabling broadcasters to keep their technical equipment that receives or sends signals from/to OBS, while saving energy by reducing the

heat, ventilation and air conditioning (HVAC) and technical power consumption. These areas are shared between several RHBs, therefore making it a more efficient use of space and more cost-effective for the broadcasters.

Within the IBC, OBS has created a better mix of technical areas and office space to help better balance airflow and reduce the amount of heating and cooling required, thereby lowering power consumption across the facility.

Additionally, in the context of the COVID-19 pandemic, OBS has further been optimising its operations at the IBC considering additional health and safety recommendations, such as re-fitting equipment for greater staff safety, adopting specific cleaning protocols and adapting the working areas for physical distancing.



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At the IBC and ZBC, a series of Centralised Technical Areas (CTAs) has been implemented to provide 'data centre' services, reducing heat, ventilation and air conditioning by concentrating power-hungry racks in central areas for optimisation.



AROUND THE CLOCK



The IBC never sleeps! One month prior to the Opening Ceremony, the IBC becomes a 24/7 facility, with thousands of broadcast personnel from all over the world working day and night. The IBC is designed to try to make broadcasters' lives easier during these intense weeks of work.

Life inside the IBC is like a small village where broadcasters have access to several facilities. For Beijing, it includes a convenience store, official merchandising store, bank, medical centre, post office, media dining hall, coffee corners and a bar.

A transport mall, shared with other accredited media, is conveniently located next to the IBC to allow broadcasters to go to the Olympic venues and back to their hotel.

The IBC won't be the only place broadcasters will call home for the Olympic Winter Games Beijing 2022. To assist broadcasters in reducing travel time, as well as optimise resources, OBS has established a secondary broadcast centre in the mountains, referred to as the Zhangjiakou Mountain Broadcast Centre or ZBC.

The ZBC will also operate around the clock and offer broadcaster some facilities, although not as extensive as those in the IBC.

CDU: THE MOST IMPRESSIVE ROOM

There is one room inside the IBC which usually leaves every visitor awestruck: the **Contribution, Distribution and Unilateral (CDU)** master control room, located in the OBS Tech area.

Imagine a 24-metre-long wall covered by monitors from where you can view more than 350 picture-in-picture mosaic of the live broadcast of the Games as the action comes to life in the Olympic venues.

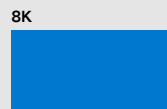
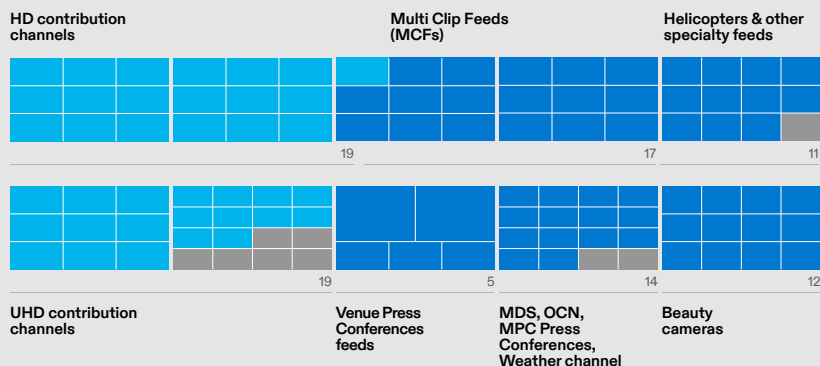
Through the glass windows, broadcast personnel and visitors can have a sneak peek as they pass by and watch the contribution team receive, monitor and control all incoming video feeds from the venues. The signals are passed to the distribution area, where they are processed and distributed to the RHBs in their selected format (HD or UHD). Alongside that workflow is a team monitoring the feeds from RHBs' unilateral camera positions at the venues and their remote TV studios.



© 2021 Olympic Broadcasting Services / Silvio Avila
The Contribution, Distribution and Unilateral (CDU) master control room at the IBC during the Olympic Games Tokyo 2020.

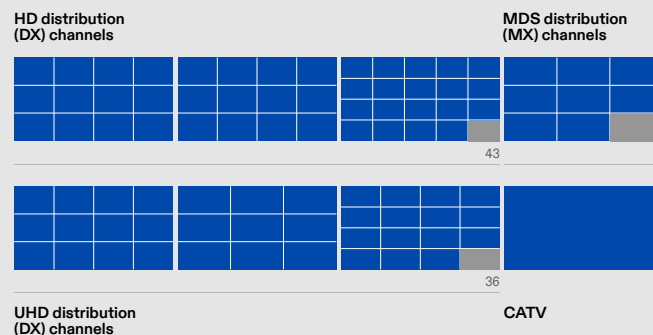
CONTRIBUTION

All signals produced by OBS from each of the venues are received at the Contribution centre



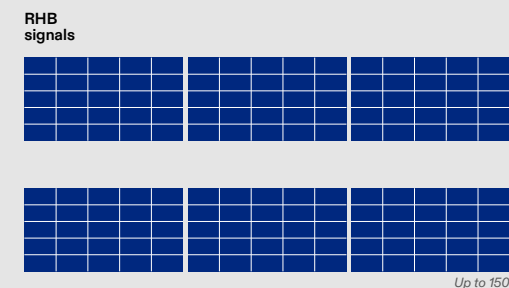
DISTRIBUTION

From the Distribution centre, all signals will be monitored, processed and distributed to the broadcasters



UNILATERAL

All signals produced by the RHBs at the venues will be checked and equalised, not synchronised, at the Unilateral centre and then passed on to the broadcasters



PQC: THE HEART OF THE BROADCAST COVERAGE



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Each OBS coordinating producer oversees the coverage of their respective sports from the PQC during Games-time.



© 2021 Olympic Broadcasting Services / Silvio Avila
The PQC consists of six multi-viewing control booths (one for each coordinating producer and an additional one for the producers in charge of the beauty cameras and venue remote production), a supervision table with the OBS Chief Content Officer at the centre and graphics supervisors on his left, and a separate audio quality control room.

Always in darkness and filled with serious-faced producers, audio and graphics supervisors, the **Production Quality Control (PQC)** room is where all of the content generated by OBS from the competition venues – video, audio, graphics – is monitored for compliance with Olympic production standards and values.

Just before a live event, the buzz in the PQC reaches elevated levels. You can feel the tension rise as the transmission starts. This is finally the moment of truth. Everyone has worked hard

together to ensure that the action is perfectly captured and world-class coverage delivered.

The PQC is in constant communication through wire intercoms with all the Venue Production Teams, looking out for any glitches that might occur and make any necessary immediate adjustments, including advisory graphics and reactions to any unforeseen circumstances. Both sides working together like a well-coordinated symphony.

8K AND THE FUTURE OF RESOLUTION

One of the first things you notice when you enter the lobby of the Main Media Centre (MMC) is a larger-than-life screen displaying action from the Games in amazing 8K resolution with next-generation immersive audio.

Measuring over 15 metres wide and 8 metres high, this massive screen will show even the tiniest detail in crystal-clear quality, thanks to the astounding 7,680 × 4,320 pixel display. Additionally, with the latest immersive audio technology, sounds will be perceived as coming from infinite points around and above, creating a truly immersive experience.

For Beijing 2022, OBS, China Media Group (CMG) and NHK (the domestic RHBs for China and Japan, respectively) will collaborate to produce 8K coverage from selected competition venues as well as from the Bird's Nest National Stadium.

NHK will be producing the figure skating events, while CMG will be delivering the Opening and Closing Ceremonies, freestyle skiing/snowboard big air and speed skating in 8K.

Nearly 70 hours of 8K live coverage is expected to be produced during the Games.



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The Olympic Winter Games Beijing 2022 will act as a showcase for 8K broadcast, with OBS, CMG and NHK planning on producing nearly 70 hours of live coverage in this truly immersive format.

CHAPTER 4

HOW THE WORLD WATCHES THE OLYMPIC WINTER GAMES

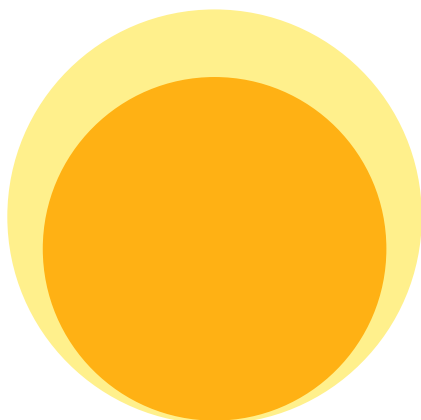
The Olympics are where the world comes together, transcending sport to reach an international audience inspired by athletic feats and powerful human stories. As the only truly global multi-sport competition, the Olympic Games are also the most-watched sports event in the world.

The combined expertise of OBS and the Rights Holding Broadcasters brings the images and sounds of the Games to life and engages audiences across multiple platforms. Leading-edge technologies and an enriched content experience will make Beijing 2022 the most immersive Games yet.

