

# C O D E X

2019 - ISSUE 12

4K PRODUCTION CASE STUDIES | DP INTERVIEWS | DIT STORIES

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MARY POPPINS RETURNS



HIGH DENSITY ENCODING



CHRIS BOLTON DIT



CAPTURED ON  
**CODEX**

**SUCCESS STORY: COLD WAR**  
**CINEMATOGRAPHER: ŁUKASZ ŻAL**  
**RELEASE: 2018**

# CRAFTING A STARK AESTHETIC

Łukasz Żal, PSC shoots on the very edge of invisibility for *Cold War*



***Cold War* is a 1950s-era love story between a musician and a singer whose fraught, intermittent affair is haunted by Europe's tragic past.** Based loosely on the story of director Paweł Pawlikowski's parents, the film has been nominated for three Oscars including Best Foreign Language Film, Best Directing, and Best Cinematography for director of photography Łukasz Żal, PSC. Żal has also received nods from the ASC and BAFTA and took the Silver Frog at the Camerimage Festival in his native Poland.



Żal and Pawlikowski made a strong impression in 2013 with *Ida*, which shares some visual aspects with *Cold War* – it's presented in black and white, in a less horizontal, 1.37:1 frame. But Żal says that *Cold War* was a much more involved and expensive production. Prep included, he worked on the film for more than a year, and the visual style, filming locations and period required extensive visual effects that are completely unnoticed in the final product.

**Shooting ARRIRAW on Codex was an amazing advantage. That's in addition to the low light capabilities. We were sometimes shooting on the very edge of invisibility**

Łukasz Żal

"The idea for the film was to build everything in layers behind, with quite deep depth of field, instead of using width to create interesting compositions," says Żal. "Paweł had been shooting documentaries in that aspect ratio, and we felt that it's powerful and less obvious. You can play with it. Sometimes we placed people on the bottom of the frame, with more space above their heads. You can create an image that is more like a poster, and it strengthens the link to older films of that era, too."

With more effects work, a bigger budget, and the deep focus approach, the filmmakers chose to work with ARRI ALEXA XT. Unlike *Ida*, *Cold War* was shot using the trusted Codex recording system in the ARRI ALEXA XT and XR drives capturing images in the 3.4K ARRIRAW format, resulting in extra image data that helped when a shot needed a slight reframing in post. The lenses were mainly ARRI/Zeiss Ultra Primes, as well as Cooke S4s and Angenieux zooms. The Ultra Primes were chosen for the neutrality and clarity – part of the discipline the filmmakers imposed as part of their overall approach.

For this film, I chose the lenses because they don't have a specific look," Żal says. "They're perfect, and they work well wide open. They show you the work as it is, with no distractions. That meant we had to concentrate on what was in front of the camera, paying attention to every detail in creating a space where everything is in focus."



Early in the process, Żal shot side-by-side tests with ALEXA/ARRIRAW and 35 mm film. They based two LUTs – one for night and one for day – on the graded 35 mm film images.

"In post, we spent a lot of time observing grain from Kodak's 500T stock, how 35 mm film works in the blacks and whites and contrast, and playing with it in our images," he says. "It's intriguing, adding final touches in order to find the silver image that was our aim. When you work really hard at it, and put all those elements together, it starts to look quite interesting. You can feel the three dimensions of the space. Eventually, we fell in love with those images."

Finding the proper contrast was key to the entire visual strategy – true of any black and white film, but in this case, a metaphor for the two extremely different characters. Żal boosted contrast subtly as narrative tension was raised.

"They were struggling most in the Paris scenes, so we were working to achieve the strongest contrast, and a feeling of glamour," he says. "I was looking for part of the image to be completely without detail, like you see with film. In grading, we used masks as a painter might, trying to make things very unequal. In other cases, we created contrast between scenes rather than within – very bright scenes, even with some burnt areas, and then very dark scenes."



Having the luxury of high-resolution monitors on the set allowed for the necessary precision. "If you can't see all the details in the blacks, for example, you can't place things so well in the frame," he says. "In that regard, shooting ARRIRAW on Codex was an amazing advantage. That's in addition to the low light capabilities. We were sometimes shooting on the very edge of invisibility."

Extensive green screen shots and compositing helped sell scenes shot in Poland as Paris and Berlin locales. In some locations, LED blue boxes outside windows were replaced and tiny bits of movement were added in the deep background

"This may have been the most technically demanding part of making the movie," says Żal. "When you have a lot of short shots and cuts, and the background elements are not in sharp focus, it's easier for those scenes to work. The production designers and post supervisors helped design the new reality behind the windows. Shooting the elements with the right focal length, focus, brightness and exposure, and blending it without an artificial feeling is very painstaking, especially for a shot that lasts 20 seconds. There's a lot of blood and sweat behind those images!"

Amazon Studios acquired the film in August 2017. *Cold War* premiered at the 2018 Cannes Film Festival, where Pawlikowski earned best director honours. Looking back on the experience after six months of prep and a seven-month shoot, Żal says every movie is like a chapter in his life.

"Collaborating with Paweł on *Cold War* was an incredible experience and honour," says Żal. "I'm greatly humbled by the recognition from the Academy and the ASC, and I'm grateful to Amazon Studios for supporting this film. I'm looking forward to the next journey."



A day exterior with Kulig is captured with a handheld ARRI ALEXA XT on Codex XR drives. Like *Ida*, *Cold War* was shot in colour and desaturated to black and white in post. Also as with *Ida*, the lighting, production design, costumes and background were designed for monochrome. Video village monitored the shoot in black and white. "I couldn't think of a colour that would make sense," Pawlikowski says of the feature's black and white imperative. "There was no colour in Poland in the 1940s and Fifties. It was all grey, brown and greenish. We played with the notion of shooting the picture [in a way that would approximate] the East German/Soviet stock Orwo, with its washed-out greens and reds, but I felt it would seem too mannered."

