

# ONCAM C-SERIES TECHNOLOGY FOCUS

## E X A M I N I N G 360-DEGREE FISHEYE VIDEO TECHNOLOGY

# INTRODUCTION

At Oncam, we pride ourselves in being the experts in 360-degree technology. Built upon the heritage of Grandeye, the inventor of the first ever 360-degree panoramic camera, Oncam's sole focus is on single-sensor fisheye video technology.

As 360-degree fisheye cameras continue to grow in popularity, this technology is becoming an essential part of many surveillance solutions. Its unique ability to capture large areas of a scene with no blind spots has made these devices a powerful tool wherever total situational awareness is required.

This white paper explores the technology behind 360-degree cameras and the unique benefits these devices provide. Single-sensor fisheye images will be compared with other panoramic video technologies available on the market today, and various use cases and industry applications where this powerful technology is best deployed will be identified.

## THE BENEFITS OF 360-DEGREE IMAGES

1. No blind spots
2. 100% coverage live and on playback
3. Camera cannot be left looking in the "wrong" direction
4. Provides views and use cases not possible with traditional narrow field-of-view cameras
5. Scalable and flexible thanks to compatibility with various VMS and NVR platforms

## WHAT IS A CIRCULAR 360-DEGREE FISHEYE IMAGE?

A circular fisheye image is created using a lens with a 180-degree horizontal and vertical field of view. This allows light from all directions to enter the lens and be focused to the image sensor. This provides the user a unique vantage point of the scene and is where the name 360-degree camera is derived from.

The visual distortion effect that is created when using specialist ultrawide angle lenses is commonly referred to as a “fisheye” effect and is another common descriptor for panoramic or hemispherical cameras. While these images must be corrected with special dewarping software, these cameras provide consistency, sharpness and reliability compared to traditional multi-sensor panoramic cameras, along with higher resolution, which increases accuracy.



Image 1: illustration of a 360-degree image

## BENEFITS OF 360-DEGREE IMAGES

The main benefit of 360-degree cameras is the ability for the devices to provide up to 100% coverage of a scene with no blind spots.

Unlike multi-sensor panoramic cameras that each record a scene, then are “stitched” together to form a full picture, fisheye images provide a complete image of a scene without the added step of stitching the images together. Essentially, users get the whole book at once instead of individual chapters that must be put together like a puzzle.

The lens is mounted in a fixed position and does not need to move or rotate to capture an entire scene. This means that everything is visible all the time, both on live and playback and an operator is not needed to ensure the camera is pointing in the right direction to capture any areas of interest while the image is being recorded. This is especially powerful for retrospective analysis of an incident where different parts of the scene can be viewed independently and without prior configuration or set up of that view.

## DEWARPING

To maximize the benefits of the 360-degree lens, the native image needs to be digitally manipulated. The process is called “dewarping” and allows for any area of the original warped fisheye to be converted to have the look and feel of a more traditional video stream. A user can then move around the image and look at different parts of it in a more natural and conventional way.

This is achieved using powerful software algorithms and can be done either onboard the camera itself or on a separate compatible Video Management System (VMS) or Network Video Recorder (NVR).