INCREASING CONTENT, EXPANDING ENGAGEMENT

6,000+

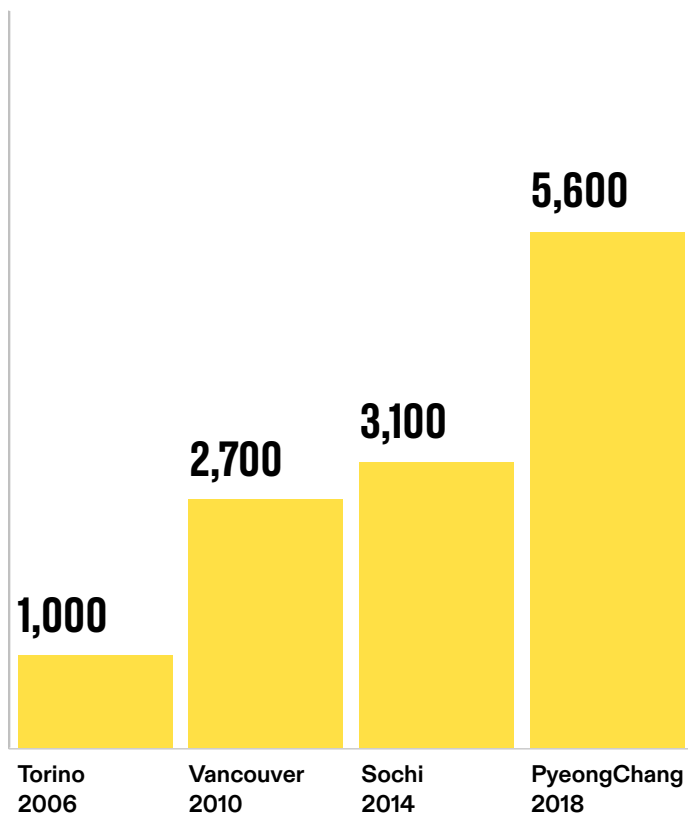
Estimated hours of content produced by OBS for Beijing 2022



● Beijing 2022
● PyeongChang 2018

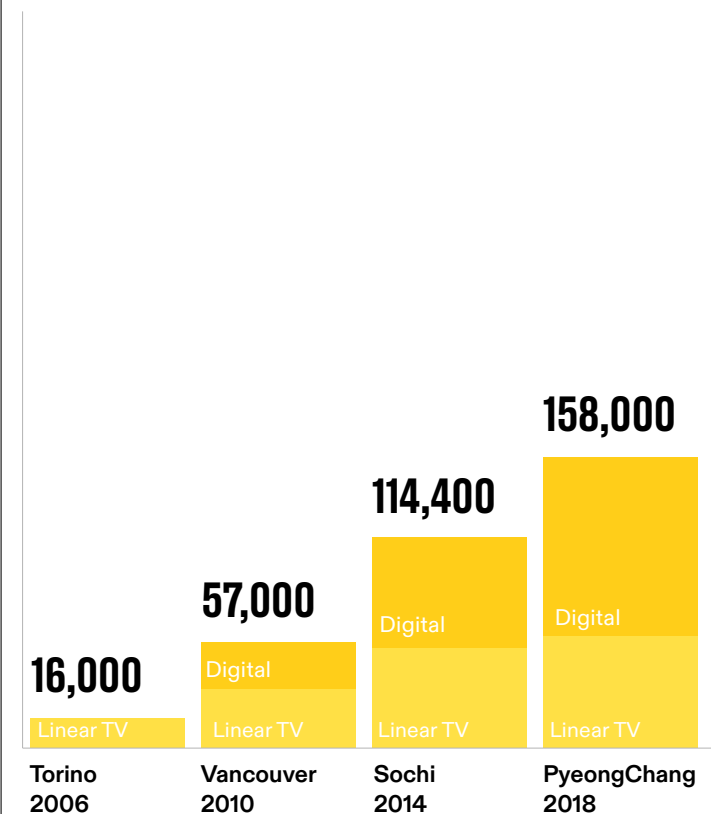
HOURS PRODUCED BY OBS

OBS continues increasing the amount of content and delivery options, while maintaining or reducing its broadcast footprint



HOURS OF WORLDWIDE BROADCAST

The number of hours of Olympic coverage is growing at an exponential rate, with digital consumption now exceeding linear television



PLANNING AND SET-UP BEHIND THE WORLD FEED

-6 TO -4 YEARS

- **Initial venue surveys**
- Reviewing the previous Olympic coverage, looking for possible improvements and innovations
- Reviewing the current technologies
- Liaising with the OCOG, the IOC and the IFs regarding production and technical requirements, competition schedule, Look of the Games, sports presentation etc.
- Discussing scenarios with the RHBs
- Developing the production plan, graphics package, production enhancements, digital and immersive content, and additional programming

-3 YEARS

- **World Broadcaster Briefing**
- Conducting additional venue surveys
- Liaising with the OCOG, the IOC and the IFs regarding production and technical requirements, competition schedule, Look of the Games, sports presentation etc.

-2 YEARS

- **World Broadcaster Meeting**
- Conducting additional venue surveys
- Sourcing all the cameras, specialty systems and production units
- Hiring RHB and freelance crews to provide venue production teams
- Liaising with the OCOG, the IOC and the IFs regarding production and technical requirements, competition schedule, Look of the Games, sports presentation etc.
- Finalising the production plan, graphics package, production enhancements, digital and immersive content, and additional programming
- Attending some of the test events to fine-tune the coverage and discuss with the IFs
- Meeting each Venue Production Team to discuss coverage plan and operations
- Liaising with OCOG Creative teams regarding Opening and Closing Ceremonies

-1 YEAR

- **Second World Broadcaster Meeting**
- Attending some of the test events to fine-tune the coverage and discuss with the IFs
- Conducting Production Planning Meetings with each Venue Production Team, as well as final venue surveys when required

-6 MONTHS

- **Technical installations start at the International Broadcast Centre (IBC)**

-6 MONTHS

For Beijing 2022, broadcasters were obliged to conduct Games-time activities for Tokyo 2020 while concurrently advancing the preparations for the Olympic Winter Games.

-3 MONTHS TO -1 WEEK

- **Technical installations start at the venues: cabling, containment, cabins in the broadcast compound, power**
- The OBS Venue Technical Operations team supervises venue overlay (camera platforms, commentary positions etc.)
- OBS broadcast venue staff is progressively deployed at each venue
- The production units arrive at each venue and start the set-up
- The OBS Venue Production Team (VPT) sets up all the cameras and microphones and ensures the signals are correctly delivered to the production unit
- The VPT conducts Technical Rehearsals (ensuring all the cameras are in the right position and all the systems are properly working)

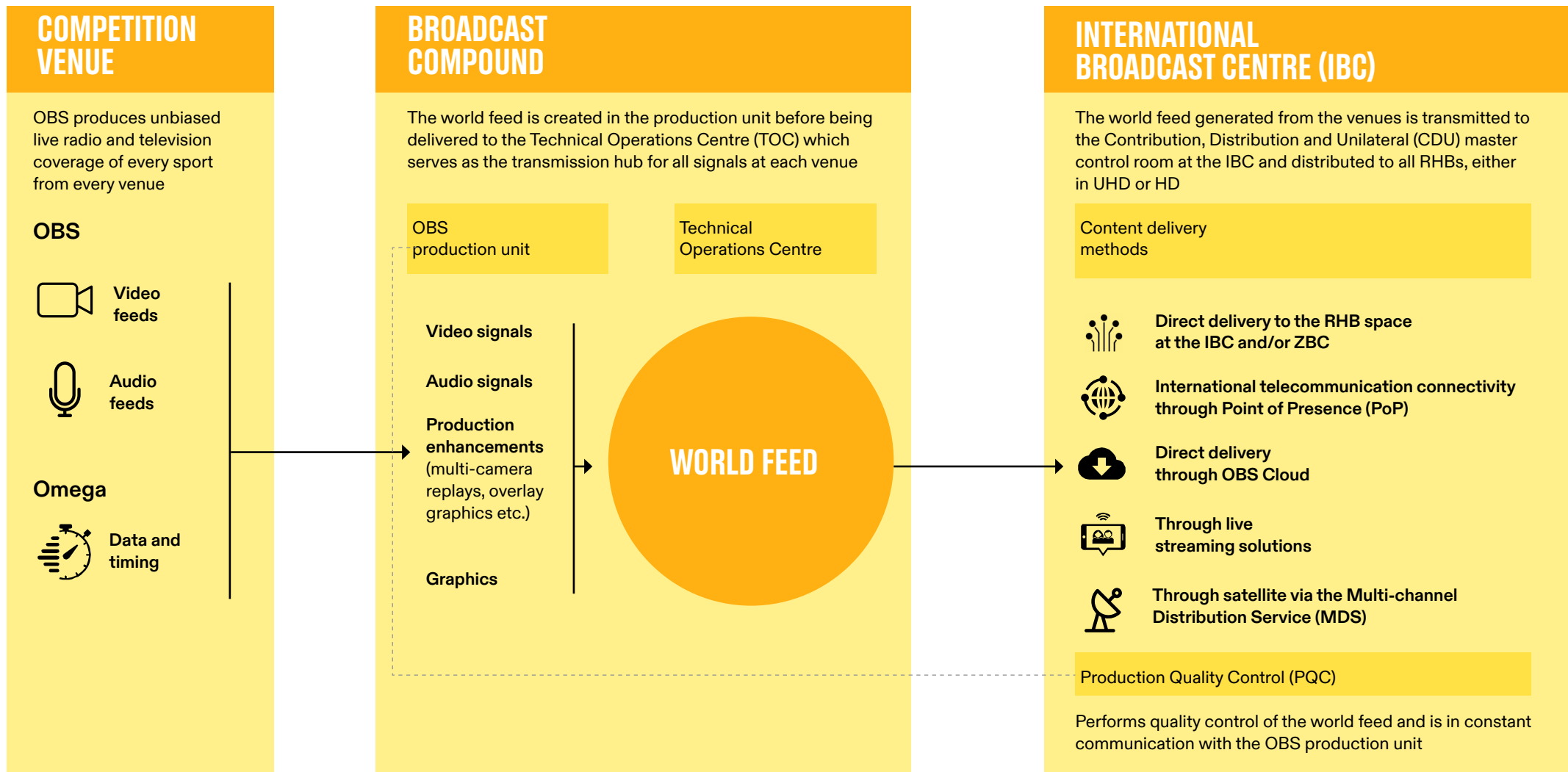
-1 DAY

- **The VPT, in liaison with Production Quality Control (PQC) at the IBC, conducts a dress rehearsal, simulating a competition day from start to finish and ensuring that the venue is ready for broadcast including athletes' and officials' workflow, results system etc.**

Legend Planning phase Set up phase

READY FOR FIRST DAY OF TRANSMISSION!