**Camera Negative:** Codex ARRIRAW 3.4 OpenGate  
**Camera Type:** ARRI ALEXA XT with Codex XR Capture Drives  
**Lenses:** ARRI/Zeiss Ultra Primes, Cooke S4s and Angenieux zooms  
**Camera Rental:** Out of Frame – Warsaw  
**Digital Intermediate Services by:** DI Factory



CAPTURED ON  
**CODEX**

SUCCESS STORY: MARY POPPINS RETURNS  
CINEMATOGRAPHER: DION BEEBE, ASC, ACS  
RELEASE: 2018

# SUPER COLOUR REBOOT

Codex goes behind the scenes with DoP Dion Beebe, ASC, ACS on the making of *Mary Poppins Returns*.



**Mary Poppins, the 1964 Disney classic, won five Oscars and was nominated for eight more, including Best Cinematography for Edward Colman, ASC.** More than fifty years later, the makers of *Mary Poppins Returns* had to reckon with the older film's heavyweight status in popular culture.



"We knew our film would be quickly compared to the original," says director of photography Dion Beebe, ASC, ACS. "So, we obviously needed to tip our hat, so to speak, and acknowledge the 1964 *Mary Poppins*."

Beebe and director Rob Marshall had previous experience bringing Broadway musicals to the screen, but the sequel offered the chance to build a musical from the ground up. Early on, they decided on a widescreen aspect ratio. The duo had gone with film emulsion on several of their previous five collaborations, including the Oscar-nominated *Chicago* and *Memoirs of a Geisha* – the latter of which earned Beebe an Academy Award.

**Shooting digital was definitely better suited to the methodical attention to detail needed**

Dion Beebe, ASC, ACS

In the case of *Mary Poppins Returns*, they chose to shoot with ARRI ALEXA SXT in ARRIRAW to Codex SXR Capture Drives, combined with Panavision G- and T Series anamorphic prime lenses and Panavision zooms. *Mary Poppins Returns* became one of the first Disney features to work with a 100% ACES on-set colour workflow.

"Rob's current working style is much more conducive to digital," says Beebe. "He can watch the actors and study their choreography on a high-def monitor. Shooting digital was definitely better suited to the methodical attention to detail needed on this assignment."

Depicting Mary's fantastical journeys also required extensive visual effects. Many of the more elaborate numbers called for three cameras. And in partial homage to the older film, some scenes combine live action with animation designed in a flatter, hand-drawn style. These factors also weighed in the decisions about format and workflow.



"It was just a really fantastic experience to work on ideas, sketching characters and coming up with ways to make everything work together," says Beebe. "We talked about how to incorporate camera movement and blocking to make sure these two worlds meet and interact."

Beebe often recorded rehearsals with a handheld Sony A7S for use in fine-tuning blocking and framing. Sometimes the rehearsals included cardboard cut-out stand-ins for the animated characters and elements. "The animators were there on the set when we recorded rehearsals, so they could get a feeling for the camera movement," he says. "I also had to think about their point of view, and how my decisions would impact the animation. The hand-drawn animation has an almost found spontaneity. It has a strange feeling, almost like a work-in-progress, because the finishes are not slick.

Rob purposefully kept that slight edge, where the characters are not fully finished and rendered smoothly. He really embraced the hand-drawn style, and the results are wonderful. It was important to consider that style and maintain it when it came to shoot the live action."

Careful control of colour was essential to success. Lookup Tables were created in pre-production with the input of costume designer Sandy Powell and production designer John Myhre.



"Our overall approach was the render a 1930s Depression-era London in fairly muted tones, giving us a platform that would lead off into the fantasy numbers with Mary and the children," says Beebe. "We created a lot of colour contrast between our real-life London to the fantasy world that she comes up to. We wanted a very vivid, colourful world that she enters. Particularly when you get into a lot of vivid colour, the question is how to complement those colours, and how to create a look for each of these numbers. They each have their own style and approach, so they're not just a mash-up of primary colours. There's also a lot of fine tuning in post through the DI." Capturing in RAW was essential to this process.

*Mary Poppins Returns* was also Beebe's first go using an ACES workflow. Incorporating the LUTs designed in the early stages required some adaptation, but that was managed seamlessly, he says. Disney was deeply involved as was the post production team. Peter Doyle and Michael Hatzer at Technicolor helped out with LUT design, dailies and final DI.



DIT Peter Welch oversaw the recording, which was done in ARRIRAW format in a variety of sensor modes, including 4:3 2.8K, Open Gate 3.4K and 16:8 2.8K to Codex SXR Capture Drives. Welch built identical DIT rigs for the second unit and the visual effects unit to ensure consistency throughout. On-set colour was controlled via Pomfort LiveGrade and the data management on Codex equipment.

*Mary Poppins Returns* debuted over Christmas and continues to show legs almost one month on. Worldwide box office is reportedly nearing \$300 million, more than double the estimated production budget of approximately \$130 million.

Beebe has gone on to shoot *I Am Woman*, the story of 1970s singer and feminist icon Helen Reddy, with director Unjoo Moon. Dion chose the ARRI ALEXA 65 and a Codex workflow for this project as well. Marshall and Beebe are already making plans for another Disney project, *The Little Mermaid*. That film is planned as a live-action remake of the 1989 animated hit.

**Camera Negative:** ARRIRAW

**Camera Type:** ARRI ALEXA SXT with Codex SXR Capture Drives

**Camera Equipment Provided by:** Panavision London

**Digital Intermediate Services by:** Technicolor Creative Services

**VFX provided by:** Framestore London; Cinesite London

# MEDIAVAULT

*Bridging the Storage Gap*



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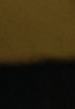
CAPTURED ON

**CODEx**

SUCCESS STORY: WELCOME TO MARWEN  
CINEMATOGRAPHER: C. KIM MILES, CSC  
RELEASE: 2016

# A WORLD IN MINIATURE

Shooting ALEXA 65 RAW with Codex in a Miniature World.



