

MEDIA GUIDE

OLYMPIC GAMES

TOKYO 2020

July 2021



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.

HOPE, LIGHT AND RESILIENCE

The year 2020 opened in a way that no one could have predicted. The COVID-19 pandemic spread across the globe at an alarming rate, shutting down businesses, schools, social gatherings and sporting events. The world was forced to react to a constantly evolving situation, making the best decisions possible as new information continued to pour in.

On 24 March 2020, the International Olympic Committee (IOC), in conjunction with the Tokyo 2020 Organising Committee and the government of Japan, took the unprecedented step to postpone the Games in order to safeguard the health and well-being of the athletes, spectators and all involved in the organisation of the Olympic and Paralympic Games.

This decision was widely applauded by government officials, National Olympic Committees, International Federations and, most importantly, the athletes themselves. OBS took part in many early discussions and fully supported this conclusion as the best possible outcome.

Less than a week later came the announcement of new dates for the Tokyo 2020 Games as 23 July to 8 August 2021, to align as closely as possible to the previous year's schedule. This postponement gave the world's health authorities, the athletes, the organisers and all stakeholders including the Rights Holding Broadcasters (RHBs), the maximum time to deal with the disruption caused by the COVID-19 pandemic and prepare themselves in more optimal conditions.

Preparing for the Games continued remotely, with each OBS department working diligently to adapt and reassess their workflows to optimise their operations moving forward. Fortunately, OBS already had technology in place to facilitate this evolution.

OBS has demonstrated its commitment to digital transformation and believes that technology now provides incredible opportunities to do things in a far more efficient way. Throughout the crisis, there has been a massive adoption



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In these challenging times for all, the Tokyo 2020 Olympic Games will send a resounding message of hope, solidarity and resilience.

of remote working from people and companies around the world, and using tools to do things without necessarily having any physical presence in a particular space; which is at the heart of what OBS has been planning and designing for the Olympic Games operation for the past several years.

Navigating the way forward

The task of determining how to hold safe and successful Games is a monumental one, and the IOC, the International Paralympic Committee (IPC), Tokyo 2020 and the Japanese government have spent many months consulting with the World Health Organization (WHO) and other top health authorities to devise a comprehensive plan moving forward. Through close coordination with all parties, Playbooks were developed for each stakeholder group, outlining the rules and recommendations that all

Games participants must follow in order to keep themselves, other Games participants and the people of Japan safe throughout the Games-time period.

These Playbooks have been regularly updated, based on the latest information from health authorities and best practices that have been employed in other major sporting events. Executive Director of the WHO's Health Emergencies Programme, Dr. Michael Ryan, recently acknowledged that the Games are a complex event, but that the WHO has "confidence that the International Olympic Committee and the host city Tokyo, and the Government of Japan, will make the right decisions regarding how best to manage the risks, and are working extremely hard right now to ensure that those risks are well managed."



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Yoshinori Sakai, a student born in Hiroshima on the day the first atomic bomb devastated the city, carries the torch up the stairs to light the cauldron during the Opening Ceremony for the Tokyo 1964 Olympic Games in the National Stadium on 10 October 1964 in Tokyo.

"We will continue to be guided by scientific and medical expertise from around the world to organise safe Olympic and Paralympic Games Tokyo 2020 for everyone," stated IOC President Thomas Bach, echoing a sentiment that many Games organisers have felt over the course of the re-planning of the Games.

While the situation is constantly evolving, OBS is confident that by following the guidelines set forth in the Playbooks, we can achieve a safe and successful Games delivery and Tokyo 2020 will act as a triumphant 'celebration of humanity'.

Just as Tokyo 1964 was innovative in how it broadcast the Games, Tokyo 2020 is already set to leave its mark on Olympic broadcasting.

When Tokyo hosted the Olympic Games more than half a century ago, it was heralded as a symbol of Japan's post-war recovery. This time around, Tokyo is aiming to bring the world together after an unprecedented crisis and achieve another historic Games – 17 days of incredible sporting feats, athletic prowess and raw emotions that will unite us all.

Building on the 1964 legacy...

In 1964, the Olympic Games were held in Asia for the very first time. This was a hugely important moment for Japan, a country that had risen from the ashes of World War II, which had ended only 19 years earlier, to become a major economic power.

Reconstruction, peace and understanding between peoples were the core themes of the Games. The 1964 Games in Tokyo were a catalyst in the country's urban development and economic growth. However, modern Japan was shaped by the 1964 Games in far greater

ways than just new infrastructure and facilities. It also played a key role in the country's identity and the subsequent sporting boom that took place in Japan. It was thanks to the Games that sport became part of the day-to-day lives of the Japanese people. Some iconic venues such as Nippon Budokan, Tokyo Metropolitan Gymnasium and Yoyogi National Stadium will hold echoes of the 1964 Olympics as they will serve again as Olympic venues. The long-lasting effects from the 1964 Games will certainly add greater depth to the stories being told this summer.

When the Opening Ceremony took place on 10 October 1964, audiences around the world were watching the Olympics live on television and also in colour for the first time. That day Olympic broadcasting changed from an event that only residents of the host nation could watch to something the entire world could view, live and in colour, thanks to satellites beaming pictures around the globe. Though coverage was still limited, the 1964 Tokyo Games became known as the "TV Olympics" for bringing live Olympic sports to the world.

Just as Tokyo 1964 was innovative in how it broadcast the Games, Tokyo 2020 will also leave its mark on Olympic broadcasting.

... and creating a new one in 2021

As host broadcaster, OBS is committed to delivering premium quality content and enhancing the way worldwide audiences experience the Olympic Games. For Tokyo 2020, OBS will again push the boundaries of Olympic broadcasting by producing 30 per cent more content than in Rio, in more formats, to assist the world's broadcasters in bringing the Games to more devices and platforms, and through more channels than ever before.

These Games will also demonstrate how advances in technology can bring value to storytelling, while also offering the ultimate viewing experience. OBS will be leading a

significant technological transition from High Definition (HD) to Ultra High Definition (UHD) High Dynamic Range (HDR), taking viewers closer to the athletes than ever before. Fans around the world will benefit by watching even more breathtaking pictures, while next-generation immersive audio will transport them right into the heart of the action. Due to its scale and complexity, this new broadcast environment will represent a benchmark for the sports broadcasting industry and pave the way for future Games.

In recent years, as viewing habits have changed and become more diverse, OBS has ensured that the focus is no longer only on delivering content for linear television, but also for digital platforms. Viewers now have more options as to how and where they can watch the Olympics. With streaming to laptops, tablets, smartphones and via social media becoming mainstream, demand for more content has exploded, and the need for faster turnaround has become key to broadcasters' workflows. To help RHBs in their multi-platform strategies and respond to their digital needs and this growing demand for content, OBS has extended its media server to the Cloud for Tokyo 2020, enabling RHBs to access all Olympic content from anywhere in the world, as well as edit and download all the short-form content in multiple formats and profiles.

OBS has teamed up with Worldwide TOP Partner Alibaba Group to create the OBS Cloud, a suite of custom-made cloud-based solutions specifically adapted to the extremely demanding, data-heavy broadcast workflows. OBS Cloud offers the high-performance connectivity, processing and storage capabilities required for the broadcast of the Games. Not only can RHBs access all OBS content remotely, but they are also now able to set up their own content creation, management and distribution systems within the platform.

If most broadcasters were already convinced

about the long-term potential of Cloud innovation and remote production, the global pandemic accelerated the adoption of remote production workflows. Remote production is enabling broadcasters to deliver more content to more screens, across more devices than ever before. This change happening behind-the-scenes is a major change in the way the Olympic Games will be broadcast this summer.

Other innovations will be much more visible to audiences when the Olympic Games go on air, such as the Artificial Intelligence (AI) based 3D Athlete Tracking technology developed in collaboration with Worldwide TOP sponsors Intel and Alibaba. This technology will offer viewers a new way to experience the action from the Athletics 100m races, taking speed analysis to the next level, representing one of many new innovations introduced by OBS for these Games.

Tokyo 2020 will be the source of countless stories, be they of glory, of despair or of the human spirit, and OBS is committed to providing RHBs with everything they need to bring these stories to their viewers, captivating worldwide audiences during the Games and beyond.



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The Olympic Rings have been installed in the Tokyo bay, with the iconic Rainbow Bridge and Tokyo Tower in the background.

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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 166 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 of approximately 8,100 personnel to deliver the live broadcast of the Games and support the RHBs' operations.

Members of the OBS Management team have an average of eight Olympic Games experience each. Collectively, the entire OBS staff has worked across more than 650 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 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 166 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 nine 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.

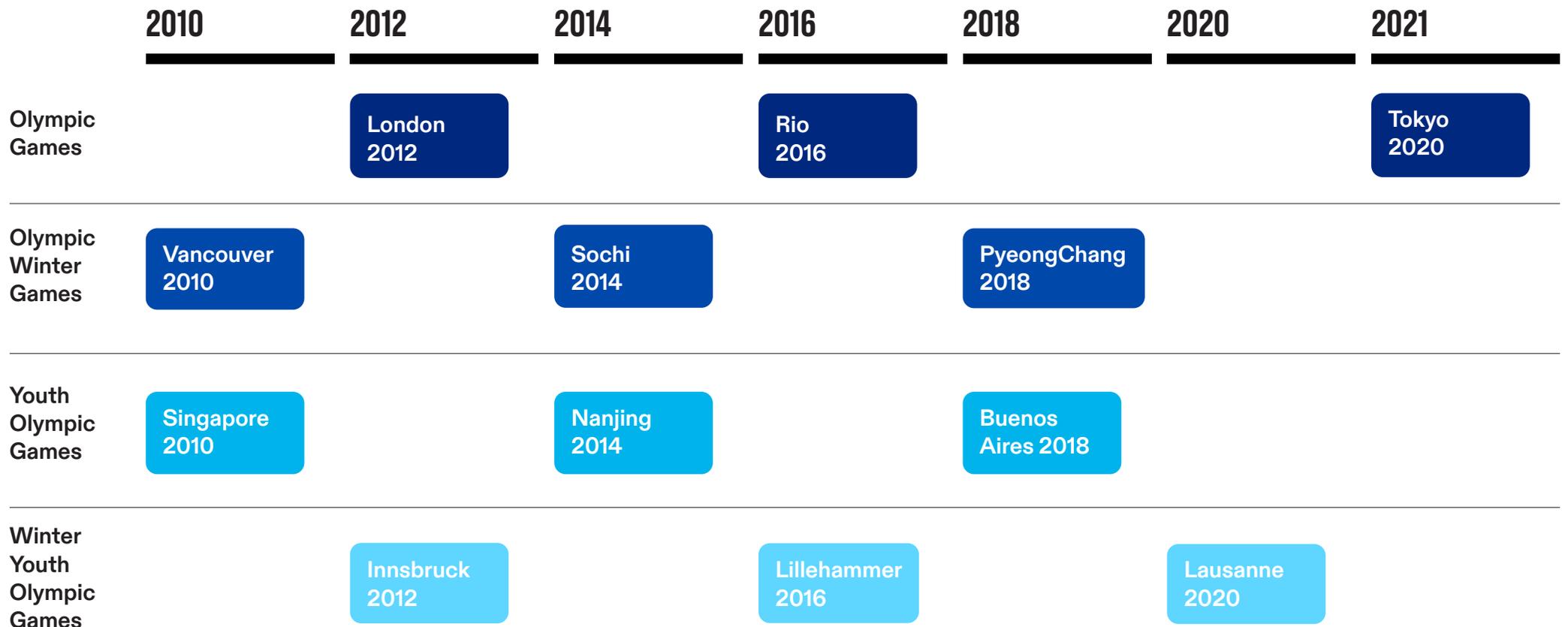
2007 OBS Board of Directors approves the plan to create a permanent central planning structure for OBS, working across all Games. The core team in Madrid expands from 18 employees to 146 broadcast professionals.

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



© 2016 Olympic Broadcasting Services / Cristina Ponce de León
View of the master control room within the Contribution, Distribution and Unilateral (CDU) centre at Rio 2016.

delivering solutions across the various aspects of the operation.

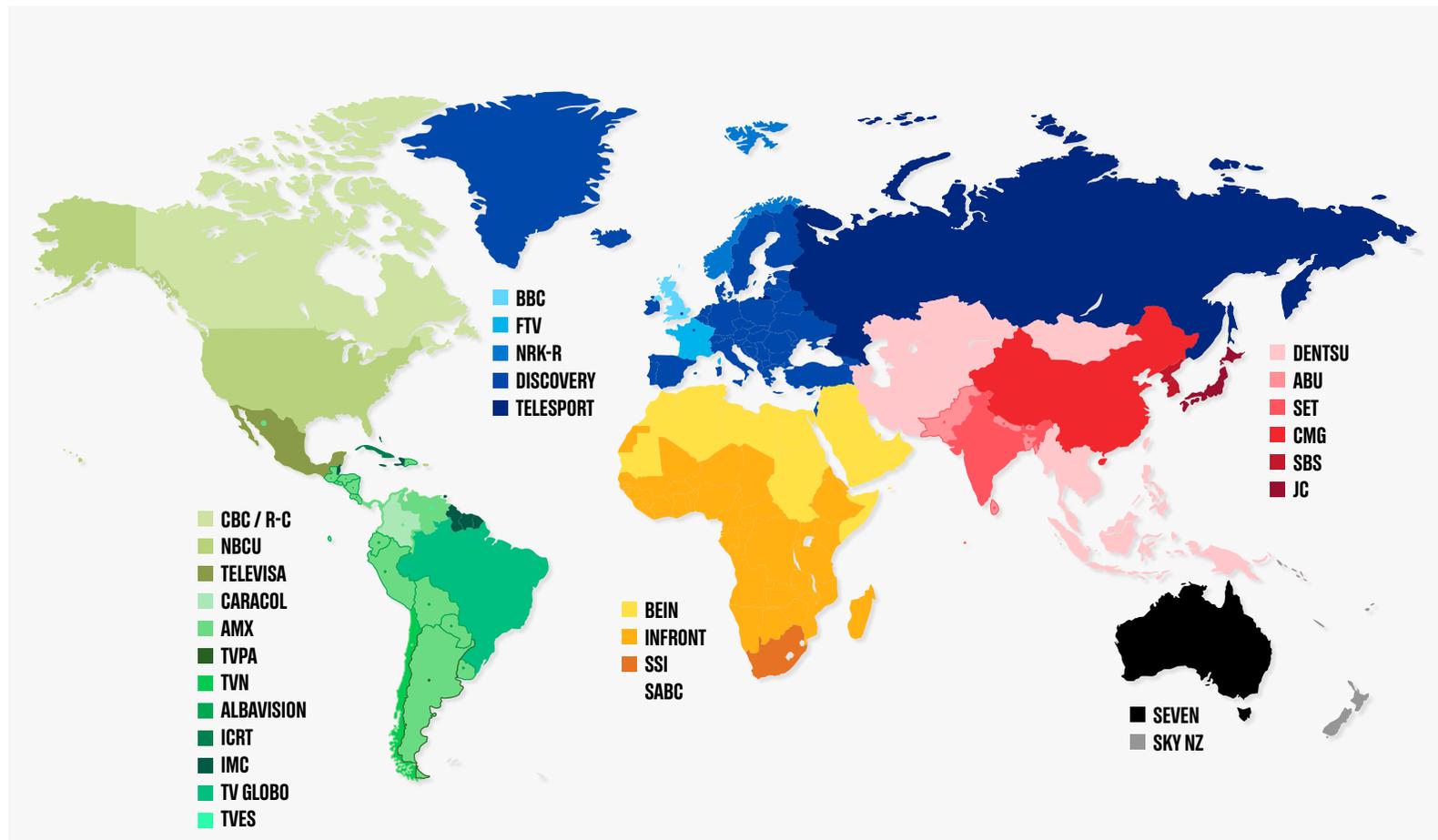
Setting up the host broadcast operation also entails a tremendous logistical challenge, which involves transporting tons of equipment to the host city(ies), ensuring its safe delivery and then providing the same service when it is time to pack up and leave. It also means recruiting thousands of broadcast 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 their service needs 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 operation with the postponement of the Games and the global pandemic.

Like all parties, OBS had to realign its plans by another year, while ensuring cost control through innovative thinking and streamlining processes. The re-scheduling of the entire operation has been a massive undertaking, but OBS can count on the incredible commitment of the OCOG and the support of all its partners to deliver successful Games in 2021.

OBS has been working closely with the IOC, the Japanese authorities and the OCOG to implement COVID-19 countermeasures and to ensure the safety and security for everyone involved.

OBS IS AT THE SERVICE OF THE RIGHTS HOLDING BROADCASTERS



To date, 29 RHB organisations have reached agreement and purchased the rights to broadcast the Olympic Games Tokyo 2020, 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.

