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WARWICK

# HDR with 20 stops of latitude

**Camera Technology**

**Researchers at the University of Warwick have been working on a High Dynamic Range camera that creates imagery more representative of real world lighting. David Fox finds out more**

A new camera, post production and display system that offers the highest of High Dynamic Range recording, similar to the human eye, has been demonstrated by researchers at the University of Warwick (UK).

A typical broadcast camera can handle about ten to 12 f-stops of dynamic range. High-end cameras, like the Arri Alexa, offer about 15 stops, almost as much as film stock, while the best currently available video camera, the Red Epic, in its HDRx mode, is claimed to offer 18 stops. Each stop up or down represents a doubling or halving of light, so the 20 stops being claimed by Warwick covers everything from deep shadows to the sun in a single shot.

HDR imaging has been available for stills cameras for more than a decade, and HDR video sequences have been assembled from multiple stills, but until now HDR hasn't been possible with realtime video.

"If the human eye can see it, this camera can capture it, and that's the difference — whereas before, with traditional camera technology, you haven't been able to capture what the eye can see. You either have under- or over-exposed parts of the scene," says professor Alan Chalmers, head of the Visualisation Research group, at the university's WMG International Digital Laboratory.

The lab has been conducting HDR research for several years, but this is the first camera that it has worked with, and has been developed as part of a joint venture with the German high precision camera company SpheronVR. In a video made by the lab, the difference between how a broadcast camera and the HDR camera handled a difficult scene (with a light pointing at the camera from behind the speaker) was very obvious.

"We have put together unique compression software with a high performance HDR camera and HDR displays that will revolutionise the use of HDR in a range of applications. The impact will be enormous — for example, the ability to clearly see the football when it is kicked from the shadow of the stadium into sunshine," he says.

"We have also recently successfully trialled its use to assist and document surgery together with the thoracic surgery team and the multi-media group at Heartlands Hospital. HDR is able to accurately capture for the first time the wide range of lighting present in an operation from the dark body cavities through to the bright highlights on the shiny medical instruments," he adds.

"The natural world presents us with a wide range of colours and intensities. In addition, a scene may be constantly changing with, for example, significant differences in lighting levels going from outside to inside or simply as the sun goes behind some clouds, etc. A human eye can cope with those rapid changes and variety but a traditional camera is only capable of capturing a limited range of lighting in any scene. The actual range it can cope with depends on the exposure and f-stop setting of the camera. Anything outside that limited range is either under- or over-exposed.

"HDR imagery offers a more representative description of real world lighting by storing data with a higher bit-depth per pixel than more conventional images. Although HDR imagery for static images has been around for 15 years, it has not been possible to capture HDR video until now. However such HDR images are typically painstakingly created in computer graphics or generated from a number of static images, often merging only four exposures at different stops to build an HDR image.

"Our new HDR camera technology and software enables us to capture and display dynamic HDR images, covering at least 20 f-stops, at full high definition resolution, and at 30fps. Furthermore, HDR can complement 3D technology by providing depth perception without

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the need to wear 3D glasses," he claims.

The researchers have been working with a UK production company Entanglement Productions and IBM's Austin Research Laboratory, as well as SpheronVR. Together they have also set up a spin-off high-tech company specialising in HDR technology, goHDR, which has just released a beta version of its HDR Media Player.

A compressed HDR stream is decompressed in realtime back into HDR content, which can be displayed directly on an HDR display. On a conventional screen it can either be tone-mapped (where the optimum exposures for each shot are combined and displayed as a single exposure) or the viewer can look at the available exposures.

A minute of the HDR footage takes up 42GB (as each frame is 24MB), compared to 9GB for standard HD. goHDR has developed software to allow the HDR content to be viewed online using existing broadband infrastructure. While developing this software, goHDR has obtained a patent for compressing the HDR video by 100-fold or more. The software for watching HDR video on the internet will be distributed free, and the company intends to profit from more sophisticated encoding and viewing products it will licence to camera manufacturers, broadcasters, and HDR application providers.

They have also developed an HDR display, which uses an LED panel behind an LCD panel, with the combination of the two able to show the full range of latitude.

The HDRx system for Red's latest Epic is already in use (although it can't capture the full extent of the scene that the Warwick system can). It can acquire about 18 stops of dynamic range at 5k resolution, at 48fps. In a demonstration video shot by Red (http://red.cachefly.net/walk.m4v) it is possible to see how well HDRx can handle a shot of a man walking from bright sunlight into a dark barn. The recently released Redcine-X programme can recognise the HDRx data and transcode it to other editing formats.

**www2.warwick.ac.uk**
**www.gohdr.com**
**www.spheron.com**
**www.red.com**

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