**In the world of top-shelf filmmaking, Robert Zemeckis is known for working at the farthest edge of technology's capabilities.** His collaborators know that they will be working with, and in some cases inventing, techniques as they go. A list of the director's credits is a series of landmarks in visual storytelling and its tools: *Back to the Future*, *Who Framed Roger Rabbit*, *Forrest Gump*, *The Polar Express*. Many of the techniques developed in these films and others went on to become go-to solutions in cinema production.



The technical puzzles behind *Welcome to Marwen*, Zemeckis's most recent foray, had their seeds in the mind of Mark Hogancamp, the real-life victim of a brutal beating who recovered in part through the creation of a 1/6-scale town populated with dolls representing himself and his friends. His story was eventually the subject of a documentary film, titled *Marwencol*, which piqued Zemeckis's interest.

Cinematographer C. Kim Miles, CSC was brought on to handle the images. In the tiny town, seen through Hogancamp's imagination, the characters were to be brought to life as a unique blend of *Polar Express*-style motion capture and live action. Other portions of the film are depicted with more standard realistic photography.

**The most remarkable thing about the Codex and the Vault system that we used is how unremarkable it was**

C. Kim Miles, CSC

"I thought if anyone could pull this off, it would be Bob," says Miles. "They were exploring ways of achieving the doll representation without ending up in the uncanny valley. Kevin Baillie, our visual effects supervisor, suggested that the fundamental problem with audiences not connecting with high-res animated characters revolved mainly around how their eyes and mouths were rendered. No matter how well something is done in CG, that's where the human mind looks for a connection. Once you have real eyes with real moisture and real reflections in the eyeball, it really makes a huge difference in the digital dolls – although it is still kind of bizarre to look at!"

Prep work had led Baillie to avoid real actors, whose movements just seemed wrong when they tried to act like dolls. Motion capture allowed the dolls to be presented as more rigid, with the facial features of the actual actors applied. Further tests showed that lighting the dolls and their sets normally, during the shoot, saved the expense of lighting and modelling in post.

"The doll world was essentially miniature photography in reverse," says Miles. "With miniatures, you're usually doing things to make it look bigger than it is – shooting at 60 frames per second, for example. Our challenge was the opposite – to shoot full scale objects and actors and make them feel miniature. The biggest thing with shooting miniatures is the ratio of the size of your capture surface to the objects that you're photographing. So, if you're shooting 35mm stills of plastic dolls and you're filling the frame with their faces on a 50mm lens, then you're only about eight inches away from these dolls, which gives you a pretty incredible depth of field falloff. There was no way to get a sensor that was in the correct proportion, but we thought we should get something as big as we could."



Tests with large-sensor cameras indicated that the ARRI ALEXA 65 was the right choice. The Codex Vault-XL was a key element in a dependable workflow that kept huge amounts of data moving quickly and smoothly through complex and interrelated shooting, visual effects and post processes.

"The ALEXA 65 seemed like a win-win," says Miles. "It was a platform that I was familiar with. It was the largest sensor that was available."

To take full advantage of the sensor without vignetting, Miles shot with Ultra Prime 65mm lenses from ARRI. Lighting the mo-cap situations came with other conundrums. The filmmakers took lighting cues from Hogancamp's actual photographs. Because the motion capture cameras within the volume were infrared sensitive, new ways of lighting the actors had to be devised so that the light didn't destroy all of the mo-cap information. Hogancamp often lit with bundles of Christmas tree lights, so Miles and his team strung clear, bare 40-watt bulbs into 12X12 frames, which looked great on the faces, he says, and were correct in scale.

The ALEXA 65 might seem like a counterintuitive choice. "I'm very much a dynamic range guy, rather than pixel count," says Miles. "But I was a little nervous about whether it would be too unforgiving. And I found it to be quite the opposite, because there is so much surface area to the capture sensor. The falloff on actors' faces is so much more forgiving. I found it really flattering for the female characters. As soon as we tested it, we were just blown away by the quality and the portrait capabilities of the camera. That's why photographers shoot medium format or large format still photography. It's just so much more aesthetically pleasing. It solved a lot more problems in terms of imperfection than it exposed. That was a pleasant surprise. Originally, we were going to do the doll world stuff on the 65 and then shoot the real-world stuff on a regular super 35 size sensor with an ALEXA. We ended up falling in love with what the 65 looked like, so we just shot the whole movie on the 65."



The ARRI ALEXA 65 works with the Codex Vault-XL. See this interview with DIT Chris Bolton for more info on the workflow.

"The most remarkable thing about the Codex and the Vault system that we used is how unremarkable it was," says Miles. "I don't recall us ever having any issues with any form of data management. Everything just went smoothly. On the A65, you can't help but roll terabytes of data every day. The volume of data was something I'd never experienced before. But in terms of its robustness and ease of use, there was not a single issue from my perspective. Codex and ARRI were very supportive, and any questions or concern we had, they'd addressed right away. I know that post production was very pleased with the workflow."

In fact, Kevin Baillie was an early supporter of the ALEXA idea because they'd just been through a bunch of stuff with a different camera and workflow that caused them a lot of issues. They were very glad to have a more stable platform from which to start their work. Our shooting LUTs translated very well into post, and the DI was a treat."



Looking back on the project, Miles says he relished the opportunity. "I discovered on this show was that it's really fun to be problem-solving in situations that have never come up before," he says. "We were doing stuff that no one's ever done. It was a group of people who were all focused on achieving the same goal. We created a workflow that worked for everybody. We addressed our problems early so that the post production visual effects processes were as smooth as possible, because we knew they had their hands full making these dolls come to life."