RHBs contribute up to 73 per cent to the funding of the Olympic Movement*

These Olympic broadcast partnerships have been the single greatest source of revenue of the Olympic Movement for more than three decades. The RHBs have also greatly contributed to the global popularity of the Olympic Games and promoting the Olympic values throughout the world. Through their partnership agreements, the RHBs are given access to the International Signal produced by OBS and may book the required facilities at the venues and the International Broadcast Centre (IBC) 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.

* as per the 2013-2016 cycle

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.

The RHB journey to Tokyo 2020 has taken a slightly different direction

When the postponement of the Games was announced, the final touches were being made to the IBC, and the first broadcasters were expected to take possession of their space by April 2020, marking the start of the operational phase. The RHBs, who were involved in early discussions, unani- mously rallied behind the IOC's decision to postpone the Games. Since then, OBS has been working continuously with them to ensure all the conditions are put in place to face this unprecedented turn of events and deliver the best coverage possible.

The impact of the global coronavirus crisis and postponement of the Games has been significant to the broadcasters' operations. With their schedules being planned years in advance, often around the global sporting and entertainment calendars, they were forced to re-visit their schedules, along with those of their advertisers, and adjust their plans not only for Tokyo 2020, but also for Beijing 2022.

OBS has been at their side along this unique journey, providing guidance and adapting its services to better support the re-planning efforts undertaken.

The Playbook for Broadcasters, developed jointly by the IOC, the IPC, Tokyo 2020 and the Japanese authorities, has also provided key guidelines for the RHBs' on-site operations and COVID-19 counter- measure implementation.

INTERVIEW WITH YIANNIS EXARCHOS

“The biggest challenge the Olympic Games have ever faced”

OBS Chief Executive Officer Yiannis Exarchos talks about the unexpected turn of events that led to the postponement of the Olympics for the first time in history and what OBS has in store for Tokyo 2020.

What sort of issues has the postponement of the Games caused and what has been the impact of the ongoing global pandemic on your re-scheduling efforts?

Obviously, the postponement of the Games took centre stage in all of our planning. This had never happened in the history of the Games, so we were all treading new ground in adapting and reacting to this scenario. Over the course of the past year, we have been working closely with the IOC, the Japanese authorities and the Organising Committee to establish and implement COVID-19 countermeasures and safe distancing protocols, in order to ensure the safety and security of everyone involved.

These measures have of course had an impact on the planning of the broadcast operation and RHB broadcast workflows, with some

broadcasters opting for complete or partial remote production from their home country and sending less personnel on-site. This transition was however relatively smooth due to the fact that OBS was ready to accommodate such remote production.

From a host broadcast point of view, we were exceptionally satisfied with the preparation we had at the beginning of 2020, and now that the Games are almost here in 2021, we are ahead of schedule in many areas.

We were pleased that, following the postponement of the Games, it was decided that there was no need to make any reductions to our original production plan. We will be delivering the same exceptionally high level of coverage to the Broadcasters, as initially planned.



YIANNIS EXARCHOS

Yiannis Exarchos is the CEO of Olympic Broadcasting Services (OBS), the permanent host broadcast organisation created by the IOC. 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 now a key enabler and component of the IOC's Digital Strategy. 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.

Born in Athens in 1964, Yiannis graduated from the Athens University Law School.



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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

Since no international spectators will be allowed in the Olympic venues, what do you think the future holds for fans travelling long distances to cheer on their athletes?

To be honest, I am very hopeful and optimistic about the future of large-scale sporting events and spectators continuing to be part of the action. Crowds are slowly on course to return to sporting events, it will take time but the sport world is on the road to recovery. As coronavirus vaccines have become more widely available, we can expect that sports venues will soon reopen at full capacity.

For Tokyo 2020, in the absence of fans in the stands, OBS quickly realised that we needed to think outside of the box, and consider new and innovative solutions to overcome this obstacle. We wanted them to be part of the Olympic Games and we have been looking at means of connecting with them. We will facilitate remote fan engagement directly with the athletes within the venues, as well as with other fans worldwide. Working with the Organising Committee and our broadcast partners, OBS has created a suite of digital tools that will not only allow friends and family to engage with athletes within the venue, but also provide broadcasters with access to new engagement streams and interactive modules that will provide a wealth of content opportunities, while at the same time allowing fans all over the world to be actively involved in supporting their national heroes.

How important is the full rollout of filming and production in Ultra High Definition (UHD) High Dynamic Range (HDR)?

When you talk about Japan, tradition comes to mind along with technological innovation. For OBS, these Games are going to be a major milestone due to the advances we are introducing. It is going to be the first Olympic Games to be fully produced natively in UHD HDR.

The native Olympic standard coverage will be done in 4K and this will probably take most of the equipment to fully achieve this task, but we

felt we had the support of the broadcasters for this transition at Tokyo 2020.

We will introduce several innovations, both visible, such as Virtual Reality content, and behind-the-scenes, such as Internet Protocol (IP)-enabled solutions. Also new for Tokyo will be multi-camera replays; we will go heavily in introducing analytics, especially in digital innovations. Several innovations will take place behind-the-scenes, which will make the world of broadcast more efficient.

For OBS, these Games will mark a major milestone. It will be the first Olympic Games to be fully produced natively in Ultra High Definition (UHD) High Dynamic Range (HDR).

OBS has been undergoing an intense digital transformation in the recent years and even developed its own cloud service. What will this bring to your operations?

We are introducing the OBS Cloud in partnership with Alibaba, as a way of transferring many of the operations that broadcasters usually use hardware for onto the cloud. That will make their operations far more efficient, far more productive, less costly and will mean they need less people on the ground. It is a major innovation. I note that the crisis has become an impressive catalyst for digital transformation across the globe, which in turn has accelerated the adoption of cloud technology, eventually resulting in its full use in production.

The introduction of cloud technologies in the way media works is of huge importance. We are lucky to have a top IOC partner in Alibaba, who is one of the major players on that front. Broadcast data-heavy production workflows are probably the holy grail of cloud technology, and the Olympic Games, because of its sheer

size and complexity, is a unique opportunity to introduce it into our operations.

At Tokyo 2020, we will be producing approximately 9,500 hours of content. This is far more than the amount produced by a traditional international broadcaster in a year. We will be doing that in just over two weeks. Can you imagine what it takes to archive, to manage, to stream all this content? You need tons and tons of hardware for only a few weeks. This is where the scalability of cloud technology is seemingly the answer for us. In terms of broadcasting, it is still relatively early days in the full change to cloud technology, and Tokyo 2020 will mark a first step. The Beijing 2022 Winter Olympics may then become a facilitator for its wider use.

The OBS Cloud solution comes from a collaboration between OBS and Alibaba to ensure the smooth and reliable delivery of the content produced for the cloud across the world. It is a new thing, but we believe that this can really be a driver of change to make broadcast operations far more agile, flexible and efficient.

The adoption of remote production for these Games, accelerated by the global pandemic, is a major change compared to previous editions. Broadcasters have been forced to adapt and invest in virtualisation technologies to keep TV programming on-air, while dealing with the behind-the-scenes disruptions caused by the crisis. The media industry is unlikely ever to return to the 'old', pre-pandemic ways of producing content. These remote capabilities and cloud-based workflows will not go away and will undoubtedly grow further.

How conscious is OBS about the need to focus on sustainability in its operations?

The excellent cooperation between the Organising Committee, the IOC and OBS has helped us be bolder in terms of innovation and our efforts to deliver the broadcast of the Games in a more sustainable way. The space we will be using in Tokyo for the IBC will be 20 per cent smaller than the one we used at Rio 2016 and

the footprint for broadcast in Tokyo will be about 24 per cent less than in Rio. This is not because we will be doing less, in fact we will be doing more, especially on the digital front.

Our broadcast footprint will be about 24 per cent less than in Rio, as OBS continues its efforts of doing more with less

This level of preparedness and attention to

detail has allowed us to come up with new ways of remote working with the RHBs, a way of working that everyone feels comfortable in implementing. The need for this advancement was only made clearer in light of the coronavirus crisis.

We believe that OBS has been ahead of the curve in moving towards more virtualised workflows, therefore creating a more sustainable and more innovative Games.

What is the significance of Tokyo hosting a

second Olympic Games after their hosting in 1964?

It is important to remember that the Games of 1964 were a milestone not just for technology, but for the collective national sense of identity and achievement for the whole of Japan after the tragedies of World War II. It was a time when Japan came back into the international fold in a bold and very impressive way. It was the year the bullet train was launched, and it was a year of massive regeneration in the area around Tokyo and that is why in Japan's collective consciousness Tokyo 1964 has such a huge significance that goes way beyond hosting a sporting event. I think the Japanese people's expectation and that of people around the world is to have a Games that will also be a milestone, but this time for completely different reasons.

Tokyo 2020 organisers have included disaster affected areas, how important is it to include them?

Fukushima, the area that was stricken by the 2011 tsunami, will be one of the Olympic venues. It is one of the baseball venues so we will have a full OBS operation there during the Games.

Japan is a country that suffers from natural disasters and despite them, or maybe because of them, the Japanese have developed an extraordinary form of resilience. You can see that in their collective identity that means that, even though the Games are taking place in Tokyo, there were no second thoughts in the organisers' minds as whether to include the whole of Japan in the planning of the Games, especially the areas that have suffered these disasters.

You see that in the social responsibility of many of the major companies who have put in a lot of money to help these areas recover. You also see it in Japan's sporting community where sport has helped the areas that have been stricken by natural disasters to return to normal life, and I am sure that the Games will play a similar part.



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OBS team, led by Yiannis Exarchos, took the RHBs on a venue survey at the newly-built Olympic Stadium in July 2019



© 2018 Olympic Broadcasting Services / Owen Hammond
Sport climbing is a heady mix of strength, speed, precision and daring that makes for a visually-arresting spectacle that is sure to wow the crowds when it makes its debut at Tokyo 2020. In addition to unique camera angles and ultra slo-motion shots, OBS will be using 360-degree, volumetric replay technology to capture the incredible moves of the athletes, as well as virtual enhancement tools to explain the routes and help viewers better understand the sport.

How excited are you by the Aomi Urban Sports Park cluster that will bring four of the new sports together in one venue?

There is no doubt that the innovative urban cluster concept was among the many successes of a hugely successful Youth Olympic Games in Buenos Aires in 2018. It helps create a more unified, relaxed environment around new sports that have a vibrancy and vitality that is extremely relevant to the younger generation

The urban cluster in Aomi is the first direct translation of the model in an Olympic Games. The

sports that are based there – Sport climbing, Skateboarding, Basketball 3x3, BMX freestyle – are very urban in their character, and the Sports Park will be nothing short of spectacular.

OBS will do its utmost to capture the new sports in exciting ways and make viewers feel like they have the best seats in the house.

Bringing these sports' venues together allows spectators to move from one venue to another in a convivial environment. They can spend the entire day there and discover these sports. It is a fantastic concept. It worked very well in Buenos Aires and I think it is going to be one of the best innovations at Tokyo 2020.

How will OBS's work be affected by the changes to the selling of rights agreements?

We live in times with huge changes to media, especially with the growth of digital media. To some extent, the Olympic Games will be affected, and the Olympic Games needs to take advantage of this opportunity. We already have a healthy mixture of huge traditional broadcasters who have covered the Games for many years and are planning their own futures, and then we have new digital players that are increasingly becoming involved and buying rights for the Games.

This presents an opportunity to produce content for a more diverse portfolio of stakeholders and is the reason why the sheer amount of content has risen exponentially in recent Games. It has been driven primarily by the need to produce additional content for digital

and social media platforms and that growth will continue in Tokyo. That will create extra pressure for broadcast operations, but our technology does provide the chance to do things in a more efficient way.

Many traditional broadcasters are concerned with this change of direction in the world of media, but I'm not. It provides new opportunities for the Olympic Games to be experienced in new ways, especially by a younger audience, and we are trying to do whatever is possible to exploit this opportunity.

Of course, traditional television will remain for several years and it will remain an area where most people experience the Games. They expect nothing but the best, and we must ensure OBS produces the best both in our broadcast and digital production.



© 2021 Olympic Broadcasting Services
BMX freestyle will make its Olympic debut at the Tokyo 2020 Games in 2021, where it will bring a fresh, youthful feel to the Olympic programme.

CHAPTER 2

TECH IS CHANGING THE FACE OF OLYMPIC BROADCASTING

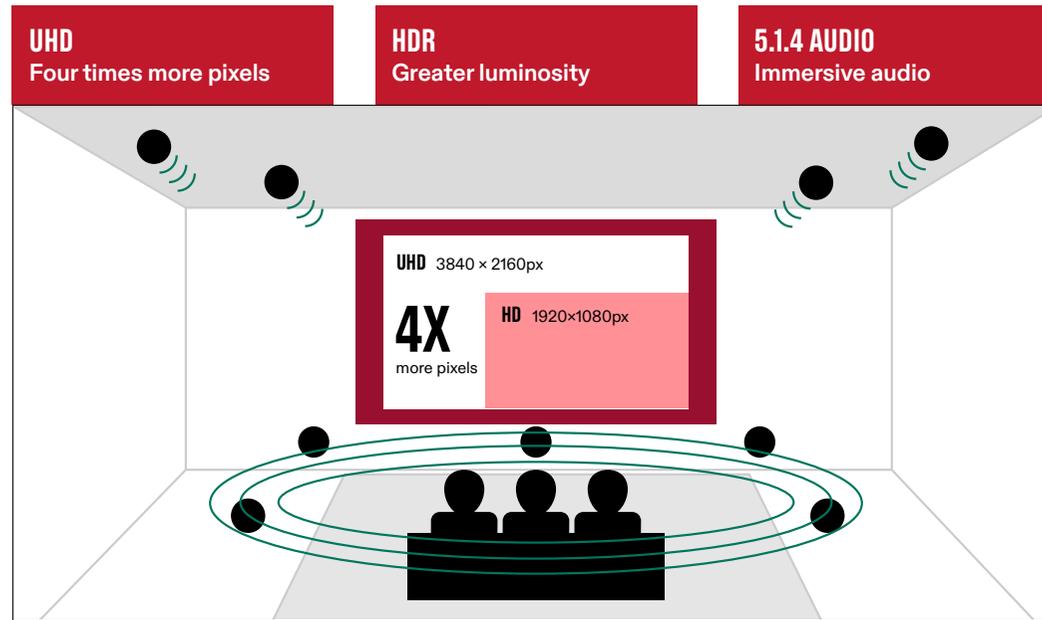
OBS has strived to always be at the forefront of technological innovation. As often as possible, OBS endeavours to drive these innovations and changes, ensuring the best possible coverage and service is provided to the broadcasters. OBS does the utmost to facilitate their operations and help them improve their audiences' viewing experience.

From the new Ultra High Definition High Dynamic Range production standard to broadcast-specific cloud technologies, to 5G wireless communications and Artificial Intelligence driven solutions, Tokyo 2020 will be setting the direction for the future of Olympic broadcasting.

DELIVERING THE FIRST UHD HDR OLYMPIC EXPERIENCE

After closely monitoring technological advances since 2015 and performing tests at Rio 2016 and PyeongChang 2018, OBS will be adopting a new production standard that captures content containing four times as many pixels as current High Definition (HD).

For worldwide audiences watching the Olympic Games Tokyo 2020, this will translate 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 in Tokyo and give them that feeling of actually being there.



Ultra High Definition resolution brings four times more detail than Full HD, 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

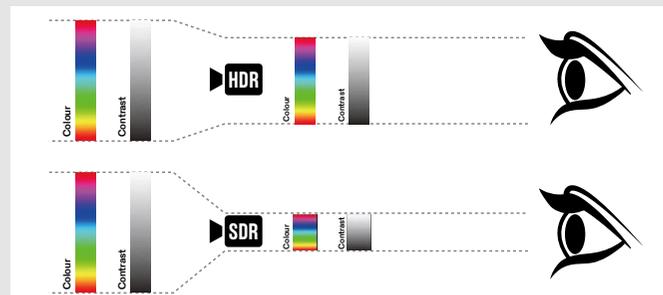
- More vibrant, vivid and realistic colours
- Greater detail and textures in high-contrasting images

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 will create a more immersive experience including more realistic pictures and a new sound approach – an entirely new level of production that will help deliver an enhanced Olympic viewing experience.

OBS will be broadcasting all outputs in UHD, combined with HDR and immersive audio from the 42 Olympic competition venues (only the production for the seven outside Tennis courts will remain in HD). Setting up a broadcast environment of this scale and complexity is a significant undertaking. Delivering UHD HDR content requires customised production units and workflows. Overall, OBS will utilise a total of 31 Outside Broadcast (OB) vans and 22 fly-away systems that have been specifically designed and fitted-out to meet the new production and distribution requirements.

