4K to see Increased Demand as Higher Standards for Positive ID are Specified

Says Andrea Iniguez, VP Business Development, Theia Technologies

On a recent tour of OEM camera companies promoting our new 4K lenses, I had the opportunity to take the pulse of these organisations about the emergence of the 4K standard in video surveillance. The majority of these companies felt that the adoption of 4K cameras by the mass security market is at least three years away. It may not see the 4K market reaching critical mass until 2020.

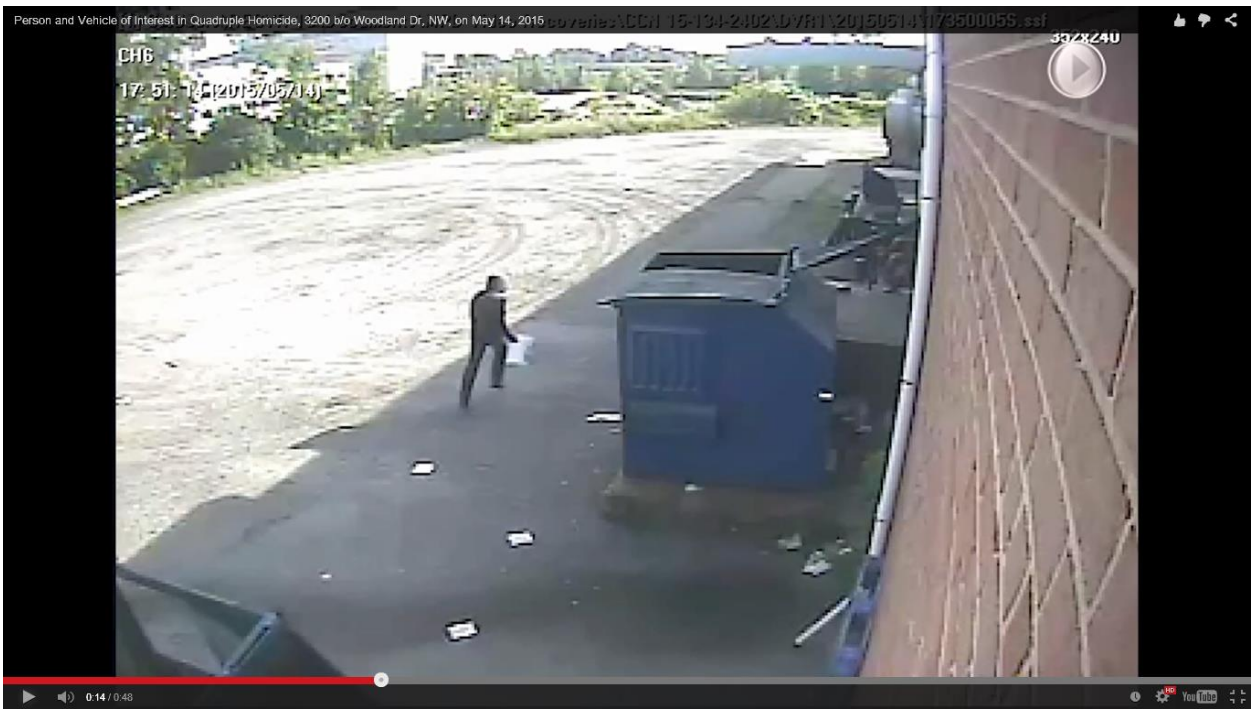
Whichever way you look at it, the security market looks poised to follow the path of HD adoption, with the broadcast media leading the way, raising the expectations of consumers and transferring those expectations to commercial markets (including professional security) two to three years later.

Much has already been written about the factors affecting (read "slowing") the introduction and adoption of 4K as a standard in the security industry. These typically include the cost of infrastructure and hardware items such as monitors, bandwidth and storage. Technological advances in areas like video transmission and improved bandwidth coverage are already addressing these limitations. One specific innovation likely to support faster 4K adoption is H.265 compression. Rapidly declining pricing of 4K monitors will also help speed up adoption.

At the same time, there are demand-led forces at work likely to drive the adoption of 4K in the industry. There is definitely a need for higher image resolution in video surveillance to support the protection of life and property. While no worldwide standard exists, the security industry seems to be heading toward adoption of the EN standard requiring 250 pixels per metre for the purposes of facial identification. Higher resolution cameras and lenses are critical to achieving this and satisfying our appetite for higher detail images.