CREATION AND DELIVERY OF THE WORLD FEED



HOW RHBS TAILOR THE WORLD FEED

RHBs deliver a customised world feed to their viewers, in their native language, across multiple platforms, from TVs and radios to computer, desktops and laptops, to smartphones and tablets.

Viewers can watch or listen to it live or through on-demand video services, at home or on-the-go.

At the competition venues

- Camera positions
- Commentary positions
- Announce or presentation position
- Athlete interviews in the mixed zone
- Influencer positions



At the IBC and ZBC

- TV studio
- Remote commentary
- Graphics
- OBS auxiliary services (including additional content)
- Various levels of customisation



Outside the IBC and ZBC, in the host city

- TV studio (at the OBS Towers or independent studio)
- Stand-up positions (OBS TV towers, Olympic Villages, Main Media Centre, onboard the high-speed train)



From their home headquarters

- TV studio
- Remote commentary
- Graphics
- OBS auxiliary services (including additional content)
- Various levels of customisation



AN À LA CARTE APPROACH

The content production and delivery by OBS is tailored to meet the needs of broadcasters, large or small. For greater flexibility, each piece of content is delivered in multiple formats and offers various levels of customisation.

In the content arena, OBS has taken an à la carte approach toward developing a wide range of flexible content delivery solutions for broadcasters, in order to meet their particular needs and adapt to all sizes of production. These solutions are constantly evolving to take advantage of technological advances and also to be better suited to responding to the RHBs' multi-platform requirements and demand for more content and faster turnaround times.

OBS offers **several turnkey solutions** for RHBs looking for fully produced programming and cost-effective alternatives. For instance, the **Olympic Channel News (OCN)** offers a variety of Olympic highlights, features and interviews that can be broadcast in the form of a 24/7 channel, while providing broadcasters with the option of adding their own organisation's logo and including commercials. The **Multi-channel Distribution Service (MDS)** is another example of a complete solution that allows RHBs to air nearly the entire Olympics from their home countries, thereby reducing their costs. Distributed globally by satellite, MDS offers nine fully programmed, ready-to-air sports channels (including the OCN). With this solution, RHBs can send fewer resources and personnel to the Games and often work without a facility within the host city.



© 2018 Olympic Broadcasting Services / Owen Hammond
The MDS is a flexible turnkey service that provides RHBs with fully produced, ready-to-air TV channels, as well as distribution channels. For Beijing 2022, more than 40 broadcast organisations have subscribed to the service and will have access to more than 2,000 hours of content, including all the live sports and Ceremony coverage.

For those broadcasters interested in **streaming the Games on digital and mobile platforms**, while keeping the development costs low, OBS also provides a ready-to-deploy, fully personalised digital application with its **Olympic Video Player (OVP)** that offers live streaming and on-demand video of every competition session. For the web, the OVP offers an embeddable player, as well as a number of widgets that can be set up to form a dedicated RHB website. For smartphones and tablets, the OVP is a stand-alone downloadable app that offers, in addition to live and recorded Olympic content, start lists, results and other key data. Customisable elements allow RHBs to add their own look and feel via logos and colours. They also have the option to add their own short-form content and advertising placement.



© 2022 Olympic Broadcasting Services
For Beijing 2022, OBS has created a customisable suite of best-in-class engagement widgets, as well as a fully managed digital solution to help RHBs amplify their Olympic digital coverage.

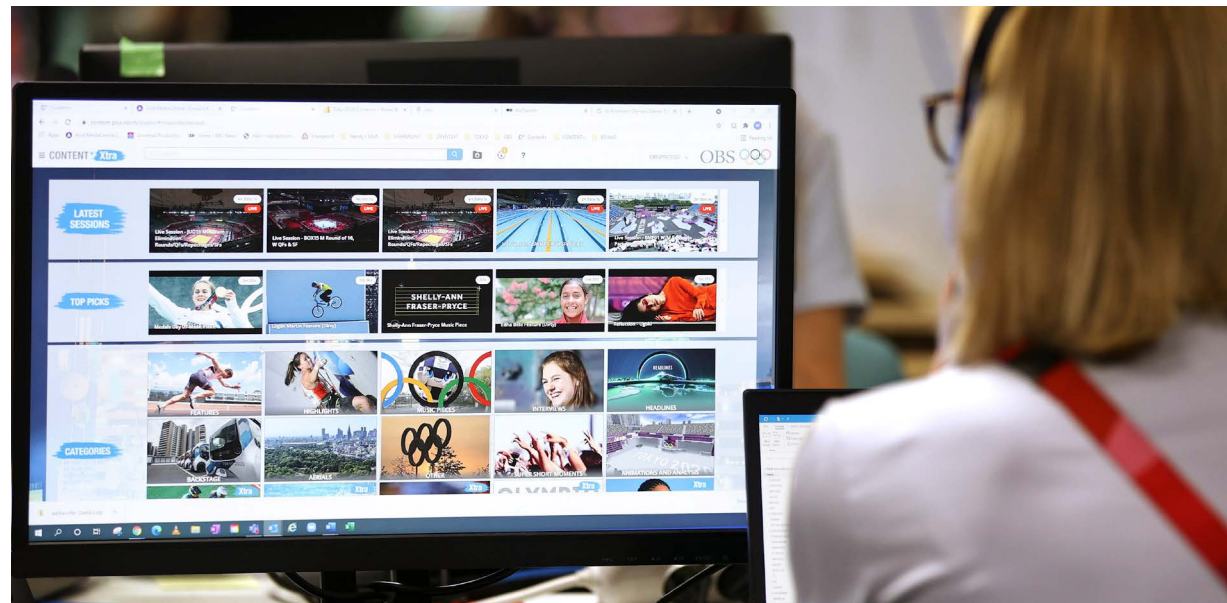
One of the strong points of most services offered by OBS is their modular aspect, allowing RHBs to use only what they really need. All content is being distributed with its potential individual use in mind. As such, broadcasters have the option of either broadcasting or streaming the OCN continuously or selecting an individual programme from the 24 aired daily, or choosing to broadcast an individual segment featuring one of their national athletes or their national team. In a similar way, on the digital front, broadcasters can opt to include a specific widget on their website, such as the medal ranking or the live streaming plug-in, instead of deploying the full OVP digital solution.

FOCUS ON DIGITAL

“Today the Games also happen on social media, so broadcasters are eager for relevant content they can quickly share on their different channels to capture their viewers' attention and engage with them. OBS has dedicated crews at every venue looking for those special moments happening behind-the-scenes – and now, for the first time, RHBs can edit available clips on Content+ before posting, allowing them to further adapt the content for each of their social media platforms.”



Karen Mullins
Director of
Production
Management



© 2021 Olympic Broadcasting Services / Silvio Avila
Content+ provides access to all the live content produced by OBS, as well as original short-form content.

With the change in viewing patterns in the last decade has come a shift to digital in the approach taken by OBS towards content production and delivery. Traditional linear TV is no longer the sole way to watch live content and enjoy all the action from the Olympic Games. Today people watch the Games on laptops, tablets and smartphones as much as they do on television. They also rely on social media, websites and apps to catch up on highlights, replays and stream live action at the same time as watching it on television.

Nowadays, viewers expect to be able to watch whatever they want, whenever, wherever and however they want.

To help RHBs provide this dynamic environment in which viewers can experience the content on their own terms and stay ahead of the curve,

OBS has created a wide range of services for the digital arena.

One of these services designed primarily for digital is **Content+**, which is a cloud-based solution offering short-form content from across the Games, as well as all live content produced by OBS, that can be easily shared across all platforms. OBS will have dedicated crews to generate behind-the-scenes content from the competition venues, the Olympic Villages and some locations outside the Closed Loop. OBS will also generate content with smartphones, providing short video clips from back-of-house athlete areas that will be available to RHBs' social media teams almost instantly.

Overall, **between 7,000 and 8,000 clips** are expected to be produced to help enhance and supplement RHB coverage. Distributed through a user-friendly web portal, in three different resolutions, this short-form content will be

accessible by the RHBs' digital and social media teams from any location in the world.

For Beijing 2022, **OBS has built a new integrated and agile editing functionality**, which allows RHBs to create sub-clips from any content, enabling them to craft their video content with an optimal length for each platform.