After *Welcome to Marwen* wrapped, Miles was invited to shoot *Project Blue Book*, a ten-part miniseries, executive produced by Zemeckis, about UFO sightings in the 1950s. He describes it as "*The X Files* meets *Mad Men*."

**Camera Negative:** Codex RAW  
**Camera Type:** ARRI ALEXA65  
**Camera Equipment Provided by:** ARRI Rental  
**Digital Intermediate Services by:** Technicolor Creative Services  
**VFX provided by:** Atomic Fiction and Framestore  
**Miniatures provided by:** Creation Consultants



SUCCESS STORY: AQUAMAN  
CINEMATOGRAPHER: DON BURGESS, ASC  
RELEASE: 2018

# GOING TO GREATER DEPTHS

Creating separate worlds for *Aquaman* called for a data-rich pipeline



**The stunning images in *Aquaman*, currently leading at the box office, reveals an astonishing world of colour and depth.** Director James Wan was brought in to create and shape this world – fresh, arresting and fantastical. Wan, one of the minds behind the moneymaking *Saw* franchise, also brought his producing skills to the undertaking. Behind the camera on *Aquaman* was Don Burgess, ASC, whose vast experience includes a number of technological milestones like *Terminator 3: Rise of the Machines*, as well as memorable, effects-heavy Robert Zemeckis films like *Forrest Gump*, *Cast Away*, *Spider-Man Flight* and *What Lies Beneath*.



Wan, Burgess and their team reportedly had \$160 million to create the unique worlds they envisioned for *Aquaman*, travelling to Morocco and Canada along the way. The main sets were built in Australia, where numerous locations were also found. Billed as an attempt to break the superhero mould and create something distinct, the film follows the watery DC Comics hero's journey as he searches his past and discovers that he is worthy of becoming king.

"We had an open canvas to design the film, and James is a very visual guy," says Burgess. "That was a great place to start. It's a movie that takes place in situations from above the surface down to the bottom of the ocean, so we had to create those worlds from scratch. Until the movie was completed, it's a world that only existed in artists' renderings. To me, an

important question was always 'At what depth does this scene take place?' That was my guide for how to approach a given scene in terms of light, colour palette and colour temperature. It gets colder and darker as you get deeper. You've got to keep reminding yourself of where you are and light accordingly. It brought a method to the madness. It's fun to sit around a table and come up with reasons for light and what it should look like. And a good way is coming back to good and evil, and helping the audience feel the threat, and hopefully see it through the eyes of the hero."

After testing a number of cameras and formats, and considering the wishes of the studio, Burgess settled on shooting ARRI ALEXA SXT cameras capturing ARRIRAW in OpenGate format direct to Codex XR and SXR Capture Drives. This was the setup used for about 80% of the film, with RED 6K Weapon and ALEXA Mini cameras used when a smaller, lighter profile was called for. The lenses were Panavision Primo 70, with some standard Primos in specialised situations.

The undersea setting also had major implications for visual effects and stunt work. An extensive prep period was taken up partly with finding convincing ways to depict underwater movement. The interactive motion of light was designed to help sell the illusion.

"We used some old techniques, like hard sources through water trays, which was fun," says Burgess. "The light penetrates the moving water and falls on the actual set piece. Some of the other units that I used actually have patterns and movement to them, which works great in certain situations. We worked with a wide variety of colour temperatures to get the feel of any particular zone that we were in. Scenes closer to the surface should feel more movement, as though the sun is actually penetrating to that depth, and there's actually a surface in motion above."



Throughout, Burgess strove to provide his visual effects colleagues with maximum resolution.

"They've gotten so good at making things seamless," he says. "Taking all these images and data and creating a unified source – it's fantastic. They're doing the heavy lifting, so you want to give them the best images possible. On a movie this size, with so many different visual effects companies involved, workflow is very important. Data management, and the way the data has to travel around the planet to actually get all of the shots made – it's come a long way.

"Years ago, I developed my own workflow on *The Book of Eli*," says Burgess. "But then every studio started developing their own ways, with their tech deals with various labs and post houses. For many reasons, the material never looked like I could make it look. I had to fight a lot of battles. We were always ahead of the technology because Bob [Zemeckis] could push us beyond. And if you look at those movies, the effects work is phenomenal. But workflows are much more comfortable now than they were."