Certainly, in reviewing video footage in the sad case of the murdered family in Washington DC in May 2015, no one can argue that higher resolution cameras would go a long way to increase the chance of gathering images suitable for positively identifying perpetrators to the level where images can be used as evidence in a court of law.

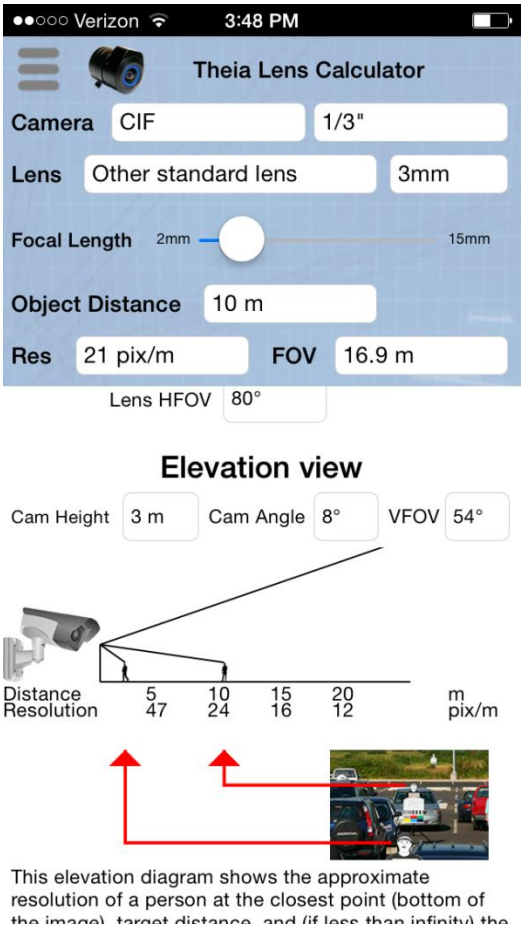
The images below taken from widely available video footage, show that the security camera in place covering this incident was only delivering CIF resolution images (352 x 240 pixels). The images show a suspect or person of interest apparently fleeing. However, the image resolution is so low that the video would be useless for identification purposes. One would even conclude, as did one of my friends and parent of two children, that the system was a waste of public resources. "What's the point?" Good question if it cannot be used to catch an alleged criminal.

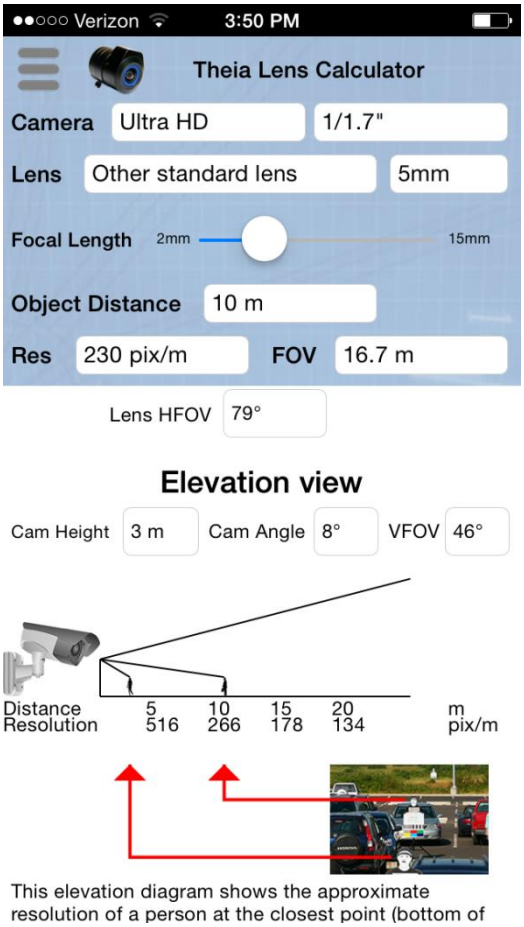


Although we don't know the exact details, we could assume from looking at the images, that the camera is approximately 10 metres away from the subject and the lens is about an 80 degree Horizontal Field Of View (HFOV) lens on a 1/3" sensor CIF camera. In that case, the pixel density in the image is only 21 pixels per metre, roughly 10 times less than the EN standard of 250 pixels per metre needed for facial

identification. At that distance, given the same 80 degree HFOV lens, an Ultra HD 4K camera would provide 230 pixels per metre – still not quite enough for identification, but much closer.