Further, OBS plans to produce fast turnaround clips from all sports, offering broadcasters access to highlights content quickly and effortlessly. OBS will create **more than 340 sports highlights clips** that RHB digital teams will be able to push on social media in a timely manner.

Reliable and high-quality **live web streaming and on-demand video end-to-end solutions** will also be provided to support the broadcasters' multi-platform strategies through the OVP suite.

TRANSFORMING DATA TO IMMERSIVE EXPERIENCES

“New technologies give us immersive ways to expand the data, beyond names, times and scores. In that sense, we only use production enhancements that bring value to storytelling and improve the viewers' understanding, not just for the sake of technology. We want to deliver informative and engaging content experiences.”



Kim Erdahl
Senior Graphics Manager

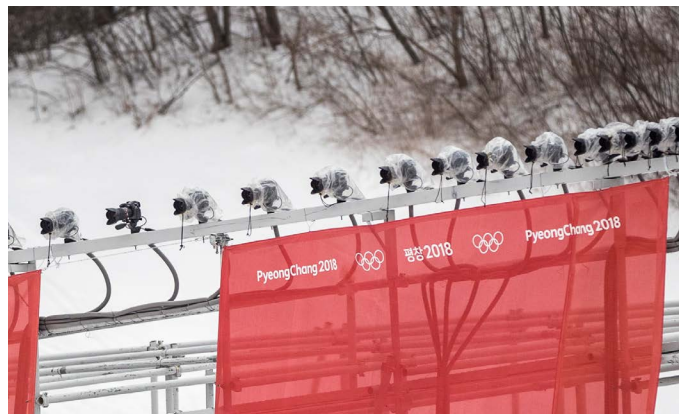
Bobsleigh, Curling, Figure Skating, Freestyle Skiing (Aerials, Big Air, Halfpipe), Ice Hockey (both venues), Skeleton, Ski Jumping, Short Track Speed Skating, Snowboard (Halfpipe, Big Air), Speed Skating

MULTI-CAMERA REPLAY SYSTEMS

In Beijing, OBS will expand on the use of Multi-Camera Replay Systems to provide replays of the action from a multi-angle perspective, enabling fans to have an up-close look at the action, from various angles, and experience Olympic winter sports in more engaging ways.

For instance, at the Zhangjiakou National Ski Jumping Centre, such camera system will be installed in proximity to the end of the take-off ramp to capture the first seconds of the ski jumper's flight. The multi-camera replays will allow viewers to have a better understanding of how athletes use their body to control the jump, having the possibility to see it from multiple angles.

A total of 10 systems will be deployed for Beijing 2022 – a significant increase since PyeongChang 2018, where only four of these systems were used to enhance the coverage of Figure Skating, Ice Hockey, Freestyle Skiing/Snowboard Halfpipe and Short Track Speed Skating.



© 2018 Olympic Broadcasting Services / Owen Hammond
Multi-Camera Replay technology helps capture unique angles from the sport action, giving viewers at home a multi-view point and a closer look at the athletes' performances.

How does it work?

Relying on a myriad of high-speed 4K cameras, Multi-Camera Replay technology offers the ability to move around the action at any given point of time and watch it from a variety of angles, in near real time. Furthermore, the replay can be paused at different junctures in the motion. The effect is similar to action scenes in the movie "The Matrix" where the camera seems to pan 360 degrees around the main actor while he floated in mid-air or dodged a bullet.

The total number of 4K cameras varies from one venue to the other (up to 120 cameras at the Ice Hockey venues). They will be placed in selected locations for optimal viewing without obstructions. Spaced at regular intervals on a rig structure, each camera is mounted on a robotic platform capable of precisely panning and tilting the camera in any direction. The camera's zoom, focus and the platform's pan and tilt capabilities are controlled from the production unit. For each replay, a single operator selects the point where the motion is frozen and can manipulate the replay from side to side around the athlete, as well as zoom in without losing resolution (thanks to the 4K resolution).

Since the system simply stitches together these feeds and does not have to virtually create filler frames, no rendering is required, allowing Multi-Camera Replay clips to be ready in under five seconds.

For curling and speed skating, OBS has partnered with Worldwide TOP Partner Alibaba to utilise its leading-edge cloud solution to seamlessly deliver the multi-camera replays. It is the first time that OBS will rely on a cloud-based workflow for replays. All frames captured by the array of cameras installed at these two venues will be sent to an edge server and be reconstructed in Alibaba Cloud to generate the replay clips. Those will be up-converted to 4K in the cloud before being sent back to the production unit in the venue compound.

Biathlon, Cross-Country Skiing

2D IMAGE TRACKING

After being successfully introduced at Tokyo 2020 (for the coverage of athletics marathon and race walks, cycling road and mountain bike, aquatics marathon swimming, triathlon, canoe sprint and rowing), OBS will use the 2D image tracking (also referred to as athlete 'pinning') technology

again in Beijing, for all the biathlon and cross-country skiing events. It will help commentators and viewers to keep track of the position of the athletes throughout the event in real-time.



© 2022 Olympic Broadcasting Services

2D image tracking will be used in the coverage of the biathlon and cross-country skiing events. These sports were chosen due to the fact that their production plan traditionally relies on sequencing cameras to understand what's happening. The new on-screen graphics will help identify the athletes appearing on the same shot, and thus tell the stories.

How does it work?

Compared to other athlete live tracking solutions that rely on GPS positioning or wireless equipment, 2D image tracking is based on advanced image processing technology that allows motion tracking.

A 'patch' (a square) is defined on selected video frames in order to identify each of the athletes. The computer then creates a 'label' that is attached to each of the identified athletes

and that will be maintained even as the image changes. This captured data is then made available to a graphics rendering platform for on-screen presentation to the viewers, enabling them to know the exact location of the athletes/groups. Additional data captured using more traditional GPS positioning can be combined with the 'labels' to identify athletes, their speed, distance to finish or relative position to the leader.

Alpine Skiing (Downhill)

LIVE SPEED MEASUREMENT

With their adrenaline pumping and their precisely curved skis helping them accelerate down the course, Olympic downhill skiers squeeze past the gate at incredible speeds. For Beijing 2022, OBS has partnered with Worldwide TOP Partner OMEGA to extend

the live speed measurement for the downhill events across the fastest sections of the course, allowing worldwide audiences to get an insight into the astonishing speeds Olympic skiers achieve.



© 2022 Olympic Broadcasting Services

The downhill is one of the signature events at any Olympic Winter Games for the breathtaking velocity of racers as they fly down the mountain at interstate speeds. But how fast do Olympic downhill skiers go? By improving the live speed measurement, viewers around the world will be able to appreciate the mindblowing speeds from Olympic skiers.

How does it work?

Speed measurement in the coverage of alpine skiing events was introduced as part of the TV graphics at Sochi 2014. However, until now, the speed was measured from a very specific position and limited to only snapshots, or just a few seconds of data. This was due to the limited sensor coverage available.

For Beijing 2022, OBS, together with Worldwide Olympic Partner and Olympic Games Official Timekeeper OMEGA, will deploy a multitude of newly-developed antennae with increased reception capacity that allow for the capture of more data throughout a much larger portion of the downhill course. The use of such technology will also guarantee an overall better speed measurement in terms of accuracy and frequency of updates.

Figure Skating, Freestyle Skiing (Halfpipe), Ski Jumping, Snowboard (Halfpipe)

JUMP DATA

In collaboration with OMEGA, OBS will offer additional 'Jump' data for selected sports/ disciplines to commentators, providing them with new levels of jump analysis.

How does it work?

Incredible motion sensors and computer vision analysis will help capture real-time data such as speed, height, length, duration, angles of skis etc.



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Curling

VIRTUAL ANALYSIS

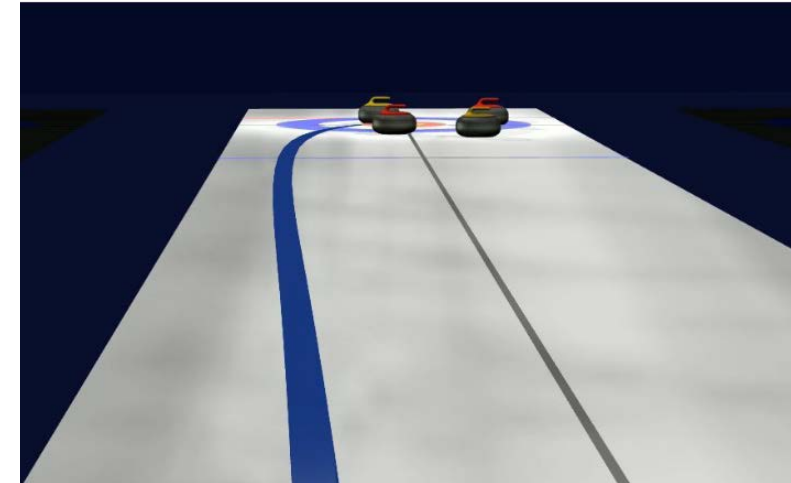
In Beijing, OBS will add new tech-dimension to sports analysis for Curling by introducing visualisation of stone trajectories and new measurements.

How does it work?

A virtual overhead camera will allow unimpeded analysis of stone position, contact points, trajectory and distance between stones for one sheet at a time.