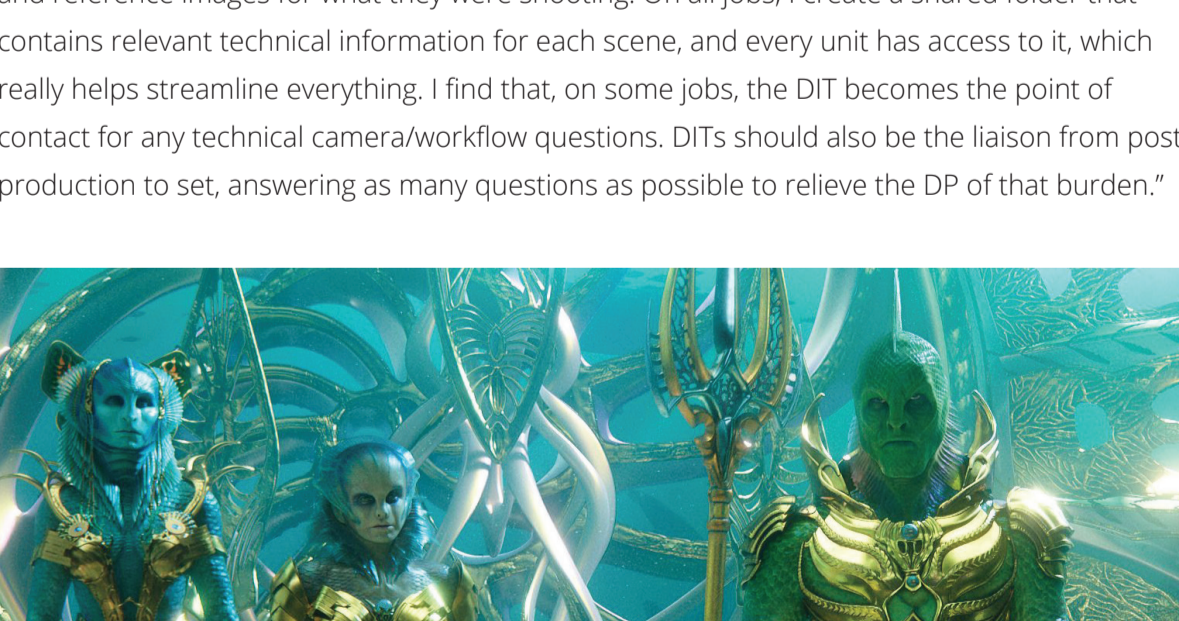
For *Aquaman*, Burgess and DIT Jason Bauer used FotoKem's nextLAB dailies system on-site at the studios. Bauer did an initial backup and QC check before sending the Codex Capture Drives to post, where FotoKem used Codex Capture Drive Docks to ingest the RAW camera data and would generate materials for editorial and visual effects directly from the RAW captured images. The image pipeline maintained 4K resolution throughout.



"Working at higher resolution creates an even more visually stunning final product, which is especially appreciated in an IMAX theatre," says Bauer. "Don's approach was to do as much as possible in-camera, and to create a digital negative as close to the desired final product as possible. This is why RAW capture is key. His goal was to keep the manipulation of the image simple, since the camera media was going through so many different VFX vendors and stages. We had one LUT that was used as the base look. We would set the desired T-stops on the lenses and then work closely with the gaffer, Shaun Conway, to dial in the levels in regard to density and colour to achieve the look that Don was after for a given scene."

Any additional colour on set was done using Pomfort LiveGrade. CDLs were exported from LiveGrade and given to FotoKem to be applied to the digital negative. Bauer also worked with First AC Donny Steinberg to monitor exposure, colour, flicker, frame rate and shutter angle.

"We also had a large second unit and several splinter units that shot simultaneously with main unit," says Bauer. "I was the liaison for technical information, providing shooting specs and reference images for what they were shooting. On all jobs, I create a shared folder that contains relevant technical information for each scene, and every unit has access to it, which really helps streamline everything. I find that, on some jobs, the DIT becomes the point of contact for any technical camera/workflow questions. DITs should also be the liaison from post production to set, answering as many questions as possible to relieve the DP of that burden."



Bauer also oversaw a strict protocol regarding framing and acquisition format. The ARRIRAW 3.4K OpenGate format, protecting for 95% of the frame, had a limit of 90 frames per second. When higher frame rates were called for, resolution was dropped to ARRIRAW 3.2K 16:9, protecting for 100%. That shift affected the field of view slightly, which could cause an issue for visual effect if not flagged.

"For every single shot, from every camera, the VFX data wrangler would get the focal distance information from the camera assistants, and the T-stops and shooting specifications from me," says Bauer. "All this information would end up on the camera reports and was placed on the shared folder to help with the visual effects down the pipeline."

Since *Aquaman* wrapped, Bauer has worked on several projects, including director Jaume Collet-Serra's film *Jungle Cruise*, based on the Disney theme park ride and shot by Flavio Labiano. Burgess has since gone on to shoot *Sextuplets*, an effects-heavy comedy starring Marlon Wayans in multiple roles, and the Netflix project *The Christmas Chronicles*, which stars Kurt Russell.

Regarding *Aquaman*, Burgess says, "I'm very happy with the way the movie turned out and the way it looks."

Given the box office numbers, it's likely that DC Comics and Warner Bros. are also pleased. After its first week in release, *Aquaman* had generated more than \$650 million in ticket sales.

**Cameras:** ARRI ALEXA SXT, ALEXA Mini, RED 6K Weapon  
**Lenses:** Panavision Primo, Primo 70  
**DIT:** Jason Bauer

**Post Partner:** Warner Brothers Motion Picture Imaging (MPI)

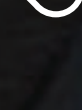
**Camera Equipment Provided by:** Panavision Sydney



## ARRIRAW HDE CASE STUDY

# HIGH DENSITY ENCODING [HDE]

## Spider-Man: Far From Home



### What is High Density Encoding?

Codex High Density Encoding [HDE] is an encoding technique optimised for Bayer pattern images and provides bitexact data reduction of uncompressed camera ARRIRAW files from cameras like those in the ARRI ALEXA family. For example, the size of a single ARRIRAW OpenGate frame at 3.4K resolution is 11.5MB, meaning that an hour is 996.2GB. HDE can reduce this with up to a 2:1 ratio.



### Initial Reaction

When HDE was first presented to key studio executives and post production partners it received a great reception, because everyone who saw it understood that it mitigates the need for increased storage and streamlines ARRIRAW workflows with lossless data compression. The reduced file size provides efficiencies all the way from dailies to VFX pulls to the final digital intermediate. The benefits are obvious to studios like Marvel whose productions are international in scope and include large numbers of VFX shots or to Netflix, whose production slate continues to grow and grow and who demand the highest quality RAW content for their feature and original series acquisition.