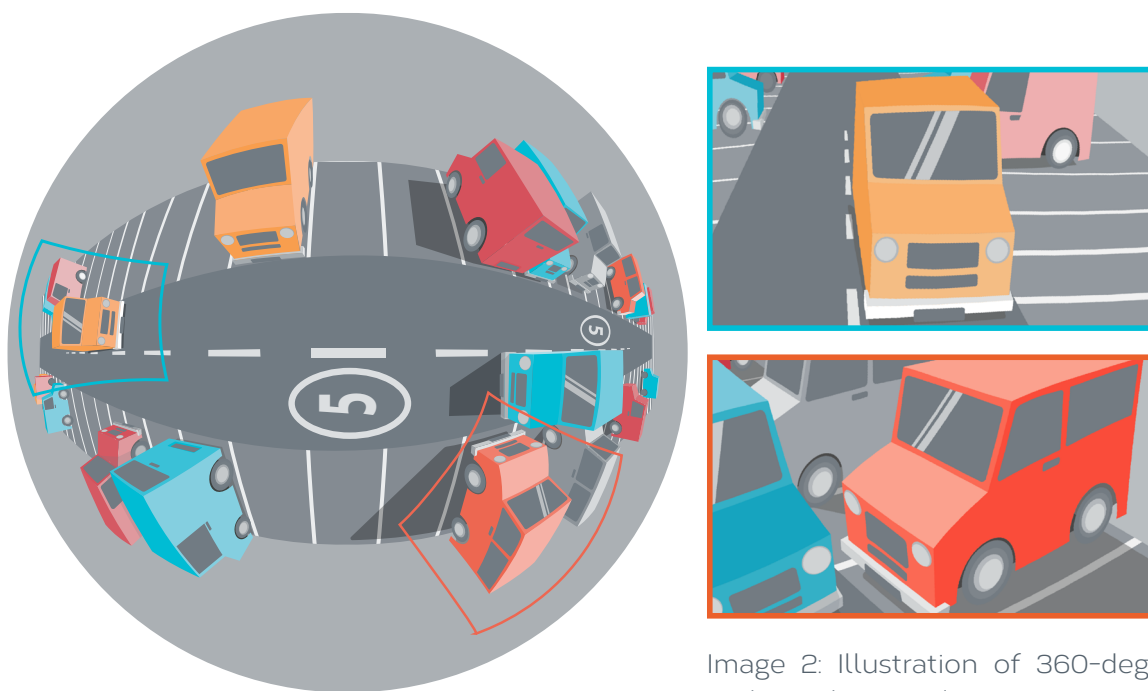


Image 2: Illustration of 360-degree image and two dewarped areas

## ONBOARD CAMERA SIDE DEWARPING

With onboard (also called edge) dewarping, the image is dewarped inside the camera itself and the resulting image is streamed as an independent view across the network. This image is sometimes referred to as a VCam or “Virtual Camera” and depending on the specification of the 360-degree camera, multiple VCams can be produced at the same time.

The benefit of this approach is that no other software or system is needed to get a dewarped view and the network bandwidth of the VCam stream will be significantly smaller than the original fisheye image.

However, this approach limits the full potential of the 360-degree image as you only see the part of the scene that the camera sends and full retrospective dewarping of the whole scene in playback mode is not possible.

## CLIENT SIDE DEWARPING

When client side dewarping is used, the whole fisheye image is transmitted across the network and recorded in full by the VMS or NVR. The dewarping is then carried out on the client and can be done on both live and recorded footage – meaning full retrospective dewarping of the scene is possible.

This functionality generally requires a bespoke integration between the camera and client manufacturers but provides the best end user experience.

Camera and client side dewarping are not mutually exclusive and can be used concurrently if required.

A VCam from the camera could be sent to an independent auxiliary system (i.e. for special monitoring or analytics) while the main system takes the complete fisheye in and use full client side dewarping