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EXPANDING THE VIEWING EXPERIENCE WITH VIRTUAL REALITY

“A well-designed VR experience can be transformative: the user feels completely transported to the heart of the action, following the athletes’ footsteps onto the field of play, and enjoying a new and unique perspective on the Olympic viewing experience. VR adoption has been growing steadily, and to further mainstream its adoption, we need to produce the highest quality content – and maintain that quality through to distribution to give viewers an unforgettable experience.”



Matt Millington
Director of Digital Content



© 2021 Olympic Broadcasting Services / Silvio Avila
Inside the Virtual Reality production gallery at the IBC during the Olympic Games Tokyo 2020.

Together with Worldwide TOP Partner Intel, OBS will offer RHBs the opportunity to provide their viewers with a deeper, smoother, and more immersive Olympic experience. **For the first time ever, OBS will capture, produce, and distribute Olympic content in live 8K Virtual Reality.**

Fans will be transported from their home country to the field of play, where they will have a better-than-front-row view of the sport as the action unfolds. Thanks to greater detail creating even more realistic images, the 8K VR distribution will bring the atmosphere of Beijing 2022 Olympic venues to life. And like never before, viewers

can engage with winter sports in a unique and profound way. Beijing 2022 marks the first ever multi-sport event to be covered in 8K VR. OBS plans to produce **more than 80 hours of 8K live Virtual Reality from the Opening and Closing Ceremonies and selected sports**, with two different sports available daily.

These sports and venues have been carefully chosen by OBS content creators based on the ability to strategically place cameras to convey a sense of proximity to the athletes, making the viewer feel like part of the action. VR opens up exciting new possibilities for

storytelling and for taking audiences even deeper into the Olympics. **The switch to 8K is a huge step towards delivering spectacular and truly immersive VR live streaming, with a guaranteed ‘wow’ factor.**

OBS will place up to six 180-degree monoscopic cameras and one 360-degree camera to capture the Ceremonies and Olympic competitions. Viewers will be able to choose camera perspectives of live streams, while OBS will also provide an additional stream with integrated camera coverage. Additionally, OBS will produce a broad variety of highlights, features, athlete experiences and point-of-view clips from all sports, some never before captured in VR. These highlights and features are delivered as VOD in a mix of 180- and 360-degree formats.

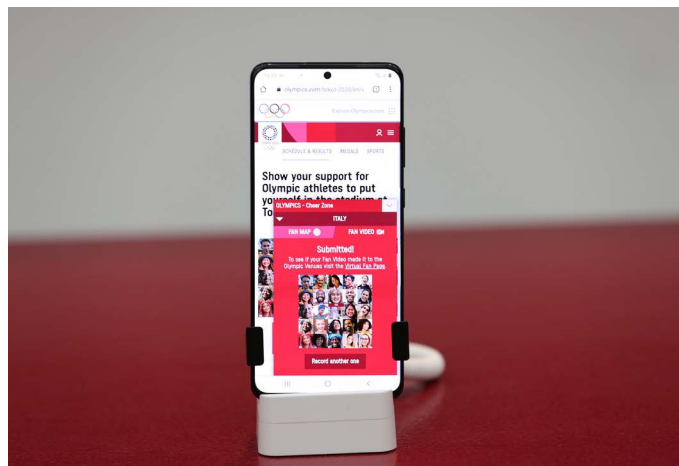
RHBs are taking the immersive media service in a variety of delivery formats including; OBS white-label solution; mobile and web SDK; direct URL streams; short-form video-on-demand downloads. The apps are available on VR headsets for Oculus Quest/Quest 2 and Pico, and also on mobile.

Furthermore, RHBs will be able to create new and exciting presentation environments, and virtual backdrops for their television studios using the 8K VR feeds.

ENHANCING DIGITAL FAN ENGAGEMENT

Building on the success from the Olympic Games Tokyo 2020, OBS will again digitally connect athletes with fans worldwide through an innovative suite of digital fan engagement applications and make them feel part of the Olympic Winter Games Beijing 2022.

Wherever they are in the world, fans can show their support using the power of the internet and cheer on their favourite winter athletes and teams.



© 2021 Olympic Broadcasting Services
Fans around the world can show their support by sending a selfie video.

Reactions of both international and domestic fans in the venues are an essential element that enhances the experience and performance of Olympic athletes, while also bringing emotional and colourful images to the Games. In Tokyo, more than 250 million cheers were received from every country, populating the cheer map shown in the Olympic venues and online. Furthermore, OBS facilitated more than 200 Athlete Moments connecting Olympians in the venues with friends and families back home – moments of pure emotion captured by OBS cameras and distributed worldwide.

The Digital Fan Engagement initiative has proved a valuable tool to reach out to and effectively engage with fans around the world and counterbalance the impact the pandemic has had on Olympic fan attendance. Both athletes and broadcasters expressed great interest in making it a permanent fixture of future Games. Thus, OBS is bringing it back on a larger scale for Beijing 2022.

Fan Video Wall

Fans are invited to video themselves recording a message of support that will be later broadcast in Olympic venues, on Olympics.com and on RHBs' digital platforms. Displayed as a video matrix on the big screens inside the Olympic venues, the Fan Video Wall helps enhance the atmosphere and sense of global fan inclusion – also



© 2021 Olympic Broadcasting Services / Owen Hammond
The Fan Video Wall is displayed on the big screens at the venues.

contributing to further enrich the athletes' Olympic experience. New for Beijing 2022, those whose clips are selected for a fan video wall will receive an email with a link to the matrix featuring their video. They can then share that clip on social media.

Virtual Cheer Map

The cheer button, available via RHBs' platforms, International Federations' websites and Olympics.com, will once again provide fans the opportunity to cheer for their favourite country. The cheers are collected and compiled into a live world cheer map, which provides a dynamic display from the world's sporting fans. With no overseas spectators allowed, this service offers the athletes the chance to virtually see and feel their fans' support.

Athlete Moment

For the debut of the initiative in Tokyo, athlete stations were installed only at selected venues. With the expansion of the project for Beijing, OBS will facilitate 'Athlete Moments' across all sports and venues, allowing even more athletes to connect with their family and friends back home immediately after walking off of the field of play. OBS will incorporate many of these 'Athlete Moments' into its coverage to share the emotion of an athlete's connection with their family and friends with a worldwide audience.

INTERVIEW WITH MARK WALLACE

“Storytelling remains at the heart of what we do”

Mark Wallace, OBS Chief Content Officer, provides insight into OBS's production plan for the Olympic Winter Games Beijing 2022.

What does your role as Chief Content Officer entail?

The role is primarily responsible for overseeing all the broadcast and digital content OBS offers to the Rights Holding Broadcasters (RHBs). The most visible is of course the live Ceremonies and sports feeds and the accompanying Multi Clip Feeds (MCFs), but also OBS produces far more products and content including Virtual Reality, the Olympic Video Player (OVP), Olympic Channel News (OCN), Multi-channel Distribution Service (MDS), additional programming, and the popular remote delivery platform Content+.

I have an incredibly talented team around me who project-manages all these products so my role is to ensure that globally all this content works together both editorially and creatively.

I work closely with the Organising Committee on the development and implementation of the Look of the Games, and how the venues are presented to TV audiences, also defining the

locations for TV studios and beauty cameras in the host city and working with International Federations on scheduling, competition format and sports presentation.

Once the Games are underway I am predominantly based in the Production Quality Control (PQC) room, which I like to think of as the nerve centre for our coverage. The PQC is really a very large outside broadcast unit from where we can communicate with all production teams in the venues and all functional areas in the International Broadcast Centre (IBC). That includes the TV directors, and production managers to assist and discuss how they are covering their sport. We may have to help with the editorial storytelling or creative coverage or the graphics to ensure that they are inserted at the right time and correctly. Our objective is to maintain the consistency of our coverage across all sports and throughout the Games.

In the PQC, there are five teams made up of the OBS coordinating producers plus some very



MARK WALLACE



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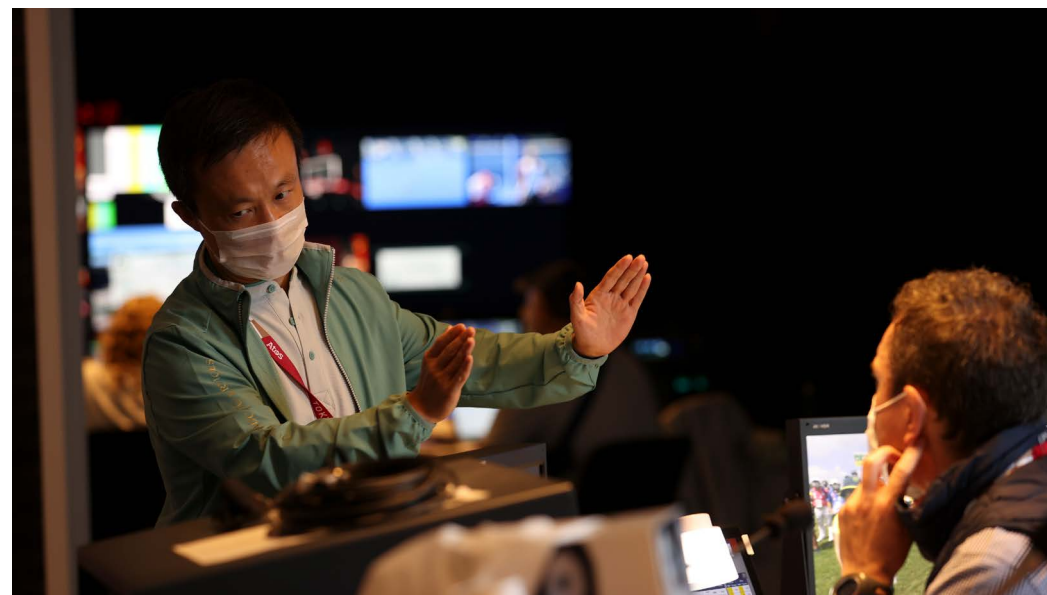
Mark Wallace is responsible for the design and delivery of the multilateral content delivery plan for all OBS operations. In this role, Mark oversees the organisation's broadcast and digital coverage at all competition venues and the Ceremonies, as well as the development of pre-Games and in-Games content. Mark also oversees on-screen graphics, archives and all the Games-time content delivery solutions such as the Multi Clip Feeds, Multi-channel Distribution Service, Digital Content Solutions, Content+, immersive media, and the Olympic Channel News. With nearly 30 years of experience working in media, Mark has specialised in the executive planning and management of major sport events, including five Olympic Games, the UEFA European Football Championships and the Rugby World Cup.