**Codex High Density Encoding doubles your transmission speeds and improves many aspects of your uncompressed RAW workflow pipeline**

### Spider-Man: Far From Home

*Spider-Man: Far From Home* is a follow-up to *Spider-Man: Homecoming*. The script revolves around Peter Parker and his friends going on a European vacation. It was clear early on that there would be multiple production locations in Europe and the United States. Principal photography was based at Warner Bros. Leavesden Studios, just outside London with additional locations in and around New York, Prague and Venice. These location changes placed particular challenges on the production and post production teams. Like *Spider-Man: Homecoming*, this was a co-production between Marvel Studios and Sony Pictures and was directed by Jon Watts.

A common challenge on many projects, including *Spider-Man: Far From Home*, is moving files securely from one place to another. Every single frame captured to be sent back to Los Angeles, so the volume of data to be transferred was large.

A simple workflow was set up by Sony and Marvel to meet this challenge, using Codex HDE to reduce the size of the ARRIRAW files, with no sacrifice to the integrity of the ARRIRAW images.



DIT Francesco Luigi Giardello (*Jurassic World: Fallen Kingdom*, *Thor: The Dark World*, *Aladdin*) and his team assisted cinematographer Matthew J. Lloyd (*Daredevil*, *The Defenders*) on *Spider-Man: Far From Home*. The primary camera used was the ARRI ALEXA Mini, shooting ARRIRAW Open Gate (3424 x 2202). The main unit had 3 Minis, and so did the 2nd Unit. Francesco and his team provided the ARRIRAW files on Codex Transfer Drives to the near-set lab. They were then cloned to a local ARRIRAW (network-attached storage) as HDE ARRIRAW files using Codex Production Suite. The file size was reduced by an average of 40%. The smaller data footprint meant that the entire movie online (on a 200TB NAS) for the duration of the shoot. This was extremely useful – if production had to return to a roll or a shoot day for regrades or metadata adjustments, they had instant access to the files they needed rather than having to wait while material was retrieved from an LTO tape.

**Integration into our products was quick and easy and the smaller data footprint improves the efficiency of our high-performance workflows, making for faster rushes turnaround**

Instead of shipping hard drives from London back to Marvel Studios in Los Angeles, the HDE ARRIRAW files were pushed via a 10GbE switch and Aspera. The smaller file size dramatically reduced the amount of data that had to be relayed from London to Los Angeles. Checksums ensured data integrity prior to Open EXR files being generated for VFX using Marvel's VFX Plates lab built on Codex Vault hardware.

Filmlight's Daylight was used to generate dailies directly from the HDE ARRIRAW files – specifically MXF files for editorial and PIX-compatible files for viewing and review at Sony and Marvel. Filmlight rose to the challenge of supporting HDE deliverables by integrating High Density Encoding into both their Daylight and Baselight products. Filmlight's integration of HDE into Baselight means that the HDE files can be used for the final digital intermediate grading.



**Codex High Density Encoding saves on storage capacity, time and money. It is a solution "that changes everything."**

## HDE KNOWLEDGE BASE

### Facts

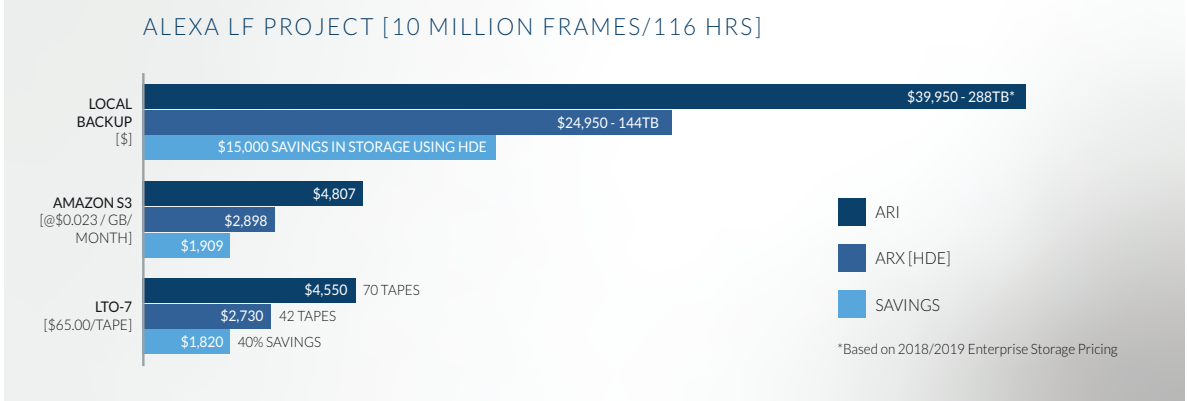
- HDE stands for High Density Encoding.
- HDE reduces ARRIRAW and other bayer pattern file sizes by around 40%.
- When an ARRIRAW image is encoded as HDE, the file extension changes from .ari to .arx. The image essence is encoded, but the file header is otherwise identical.
- HDE encoding is lossless - when an HDE file is decoded, it is a bit-for-bit perfect match to the original file.
- HDE can be used on ARRIRAW images of any resolution.