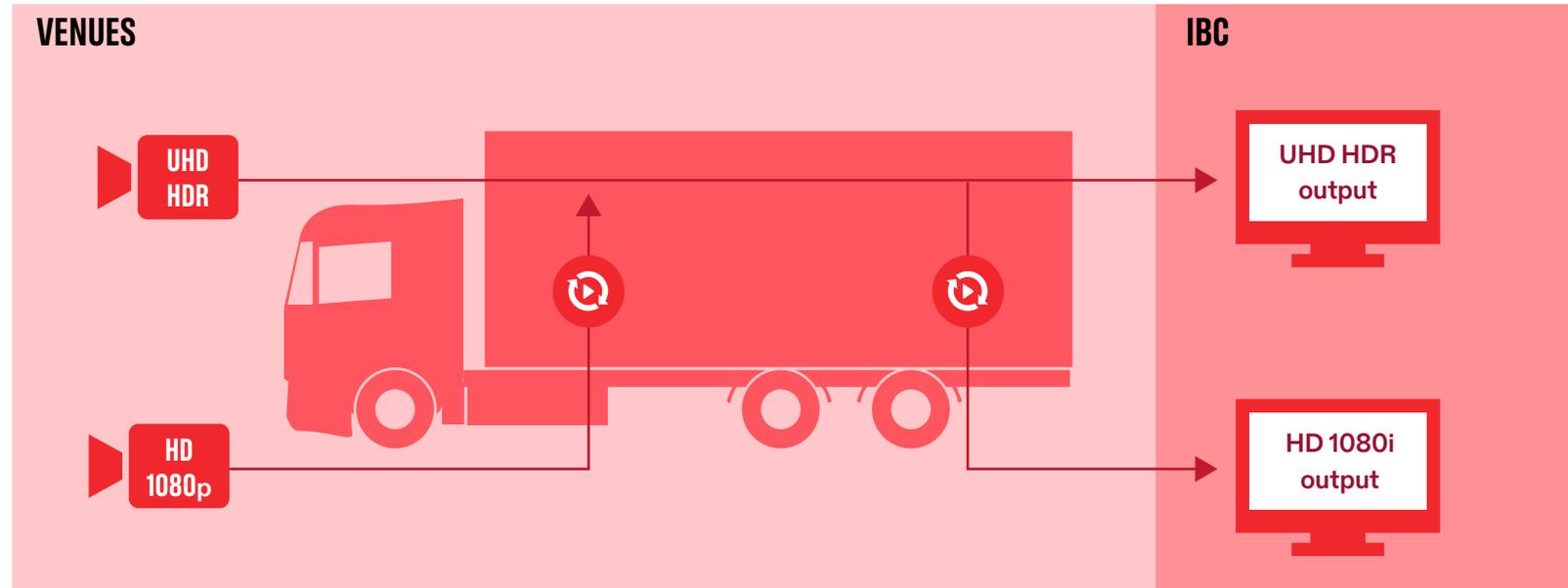
OBS will capture the sounds of the Tokyo 2020 Olympics through an immersive 5.1.4 audio configuration that enables viewers to have a more realistic audio experience, with sound appearing to come from every direction – even from above. OBS will expand upon 5.1 surround sound by adding an overhead, and thus third 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 use 3,600 microphones (28 different models). Three immersive audio quality control rooms will support the venue production and guarantee quality consistency across all sports.

INSIDE THE END-TO-END UHD HDR PRODUCTION WORKFLOW

“Our minds have been focused on developing and delivering a single HDR/SDR workflow, together with adding IP capability to our OB fleet, always making sure that we don’t sacrifice any quality in the delivery of the SDR signal. That’s quite a challenging and complex task for an event of the scale of the Olympic Games.”



Isidoro Moreno
Head of
Engineering



Almost all of the content captured 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 will need to be up-converted to UHD HDR in order to be seamlessly integrated into the main production.

OBS will deliver the UHD HDR feeds to the RHBs participating in the project, while simultaneously ensuring the content delivery also in HD 1080i SDR to all broadcasters. OBS has created a single HDR/SDR production workflow model that will allow the trucks to generate an HD 1080i SDR output via high-quality conversion from the primary UHD HDR signal.

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



© 2018 Olympic Broadcasting Services / Owen Hammond
Inside OBS's production unit during the Closing Ceremony of the Olympic Winter Games PyeongChang 2018

in-house to maximise the quality between all cross-conversions (from/to UHD-HD and HDR-SDR).

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 HD, based on the host city's HD standards. For Tokyo, the SMPTE 292 standard is used for the production of the 1080i/59.94 HD-SDI signal. OBS will follow the 59.94 Hz specification. UHD takers will receive the international signal in UHD HDR, with 5.1.4 audio configuration. The UHD production will adhere to the SMPTE 2036-1 standard and follow the 59.94 Hz specification. The HDR standard will be Hybrid-Log Gamma (HLG).

ON THE ROAD TO DIGITAL TRANSFORMATION AND REMOTE PRODUCTION

“The current media landscape is transforming the way content is being produced and delivered. International connectivity in Tokyo will be 10 times more than in Rio – this is a clear indication of the fact that broadcasters are adopting more and more digitalised workflows. The COVID-19 crisis has even further underscored the need for more flexible, digital solutions, and OBS is committed to going above and beyond to find new ways to facilitate RHB remote operations and take full advantage of cloud computing power.”



Raquel Rozados
Director of
Broadcaster
Services

For Tokyo 2020, OBS is undergoing an intense digital transformation, the result of which leads to offering enhanced services to the broadcasters in a completely new way.

In collaboration with Worldwide TOP Partner Alibaba Group, OBS has created a suite of cloud services, specifically designed for data-heavy broadcast workflows. This can allow broadcasters to carry out a virtualisation of a great part of their broadcast systems and network platforms in their own private cloud installation, integrated with Alibaba Cloud technology.

Learn more about OBS Cloud:
<https://olympics.alibabacloud.com/olympic-broadcasting-services>

With the increasing demand for more content in more formats, cloud-enabled services are becoming a key partner for broadcast organisations as they can better address media management workflows from processing to editing to distribution operations. If most broadcast organisations were still in the early stages of deployment and integration of cloud-based

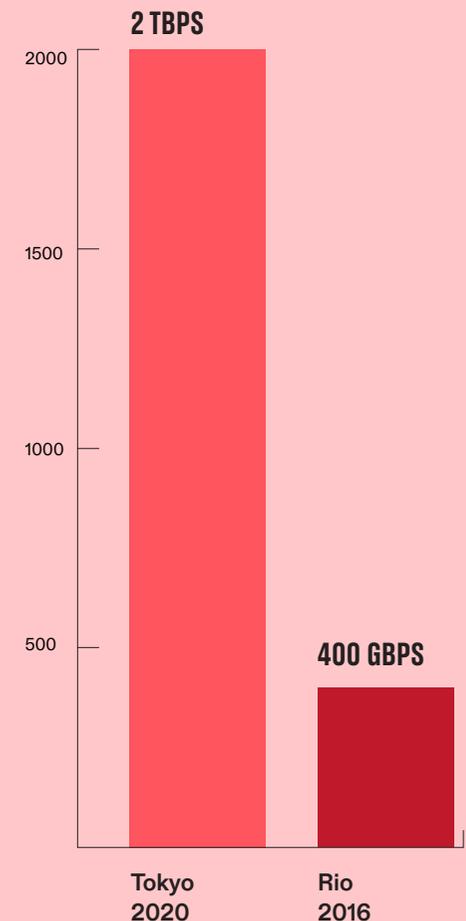
systems beginning of 2020, the COVID-19 pandemic has clearly accelerated the adoption of such solutions. Most organisations have been forced to carry out production and distribution workflows from home and, during the crisis, rely on cloud services to support their newly remote production. In that sense, workflows have dramatically changed over the course of the last months.

With the launch of 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 Tokyo 2020, several broadcasters will establish remote production capabilities and run all or part of their production outside of Japan and receive the feeds in real-time at their centralised production house back home.

Tokyo 2020 will be the most global Olympic Games, with international connectivity to exceed 2.7 Tbps

INTERNATIONAL TRANSMISSION CAPACITY BOOKED BY RHBs



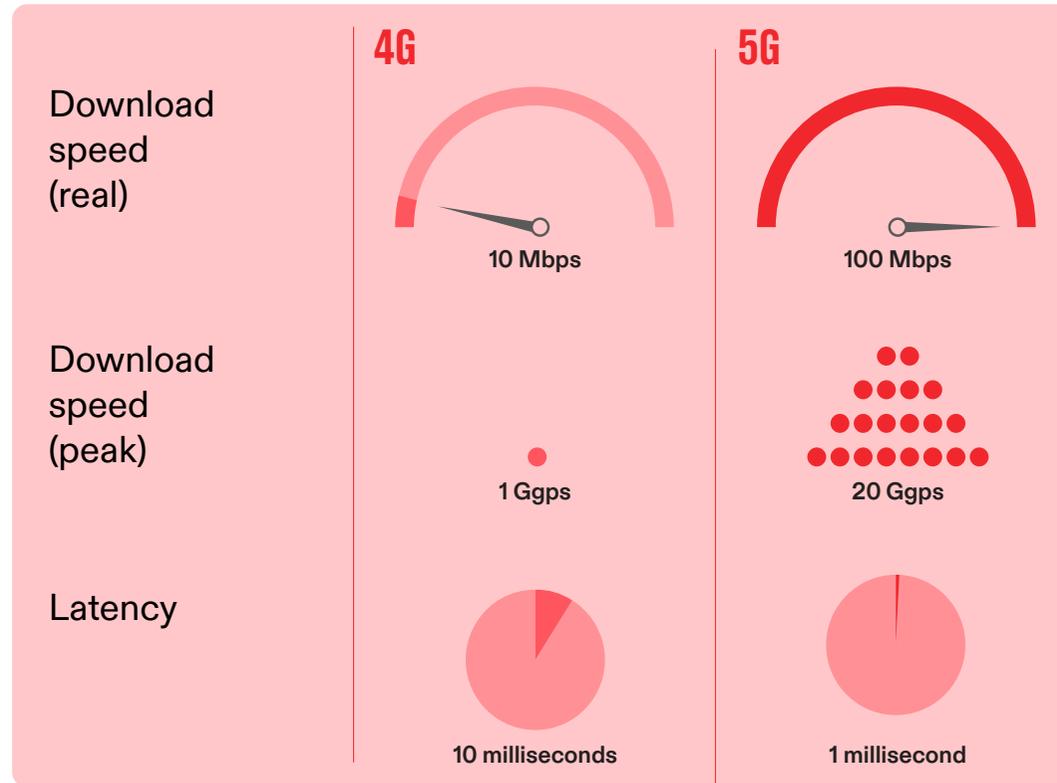
5G STANDS TO TRANSFORM LIVE SPORTS PRODUCTION

“The capability of 5G to deliver high-speed, low latency communications will enable high-quality, real-time video with less wires around the field of play. The first trials showed the potential for remote production teams to be located almost anywhere. 5G’s nearly real-time wireless connectivity also means that cameras can be untethered, allowing for more creative camera positions and angles, and reducing the set-up time and size of on-site operations.”



Mark Wallace
Chief Content Officer

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, payout, encoder, etc.) and the time when this frame is played on the display of an end-user

Current 4G/LTE technology is simply unable to support the transmission of UHD broadcast-quality video. 5G, on the other hand, is designed to handle these demanding requirements.

5G will offer a wireless contribution solution with enough bandwidth to carry UHD signals, enabling IP video from broadcast cameras to be transported with ultra-low latency in a reliable way. For broadcasters, 5G connectivity will play a pivotal role by providing the large amount of bandwidth needed for contribution of high-resolution video sources with the ultra-low latency required. 5G will also offer alternatives to traditional wireless equipment and require less frequency coordination.

OBS conducted its first field tests of network performance and quality from the end-user perspective on a 5G network at PyeongChang 2018 and will carry out real-condition trials of 5G technology again in Tokyo. At the Opening and Closing Ceremonies, OBS will broadcast content from ENG cameras using a 5G network and send it back to the IBC where the speed will be measured and the overall network performance monitored.

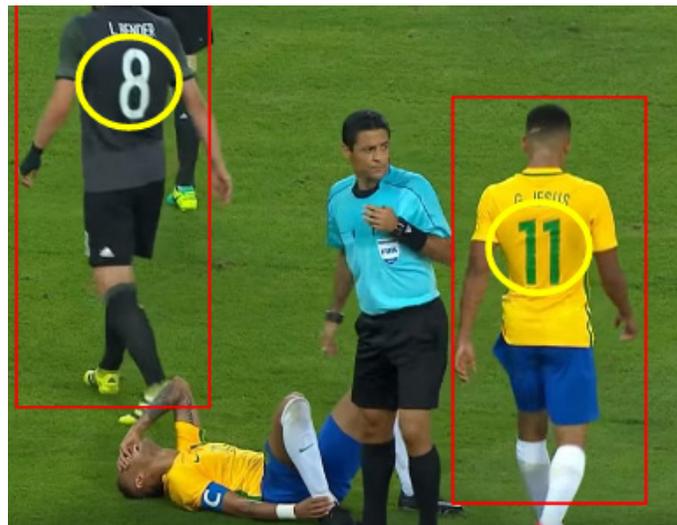
OBS is set to adopt 5G’s wireless technology further for the broadcast of the Olympic Winter Games Beijing 2022 where all the competition venues are expected to have 5G network coverage.

AI: THE POWER TO AUTOMATE WORKFLOWS AND STREAMLINE SEARCHES

“We are committed to implementing more efficient processes of creating, producing, delivering and managing recorded video material. Using AI capabilities can help us not only streamline labour- and time-intensive processes, resulting in faster turnaround, but also deliver more personalised user experiences. We could customise the automatic content offering based on user preferences, whether by National Olympic Committee, athlete or sport. It means that, instead of RHBs searching for content, content will be automatically pushed to them. AI-driven technology is making the process of content discovery faster and more accurate, adding tremendous value across the content lifecycle.”



Guillermo Jiménez
Director of
Broadcast Engineering



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In Tokyo, OBS will trial AI technology for generating video logging effortlessly.

Artificial Intelligence (AI) can be defined as the use of computer capabilities to automate manual tasks to drive efficiency. This new technology is developing at an incredible pace and particularly in the field of broadcasting. At a time when there is an increasing appetite for more content and faster delivery through 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.

For Tokyo 2020, OBS intends to leverage AI-led solutions in some of its broadcast workflows, as a way of testing how it will evolve to be included in future operations. OBS will run an Automatic Media Description (AMD) pilot project based on athlete recognition and this pilot will be conducted on a select number of specifically chosen sports. OBS will combine existing metadata such as the Broadcast Data Feed (BDF) and video logs with image recognition based on athlete bib.

Additionally, OBS will use speech-to-text technology to complement and improve the tagging of media assets. Such applications will allow a faster and more efficient turnaround of workflows such as image selection, automatic searching and clipping.

By Beijing 2022, OBS is aiming to expand this process to as many sports as possible, make the most of AI-driven tools in its internal workflows and open the service to RHBs. Ultimately, OBS is trying to develop applications that can use this enriched data to create automatic summaries and create pattern detections.

Data generated through AI-based solutions can be used post-Games to analyse production to help improve the predicted content for each user. Combined with the IOC's Sports Data Project, AI can provide insights into the expected performance of athletes and comparisons with previous Games and other major events.

INTERVIEW WITH SOTIRIS SALAMOURIS

“Making it happen”

OBS Chief Technology Officer Sotiris Salamouris talks about the complex technical backbone of the Olympic broadcast operation and the role of technology.

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 technology company to support the requirements of the Rights Holding Broadcasters (RHBs) and provide a large number of technical services. Because we relocate to the host city(ies) for a much longer period than the broadcasters do, it means we must build and put in place technical services that RHBs are unable to do by themselves.

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 to meet their production objectives. We build and deliver a lot of services

for the RHBs, from their technical facilities inside the International Broadcast Centre (IBC) to TV studios, to specific technical areas in the sports venues. We even provide cabling and technical storage services to them. Additionally, we provide broadcast telecommunication circuits to connect venues to the IBC, international connectivity to connect the IBC to the RHBs' home destinations, digital distribution services and even cloud capacity for specialised media workflows.

How do you view the effects of the coronavirus crisis on technology development? Will it stall progress or provide an unexpected opportunity?