experienced senior figures from the broadcast industry who I call the 'elders' as well as the OBS Senior Managers for Graphics and Audio. The 'elders' are highly respected and support the five OBS coordinating producers. These PQC teams talk to the production units, oversee dress rehearsals and feed content to the venue production teams, such as aerials, title sequences, and course animations. They can also talk to the OBS commentary and MDS coordinators, Content +, OCN in case there is an important story or interview, and the PQC ensures that the audio is the quality that we and the RHBs expect. It is an ongoing process and if everything is going well, I have very little to do. I am surrounded by a lot of knowledge and experience and our job is to provide a calm and reassuring voice for those at the venues in the production units and at the IBC because if we are not calm, then panic spreads quickly.

What has it been like planning during the pandemic?

The Beijing 2022 Organising Committee has helped us greatly in working with the Chinese government to get our personnel on the ground. For some venue surveys, this has meant for some people flying into Beijing on a special charter flight and then staying in their bubble of airport to hotel and venue, then back again – a process which required a great amount of planning.

There have been many, many virtual (video) meetings. We have also used an innovative system, called the Venue Simulation System (VSS), which has allowed us to look around the venues in a virtual way. This solution has been developed by the Beijing Film Academy early in the planning phase, with the support of the Organising Committee, the IOC and OBS. It renders a 3D copy of the venue where you can add various elements from Look of the Games to actual broadcast facilities such as camera platforms. Our producers could then determine which cameras were needed for



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Mark Wallace, with coordinating producer Haiwei 'Bobby' Wang, during the Olympic Games Tokyo 2020.

the coverage and place them on the platforms and footprints to assess the shots from these positions and adjust their coverage plan if necessary. This 3D wireframe world gives you a good idea, and therefore was a useful planning tool. We will probably use it again as a planning tool in the future.

One of our coordinating producers, Haiwei 'Bobby' Wang, has been based in China for the last two years, and he has been very busy doing a lot of work for all the Producers and others. He's been going to test events, filming videos, taking photos, and working closely with the International Federations. This has been invaluable for our planning.

The planning for these Games hasn't been an easy task, but we are used to it after Tokyo 2020 where we had our esteemed colleague Makoto Nakamura based in the host city, therefore we were able to make it work with no major problems.

How has the short turnaround since the Olympic Games Tokyo 2020 affected OBS's plans?

We started our planning for Beijing 2022 before Tokyo 2020, so we were in pretty good shape when the Tokyo 2020 Olympic Games ended in 2021. Most of the planning was finalised before the Tokyo Games so we only had to fine-tune our plans in the short period of time between Tokyo and Beijing.

Last winter, some of the TV directors went to survey the venues to look around and understand what could be achieved in terms of coverage. They took photos and shot videos so we knew what we needed to do to achieve an Olympic level of coverage.

Coming off the back of Tokyo, the team had a short rest of two or three weeks, and then it was 'foot down' again. As previously mentioned, I have an incredibly talented and dedicated group of individuals across all projects. There were a few things we needed to do, but now we are in good shape and that is because we did a lot of

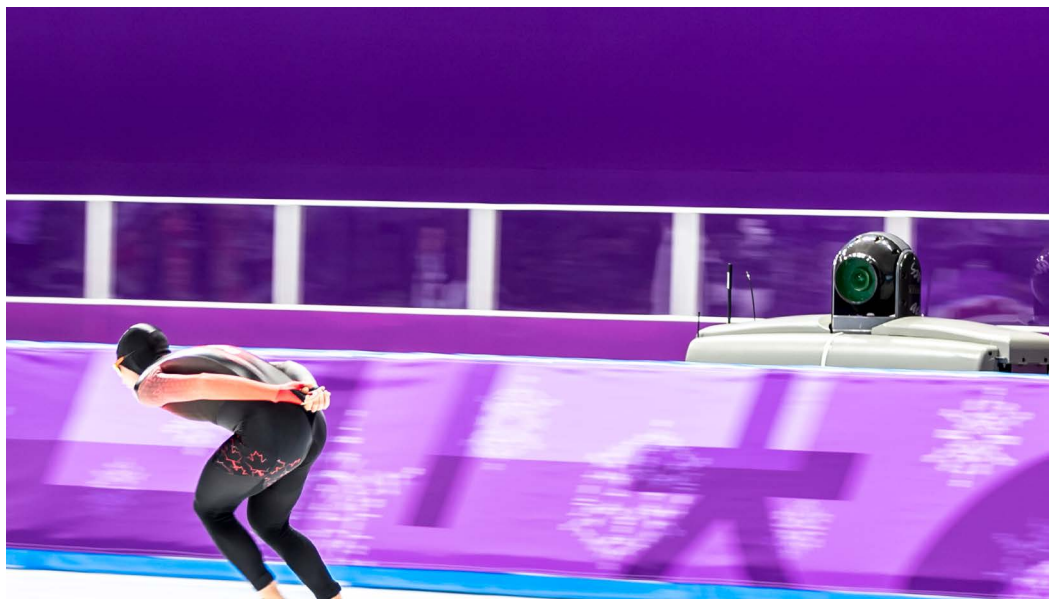
the 'hard yards' before summer 2021.

How has the scale of production grown from PyeongChang 2018?

It is bigger, because every feed, that is to say every sport and every discipline of that sport will have an accompanying Multi Clip Feed (MCF), which is a secondary feed that shows unseen shots and angles that did not make the multilateral feed from some of the high speed slow motion and specialty cameras installed at

broadcasters are even planning to stream it live. The MCFs popularity means we need to consider carefully with each sport what content goes on it. As such, it means there are more feeds coming out from Beijing 2022 than from previous Winter Games. It will represent twice the amount of content compared to PyeongChang 2018.

The other area of increase are the multi-camera replay systems. This is where there are a



© 2018 Olympic Broadcasting Services / Owen Hammond
A large number of specialty cameras help produce memorable pictures of the Games.

the venues together with athlete arrivals and warm up. It's the first time in an Olympic Games that we will have an MCF for every sport and every feed, so as an example all four sheets at curling will have their own MCF.

The MCFs have been very well received by the RHBs since their introduction at Sochi 2014 in Alpine Skiing. Since then it has expanded greatly. It allows us to feed far more content to the broadcasters to either use for analysis or montages, though, for Beijing 2022, some

number of SLR cameras on a rail or truss, and they are all recording the action simultaneously. When we play this back it allows us to freeze an athlete and move around the action, moving backwards and forward which can look very dramatic and allows more analysis. We used such systems at PyeongChang 2018 at figure skating, ice hockey, short track speed skating, and halfpipe, and in Beijing we will have 10 systems, which is a huge increase from four in PyeongChang 2018.

The quality of the images is improving Games on Games with smoother movement and now many of the systems are on a gimbals, so one can actually change the location of where they're recording. The 'holy grail' is to actually follow the athlete around and we're moving in that direction.

RHBs can of course take this content onto their digital platforms so it can go on to their social media channels such as Twitter, Instagram, and Facebook. Those shots sometimes become viral, and people start to talk about it. It is on a timeline so people can move backwards and forwards on it to look at the athlete, look at the shape of the athlete's body, look at what the athlete's legs and arms are doing and then talk about it with each other.

How will OBS continue its work with international experts?

For Beijing 2022, OBS will rely on broadcast teams who worked with us in previous Games including a Finnish team who will look after cross-country skiing again, an Austrian team for biathlon, two Canadian teams to take care of ice hockey, a South Korean crew from SBS will be at figure skating, and a Japanese team from NHK will be at speed skating. We will also have Chinese crews in charge of curling, and part of the extreme sports coverage.