These calculations can easily be performed using a tool such as Theia's Image Resolution/Lens Calculator either at www.Theiatech.com, or in Droid or Apple App versions. See the images below:





But just as we cannot insure against every possible mishap, it is not economically feasible nor socially acceptable to provide video coverage of every possible situation in which an incident or crime may occur.

As is the case in life, in video surveillance we must prioritise environments and situations where the stakes are high. Those are environments in which the threat of loss of human life is higher than normal - such as in a stadium, airport, or rail network. In these high density environments, taking extra care and precaution is warranted.

The authorities are specifying and configuring surveillance systems to spot known behaviours which may predict disorder or place others at risk. The idea is to act faster to neutralise a threat before it escalates.

In one known example in the UK, very high resolution cameras were used in a football stadium to identify the faces of individuals looking down towards the ground rather than straight ahead watching the game. Why would spectators be looking down? Football stadiums across the UK had seen a rise in pyrotechnics being lit in stadiums. In order to light the fireworks perpetrators must look down. Once lit, they kick it down the stand so that when it starts to go off the perpetrator appears to be elsewhere. By specifying high resolution cameras to do this job they were able to identify the real culprits – the ones that lit the firework – and exclude them from the ground - virtually eliminating pyrotechnics incidents in the process.

In these situations 4K video surveillance could definitely add value and would be worthy investments. In these environments, safety and law enforcement teams must be able to monitor, detect, observe, recognise *and identify* suspects and then act on this information rapidly.

Assuming 250 pixels per metre is the minimum requirement for professionally designed and specified video surveillance systems to ensure *positive identification* in situations which warrant it, 4K cameras and lenses naturally support this specification and should be considered by integrators. If an upgrade from an analogue system or lower resolution video surveillance system will be undertaken, it can make sense to leapfrog over HD and implement 4K cameras and lenses. The wider fields of view of the larger 4k sensors and higher resolutions of 4K systems may allow reduction of the total numbers of cameras needed in the system. Once the need for positive identification has been established and the requirement of 250 pixels per metre has been specified, 4K cameras and lenses can be deployed to help upgrade systems to that level (and greater) more easily than HD systems on a camera for camera basis given the same focal length lens. Of course, the investment in infrastructure capable of handling the 4K system must also be made.

For example, an HD camera with a 100 degree HFOV lens, must be only three metres away to achieve 250 pixels per metre. But a 4K UHD camera using an equivalent 100 degree lens, can be positioned a little under seven metres away and still get the desired 250 pixels per metre resolution.

Narrowing the field of view to around eight degrees HFOV with a telephoto lens, one can be approximately 108 metres away from the subject and still get 250 pixels per metre on a 4K UHD camera. But with a HD camera, one can only be 58 metres away to reach the same goal. As the target moves away from the camera and lens in space, the lower the image resolution becomes. These numbers make a significant difference when you are positioning cameras in stadiums, for example where it is not uncommon for cameras to be fitted at one end of the stadium to cover the stand at the other end up to 120 metres away.

But how does the camera manage to get more pixels on target? As with every camera and lens, the image detail or pixel density which determines pixels on target, is calculated by taking the resident number of pixels from the camera and spreading them across the entire HFOV of the lens. The higher the number of original pixels the greater the pixel density, image resolution and number of pixels on target can be delivered.

All camera sensors are carved up into pixels along a grid pattern. A common 1/ 2.8" HD camera sensor has a diagonal of about 6.46 millimetres with about 2.1 million pixels, or a pixel density of approximately 321 thousand pixels per millimetre. In the meantime, a common 1/1.7" UHD 4K camera sensor has a diagonal of around 9.33 millimetres, with about 8.3 million pixels, or a pixel density of 889 thousand pixels per millimetre, nearly three times the density of the HD sensor.

Of course, video surveillance itself does not prevent crime. But even if the higher resolution video footage could only be used in the prosecution of a crime after the fact, the investment in the higher 4K resolution systems would no doubt be justified in many situations. 4K is poised to be included increasingly in surveillance system configurations as 250 pixels per metre (or more) densities are demanded.

We believe that pending CCTV quality standards requirements and continued adoption of innovations in video transmissions, video storage and bandwidth provision, will all combine to see 4K achieving stronger and quicker market penetration than many have predicted.