Clearly, this will be an opportunity. A major hurdle in the fast adoption of digital workflows in the media industry has not been the lack of technology or digital tools per se; on the contrary, we have long realised within OBS that the existing technology is already quite advanced and reliable and could already be used for more efficient planning and in actual production workflows. Probably the biggest



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.

hurdle has been the level of inertia of others to adopt something that is so different from what has been used in the past, and such inertia is quite an important factor that should never be underestimated. We realise again and again the adoption of new technologies takes a long time, despite them being already available and mature enough. In the end, it comes down to demonstrating the value of the technological advances to people and emphasising that it should make their day-to-day tasks easier. The early tangible benefits of technology is there to help gain buy-in and gather momentum for further adoption and advances. Then, there needs to be widespread training to familiarise large numbers of future users with the new capabilities and possibilities. In this sense, the coronavirus pandemic has been a supremely disruptive experience; it has made the advantages of digitisation even more obvious and provided a 'super accelerated' training to millions of media professionals on digital workflows and tools that otherwise would have taken years to be completed. Following the pandemic, we will enter a very different era in the methodologies and workflows that will be followed in content production, management and distribution – and OBS is more than ready to accept the challenge.

How significant is the change to Ultra High Definition (UHD) and how is it changing how the industry works?

It is very big change, a substantial change to what we have done before. We have transitioned between technologies at previous Games, notably at Beijing 2008 when we went from standard definition coverage to High Definition (HD). The change now is similar in terms of breadth, but the challenge is greater because the step between HD and UHD is much more demanding than between standard and HD. There is also the additional element of the transition from SDR (Standard Dynamic Range) to HDR (High Dynamic Range) and WCG (Wide Colour Gamut) which comes with its own unique difficulties.



© 2019 Olympic Broadcasting Services
Sotiris Salamouris during a dedicated UHD HDR seminar hosted by OBS in Madrid.

The Ultra High Definition technology has reached a maturity level such that we are all confident that it is ready for Tokyo 2020.

Technologically, it is a big step and made even more substantial because of the size of the broadcast operation at an Olympics. We need to support more than 40 venues – this means a comparable number of available production units. There are more than 50 outside broadcast vans and fly-pack systems that we need to assemble to cover the Games, and all of them need to transition to UHD and HDR/WCG.

It is a tremendous change and requires a lot of attention to how it is being engineered. Everyone in the industry knows that it has been coming, and while they may have expected it to take place over a number of years, the reality is that it has recently been speeding up, especially in the world of sports content. Most of the equipment that is reaching the broadcast market now is UHD ready and works on UHD workflows. The technology has reached a maturity level such that we are all confident that it is ready for the broadcast coverage of the Tokyo 2020 Games. However, this is not something that you can take lightly, especially in our own production environment, since there are so many moving parts that need to be brought together.

We have done our homework and we are confident that the transition will be successful and the Olympic UHD HDR content will be stunning and delivered as per the strict quality expectations our RHBs have. Of course, we understand that there is a lot of attention on us and on what we are doing in Tokyo. It has a major impact on the broadcast industry because if we weren't to introduce it for the Olympics, it would probably take even longer to be widely adopted. We offer a service to the RHBs to satisfy their needs and, by doing this, we believe that we are also helping the industry move forward and transition faster and easier.

Few industries have such requirements in terms of number and size of data flows, combined with ultra-low latency and zero tolerance for data loss. How is Internet Protocol (IP) technology supporting your operations?

IP has been making its way to broadcast operations for a long time now. Twenty years ago, we were using tapes and broadcast production and distribution were dominated by bespoke hardware-based systems. Migrating to IP means changing the workflow environment from being hardware-based to more and more rely on software. Non-live workflows, such as highlights editing, were the first to migrate IP with the

adoption of file-based broadcast systems. This transition dates back to the early 2000s and nowadays we don't even remember the days of tape-based editing or archiving.

So, what is happening now is actually the last part of the transition to IP, with highly-reliable IP-enabled solutions for live transmission. For Tokyo 2020, all our UHD overlay design, on top of our HD broadcast systems, is based on IP, with IP being used for all our UHD contribution and distribution. It was even more demanding as we implemented a full ST-2110 platform to carry, route and distribute UHD content, with its extremely high bandwidth requirements. But for us, it was a step that made sense. In our environment and with our own very extensive and complex requirements, when it comes to signal contribution, processing and then distribution, IP, and in particular ST-2110, was probably the only technology that could scale with all our needs. The reason behind this is not a surprise. For many years since its inception, the broadcast industry had to develop its own bespoke technology. Broadcast scientists and engineers have been developing all the technology, the standards and the tools necessary to make the television and media industry work. But then, when IP-based systems became mainstream in other major industries, especially in Information and Communication Technologies (ICT), we were able to benefit from these developments also in broadcast and media production in general, enabling us to progress through the phases of IP adoption much faster, easier and in a relatively cost-effective manner. We no longer needed to develop all the technology by ourselves. That's a considerable advantage. Using IP offers us more flexibility and a far higher scalability than the legacy technological stack.

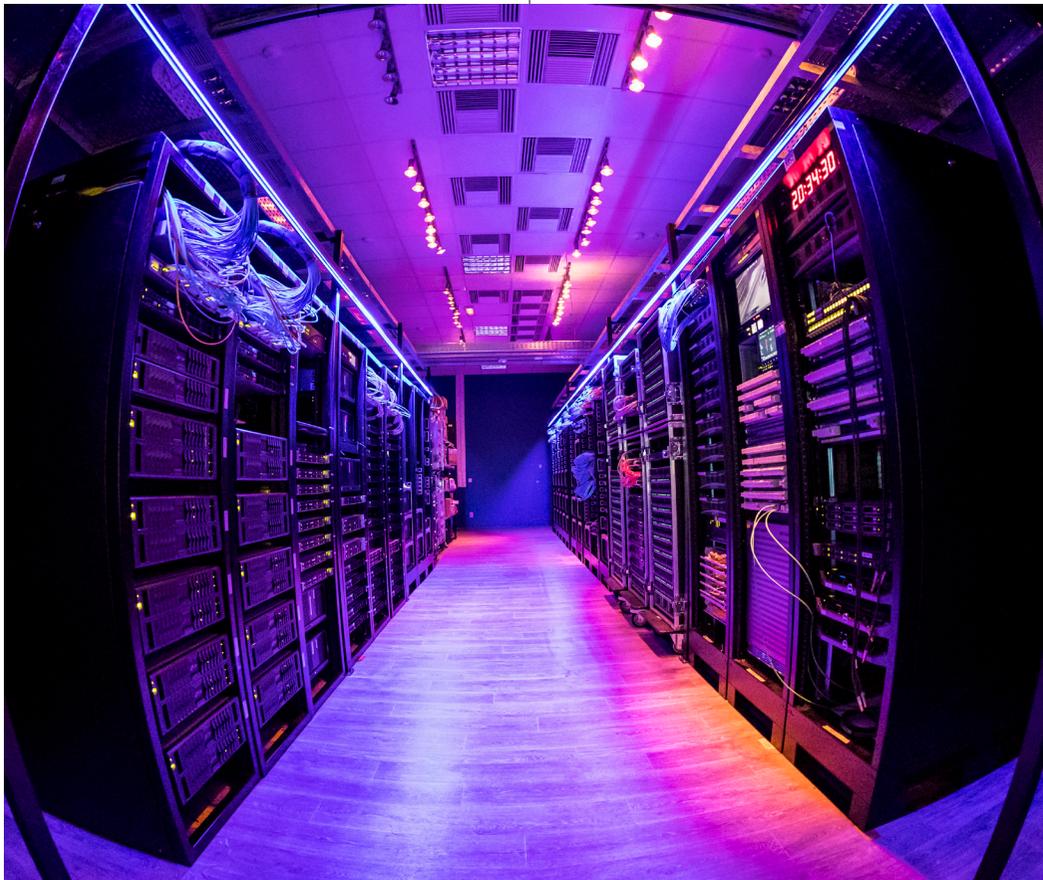
OBS has been developing cloud technologies. How will it benefit OBS and the RHBs?

There was a time, not many years ago, when there were many doubts within the broadcast industry over the value of using the cloud, but

that doubt is finally gone now. We are talking about a logical step that sits alongside the ongoing progress in digital transformation and dematerialisation of processes that we have been experiencing in broadcasting.

However, although cloud technology has gradually been considered more and more adequate for the implementation of digital distribution workflows, there has still been certain reluctance amongst broadcast professionals to be used for intensive content production workflows, especially in the context of live sports events. While this hesitation is understandable up to a point, due to the known demands of our workflows for high bandwidths, large storage and low latency, we can see again that there is also an inertia factor. Cloud technology is already adequate for several of our demanding post-production workflows. Not only that, cloud may be the best option available to address some of the unique challenges that we are facing when trying to implement complex workflows, especially in an unforgiving environment such as the broadcast of large sports events where the most scarce resource is actually time.

We continue growing from Games to Games, generating more content, covering more hours and distributing an ever increasing volume of additional footage. As a result, the size and complexity of the broadcast systems that we have to install and operate locally in our facilities in the host city(ies), both in the IBC and in the venues, has continued increasing. The time available, however, that we have to build our technology systems in the host city(ies) is on average eight to 10 weeks, and that isn't going to increase. So, though we have an expectation to continually increase our production output, the timespan available to build all the necessary infrastructure will always be the same, or may even have to be further reduced in the future. Of course, we can see that there is a hard limit approaching if this trend continues as such, which is expected to happen. We are building in these 10 weeks the equivalent of multiple





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With technology developing so rapidly, OBS can count on a remarkable partner in Alibaba Group. Sotiris Salamouris (on the right) welcomed the representatives of Alibaba to the IBC at PyeongChang 2018 to take a look at how technology is transforming the broadcast of the Olympic Games.

permanent production and broadcasting facilities that in other circumstances would have taken months or even years to be completed. We have been achieving that by constantly improving our planning processes and aggregating important experience and knowhow in doing so, Games after Games. However, we all recognise that it is impossible to maintain such an increase while the time available for installations and commissioning will have to remain limited. This is precisely where cloud technology helps. It provides us with the opportunity to implement our systems much earlier and without any dependency with the local infrastructure in the actual Olympic venues, including the IBC. You can build systems on the

cloud, test them properly, switch them around and do all your preparation well in advance, all before setting foot in the host city(ies). Then you can fire it up, just before the Games, with all the systems already configured, tested and ready for operation. So now that you can disassociate yourself from being local in the venue or the IBC and being able to operate off-site in the cloud, it means that you can continue increasing the size, the complexity of your systems, and consequently, the volume of your output, without further increasing your infrastructure in the host city(ies). This is great news regarding our strong commitment, as part of the Olympic movement, to contain the total footprint of the Games.

IP, cloud, 5G and AI are all breaking the conventional frame of broadcast production and transforming the fundamentals of content delivery and viewers' experience. At OBS, we believe there is tremendous potential in the convergence of these technologies.

To what extent is OBS going to experiment with 5G technology in Tokyo?

We see 5G as a much welcome technological change. It will create a lot of advancements in broadcast, especially for the live coverage of the Olympic Games. It has some features that make it different from what we were doing with previous generations of the technology of mobile networks, and ultimately it is much more powerful and relevant to our needs.

We conducted our first 5G trial in PyeongChang where we used 5G to produce part of the multilateral coverage in Bobsleigh. Tiny fixed lens cameras were fitted to the front of the bobsleighs to offer a driver's eye view of the descent down the twisting Alpensia track where the pictures were transmitted over 5G and then cut into the live HD production.

We have been working with our partner Intel to further explore different options of how we can use 5G in our future operations. There are many applications available. The most obvious is using 5G as a further enhancement to the existing solutions that rely on bonding technology for live wireless transmissions from locations which are covered by a mobile network, but are difficult or expensive to connect by other means. Broadcasters have been using bonding and 4G to provide live streams back to their studio and, with 5G, it will be higher in quality because it

offers more bandwidth and even less latency.

These are the first obvious applications where 5G can and will be used in broadcast operations, and this is also one of the applications that we have prepared ourselves, together with our partner Intel, to actually implement during the Tokyo 2020 Games. Part of our coverage within specific areas inside the Olympic Stadium will be done in that way.

5G has first of all a great potential to help us enhance the options for wireless and mobile video coverage without a further increase in our needs for temporary assigned frequencies – something that has always been one of the major challenges in an event the size of the Olympic Games. However, video coverage is not the only application that can be interesting for the broadcasters. 5G can also be used in conjunction with Internet of Things (IoT) devices that are connected with sensors able to receive signals from athletes during the competition.

5G's low latency, fast speeds and higher bandwidth capacity is pushing to new heights, not only content distribution to mobile devices, but also has the potential to transform contribution links in the near future.

Broadcasters are very interested in the use of real-time performance data that can become available through 5G. Such data can help them significantly enhance their storytelling. Of course, data from sensors can also be received through other types of wireless technologies but, again, 5G is a much more efficient and powerful technology that can offer ultra-high data collection speeds with very low latency. Further, it would remove the need for setting up overlay or temporary systems which always come with a certain impact on infrastructure

requirements that tend to increase the overall size of the Games.

How far has OBS gone with developing Artificial Intelligence (AI) technology?

AI is certainly exciting. It has opened up promising opportunities, especially when it comes to video and audio recognition. The use of AI allows you to analyse, classify and, eventually, start understanding what is "inside" your pictures. Tagging, or logging as it is usually known in the broadcast industry, is a first important step for a wide number of important processes in video and audio.

AI comes with the promise to automate and enrich the tagging process, which, up to now, could only be performed by people. Video and audio recognition (which is the equivalent of effective tagging) can be the starting point of many interesting applications that can be extremely useful in the world of sports content production: from live automated video switching (and thus automated live production), which is already happening in some sports that are simpler to cover, to fully automated highlights, which again is already available to some extent and for some of the most popular sports.

For many years at OBS, we have tagged our footage, relying on our Broadcast Training Programme (BTP) which trains students from the host city(ies) in online, real-time tagging. We employ approximately 120 people just to tag our video sources, however even with that many human resources, it isn't enough. They can only do so much and it is not possible to tag everything. AI takes tagging to the next level.

Also, we only do logging and tagging of our live coverage, simply because we don't have the capacity to do it for the other types of content we produce during the Games, for example, the content from our Electronic News Gathering (ENG) coverage. During the Tokyo 2020 Games, we expect to produce more than 9,500 hours of content, out of which approximately

3,800-4,000 hours come from our live coverage. For all the non-live content, our tagging scope is, out of necessity, quite limited.

In Tokyo and subsequently Beijing, OBS will run Proof of Concepts (PoCs) of AI technology, where we will try, as a start, to identify which athletes are appearing where and when. Broadcasters want to use the footage that feature their national athletes, but searching specific content through hundreds of hours of footage is a laborious task if the content is not densely logged, which is exactly the case with our ENG material.

If we were to tag all our content, it would require an incredible effort and a large number of human operators. By using trained AI systems, this could be accomplished in a fraction of the time (and thus costs), while increasing both the speed of searches and the accuracy of the search response.



© 2016 Olympic Broadcasting Services / Warren Little

AI technology has huge potential to change the entire archive workflow as it could streamline laborious tasks such as metadata tagging and clip generation.