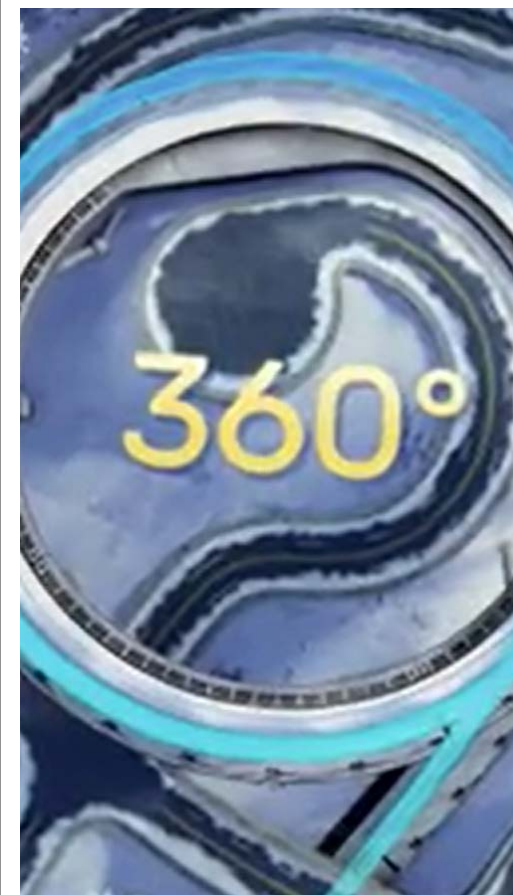
As with Tokyo 2020, a lot of our production meetings have been through video calls, and it is just a matter again of making sure the TV directors have everything they need to understand our vision and philosophy, as well as operational matters such as how they get into Beijing, and the rules to follow to ensure a safe environment for everyone.

What sort of additional content does OBS provide?

As a team we try to consider what additional content would be required by the RHBs. Firstly, we provide a broadcast animation package. This includes the opening and closing

title sequences, break bumpers, animated backgrounds, and various types of music, all of which can be tailored by the broadcasters for use in their coverage of the Games.

We also produce explanatory sports guides that are 60 to 90 second videos explaining each discipline. Broadcasters have been using them since November in their build-up to the Games programming. Those sports guides can be enhanced by a series of athlete profiles, which have been produced and released in advance by the OCN team.



© 2021 Olympic Broadcasting Services
For Beijing 2022, OBS has produced 24 sport guides that highlight key skills for each sport/discipline.

Just before the Games, we will distribute aerial footage along with the interviews, athlete profiles and cultural features that our OCN and Content+ teams will produce before and throughout the Games. OCN is also responsible for ensuring all the medallists are interviewed, in English and their mother tongue.

All this material goes onto our online remote distribution platform, Content+, as well as OCN.

It is all encompassing, and in total we will produce more than 6,000 hours of content for these Games.

Where does storytelling fit into your output?

Storytelling remains at the heart of what we do. If you're not storytelling, you're not engaging the viewers. It is that simple. If we are not engaging with people and creating those stories for commentators to tell, then we are not doing our job as host broadcaster. That is also the reason why OBS brings in experts to work as part of our venue production teams, and OBS brings the same level of expertise to the PQC with some of the best, most experienced producers in the broadcast industry. Only then, can we make sure that we are telling the story in the truest form.

When you look back at the broadcast of the Olympic Games, you are not necessarily looking at the quality of the pictures or graphics or any of that. What you remember are the stories and how they were told. If we don't capture the story, we have failed and that's why storytelling is and will always be at the heart of everything that we do.

How does the evolving technology support the storytelling?

Technology and data have undoubtedly had an impact on how we tell the stories of the Games. It allows the viewer to understand the excellence, expertise and skill levels of the Olympic athletes. The technology has allowed viewers to see and better understand the athletes' movement, biometrics, what tactics a team uses etc.



© 2021 Olympic Broadcasting Services / Owen Hammond
Multi-camera replay systems, shown here at golf during the Olympic Games Tokyo 2020, provide new perspectives on the athletes' performances and a more immersive viewing experience.

For instance, most replay systems come from one camera and the audiences are looking at an event from one angle only. With the multi-camera replay systems, it feels like the viewer is moving around the athlete and seeing them from different angles in a more immersive way.

In Tokyo, in golf, we analysed an athlete's drive off the tee. We could freeze the drive as the club went up, move around the athlete and then roll it on as the athlete teed off. You could see the athlete's shape, what muscles are used, etc. So technology meets our remit to inform and educate, but is also entertaining.

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How will the Digital Fan Engagement initiative work?

There are three aspects to fan engagement: the cheer map, the fan video wall and the athlete station or athlete moment, primarily it is the latter that can be used within the multilateral coverage.

Introduced for the first time at the Tokyo 2020 Olympic Games, the athlete moment is a station where the athlete can talk to their family and friends through a video conference system as they walk off the field of play, with OBS camera operators capturing the emotions of those moments. Depending on the sport, we will try to incorporate the athlete moment into the multilateral feed, where editorially it makes sense, most probably at Victory Ceremonies, but not only.

In Tokyo, the Digital Fan Engagement was well received both from the athletes and broadcasters. With the lack of international spectators, the cheer map, the fan video wall and the athlete moments helped convey support from fans around the globe to the athletes. In Tokyo, the athlete station was implemented in selected venues. For Beijing, we are bringing the athlete stations to all venues and we're trying to engage with as many athletes as possible.

How can Virtual Reality (VR) enhance a viewer's experience?

VR in my opinion is best viewed through a headset or HMD, though it can be viewed on a phone or tablet. The difference from broadcast coverage is of course that the user can decide where they want to look. Normally the TV director will decide the framing and cutting of shots, but with VR you can look wherever you want. It's like being there, and you see all the things that traditionally we might keep out of the broadcast coverage. You can hear what's going on and see what's going on all around you.

It's a different experience and an interesting

one, but it has to be done the right way, in the highest possible quality for achieving a great user experience. We've been working closely with Intel, and they know this area of VR very well and have developed it from one Games to the next.

How did you go about getting beauty shots and aerials for these Games?

We have installed 12 beauty cameras dotted all over Beijing and up into the mountains, capturing iconic landmarks such as the Great Wall, Tian'anmen Square, and the Forbidden City. The Organising Committee has played a key role in helping us achieve this.

As part of these beauty cameras we also have a cable camera which extends from the Linglong Pagoda across the Bird's Nest which will be used in the Ceremonies and Medals Plaza coverage, as well as offering unique views of the

Olympic Green. These are the shots that people remember, which live long in the memory as iconic shots from each Games.

There is understandably tight security over Beijing and other venues for filming from helicopters and drones. Therefore we have worked closely with BOCOG and local security agencies and will utilise local police helicopters. It complicates matters to an extent, but we've done it before in 2008 with no problem. We will also have helicopters in the mountains, which will shoot 'fly-bys' at the start of competition. We will record these aerial pictures and then send them to the production units and onto the RHBs via the MCF.

For the coverage of some snow sports, we plan on deploying five or six drones for the live coverage, some are tethered, some not, as well as some 360-degree content for VR.



© 2021 Olympic Broadcasting Services / Silvio Avila
OBS offers broadcasters beauty shots from the host city to enhance their Olympic coverage and news reporting.



© 2021 Olympic Broadcasting Services / Silvio Avila
Exchange between Mark Wallace and OBS Coordinating Producer Chris Jensen inside the PQC during the Tokyo 2020 operation.

For the first time in a Winter Games, OBS will debut drone coverage at alpine skiing, biathlon, big air, cross-country skiing, freestyle skiing/snowboard cross and snowboard parallel giant slalom, providing dynamic overhead aerial action to allow viewers to understand better the relationship of athlete and field of play.

Again, our collaboration with the Organising Committee, the military, and the police has been pivotal in us being able to have such an operation and offering worldwide audiences unique aerial pictures from the Games.

How will you work around not having full crowds?

The Olympic Winter Games Beijing 2022 will have a limited number of fans allowed in the venues and we will do our utmost to capture

the atmosphere coming from the spectators' stands.

Given the fact that the Games will be played in front of spectators, we don't see the need to use crowd sounds through the PA system at this time as per what was done for the Tokyo 2020 Olympic Games. We have still prepared for a no-spectator scenario and have gathered crowd sounds from PyeongChang 2018 for every sport. However, the intention is to go with live sounds, which means we don't have to try and synchronise the audio with the visual. We feel it is better to go with natural sounds where possible.

BEHIND THE BEAUTY CAMERA PLANNING

“We have installed 12 beauty cameras for the coverage of the Beijing 2022 Olympics. If you ask me which of them is the most iconic, or the most impressive, or the most historical, I don't have a clear answer. They are all different and represent different aspects of the Chinese culture.”



Haiwei 'Bobby' Wang
Coordinating
Producer



© 2021 Olympic Broadcasting Services
Beauty camera surveys sometimes include a lot of hiking and climbing as OBS tries to find the best spots that will capture viewers around the world.

In order to provide broadcasters with scenic views from Beijing during the Olympic Winter Games, OBS has positioned 12 beauty cameras across the city, as well as in the mountain cluster and some other iconic locations.

The work behind the Olympic beauty camera coverage plan usually takes between three and four years. It starts with a brainstorming session to explore which beauty shots would better capture the beauty and atmosphere of the host city and host country, as well as the essence of the Games. However, when it comes to determine the locations, other factors are taken into account, such as technical feasibilities and operational practicalities. Some options are sometimes discarded due to challenging access or difficult installation conditions. Particularly for Winter Games, the weather conditions play a key role and can make a huge difference in the quality of the beauty camera shots. A timely snowfall creates the perfect winter shot.