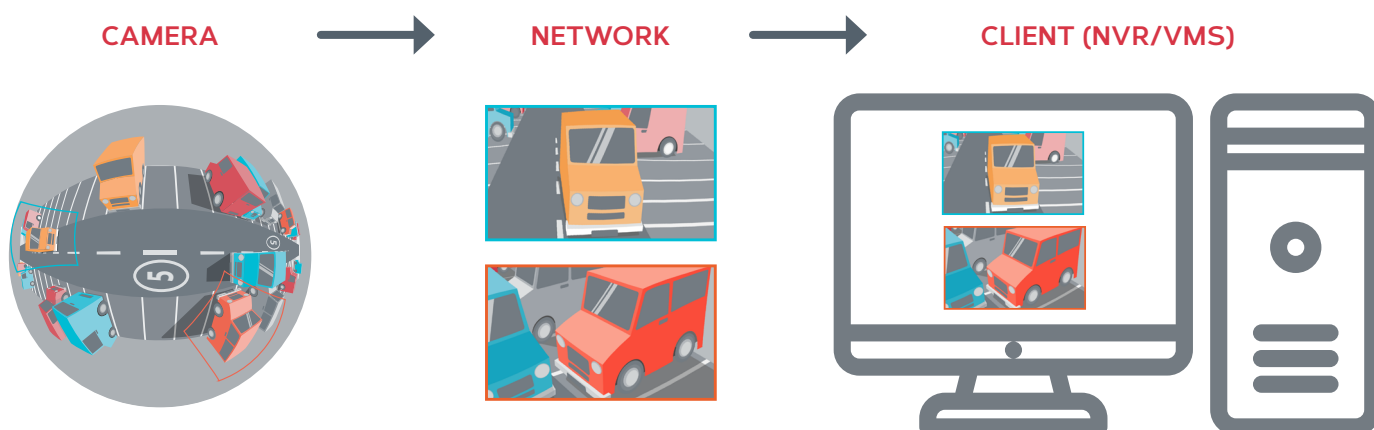


Image 3: How onboard camera side dewarping works

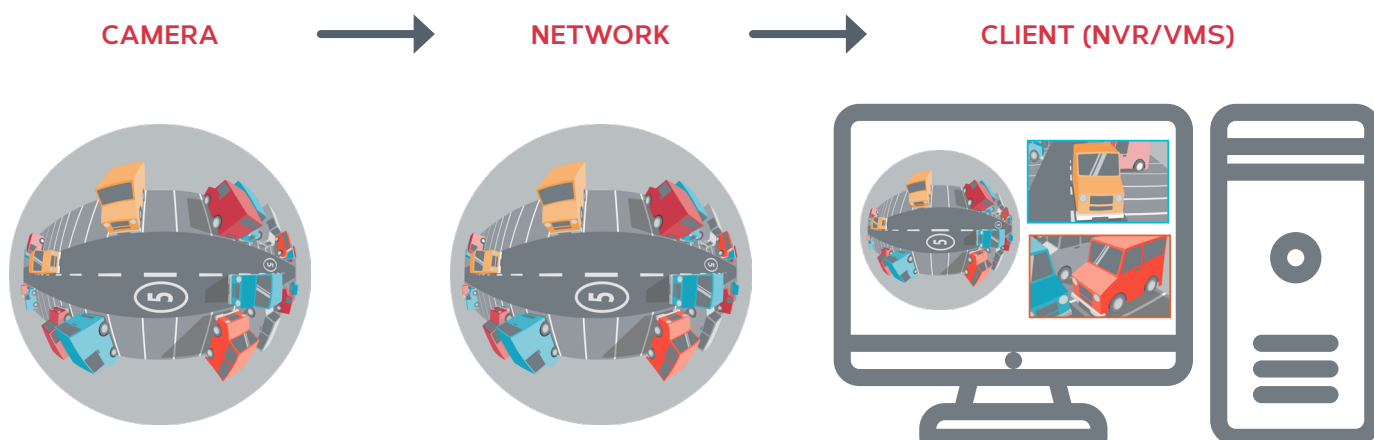


Image 4: How Client side dewarping works

## WHAT IS THE DIFFERENCE BETWEEN SINGLE AND MULTI-SENSOR TECHNOLOGY?

Wide-angle views can be achieved via single-sensor or multi-sensor technology. Single-sensor cameras have one fisheye lens which produces a seamless image. Multi-sensor cameras will use an array of lenses to capture the view.

Multi-sensor panoramic cameras can provide higher levels of detail at further distances as a result of the increased number of sensors being used to make up the image. Some models allow the lenses to be moved and some have different zoom and focus options. The individual images can either be viewed independently or stitched together using software to create a single image. The main benefit of this approach is more pixels on target due to the multiple sensors used.