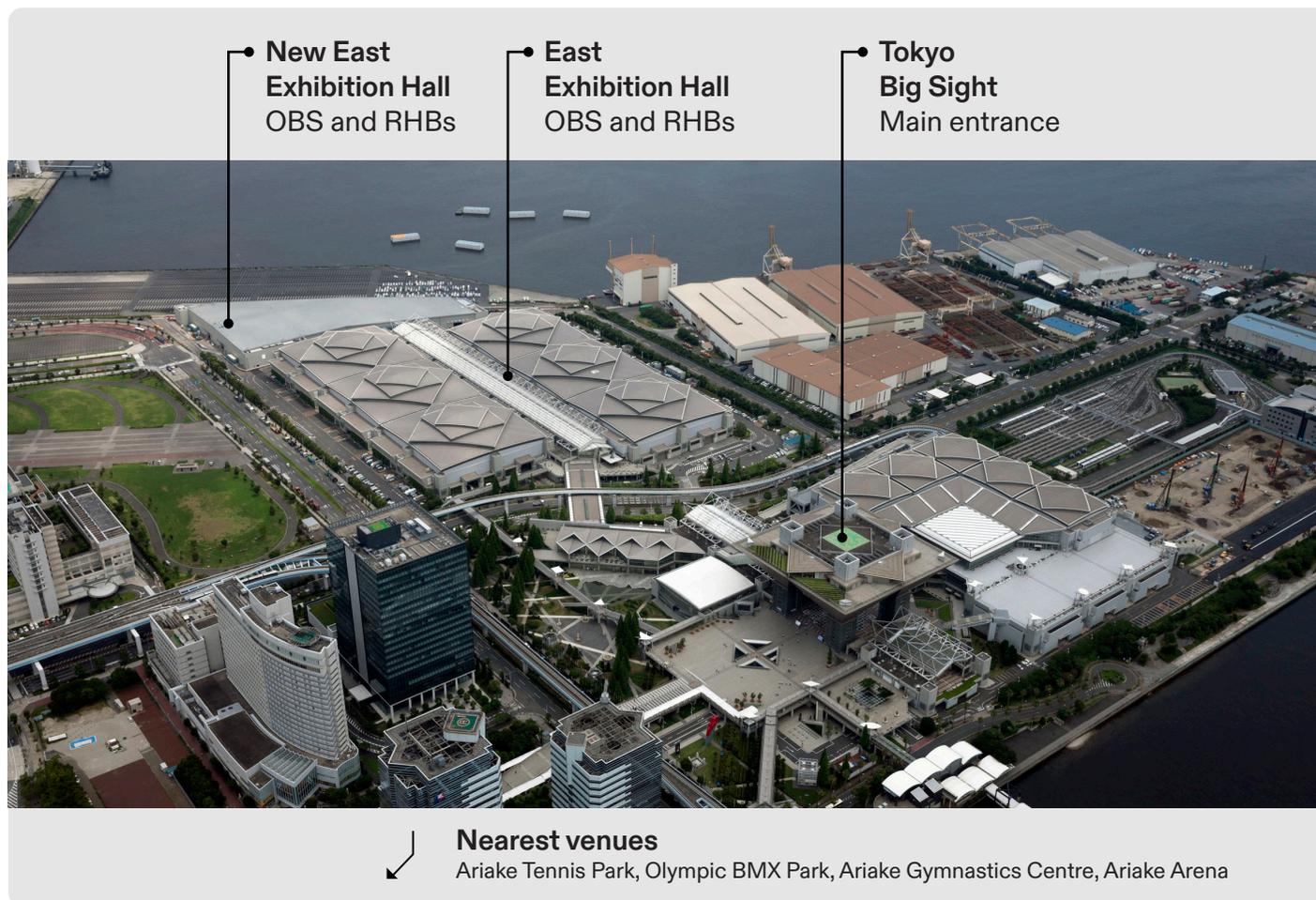
CHAPTER 3

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 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



For the coverage of the Olympic Games Tokyo 2020, OBS and broadcasters will operate from Tokyo Big Sight, Japan's largest convention centre. Located in the Odaiba waterfront area, they will find themselves at the heart of the Tokyo Bay Zone, one of the two Games clusters.



23 June
08 August



24
hours



40,000sqm
of functional space, housing a variety of technical and administrative facilities for both OBS and RHBs



118
incoming feeds

64
concurrent feeds at CDU at busiest point on Day 2 of the Games

THE HEART OF THE BROADCAST OPERATION

“Five years in the making, working hand-in-hand with the broadcasters to assist them in designing their modular space and planning their operations, RHB areas are just about to materialise. OBS is ready to provide around the clock support to more than 80 broadcast organisations at the IBC, as well as facilitate remote operations worldwide.”



Tomoyo Sato
Broadcaster Services
Senior Manager



© 2021 Olympic Broadcasting Services
Japan Consortium (JC) was the first RHB to take over their space at the IBC in April 2021.

Overall, 21 RHBs will have a base of operations at the IBC for the Tokyo 2020 Games, which represent more than 80 organisations when counting their sublicensees.

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.

OBS technical facilities mainly operate from an area called OBS Tech, which is made up of the Contribution, Distribution and Unilateral (CDU) master control room, the Transmission centre, the Commentary Switching Centre (CSC) and Archive Services.

In an effort to optimise the broadcast operation and make it more sustainable for Tokyo 2020, OBS has introduced new Centralised Technical Areas (CTAs) located in key areas of the IBC. Adjacent to the RHB areas, allowing for direct cabling, these mini data centres will host and centralise all technical equipment from each RHB in a dedicated, secure area with specific cooling capacity.

TAILOR-MADE FOR EVERY PURPOSE

“Bringing to life the world's largest sports broadcast centre is a thrilling experience. For each new IBC project, we create a concept design based on broadcast specific requirements, site surveys to understand construction constraints and any learning from past Games, with keeping in mind through all aspects of the design possible efficiencies in how we, and our facilities, operate.”



Eugenia Sofia Fuenmayor
Director of Construction



© 2020
Olympic
Broadcasting
Services

OBS has turned Tokyo Big Sight into state-of-the-art broadcast facilities, using pre-fabricated, modular panels that can be recycled and reused over the course of several Games cycles.

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 seven months to one year, 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 Olympic Games.

Like each edition of the Games, every IBC project is unique. For Tokyo 2020, OBS embraced the opportunity to use an existing facility, underlining an integral part of the shared commitment between OBS and the OCOG to reduce the environmental impact of new construction for the Games.

The IBC 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.

Due to the mind-blowing amount of resources that go into the fit-out of the IBC to convert the empty space into a suitable broadcast environment, OBS tries to re-use materials whenever possible. Approximately 300 containers containing previously used pre-fabricated, modular panels for the building of the RHB studios and offices as well as cables and other equipment were shipped in October 2019 for the start of the fit-out process.

When it was decided to postpone the Games in March 2020, the overall IBC project was on track, with nearly all the technical infrastructure installed and equipment and furniture either delivered, or en route. The IBC fit-out had been completed with 30 per cent of equipment installation in place and remote access established for testing. OBS was forced to put its IBC operations on stand-by, which meant transferring part of the broadcast equipment to the OBS warehouse in Tokyo for storage. It was agreed with the OCOG that all the installations realised during the fit-out would remain in place until activity could continue the following year.

OBS resumed its operations at the IBC in March 2021, this time taking into consideration not only the aspects of each unique space, but also the necessary physical distancing and hygiene requirements that have been put in place in order to provide a safe working environment for all broadcast personnel.

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 there 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 extensive facilities including a laundry and dry cleaners, convenience store, official merchandising store, bank, massage room, medical centre, post office, several restaurants, coffee corners and a bar.

The most hidden room?



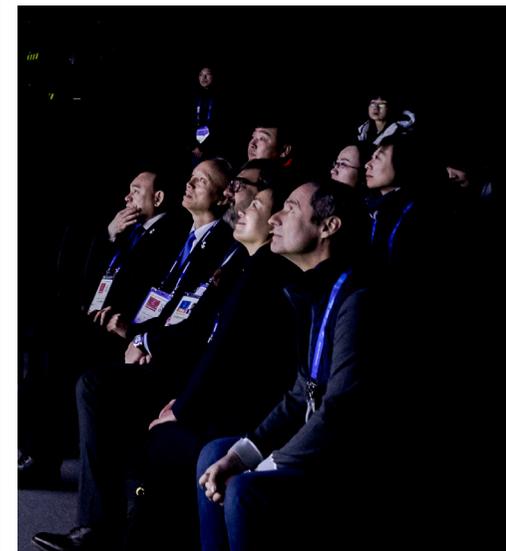
The Production Quality Control (PQC) room. Always in darkness and filled with serious-faced producers, audio and graphics supervisors, the PQC is where all of the content generated from the competition venues – video, audio, graphics – is monitored for compliance with Olympic production standards and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

The most impressive room?



There is one room at the IBC which usually leaves every visitor awestruck. It is the Contribution, Distribution and Unilateral (CDU) master control room, located in the OBS Tech area. Imagine a 23-metre-long wall covered by monitors from where you can view a 450 picture-in-picture mosaic of the live broadcast of the Games as action happens in the Olympic venues. Behind 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.

Did you know there is a movie theatre inside the IBC?



But it is not your typical theatre. It is a state-of-the-art theatre where you can watch selected Olympic events in 8K Super Hi-Vision (SHV) HDR, with a 22.2 multichannel sound system. It is the world's most sophisticated broadcasting system, part of a collaborative project between OBS and Japanese broadcaster NHK. With 8K SHV featuring 16 times the number of pixels compared to HD, and immersive three-dimensional 22.2 surround sound, it provides an ultra-realistic viewing experience, that creates the sensation that you are in the stadium, alongside the athletes. For Tokyo 2020, in addition to the Opening and Closing Ceremonies, OBS and NHK will offer 8K SHV live coverage of selected sessions of athletics, badminton, football, judo, swimming, table tennis and volleyball. Additional sports highlights will also be produced by ENG crews across other sports/disciplines, including artistic gymnastics, artistic swimming, basketball 3x3, skateboarding and sport climbing.

CHAPTER 4

HOW THE WORLD WATCHES THE OLYMPIC GAMES

The Olympics are an event like no other. With more than half the world's population watching as athletes strive for the ultimate sporting glory, it is of little surprise that the Olympic Games are highly anticipated and the most-watched sports event. The Olympics have the power of attracting audiences that transcend the hard-core sports fans.

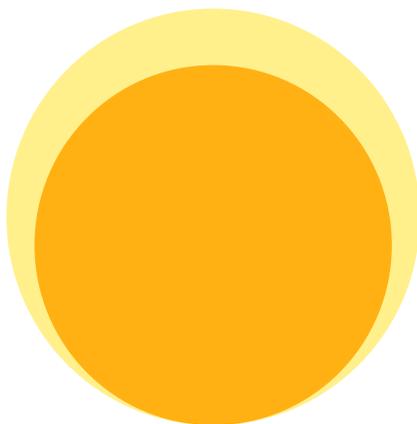
This summer, Olympic fever will once again sweep the world and audiences will be captivated by the stories of athletes' tireless pursuits to write their names into Olympic history. Thanks to the combined efforts of OBS and the Rights Holding Broadcasters, viewers will have unprecedented access to an enriched content experience. The Tokyo 2020 stories will be shared across a myriad of platforms, as never before for an Olympic Games.

INCREASING CONTENT, EXPANDING ENGAGEMENT

OBS will produce 30% more content compared to Rio 2016

9,500+

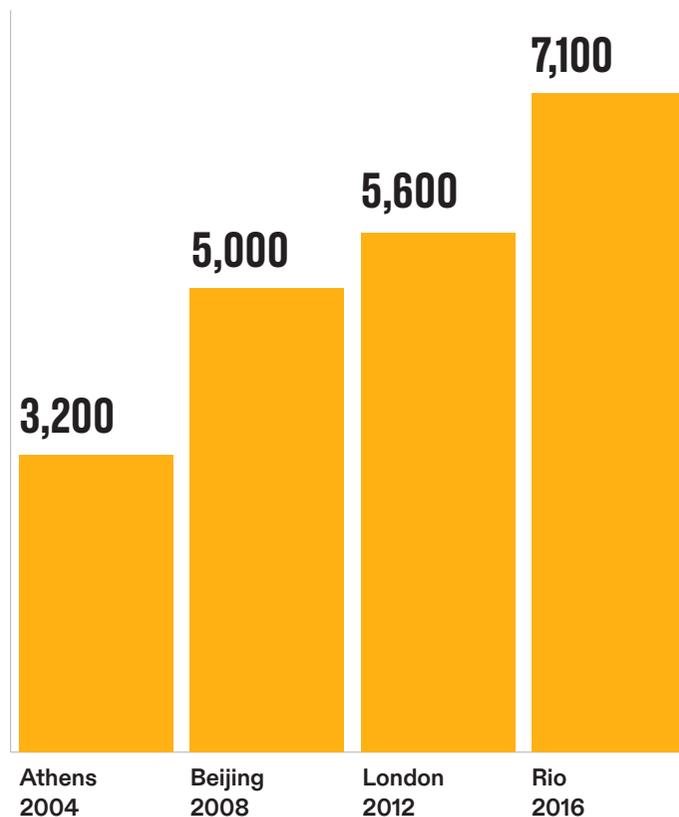
Estimated hours of content produced by OBS in Tokyo



● Tokyo 2020
● Rio 2016

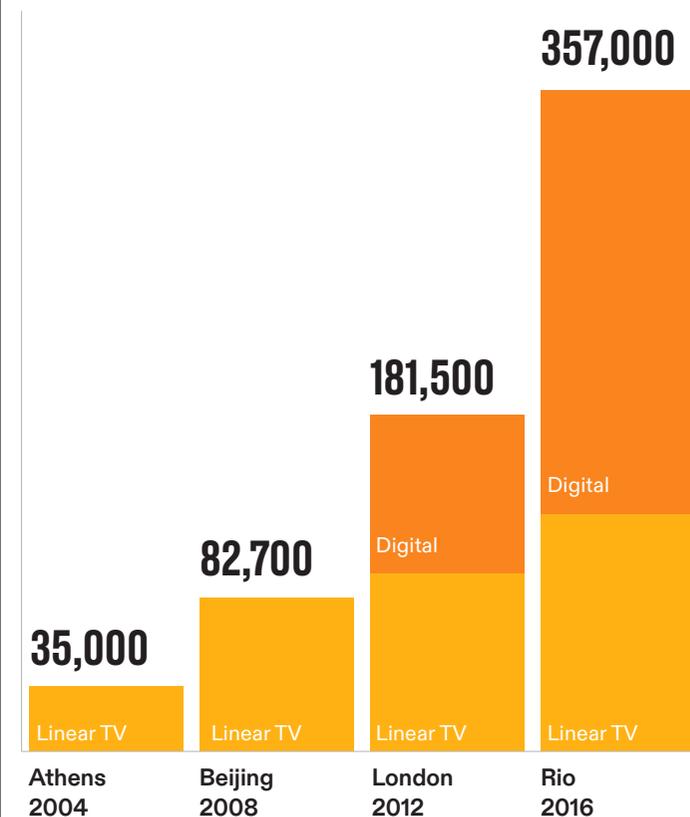
HOURS PRODUCED BY OBS

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)**

For Tokyo 2020, progress was interrupted due to the postponement of the Games. One year later, operations resumed.

-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



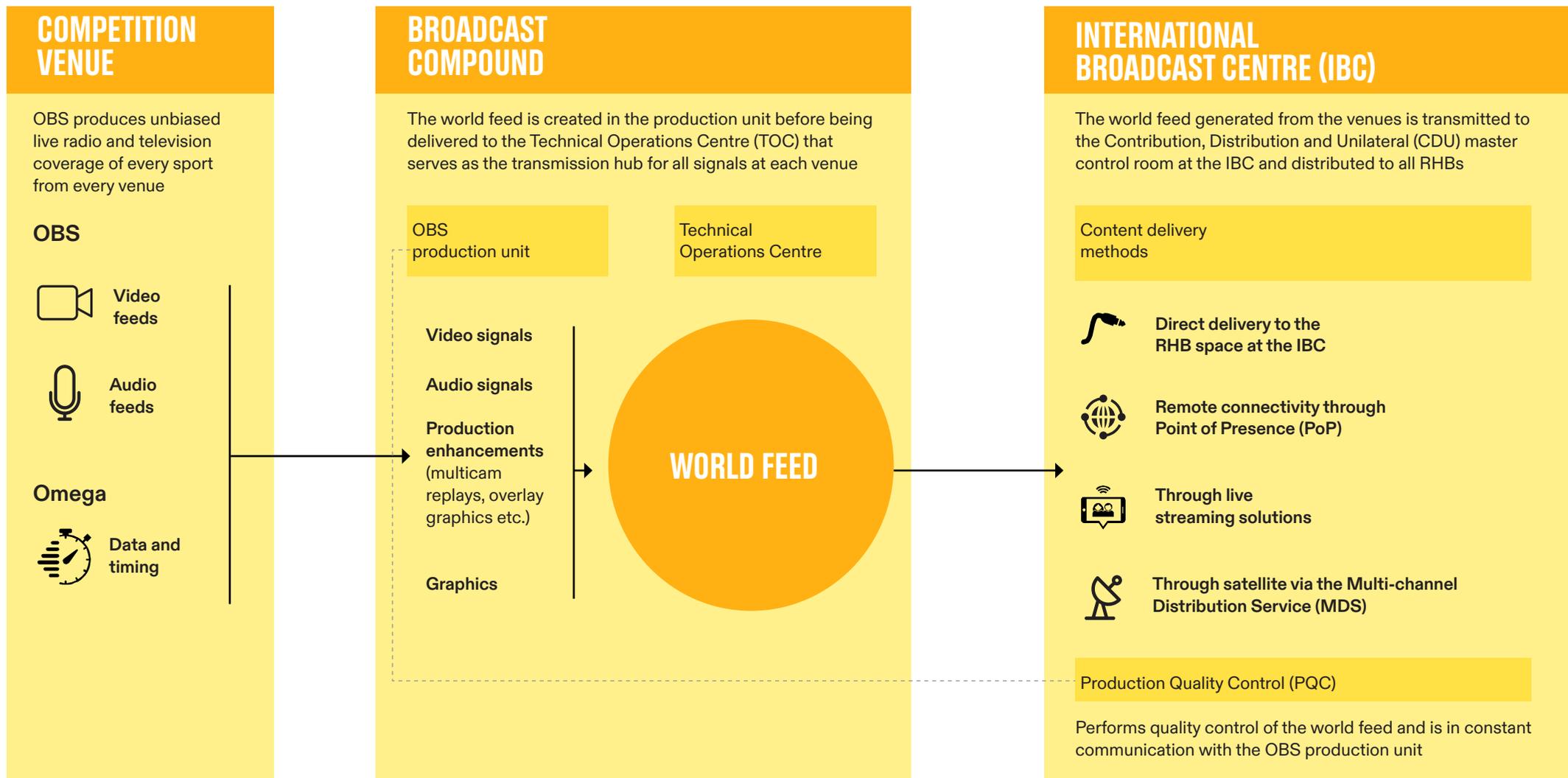
Planning phase



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 each competition venue

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



At the IBC

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



Outside the IBC, in the host city

- TV studio (at the OBS Towers or independent studio)
- Stand-up positions (OBS TV towers, Olympic Village, in Tokyo and around)



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.