Beijing City Central Axis

The Beijing City Central Axis location was chosen because it tells the history of the development of the city of Beijing. This beauty camera sits on the roof of a normal residence

building situated not far from Yongding Gate. Yongding Gate used to be the southern end of the city. Further up north, there is Qianmen Gate, which literally means "Front Gate", which stands in front of the Tian'anmen Square and the Forbidden City. Beyond are Jingshan Park, Drum Tower and Bell Tower. The new extension of the Central Axis is the Olympic Park at the north end, and though the Bird's Nest and the Water Cube cannot be seen, the Olympic Tower clearly appears in the background. While this vertical axis is pulling the thread of the history of the city of Beijing, the camera will also capture modern China with the high-speed train linking Beijing to the rest of the country.

Badaling Great Wall

The Great Wall of China is one of the most iconic monuments in the world. What many people don't realise when they first think about the Great Wall is that this project was not completed all at once. In fact, the Great Wall as we know it today was continuously built over a period of roughly 1,700 years. The Great Wall was built as a line of defence. However, it isn't a single wall – but a patchwork of smaller walls built over several centuries. When it came to decide on a location for the beauty camera,



© 2022 Olympic Broadcasting Services
Broadcasters will be able to include spectacular daytime and nighttime views of the Olympic Green in their programming thanks to a beauty camera installed in the Pangu Plaza building.

it was tricky because there are many sectors of the Great Wall around the Beijing area. The OBS team checked several spots, including Juyongguan, Jiankou and Mutianyu, but finally selected a more broadcast-friendly location, where it was technically possible to install a live broadcast camera, and operationally safe to transmit signals 24 hours a day.



© 2022 Olympic Broadcasting Services
OBS will operate a beauty camera from the iconic Great Wall.

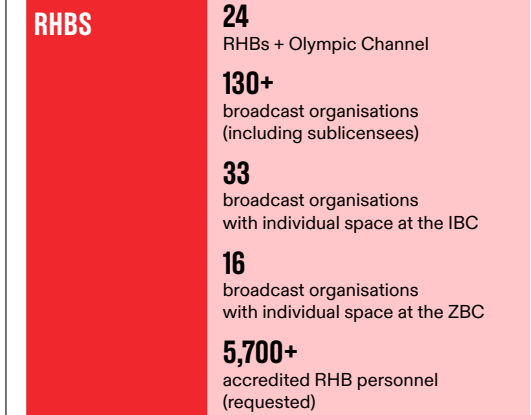
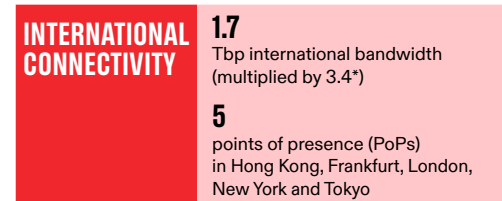
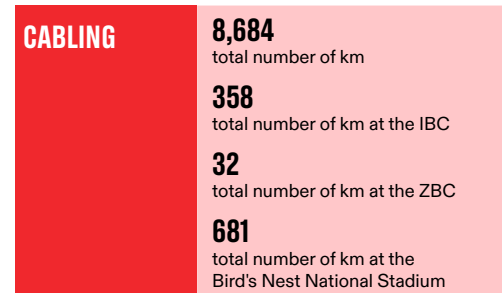
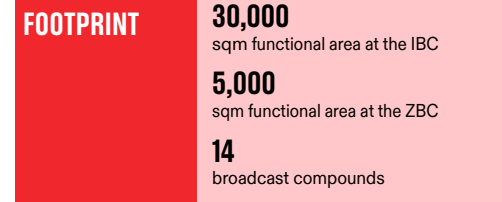
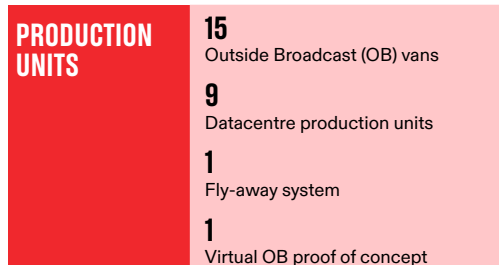
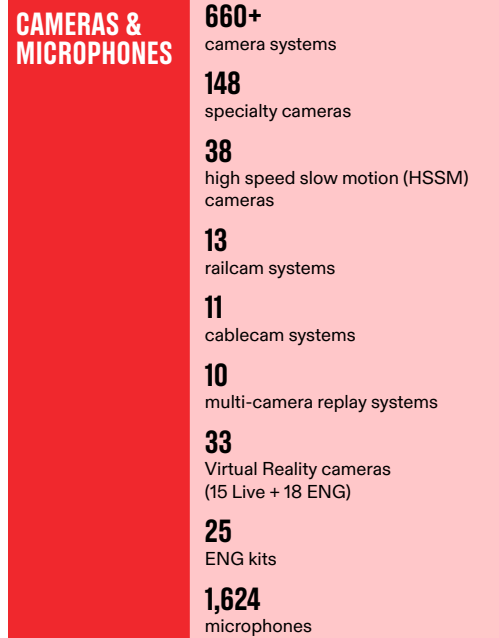
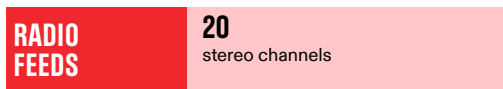
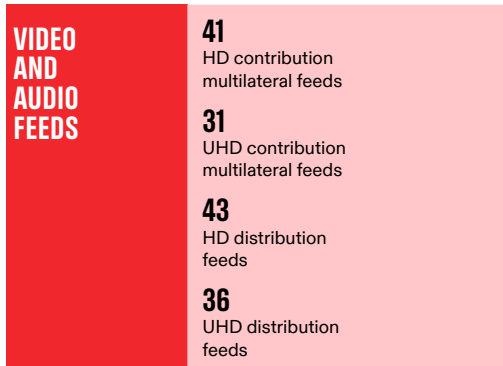
Shougang Park

The beauty camera installed at Shougang will tell the story of a district, once the burning heart of Beijing's industrial complex, now standing proud as a monument to the city's sustainable, urban regeneration efforts. In Chinese, 'Shou' means capital, and 'Gang' means steel. It was the former location of Shougang Company Ltd, a pig-iron plant originally founded in 1919, which was also inevitably a major source of pollution in western Beijing. An iron ore storage tower has become home to the Organising Committee, while blast furnaces have been transformed into training centres. During the Games, the world's top snowboarders and freestyle skiers will be flying down the big air ramp set off the side of former vast 70-metre cooling towers in the heart of Beijing's former industrial district – likely to provide some of the most iconic pictures of the Games.

CHAPTER 6

BROADCAST KEY FACTS AND FIGURES

BROADCAST COVERAGE BY THE NUMBERS



* Compared to the Olympic Winter Games PyeongChang 2018

TOP 10 FIRSTS AT AN OLYMPIC WINTER GAMES

UHD HDR 5.1.4 IMMERSIVE AUDIO

- 1 OBS will have a full native UHD HDR production, with 5.1.4 immersive audio. OBS has transitioned its contribution and distribution networks to a state-of-the-art IP-based core system to support the UHD HDR production workflow.

MORE CONTENT, IN MORE FORMATS

- 2 OBS will deliver a record 6,000+ hours of content (versus 5,600 for PyeongChang 2018) in more formats and profiles in support to the RHBs' multi-platform strategies
- 3 Every live sports feed will have an accompanying Multi Clip Feed (MCF). OBS will produce a MCF from every sport/discipline and field of play. Additional drone footage, as well as fast-turnaround sports highlights, short-form content and mobile-generated clips

TECH FUELLED PRODUCTION ENHANCEMENTS

- 4 Multi-camera replay systems (10 systems in total) including two systems using cloud technology for data processing in partnership with Alibaba

8K Live Virtual Reality, providing 180-degree monoscopic / 360-degree panoramic sports coverage, as well as virtual presentation backgrounds for TV studios
in partnership with Intel

2D Image Tracking (Biathlon, Cross-Country Skiing)

Extended live speed measurement (Alpine Skiing)
in partnership with OMEGA

Additional 'Jump' data (Halfpipe, Figure Skating, Ski Jumping)
in partnership with OMEGA

Virtual analysis (Curling)

5G-connected live and near-live cameras used for live coverage (several sports)

REMOTE PRODUCTION

- 5 OBS will cover press conferences from selected venues and MPC Main Press Conference Room, as well as the Beijing and Zhangjiakou Medals Plaza Victory Ceremonies, via remote production. The remote production galleries will be set up either within the compound or at the IBC.

INCREASED CLOUD BASED WORKFLOWS AND SERVICES

- 6 OBS will experiment with a virtualised Outside Broadcast (OB) van for live production at Curling
in partnership with Intel
- 7 OBS has further transitioned its broadcast workflows to the cloud, offering additional services to the RHBs, such as new remote editing capabilities for Content+ and live distribution of the multilateral signals either in HD or UHD
in partnership with Alibaba

MORE SUSTAINABLE IBC DESIGN

- 8 OBS has been optimising space and looking for efficiencies in the design of the IBC and ZBC, reducing its requirements and introducing 'data centres' type of infrastructure to the RHBs via the Centralised Technical Areas (CTAs)

FOCUS ON DIGITAL AND SOCIAL MEDIA AND FAN ENGAGEMENT

- 9 OBS will offer new positions close to the field of play and in back-of-house areas at selected venues to help RHBs engage their audience on social media
- 10 OBS will deploy the digital fan engagement suite, which allows remote viewers to interact with live events in Beijing and athletes to their close ones right after they finish competing

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