### Example HDE File Size Reduction

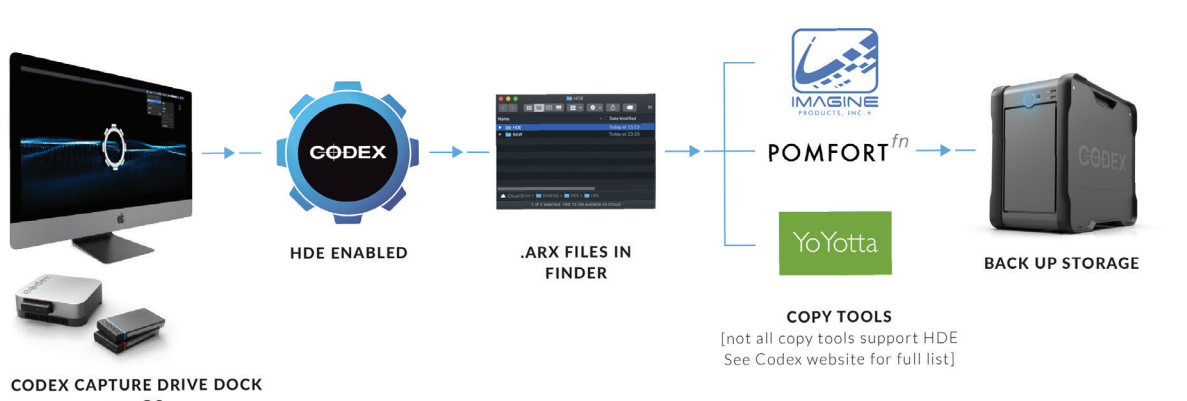
### Advantages

- Lossless reduction of the storage size of ARRIRAW images.
- All the original pixel values can be accessed.
- The reduction in size for ARRIRAW images drastically reduces storage costs and file transfer times, speeding up your workflow and saving you money.



### Performance

- HDE provides fast encode/decode speed. (CPU dependent)
- 4K ARRIRAW image can comfortably be encoded at 24fps on a modern MacBook Pro laptop.
- ALEXA LF OpenGate (4448x3096) can be encoded at over 50fps using a 10-core iMac Pro.



Learn more about Codex High Density Encoding and HDE Partners [here](#).





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# WELCOME TO WORKFLOW

Codex talks to DIT, Chris Bolton and his work on *Welcome to Marwen*



**When a devastating attack shatters Mark Hogancamp (Steve Carell) and wipes away all memories, no one expected recovery.** Putting together pieces from his old and new life, Mark meticulously creates a wondrous town where he can heal and be heroic. As he builds an astonishing art installation - a testament to the most powerful women he knows through his fantasy world, he draws the strength to triumph in the real one. In a bold, wondrous and timely film, *Welcome to Marwen* shows that when your only weapon is your imagination...you'll find courage in the most unexpected place. However, when it came to the production data workflow for this project, Chris Bolton, DIT, left nothing to the imagination. Working with an incredible team from production to post, Chris outlined his approach to this show and the overall workflow.

**What was it like working with such a technical Director as Robert Zemeckis? Was DoP C. Kim Miles just as technical or did you have to help out a lot?**

When I learned I was awarded *Welcome to Marwen* under the direction of Robert Zemeckis and the keen eye of C. Kim Miles, I knew I had to step up my work to another level as Robert expects the very best from his crew.

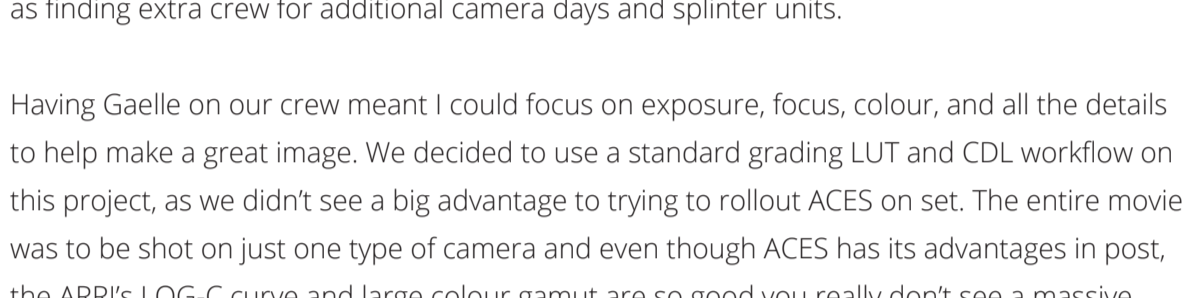
Even though this was not an action film with difficult locations, and a vast array of cameras, like some of my previous projects, *Welcome to Marwen* took place in two worlds. One based in reality and one based in fantasy, so it was important to know what world we were shooting in. Robert lived and breathed this project and being such an incredible story teller and visual thinker, he knew what was technically possible with the motion picture gear and expected his crew to be masterful with each of their professions.

**The Codex Vault XL offload system was on a cart on the camera truck for all locations and was a smart plan**  
*Chris Bolton*

C. Kim Miles is an incredibly technical Director of Photography when it comes to lighting and the aesthetics of good photography. Kim knew how to plan ahead and hire the right people who complemented his strengths, so he didn't have to spend time on the small details that took him away from the story telling process. Though this was my first time working with C Kim Miles his reputation preceded him, beyond hearing he has a masterful eye. He also is an amazing leader. I knew I had to work with him. My broad range of experience in camera, photography and post workflows along with the amazing camera team led by A Camera 1st AC Douglas Lavender, Kim knew the story was in good hands.

**How many A65 cameras were used on this show?**

Our main unit utilised two Alexa 65's with a third body for splinter units and 2nd Units. The last 4 weeks of production were on a motion capture stage where we carried an additional body for the mo-cap scenes. Robert Zemeckis and C. Kim Miles prefer to shoot with minimal numbers of cameras, without limiting camera movement and allowing for the best possible lighting and composition for each scene. Shooting with too many cameras can compromise the photography.



**Were you managing colour on set as well as data? Or did you have a utility assist for DIT work and Data was handled by someone else?**

Shooting with the Alexa 65 creates massive RAW files, this made it essential to hire a Digital Loader to take care of the backup of the camera original footage and to create a detailed database of metadata and scene information for every shot. The Codex Vault-XL offload system was on a cart on the camera truck for all locations and was a smart plan. Our camera team was very fortunate to have Gaelle Jeco behind our precious footage. She was basically our camera departments best boy, who along with taking care of the data also took care of ordering daily gear, keeping all of the departments scheduling and paperwork sorted, as well as finding extra crew for additional camera days and splinter units.