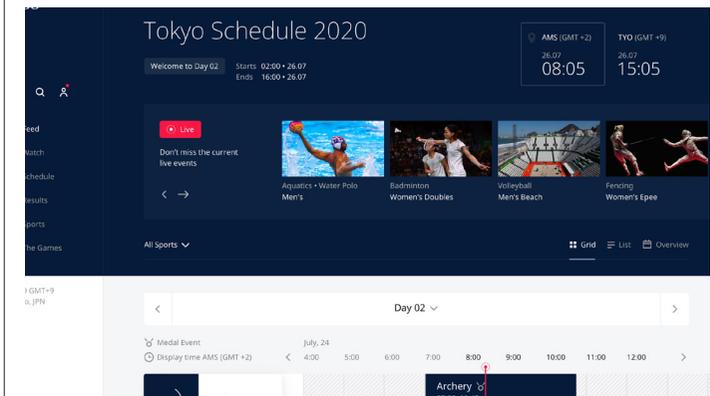
In the content arena, OBS has taken an à la carte approach toward developing a wide range of flexible content delivery solutions for broadcasters, in order to meet their particular needs and adapt to all sizes of production. These solutions are constantly evolving to take advantage of technological advances 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 15 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.



© 2016 Olympic Broadcasting Services / Cristina Ponce de León
The MDS is a flexible turn-key service that provides RHBs with fully produced, ready-to-air TV channels, as well as distribution channels. For Tokyo 2020, RHBs will have access to more than 3,500 hours of content, including approximately 2,400 hours of live sports and Ceremonies.

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.



© 2020 Olympic Broadcasting Services

For Tokyo 2020, 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

“OBS has social media managers who analyse the content, keep track of what is happening at the Games and try to identify any material that might be relevant for social media use. With Content+, OBS offers RHB digital teams an intuitive tool to easily review clips as soon as they are produced and publish them onto their social media platforms in the span of just a few minutes.”



Karen Mullins
Director of
Production
Management



© 2020 Olympic Broadcasting Services / Owen Hammond
OBS will capture behind-the-scenes content at each venue for RHBs to post on their social channels.

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 another event on television. 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 developed a wide range of services for the digital arena.

One of these services designed primarily for digital is **Content+**, which is an online resource offering short-form content from across the Games that can be easily shared across all platforms. OBS will deploy dedicated crews in Tokyo to generate behind-the-scenes content from the competition venues, the Olympic Village and around the city. 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 9,000 clips are expected to be produced to help enhance and supplement RHB coverage.

Distributed through an user-friendly web-based platform, 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.

Additionally, OBS plans to produce fast turnaround clips from all sports, offering broadcasters access to highlights content quickly and effortlessly. Through this new offering called the Sports Clip Service, OBS will create more than 1,800 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.

ENHANCING THE VIEWING EXPERIENCE THROUGH TECH

“New technologies are exciting, but only if they can add value and enhance the viewers’ Olympic experience. It is with this guiding principle that OBS identifies what relevant emerging technologies might help improve the coverage of the Olympic Games. We incorporate production enhancements on the basis that they are informative and help deepen the viewers’ understanding of the sports events they are watching.”



Kim Erdahl
Senior Graphics Manager

Basketball 3x3, Gymnastics, Athletics Track & Field, Cycling BMX Freestyle and Racing, Golf (Hole 14 Tee), Football Women's Final, Skateboard Street, Sport Climbing, Volleyball

MULTI-CAMERA REPLAY SYSTEMS

In Tokyo, OBS will provide viewers with a totally new way to see the action for a summer edition of the Olympic Games as Multi-Camera Replay Systems will help 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 action like never before.

How does it work?

Relying on a myriad of high-speed 4K cameras, Multi-Cam 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. At selected venues, between 60 and 80 4K cameras 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-Cam Replay clips to be ready in under five seconds.



© 2018 Olympic Broadcasting Services / Owen Hammond
4D Replay technology will help capture never-seen angles from selected sports/disciplines in Tokyo and enhance the viewing experience.

Athletics Marathon and Race Walks, Cycling Road and Mountain Bike, Aquatics Marathon Swimming, Triathlon, Canoe Sprint, Rowing

2D IMAGE TRACKING

As part of a new innovation for the Tokyo 2020 Games, OBS will provide more insight than ever before in selected sports/disciplines by using video tracking technology to help commentators and viewers keep track of the position of the athletes throughout the event in real-time.

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/boats. The computer then creates a 'label' that is attached to each of the identified athletes/boats 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/boats. 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.



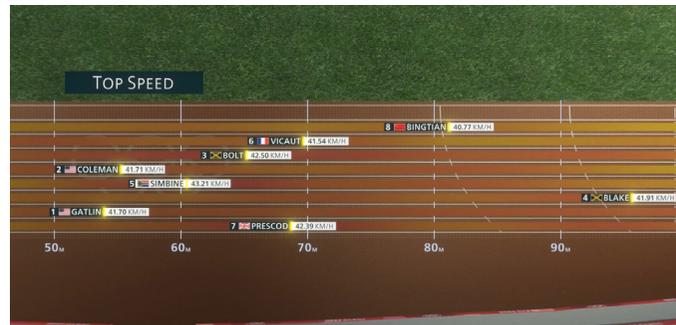
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2D image tracking will be used in the coverage of the outdoor races. These sports events were chosen due to the fact that their production plan traditionally relies on sequencing cameras to understand what's happening. The new on-screen graphics will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

Athletics 100m (incl. Decathlon), 200m (incl. Heptathlon), 400m (incl. Decathlon), 4x100m Relay

3D ATHLETE TRACKING

Developed by Worldwide TOP sponsors Intel and Alibaba, the new AI-powered 3D Athlete Tracking (3DAT) technology is a first-of-its-kind broadcast enhancement technology using artificial intelligence and computer vision to enhance the viewing experience with near real-time insights and overlay visualisations during the athletics sprint events (100m, 200m, 400m, 4x100m Relay, as well as Decathlon/Heptathlon).



It will provide an inside view into the results of a race and how Olympic athletes perform and compare against one another. Broadcasters will be provided with next-generation graphics showing a broadcast overlay visualisation of the race with each runner's sprinting speed at certain points in the race and additional race data. It will offer a more in-depth post-race analysis and reveal an extra layer that wasn't evident during the race itself. For instance, viewers will be able to understand at what exact moment each sprinter reached their top speed and analyse the different phases of the race in detail through a coloured visualisation of changes in speed.

How does it work?

Four in-venue pan-tilt mounted cameras will be installed at the Olympic Stadium to capture live the sprint athletes' performance. The 3DAT technology relies on massive computing power that can process large data sets. Using the speed of the Intel processors (hosted on Intel-based data centres in Alibaba's cloud infrastructure), OBS will be able to deliver this new analytical data as part of the multilateral feed within a fast turn-around time.



© 2016 Getty Images / Ezra Shaw

Archery

BIOMETRIC DATA

When at full draw, shooting for a medal, without the slightest visible movement in their body: what is actually happening inside an archer's body?

For the first time at the Olympics, RHBs will be able to bring their archery coverage to the next level and reveal the inner workings of Olympic archers by displaying biometric data. In collaboration with Worldwide TOP Partner Panasonic, OBS will rely on contactless vital sensing technology to provide live heart rate monitoring.



© 2021 Olympic Broadcasting Services

Four cameras will be placed at approximately 12m from the athletes, focusing on their face and analysing the slight changes of skin colour generated by the contraction of blood vessels from the captured video. Audiences will be able to witness the heartbeat variations and adrenaline rush experienced by the archer's body, as they shoot their arrow, through an on-screen graphic.

Basketball

TRUE VIEW

Using Worldwide TOP Partner Intel's True View technology, OBS will offer for the first time immersive replays for all Basketball matches. TrueView builds three-dimensional (3D), 360° video through an array of cameras installed high in a stadium or arena.

In Tokyo, a total of 35 4K cameras will be mounted at the concourse level of the Saitama Super Arena to capture volumetric video that, once processed, renders 360° replays, bird's eye views, stunning freeze frames and compelling stories from any perspective on the court. OBS will produce between up to 10 True View clips for every Basketball game.



© 2021 Intel



© 2021 Intel

Sport Climbing

VIRTUAL 3D GRAPHICS

Making its Olympic debut at Tokyo 2020, Sport Climbing takes the challenge of scaling steep ascents to a whole new level. Using a range of hand and foot holds of different shapes and sizes, climbers put their skills and strength into practice on a wall measuring either 15m in height (Speed and Lead) or 20m in width (Boulder). To help audiences understand the challenges faced by the athletes and get insight into how they solve problems, innovative, computer-generated graphics will enrich the coverage of this new Olympic sport.

OBS will create a 3D representation of the holds and walls, creating a virtual world that looks more real than what a camera could capture. This 3D model allows for detailed analysis of



© 2018 IOC / Simon Bruty

the wall's angles and holds and give viewers a hint of what it might feel like to tackle the ever-changing challenges on walls. Augmented Reality (AR) technology will be used to switch between the (real) camera shots and this virtual world at any given point of time, as well as generating virtual data about the holds, the wall's varying angles and the routes. In this virtual world, one can zoom in at any time, with a very close-up look at a tiny detail on the hold, while at the same time also zoom out to assess the wall in its entirety. Virtual 3D graphics technology will provide commentators with access to a huge amount of analytical data, enabling them to explain to their viewers what goes on in the athletes' minds when progressing on the walls.

IMMERSIVE STORYTELLING

“Immersive tech offers an incredible opportunity, enabling fans to feel like they’re at the Olympics, even when they’re watching the Games from home. Beyond providing the viewers with the feeling of ‘being there’, we are trying to create content that resonates. These new immersive experiences are expanding the story by delivering new viewpoints and perspectives that, not only allow for a greater appreciation of the action, but create further engagement.”



Matt Millington
Director of Digital
Content Production

This summer, viewers around the world will literally step inside the Tokyo 2020 Olympic Games as OBS will offer RHBs the possibility to create a more immersive experience, with live and on-demand virtual reality content from the Games. Fans will be transported into the midst of the action and feel like they are part of the Olympic Games, allowing them to deeply engage in the sports they love to see once every four years.

This immersive content will let them hop around the field of play to look around for themselves as the action unfolds, all without leaving the comfort of their home. This is the most realistic experience one can get from viewing a sporting event without actually attending in person.

OBS plans to produce approximately 110 hours of live immersive 180° stereoscopic and 360° panoramic coverage from the Opening and Closing Ceremonies, as well as from selected sports (with two being featured daily) including Athletics Track and Field, Basketball, Beach Volleyball, Boxing and Gymnastics.



© 2021 Olympic Broadcasting Services

These sports and venues have been carefully chosen by the OBS content creators, based on the possibility to place the cameras in strategic positions that could best convey a sense of proximity to the athletes and make the viewer feel virtually part of the action.

VR offers a new and exciting way of storytelling and has opened up new possibilities of taking audiences even deeper into the Olympics.

OBS will place up to six 180° stereoscopic cameras, in a fixed position, together with a 360° camera to capture the Ceremonies and Olympic competitions. Viewers will be able to choose camera perspectives of live streams, while OBS will also provides an additional stream with integrated camera coverage.



© 2019 Olympic Broadcasting Services

Additionally, OBS will produce a broad variety of highlights, features, athlete experiences and point-of-view clips from almost every sport, some having never been captured in VR before. These highlights and features will be delivered as VOD in a mix of 180° and 360° formats.

RHBs can choose to take either the OBS white-label solution or a Software Development Kit (SDK) for integration of the full service within their own digital properties. The apps are available for mobile and web users (without the need for VR headsets), as well as for Oculus Quest/Quest 2 users.

DIGITALLY CONNECTING WITH OLYMPIC FANS WORLDWIDE

In these difficult times, the ability of sports to bring people together is missed more than ever. Fans are a key component of the Olympic Games, and the sports eco-system in general.

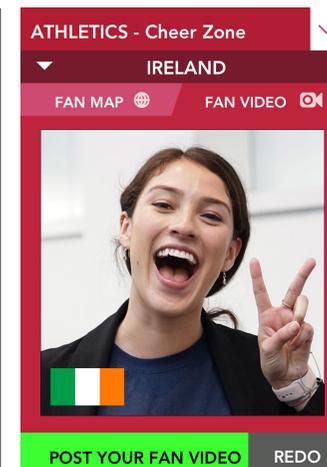
After a year of disruption to sporting events around the world, the Tokyo 2020 Olympic Games aims to become the first major international sports event to implement an innovative digital remote fan engagement solution.



© 2016 Getty Images / Ryan Piersie

Reactions of both international and domestic fans in the venues are an essential element that enhances the experience and performance of Olympic athletes and also bring emotions and colourful images to the Games.

To counterbalance the impact the global pandemic had on fan attendance for the Tokyo 2020 Games, OBS has created an innovative suite of digital fan engagement applications, in cooperation with the RHBs and the Organising Committee, giving overseas fans the opportunity to be present in some ways and cheer on their favourite athletes/teams.



To allow fans to attend the Tokyo 2020 Games virtually, OBS will be providing an online 'Cheer Map' and 'Fan Video Wall' that brings audience participation direct to the venues. Audiences can access the Cheer Map and Fan Video Wall feature via participating RHBs, as well as at the Tokyo 2020 section at [Olympics.com](https://olympics.com).

Furthermore, OBS will facilitate 'Athlete Moments', allowing athletes at selected venues to connect with their family and friends directly after their event.

INTERVIEW WITH MARK WALLACE

“Storytelling is king”

While tech advancements have markedly improved the Olympic viewing experience, one premise has remained consistent throughout the history of Olympic broadcasting: Storytelling is still king. And Mark Wallace, OBS Chief Content Officer, couldn't agree more with this. Storytelling is the foundation upon which the entire OBS production is built.

What does your role as Chief Content Officer entail?

My job ultimately is to produce all of the content OBS offers to the Rights Holding Broadcasters (RHBs) prior to and during the Olympics. For Games-time, that is now not only the live sports feeds, but also a broad range of additional content for both linear and digital platforms. I also work closely with the Organising Committee on the development and implementation of the Look of the Games in the venues, and how the venues are presented for TV audiences. I'm also involved in sports presentation, notably the movement of athletes and technical personnel on and off the field of play.

What is the scale of OBS's broadcast production at Games-time?

OBS employs about 8,100 broadcast professionals, and the core of our operation is the live sports coverage from each competition venue. We bring in the best venue production teams that the world has to offer to produce that action and I have a group of producers who oversee

the various sports and ensure the coverage of every sport is consistent and is of Olympic quality, which is an industry leading standard. We will use a total of 1,049 camera systems for the broadcast of the Tokyo 2020 Games of which more than 210 are slow-motion cameras. We will also have no less than 11 four-point cablecam systems in place, as well as a broad range of other specialty equipment.

Aside from what we see on television, what else does OBS deliver?

We now have other feeds coming out from some of the venues, notably the Multi Clip Feeds (MCFs) which run simultaneously with the main coverage and offer unseen angles from point-of-view (POV) and super slo-motion cameras, and all our specialty systems. They help RHBs tailor their own programming with enhanced analysis. There will be 75 multilateral feeds and 28 MCFs coming from the venues in Tokyo, which represents a huge amount of content distributed to the RHBs through a 48-channel VandA package and an additional 28-channel VandA+ package. For the



MARK WALLACE



© 2018 Olympic Broadcasting Services / Owen Hammond

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.

first time, we have native UHD HDR production, with 68 multilaterals distributed in a specific Vanda package consisting of 44 channels.

Who are the venue production teams responsible for executing the OBS production plan?

To execute our coverage plan, we bring in expert venue production teams with extensive knowledge of the sport. These teams are either freelance professionals or come from broadcasters who are our RHBs. Notable examples are NBC, the US rights holders who will provide expertise in Golf, Sky New Zealand for Rugby Sevens, China Media Group for Table Tennis, Badminton, Gymnastics and Sport Climbing, and Japanese broadcaster NHK who will assist with Judo and Karate. We work with these teams to place the cameras and microphones, to adjust the lighting, so as to ensure the coverage will be of a very high standard. As one of the industry leaders, Japan provides a high level of local expertise, so in total nine venue production teams are from Japan.