However, multi-sensor cameras can present several challenges that can be avoided when using single-sensor camera technology

- The use of multiple cameras means they are not discreet units and the form factors can be very large and bulky.
- They can have image stitching issues: if lenses are not properly aligned, blind spots or overlaps are created.
- They can present light balancing issues, as each sensor is normally optimized for brightness and white balance differently and independently.
- They can be more expensive than single-sensor cameras.
- Multiple moving parts can create problems when repairs are required, often necessitating extensive troubleshooting when issues occur.
- Are better suited outdoors and have limited use cases indoors.

## HOW DOES 360-DEGREE TECHNOLOGY COMPARE WITH OTHER TYPES OF CAMERAS?

A smart surveillance solution is one that leverages the different types of cameras available and integrates them based on their main benefits. Limiting to just one type in a system is never advised or encouraged.

If a high level of identification or detail is needed, then a narrow field of view camera can offer more detailed coverage at specific choke points such as entrances and exits. The 360-degree images cover relatively large areas, so there may not be sufficient resolution in all parts of the image for applications such as facial recognition or license plate recognition.

Traditional pan/tilt/zoom (PTZ) cameras continue to have many useful applications, especially where high-detail images are required at a long distance and a live operator is available to control the camera and follow objects and people of interest.

The unique views offered by 360-degree cameras are designed to complement existing technologies, not replace them, and also open up new solution possibilities outside of pure security applications.

## APPLICATIONS OF 360-DEGREE TECHNOLOGY

Thanks to the ability to monitor large areas and provide unparalleled views, the use of 360-degree camera technology is increasing.

But no matter the application, there's one key element that can make or break an entire surveillance system: the quality of the technology. Inadequate surveillance technology can cost organizations time, money and other resources that can thwart their security and business goals.

That's why it's extremely important to take advantage of surveillance systems that leverage the highest quality features to create a usable image or video. When it comes to 360-degree cameras, these features should include:

- A *high-speed frame rate*, which enables users to view live and recorded footage in high resolution without motion judder or blur, and a *guaranteed frame rate*, which makes it easier to comply with applicable minimum legal fps specification standards.
- The latest generation of *HDR technology*, that reveals the finest details in both light and dark areas of every scene for realistic image quality with smooth motion and playback.
- *Advanced compression technology* that can work seamlessly alongside standard compression techniques to increase the compression ratio. This then saves storage costs by significantly reducing the space used by any video recording and saves network infrastructure costs by minimizing the bandwidth of video data being transmitted over the network.
- Optimizing imagery with *low-light technology*, which produces clearer and brighter images with less noise, even in low light conditions.
- Strengthening the *cybersecurity* of the device, increasing the security level of access to the camera and encrypting video and other data transmission.

Operators expect surveillance cameras to be their eyes for what they can't see at all times. And in real life, if someone's eyesight isn't perfect, they use contact lenses or glasses to improve their vision. The same concept should apply to video technology: businesses should look toward features that enhance image quality through aforementioned factors to ensure that they're gaining the highest level of situational awareness and intelligence from their systems.

The availability of efficient compression, light management, and HDR technologies, together with specialized mounting accessories have further added to the influx of adoption, taking the technology use way beyond that of just a conventional security camera.

## ABOUT US

Oncam is a global independent manufacturer specialized in single-sensor 360-degree fisheye cameras and video surveillance technology. The company creates and deploys an open platform with specialized IP video and dewarping technology to create award-winning video-led solutions for stakeholders from C-suite to the security officer in multiple customer sectors. Oncam allows better decisions to be made based on real-world and digital data.

Oncam, founded in 2007, is part of ONVU Technologies Group, and is a leading innovator in 360-degree and panoramic IP video technologies globally. Oncam is headquartered in Switzerland and operates from regional hubs in the UK, US and India.

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