



2018  
CASE STUDY

# New High-Speed Lighting Technique Illuminates 'Ride Of The Valkyries' In Marvel Blockbuster

Using a Phantom camera and custom lighting rig, one creative studio found a way to move light at eight times the speed of sound – a new lighting technique for high-speed imaging that gained critical acclaim in *Thor: Ragnarok*.

The actors, including Cate Blanchett, stunt performers and soon-to-be-winged horses, take their places against the bluescreen. Above them hangs a large, circular rig adorned with hundreds of strobe lights. As soon as the director calls “action,” artist Carlo Van de Roer hits the button – triggering the high-speed Phantom camera system and lighting array. The bulbs flash sequentially around the ring so fast, it appears to happen instantaneously.

The resulting effect, however, is being lauded by film critics as the most visually-stunning scene in a Marvel movie ever.



*When it's too fast to see and too important not to.*<sup>®</sup>

## A CREATIVE LAB FOR NEW IMAGING TECHNOLOGIES

Van de Roer is the co-founder and creative director of Satellite Lab, a New York City-based creative studio and R&D lab that develops and uses in-camera imaging technology for filmmaking and photography (see sidebar). Van De Roer, along with technical director Stuart Rutherford, founded Satellite Lab to further develop DynamicLight technology, their patented system that enables the use of moving light sources within footage captured at any speed – including the seemingly frozen world of high-speed imaging. The technique utilizes a high-speed camera to arrest a moment of time, as well as software-controlled lighting that moves at the equivalent speed of 10,000 feet per second. “The action we shoot comes across as being suspended in time,” Van de Roer says. “It looks like things are barely moving at all. You get the sense that time is frozen, but we’re able to move the light around within that frozen world.”

Using specialized software, the Satellite Lab team can control the movement of light sources and the movement of the scene as independent variables, enabling Van de Roer and his fellow artists to:

- Control the speed of the light (acceleration and deceleration, for example) relative to the action
- Move light sources on straight, curved or multiple paths
- Use light sources to illuminate in any pattern, whether randomly, in sequence or in a prescribed formation



*The Satellite Lab team programmed the lighting array so that each sequential strobe was synced to a sequential frame in the Phantom camera.*

### SATELLITE LAB TECHNOLOGIES

Satellite Lab specializes in the precise synchronization of strobe lighting to the camera system. In addition to DynamicLight, the lab has developed the following technologies:

- **FrameLight:** Provides the ability to shoot video and stills simultaneously using synchronized strobe lighting.
- **PlateLight:** Patent-pending technology that provides the ability to shoot live action with multiple lighting scenarios simultaneously. Each lighting scenario is acquired as a separate plate, which can be combined in post for creative or technical flexibility and efficiency.



**“We’re talking 10,000 feet per second – or eight times the speed of sound. It’s impossible to move anything that fast physically.”**

## **DYNAMICLIGHT ON THE BIG SCREEN**

The lab’s work on DynamicLight attracted Hollywood’s attention. Van de Roer and his colleagues received a call from Taika Waititi, director of the 2017 film from Marvel Studios, *Thor: Ragnarok*. The filmmaker wanted to collaborate with Satellite Lab on a slow-motion flashback scene, during which Valkyrie and her fellow Asgardian warriors lead an attack on the villainous Hela (played by Cate Blanchett) while riding flying horses. To emphasize the fact that the scene was a memory and therefore a departure from the linear storyline, Waititi wanted to shoot it using DynamicLight technology. “The combination of high-speed imaging and moving light creates this sense that time and space are out of whack,” Van de Roer says. “Like time itself is moving through this brief moment in a slow, soupy way.”