What innovations has OBS made since Rio 2016 and PyeongChang 2018?

The continued expansion of the MCFs is a response to RHB requests. For Tokyo 2020, most of the sports will have a MCF. The RHBs will be using these in their studio for analysis and for making music clips and transitions.

In selected sports, we will also be delivering multi-camera replays where the image freezes, and the viewer moves around the action. We have utilised these before, but never as extensively as we will in Tokyo. Such production enhancements are ideal for analysis because you can now see something on the multilateral feed that you couldn't before. For example, we can freeze the athlete in mid-air and see the exact body shape of the athlete. It has a definite "wow" factor.

We will also be employing Intel's TrueView system in Basketball which can utilise virtual cameras to allow the viewer to move into the



© 2018 Olympic Broadcasting Services / Owen Hammond
Mark Wallace with the Production Quality Room (PQC) team at PyeongChang 2018

venue and make it feel like being on the field of play and part of the action, alongside their favourite athletes. This will enable better storytelling as replays will have more angles and then of course there will be more data for viewers to access than ever before. We will capture more data on the athletes' performance, so the viewers will have access to additional information, enabling them to have a more complete understanding of the action.

We are also excited to partner with Intel and Alibaba to bring the next era of technology by enhancing the viewing experience for the Athletics sprint races. Relying on 3D Athlete Tracking technology, we will be able to reveal never-before seen insights into athletes' velocity and acceleration, and how they perform against each other. The technology can convert that data into visual overlays which can be broadcast over replays, providing commentators with a great tool for analysis and further fan engagement.

There is a unique phenomenon with the television audience for an Olympic Games. Many are what I would call the Olympic viewer. They are someone who doesn't usually watch a lot of sport and they decide they want to watch the Olympics because of the storytelling, narrative and personalities. Our job is to entertain, inform and educate the viewer, engage them and keep them interested in sport and the story.

Our goal is to further educate the viewers and engage them through good storytelling, and even more when introducing them to new Olympic sports such as Sport Climbing and Surfing.

How much is the work of the host broadcaster about storytelling?

The Olympic Games are not just about sport, they are about humanity and emotion, stories and narrative, and this aspect is something I look forward to at each Games.

The goal of OBS production is to tell the unique and inspiring stories inherent to each athlete's performance. Athletes are always at the heart of our coverage and conveying their emotional journey to the fans at home is at the forefront of all our efforts. That's our job to get these emotions and stories through the screen to audiences around the world.

What are your plans to compensate for the lack of spectators in the venues?

For the last 15 months, since the beginning of the global pandemic and the challenges faced by sports events organisers, OBS has been preparing for different scenarios in the event that all sports and the Ceremonies in Tokyo would take place without spectators. Together with IOC Sports and the Tokyo 2020 Organising Committee, OBS has been assessing different options for virtual crowd effects that could be made available either inside the venues or for broadcast. What was important was to provide a sound mix that would be consistent across all sports and venues and ensuring those simulated elements would help enhance the coverage for the individual sports and venues.

With this in mind, OBS assembled a vast sound bank of crowd samples and ambient sound from previous Olympic Games for the majority of the sports and will now make these sound mixes available to the Tokyo 2020 Sports Presentation team for use on the Public Address (PA) system where relevant and appropriate. These venue specific sounds will be played out at low levels to help mitigate any echoing at the venues, while providing atmosphere sound.

Please note that these ambient sounds used to support the sports presentations at the

venues will be not be used at outdoor venues with a large field of play (sailing, golf, athletics marathon/race walks, cycling road events, canoe sprint/rowing, equestrian cross-country, surfing). Normal PA introduction of athletes and teams will still be included together with music.

For those new sports that were added to the Olympic programme (with the exception of surfing), OBS collected indoor and outdoor venue ambient sounds from similar sports in order to offer the Tokyo 2020 Sports Presentation team a relevant selection of sounds. While the ambiance within the venue certainly enhances the broadcast of the Games, it does not define it. In that sense, OBS doesn't feel the need to "recreate" the Olympic atmosphere, because as long as we are able to tell the stories of the athletes, the Games will remain as captivating as ever.

For the first time in Olympic broadcasting, OBS will capture the sounds of the Tokyo 2020 Olympics through an immersive 5.1.4 audio configuration that will immerse TV viewers in the action, enabling them to listen to details of the sports as never before.

What is the impact of using UHD HDR cameras for the first time?

They will offer more depth of field and the resolution of the image will certainly improve so pictures will feel more real. In terms of the image and how the image looks, UHD HDR will definitely make a difference. For capturing all of the nuance of facial expression, you can't beat UHD. It is a significant technological advance.

In terms of storytelling, I don't think it has much of a bearing, this comes from the venue production teams knowing the sport they are covering, knowing the storylines, who won gold in the previous Olympics, who is the current world champion. Our editorial line, the content and how we cover things won't change greatly, only the methods we use to tell a story.

How have you prepared for the five new sports?

We want to make their coverage the best it can be. The production teams we have brought in have great knowledge and expertise, and we have been working closely with the respective IFs to see for instance if we can put POV cameras or microphones on the athletes or referees to bring a more immersive experience to the viewers. With Sport Climbing, we will offer a virtual 3D animation of the wall to see how the holds and the wall's varying angles look. We will have four-point cablecam systems at BMX and Skateboarding.

The job of our producers and directors is to tell that story to someone who may never have watched that sport. We need to present each of these new sports in an informative yet exciting manner. The graphics need to be immediately understandable and once again, good storytelling is essential.

How has OBS embraced virtual reality?

We have been experimenting with VR since 2016. Again in Tokyo, we are offering a live VR app solution for RHBs. The user will be able to cut around the cameras live and take a 180° and 360° look around. We've chosen sports where we can place these cameras on the field of play, or in places that provide the viewer with a unique position and experience. A viewer may find themselves in a location they would not even achieve as a spectator in the venue. At Gymnastics, you will be right at the heart of the action, on the field of play, surrounded by the athletes and the apparatus. We also offer the curated feed, cutting the VR cameras and telling the story.

For the first time, we also have been filming some pre-Games content around the host city and athlete build-up in different countries for our VOD service that will provide VR features. We plan to fix cameras onto athletes during their training sessions when we will be able to record that performance for VOD and give the VR user the chance to feel what it is like to be an

Olympic athlete. VR is an immersive experience, not broadcast television, and that is how you have to think of it.

Where does digital and social media fit into the output produced by OBS?

More and more people watch the Games via streaming on their tablet, smartphone or laptop. These are the new viewing methods. Demand for more digital and social media content has exploded over the last decade. We had to expand our offering and drive new content production and distribution models for digital. Our Olympic Video Player, digital content components and Content+ service have been specifically designed to help RHBs with their digital strategy.

People still like to watch sport live. They like to watch it together and it is generally a communal thing. They like to watch it in the traditional form, on a television, but the amount of younger people watching on their mobile devices is increasing greatly. With broadcast, the RHBs control what the viewer watches; with digital, it is more interactive. Digital offers something classical TV sports does not: audience participation. You may want to have access to data or watch some features that are connected to an athlete you are watching live, and you can do that on digital.

Nowadays production is also about developing interaction, bringing communities together and keeping the audiences engaged. To assist the RHB digital and social media teams in Tokyo, OBS will have dedicated teams that will move between Olympic venues and film social-first, short-form content from their smartphones. These give viewers a behind-the-scenes glimpse of the Olympic Games and allows for a deeper Olympic experience.

CREATIVE TEAMS BREAK NEW GROUND AROUND PRE-GAMES CONTENT

“Creativity and innovation are key elements when it comes to producing additional content. For Tokyo 2020, Japanese culture undoubtedly inspired our creative teams, resulting in a high-value and innovative content offering. Using motion capture technology, we have animated real athletes into the avatars featured in our Sports Guides in a unique way that we believe will help broadcasters engage their audiences across all their platforms.”



Wendy McInroy
Programming
Content Manager

For Tokyo 2020, OBS has created original pre-Games content to support broadcasters' promotional efforts for the Games, including 63 Sports Guides and 50 Pre-Games Trailers.

The Sports Guides (two to three minutes in duration) highlight skills required for each sport that will enable broadcasters to further explain each Olympic sport to their audiences. The Pre-Games Trailers are short films (approximately 30 seconds) with high production values, aimed at helping RHBs promote the Games in the lead up to the Opening Ceremony, or to include in their preview programming for upcoming events during Games-time.



© 2019 Olympic Broadcasting Services
3D Motion Capture was used to capture athletes' skills and techniques for the Sports Guides

It was the first time for OBS to use cutting-edge motion capture technology in its content production. Motion capture is the science of tracking human movement in real time, using the data to create digital character models in three-dimensional computer animation. OBS has taken full advantage of the technology's ability to bring lifelike motion to animated characters and transform professional athletes into avatars for its Sports Guides series.

In a purpose-built motion capture studio in Pinewood, London, athletes wore specially designed sensor-laden bodysuits to demonstrate key skills and techniques of each Olympic sport. The data recorded by the sensors was collated, and a three-dimensional replica of the moving athlete appeared simultaneously on a computer screen. This allowed OBS's creative teams to emulate

all the nuances of the skills and techniques of each Olympic sport. They then placed each 'avatar' (animated athlete) in a futuristic urban rooftop environment that has been specifically created as a background for each Sports Guide – a nod to the high tech reputation of the host city.

It was an intricate process ensuring that the avatar truly reflected the movements and techniques of the athletes accurately. For each sport, prior to filming, OBS's creative teams pre-planned the key skills that would be featured in the Sport Guides, prepared detailed scripts and fact checked all technical information with the International Federations to ensure accuracy.

The concept of the Pre-Games Trailers has also evolved, compared to previous Games. In the past, the Pre-Games Trailers were filmed in both studio and controlled locations close to OBS's production base. For Tokyo 2020, OBS decided to film some Trailers in the host city to showcase all that Tokyo has to offer. The crew spent two weeks in Tokyo in 2019, filming across the city, and captured the true essence of the host city. The majority of the Trailers focus on one specific sport; however, two special 100 Days to Go and 50 Days to Go Trailers are a celebration of all Olympic sports and the Games as a whole. Broadcasters will be able to use these original Pre-Games content to build anticipation and promoting their Olympic coverage.



© 2019 Olympic Broadcasting Services / Owen Hammond
Pre-Games Trailer filming at teamLab Borderless in Odaiba

CHAPTER 5

TOWARDS A MORE SUSTAINABLE PRODUCTION

Sustainability is one of the three pillars of Olympic Agenda 2020 – the strategic roadmap of the Olympic Movement – and OBS is fully committed to adopting its principles across the host broadcast operation.

The COVID-19 pandemic has clearly demonstrated the necessity, value and benefits of sustainability in people's daily lives. Whilst the global coronavirus crisis has caused widespread disruption, it has also provided an opportunity to rethink and reshape the future. It requires new ways of thinking, new priorities, new standards and new ways of doing things.

SUSTAINABILITY IS CORE TO THE PLANNING OF THE HOST BROADCAST OPERATION

“We know that the more we integrate sustainability into our operations, the bigger the positive impact we can have on the planet and the host city(ies). Doing more with less is something we truly believe in at OBS.”



Monica Barra
Planning
Manager

OBS has long embedded sustainability into its operations, working diligently toward minimising its environmental impact and the resources used for the Games' planning and on-site broadcast operation, while attempting to further reduce costs for the local Organising Committees. From Games to Games, OBS continues optimising its operations, resulting in a more sustainable model that positively impacts the host city(ies), the broadcast industry and beyond.

As part of its sustainability strategy, OBS has identified three sustainability focus areas:

- **Reducing the footprint** through space optimisation, energy efficiencies and digital transformation
- **Combating climate change** through sustainable sourcing, recycling and waste prevention
- **Creating a positive legacy** in each host city(ies) by educating the next generation of broadcasters through the Broadcast Training Programme (BTP)



© 2017 Olympic Broadcasting Services / Cristina Ponce de León

Within the past five years, OBS has been implementing sustainable business practices at its headquarters and warehouse in Madrid and taking important steps to meet its energy and emission reduction targets. OBS has created an ISO-certified building design which has significantly reduced the amount of energy required across its facilities. OBS has also invested in new methods and more eco-friendly materials in order to ship its broadcast equipment around the world.

DIGITAL TRANSFORMATION AS AN ENABLER OF SUSTAINABILITY

By adopting new technology and workflows and continuously upgrading its equipment and systems, OBS is not only driven by the desire to be at the forefront and lead new developments in the broadcast industry, but also by its responsibility to ensure that its sustainability goals are met across all aspects of its service.

“OBS's virtualisation push has largely been led by a strong commitment to improve our services while also decreasing the footprint of our physical infrastructure and the complexity of the broadcast operation. Virtualisation reduces our Games-time space requirements, both in the International Broadcast Centre and the venues, which leads to reduce our overall energy consumption.”



Mario Reis
Director of
Telecommunications

Cloud-based infrastructure and remote access

By adopting remote access solutions and cloud-based services as part of its workflows, OBS has set a new benchmark and is changing the way the Olympic Games are being broadcast. The COVID-19 pandemic has even further accelerated it, with the Rights Holding Broadcasters (RHBs) shifting towards a remote production model and sending fewer on-site broadcast personnel compared to previous summer editions of the Games.

For the first time, thanks to the launch of OBS Cloud, OBS and the RHBs can remotely configure their systems and test them beforehand, enabling them to mitigate unanticipated challenges and also lower their set-up lead time, and therefore keeping their number of days in the host city to the minimum. With these reliable and efficient tools, RHBs can now embrace remote production to deliver the Olympics and literally do more with less.



© 2018 Olympic Broadcasting Services / Owen Hammond
At the Youth Olympic Games Buenos Aires 2018, OBS tested remote production for the coverage of selected sports in an effort to optimise its production plan. For Tokyo 2020, part of the live coverage of tennis will be done remotely, with robotic cameras installed at side courts while the production gallery will be installed at the IBC. OBS will have a similar set-up in the press conference room of selected venues.

Upgraded equipment

Upgraded equipment based on new standards means not only improving performance and catering for new needs and demands, but also providing optimised energy efficiency, low maintenance and sometimes the need for less equipment or cabling to be installed. For Tokyo 2020, it is the first time that the core system of the multilateral feeds will be fully supported by Internet Protocol (IP) technology.

Fibre optic

Relying on fibre optic technology for its data transmission systems, OBS has considerably reduced its cabling requirements at the venues and the IBC over the years, while improving the reliability of the signals and reducing the costs. It has also resulted in significant reductions of on-site set up and retrieval times, helping OBS reduce its impact in the host city. Furthermore, since Rio 2016, OBS has been recovering the majority of its cables after each Games to be re-used in the following edition.

A MUCH REDUCED FOOTPRINT AT THE IBC

OBS architects have taken a bold step in re-imagining the IBC, with a fresh approach to optimising space usage, maximising efficiency, and improving sustainability.



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The newly introduced Centralised Technical Areas (CTAs), bringing RHBs' technical equipment together in a shared space, is a step further towards reducing the overall broadcast footprint and increasing efficiencies

Focus on optimising space...

The IBC is the heartbeat of an Olympic Games broadcast operation, both for OBS and the RHBs. It has a massive physical presence, but one in which OBS has done its utmost to reduce the environmental impact and increase efficiencies.

Two of the exhibition halls of the Tokyo Big Sight conference centre will be home to the IBC for the Tokyo 2020 Games. Using a pre-existing facility means that construction and power costs have been significantly reduced for the Organising Committee, a factor that was enhanced further when OBS cancelled the need for an additional 2,500sqm temporary building adjacent to the IBC that would have been used for OBS operations.

OBS has also been optimising its needs for a warehouse in/around the host city. The

warehouse in Tokyo is one-third smaller when compared to previous Games (9,000sqm) – a reduction that will be matched by a corresponding decrease in ancillary services.

Within the IBC, OBS has reconfigured the typical layout to create a better mix of technical areas and office space which will better balance airflow and reduce the amount of heating and cooling required, thereby lowering power consumption.

In order to keep the broadcast footprint and costs to a minimum, it was decided following the Olympics' postponement to maintain the infrastructure that had already been built inside the IBC. The fit-out work resumed in March 2021.

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.

... and facilitating remote production

Since the beginning of the planning for Tokyo 2020, OBS has encouraged RHBs to deliver the Games remotely as much as possible by using a range of OBS adapted services such as the Multi-channel Distribution Service (MDS), IP delivery of the signals, Content+ and OBS Cloud.

This content delivery strategy paid off as space required by RHBs at the IBC has been reduced by 21 per cent compared to Rio 2016. Broadcasters are adopting new ways of broadcasting the Games by turning to remote, cloud-based production and reducing their on-site presence. The pandemic has only helped to scale this up more rapidly than ever before.

MORE COVERAGE WITH LESS

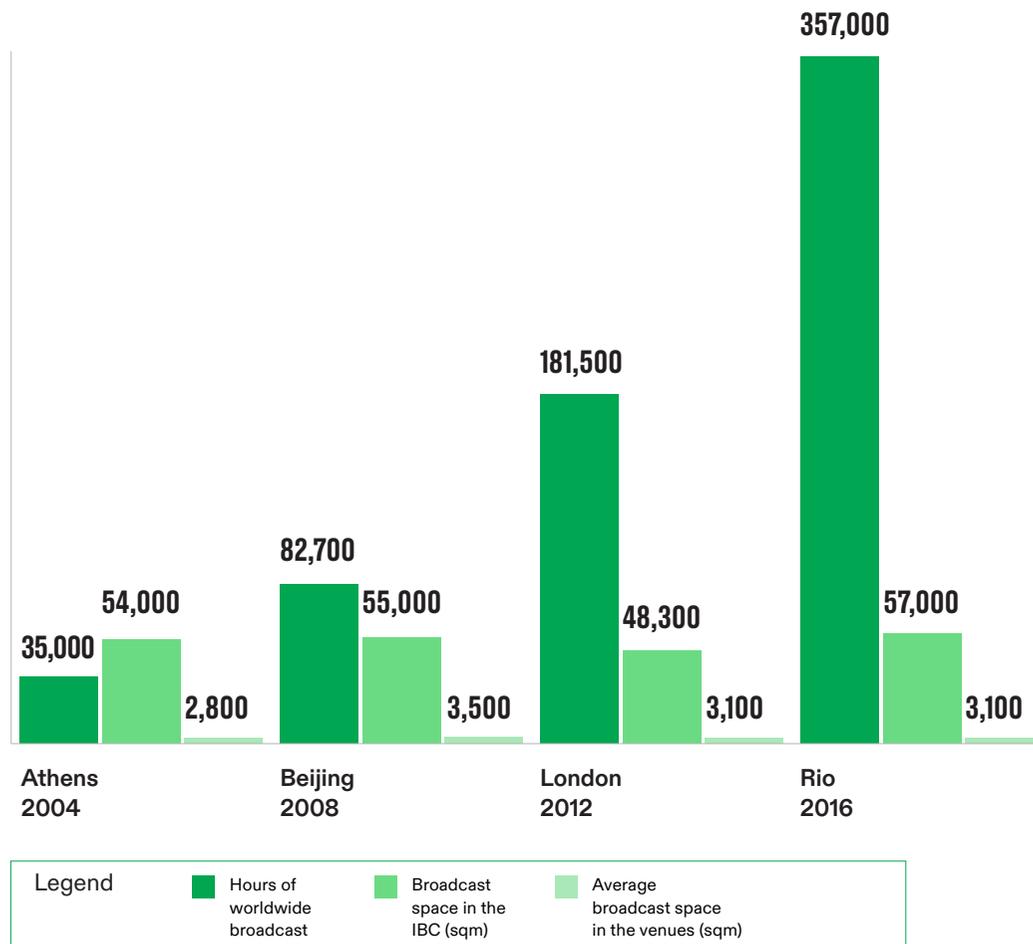
More broadcast hours, less IBC and venue space

OBS has been working diligently to reduce the amount of space that was required across the 42 competition venues, with flexibility at the core of the planning process.

For instance, at the Olympic Stadium, OBS will use an existing temporary building rather than installing temporary broadcast cabins.

As a result of such savings, the number of cabins required at the venues is identical compared to Rio 2016 – this despite the fact that the number of compounds has increased from 27 at Rio 2016 to 39 at Tokyo 2020.

In total, OBS has managed to reduce the aggregate size of the broadcast compounds by a total of 24 per cent. The average broadcast space in the venues is 2,570sqm.



OIS joining forces with OBS for a more streamlined operation

Previously managed solely by the IOC, the Olympic Information Service (OIS) now sits within OBS. OIS is a professional sports reporting and information service designed to keep the accredited media informed during the Olympic Games. OIS enhances the Games coverage by supplying key information on the athletes, the competition and the Olympic Games, as well as flash quotes from the mixed zones and press conferences.

In determining the cooperation strategy between OIS and OBS, several areas have been identified where optimisation can occur, such as the operation in the mixed zones and press conference rooms and sharing resources. This collaboration will benefit all media as it will lead to further information sharing that will improve output across the board. There will be constant communication between OIS and OBS, before and during the Games, to ensure editorial consistency and that stories, quotes, and issues are not missed by any output.

LEGACY USE OF THE TV TOWERS

OBS has introduced a demountable modular TV tower model that can be re-used from one Games to the next, significantly reducing construction costs and workdays, as well as offering RHBs a cost-effective solution.

At Tokyo 2020, OBS has installed two TV towers, situated respectively on the Odaiba waterfront and in proximity to the Olympic Stadium, ensuring the best backdrop for the world's Olympic TV shows. The modular panels making up the studios will be in use at their third Games having made their debut at Rio 2016 and re-used at PyeongChang 2018.

From a construction standpoint, these temporary TV studios are 75 per cent less expensive than a new build each time. Furthermore, modular construction cuts the amount of fit-out and dismantling time by about 20 per cent.

© 2021 Olympic Broadcasting Services / Jochem Van Apeldoorn
Within the span of just a few weeks, OBS has built a modular TV tower in Odaiba. In total, it will house six RHB studios (four singles and two doubles), together with four stand-up positions by the side, all facilities offering an unparalleled view over the Olympic Rings installed in the Tokyo bay, the Rainbow Bridge and Tokyo Tower.



SUSTAINABLE SOURCING AND RECYCLING

Since 2016, OBS has been participating in an IOC-led carbon footprint study to assess the organisation's operational carbon footprint. An example of the outcome of this study is the creation of the IOC Sustainable Sourcing Guidelines that highlight requirements and recommendations for purchasing goods and services in a more sustainable manner.

These guidelines have led OBS to introduce a sustainability clause in its procurements. It is a vital step and one that will have far-reaching benefits, considering that, at each Games, OBS interacts with approximately 1,200 vendors.



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Containers transporting recycled materials from previous Games were shipped to Tokyo for the IBC fit-out in summer 2019.

From the sourcing of equipment and materials to the disposal or recycling, there are many opportunities to make a valuable contribution to sustainable resource management and waste reduction. Whenever possible, OBS uses re-purposed materials from previous Games. Until Sochi 2014, OBS dismantled and disposed of the IBC's fit-out materials, resulting in large volumes of debris. It was extremely wasteful and also meant high costs of new overlay for each Games. Following Rio 2016, nearly all overlay materials such as power panels, ceilings, lighting, carpets and air ducts were dismantled, collected from the IBC and transported by sea freight to PyeongChang for reuse in the IBC for the Olympic Winter Games in February 2018.

This reuse of modular panels is estimated to have eliminated 3,000 truckloads of waste, while approximately 50 per cent of cabling was salvaged from Rio 2016 for reuse at PyeongChang 2018. These materials occupied more than 300 shipping containers.

For Tokyo 2020, the goal is to re-use 90 per cent of the materials from PyeongChang 2018. Depending on the condition of the materials after three Games, a decision will be made on whether they can be reused once more at an IBC. If not, alternative reuse options will be considered, including donating them to UN agencies for redistribution to those in need.

Recycled Olympic materials are already being put-to-use in a positive way. Following PyeongChang 2018, previously used modular panels and containers were shipped to a refugee camp in Uganda where they were used to make much-needed housing. The work was financed by OBS in lieu of the costs of recycling those materials in Korea.



© 2018 Olympic Broadcasting Services
Following PyeongChang 2018, OBS donated building equipment, including solar panels, to the United Nations Refugee Agency (UNHCR) in Uganda, offering new housing and life-saving electricity to the Bidi Bidi refugee settlement.

A LOW-IMPACT UNIFORM

“We made ethical and sustainable choices when sourcing our Games-time uniform for Tokyo 2020. We carefully considered the materials used and worked together with our supplier to reduce waste, chemicals, and plastics that endanger our planet’s ecosystems.”



Patricia Diaz
Senior Manager
Games Services

As per previous Games, OBS staff, freelancers and vendors working in Tokyo will be asked to wear a specific uniform that will help them be identified at the IBC and the venues as part of the host broadcast team. When considering the sheer number of pieces that would be required, OBS was compelled to find ways of aligning its sustainability objectives with the uniform manufacturing process. For Tokyo 2020, OBS has made an environmentally responsible choice.

No water pollution and no chemicals

Twenty per cent of the water pollution, globally, is caused by textile processing. About 25 per cent of the chemicals produced worldwide are used by the textile industry. The OBS uniforms have been manufactured from fabric that was solution dyed. In the solution dyeing method, the colour is added to the liquid state of the fibre components, before the fibre is produced, which reduces the amount of water and chemicals required to colour it.

Responsibly made with recycled materials

OBS staff will wear polos and tee-shirts made entirely of plastic bottles. Plastic bottles were collected by local communities in countries plagued by plastic waste, then got cleaned and shredded, turned into polyester thread, and finally woven into fabric for use in the OBS uniform. This bottle-collection process provided jobs and income for those communities, while simultaneously mitigating environmental harm. Additionally, the bags and backpacks have been manufactured from discarded fishing nets collected from the ocean.

Label-free

All uniform labels have been eliminated from the individual garments, and instead, an eco-friendly fabric option has been created with a specific design and colour code.



bluesign® certified

All uniform items will carry the bluesign® certificate, which ensures sustainable textile production. In traditional manufacturing, there is no way of knowing which chemicals are being used in dye and wash processes. bluesign has identified over 900 potentially harmful chemicals. To earn bluesign certification, manufacturers must prove that those chemicals have been completely eliminated from the production process. The items must meet certain criteria such as guaranteeing the highest degree of safety for the consumer, manufacturing with the lowest possible impact on people and the environment, and the responsible use of resources.

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Services
The OBS Tokyo
2020 uniforms
will be more
respectful of the
environment

CREATING A LASTING LEGACY BY TRAINING THE NEXT GENERATION

“Far from being a deterrent, the postponement of the Games has provided higher levels of motivation to the Japanese students who were enrolled in our training programme. More than 80 per cent confirmed their participation within a few weeks following the decision. The students remain committed and are excited to play a role in the successful delivery of the broadcast coverage of the Tokyo 2020 Games.”



Luana Florentino
Training and
BTP manager



© 2016 Olympic Broadcasting Services

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 Tokyo 2020, approximately 1,200 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.

Participants took part in intense training workshops during the fall of 2019, then 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 10,000 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.



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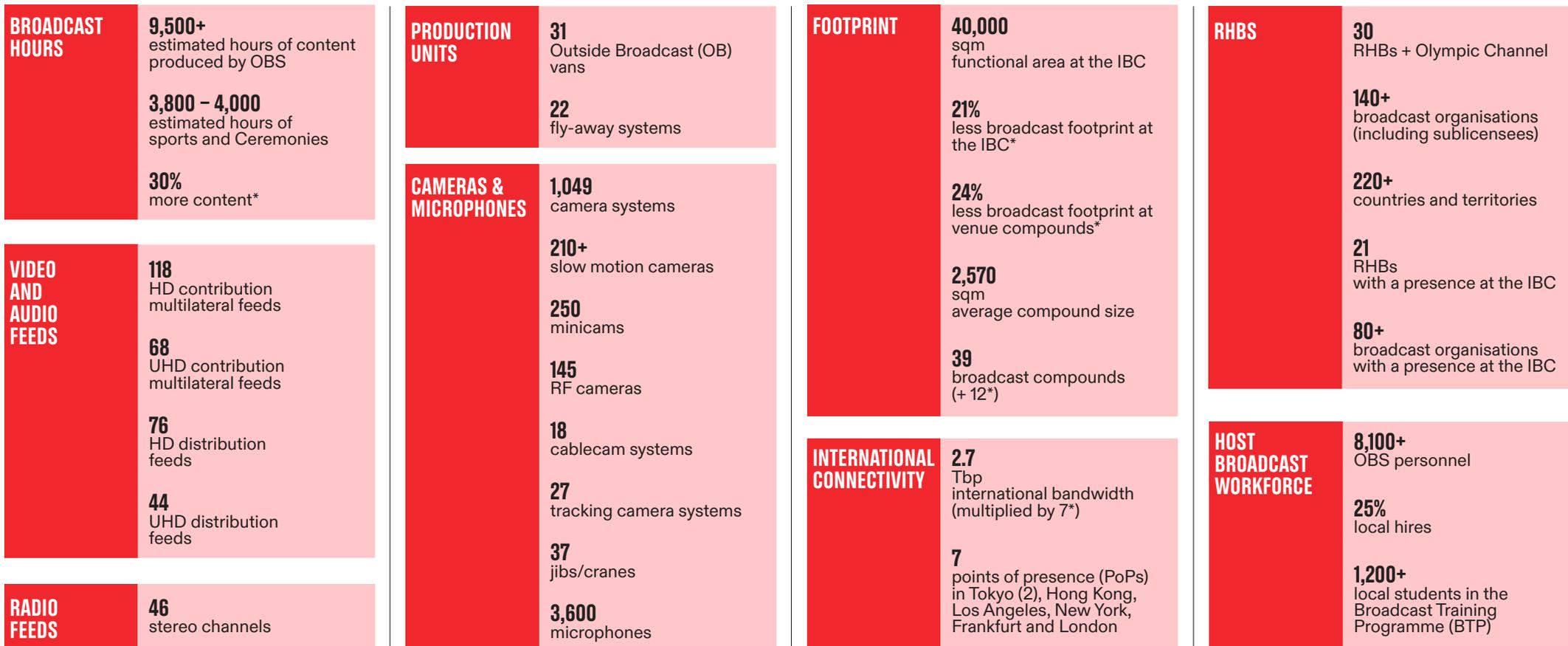
The BTP is often qualified by the participants as a once-in-a-lifetime experience.

When the curtains close on the Tokyo 2020 Games, a strong human legacy will be built in the broadcast industry for years to come. **OBS takes much pride in leaving the host country with young people eager to put into practice the lessons they have learned during their Olympic experience and inspired to pursue their career ambitions.**

CHAPTER 6

BROADCAST KEY FACTS AND FIGURES

BROADCAST COVERAGE BY THE NUMBERS



* Compared to the Olympic Games Rio 2016

TOP 10 FIRSTS AT AN OLYMPIC GAMES

UHD HDR 5.1.4 IMMERSIVE AUDIO

- 1 OBS will have a full native UHD HDR production, with 5.1.4 immersive audio (only the coverage of the seven outside Tennis courts will remain in HD). OBS has transitioned its contribution and distribution networks to an all-IP infrastructure to support the UHD HDR production workflow.

MORE CONTENT, IN MORE FORMATS

- 2 OBS will produce additional Multi Clip Feeds (MCFs), as well as fast-turnaround sports highlights, short-form content and mobile-generated clips
- 3 OBS will deliver a record 9,500+ hours of content in more formats and profiles in support to the RHBs' multi-platform strategies

NEW TECHNOLOGIES

- 4 Multi-camera replay systems (several sports)

3D Athlete Tracking (Athletics 100m)
in partnership with Intel and Alibaba

True View (Basketball)
in partnership with Intel

Biometric data (Archery)
in partnership with Panasonic

Live and on-demand immersive 180° stereoscopic and 360° panoramic coverage (several sports)

Virtual 3D graphics (Sport Climbing)

2D image tracking (several sports)

REMOTE PRODUCTION

- 5 OBS will cover the seven outside Tennis courts, as well as certain press conferences, via remote production. The remote production gallery will be set up at the IBC.

OBS CLOUD AND VIRTUALISED WORKFLOWS

- 6 OBS has rolled out a set of cloud-based solutions specifically designed for high-demanding broadcast workflows, called OBS Cloud, which allows for greater flexibility and remote production *in partnership with Alibaba*
- 7 OBS has transitioned part of its broadcast workflows in the cloud. The OBS video server will be extended to the cloud with increased capacity and worldwide accessibility.

MORE SUSTAINABLE IBC DESIGN

- 8 OBS has been looking for efficiencies in the design of the IBC, notably introducing mini data centres known as Centralised Technical Areas (CTAs)

FOCUS ON DIGITAL AND SOCIAL MEDIA AND FAN ENGAGEMENT

- 9 OBS has introduced 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 has created an innovative digital fan engagement suite, which allows remote viewers to interact with live events in Tokyo and RHBs to connect athletes with their fans

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