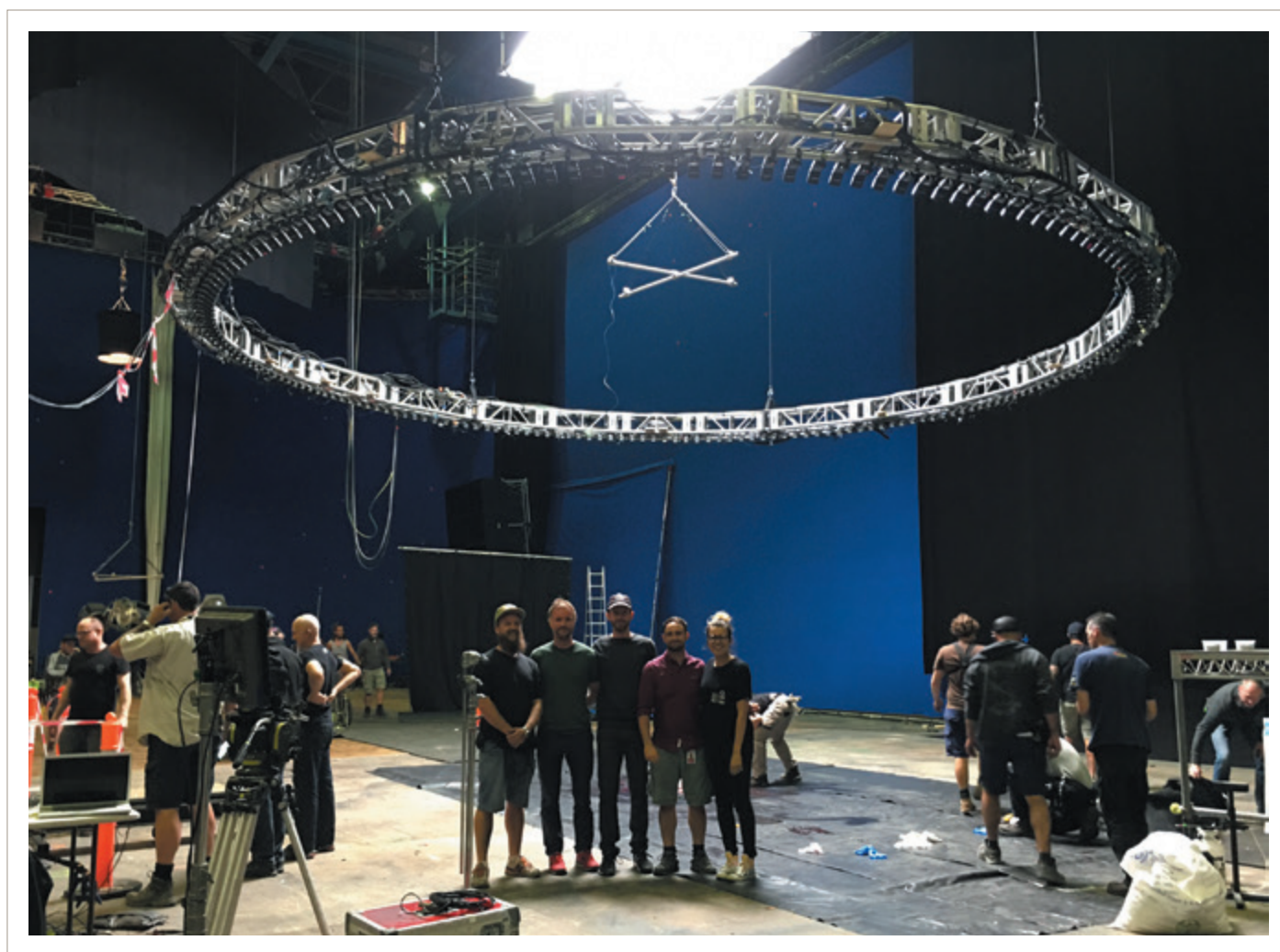
The Satellite Lab team collaborated with the film’s visual effects studio, Rising Sun Pictures, and VFX supervisor Jake Morrison to create the epic flashback scene, which they shot using a Phantom high-speed camera and custom lighting array. “When you work with high-speed cameras, you need a lot of light,” Van de Roer says. “Once you get above 2,500 frames per second, you have to bring in large lighting units. But these units are big, expensive and heavy.”

### **WHY LIGHTING MATTERS AT HIGH SPEEDS**

When it comes to camera systems, lighting always matters. It takes on even greater importance when shooting at high speeds because insufficient or the wrong kind of lighting can ruin the shot. When you increase the frame rate, you’re also increasing the amount of light required to properly expose the subject. For example, shooting at 1,000 fps requires 5.25 times more light than shooting at 24 or 25 fps. Oftentimes, filmmakers will opt to use LED light sources. For one, LEDs are inherently cooler than other light sources, such as tungsten, and are available in a variety of sizes, configurations and output levels. LEDs also leverage DC power, which, unlike AC power, is a continuous light that is not prone to flicker during high-speed video playback. And finally, many LED lighting systems are powered by a removable battery, making them easy and convenient to use in the field.

Instead, Van de Roer and his team constructed a massive steel ring that they hung over the actors during filming. Connected to this ring were 200 individual strobe lights. Although each strobe light was only a few inches wide, it could emit as much light in a short burst as the larger LED units typically used for high-speed imaging (see sidebar). “When we were first developing DynamicLight, we had to figure out how to move a light source very fast,” Van de Roer says. “We’re talking 10,000 feet per second – or eight times the speed of sound. It’s impossible to move anything that fast physically.”

The array enabled Van de Roer and his team move the light digitally. Using special Satellite Lab software, they synchronized each flash to a single frame of action with their Phantom Flex4K high-speed camera. Designed for cinematography, this camera provides exceptional flexibility with its frame rate capabilities; it can shoot at speeds up to 1,000 fps at 4K and 2,000 fps at 2K/1080p. In addition, its super-35mm 4K sensor provides sharp, detailed images with low noise and high dynamic range.



*Van de Roer (middle) and the Satellite Lab team pose under the lighting array, which can move light at 10,000 feet per second – or 8 times the speed of sound.*



For the flashback scene, Van de Roer and his team filmed the actors at 1,000 fps. They also programmed the array so that each sequential strobe was synced to a sequential frame in the camera. In real-time, the flashes looped around the array so quickly, it appeared to happen instantaneously for everyone else on set. But in the high-speed replay, each flash stretched across five seconds – appearing to dance around the faces of the actors as they moved in slow-motion.

“The result is a playful representation of time,” Van de Roer says. “It conveys the tension between how we’re used to seeing time operate and how we actually do see time operate.”

*Cover image used with permission from Marvel Studios.*



*Designed for cinematography, the Phantom Flex4K high-speed camera can shoot at speeds up to 1,000 fps at 4K and 2,000 fps at 2K/1080p*



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