Having Gaelle on our crew meant I could focus on exposure, focus, colour, and all the details to help make a great image. We decided to use a standard grading LUT and CDL workflow on this project, as we didn't see a big advantage to trying to rollout ACES on set. The entire movie was to be shot on just one type of camera and even though ACES has its advantages in post, the ARRI's LOG-C curve and large colour gamut are so good you really don't see a massive difference when linearising and viewing in REC709. If we did view in HDR, then I could see ACES as a big benefit.

For applying the colour changes to the live SDI feed we used Pomfort Live Grade along with the FSI BOX-IO hardware. The software allowed us to not only generate and apply the LUTs and CDL's, but also create non-destructive reference grabs thanks to the FSI BOX IO's. This allowed me to regrade retroactively if the look altered at all during the scene. Being able to go back and refresh the still with a new look parameter was very useful. The library compare feature was very useful when shooting scenes out of order or picking up portions of a scene at a later time.

**Were you cloning and processing direct to Transfer Drives and shipping these to near-set or local post in Vancouver?**

Gaelle was cloning and processing the Alexa 65 footage from the 2TB media to 8TB SSD Transfer Drives using the Codex XL that was parked on the camera truck. The Transfer Drive was then shipped to our production office where Technicolor had setup a dailies system at our production office. They used another Codex Vault-XL for ingesting the data from the Codex Transfer Drive to a RAID array and LTO attached by 40Gb fibre.

This process of backing up the footage and generating the LTO tapes typically took about 36 hours so the production had to carry enough camera media to last us two full shooting days as the Codex Capture Drive media acted as our on-set backed-up.

This was a little bit of different work flow than what I have become used to. Normally I would have an on-set RAID to duplicate the footage to be held for a couple of days. It would not financially viable to build and/or rent a system that would live on the truck, that could do this in a timely manner.

**How much data did you generate on a given day?**

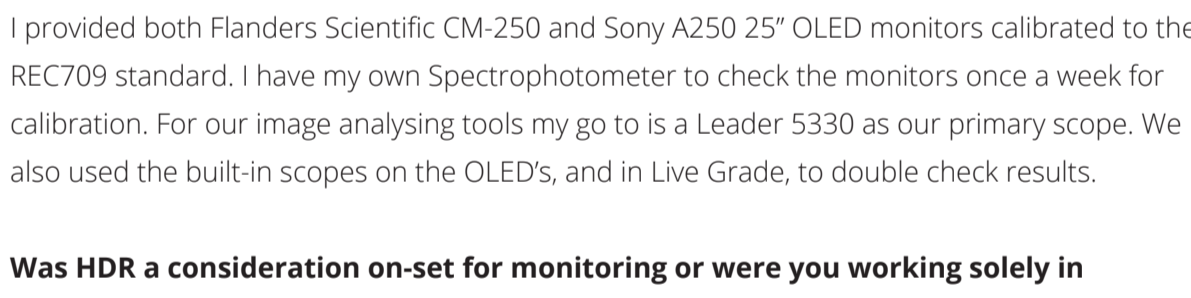
Our footage volume varied a fair amount. Some days we would shoot as little as 6TB and on other days it would go as high as 24TB. With the Alexa 65 this is not totally unusual.

Thankfully Robert Zemeckis doesn't like rolling resets, this helped in the amount of data that was shot. We call this the "old school approach" where the director would save the film in the camera whenever possible. This in my opinion shows a lot of respect for the craft and the production team.

**Did you manage the motion capture data as well, or was this and pre-vis a whole separate entity for data?**

No, I only assisted the VFX team with a few of the data points that they needed from the camera. During the live action components, we had a small VFX team taking care of the necessary notes needed by the VFX houses.

During our weeks in the Motion Capture volume, our VFX team ballooned to a large team taking care of the witness cameras, live tracking markers on actors, cameras, and set objects. The team also produced a live representation of the CG dolls and virtual set to help formulate the shooting angles and lenses to be used. This also helped show the actors the environment that they would be interacting with.



**Besides camera, what other "metadata" is passed through your department? Camera Reports? Sound Reports? Any stills from the DP? Any technical data from VFX that you needed to back-up along with the RAW data?**

Our department took care of the camera footage, the audio departments Broadcast Wave files, DIT colour notes, CDL's, reference grabs and the odd alternate camera footage that was used for monitor playback. A complete VFX team took care of all the witness cameras, motion capture data, and camera position information. The one thing the team really liked was using the Prime 65 lenses. The camera displayed the focus position and T stop right on the SDI display. They kept all the playback video so they could check notes when needed.

**Was their near-set dailies and post? Did you work with this team closely throughout the show or with the local post facility in any capacity?**

Our near set dailies were taken care of by a team from Technicolor Los Angeles that set up a small dailies facility at our production office. We communicated at least once a day, and I was their liaison on-set if any questions were raised. Derek Hogue from Image Movers oversaw the whole production to post production process. We had a lot of discussions early on setting up the area we would extract from the sensor, based on reverse pixel level math, so we had the ideal capture area for down sample, and optimum delivery of all the side car files.

**Were you using a "show" LUT when grading with Pomfort LiveGrade and then creating CDLs that were used for dailies?**

We did consider using ACES on this project on-set, but when shooting with the ARRILOG-C curve and large colour gamut, we decided to utilise 33Cube grading LUT's and CDL's for camera matching, and to mould the look to the specific scene using the CDL controls. During the camera tests I created a 3D LUT based off of a Kodachrome film emulation, and a K2S2 LUT that got us into the ball park of what C. Kim Miles wanted. Kim wanted to create two distinctive looks. A real-world look shot on the ARRI Vintage Primes and utilised a K2S2 starting point, with some custom modifications, and a Doll World look shot with the Prime 65 lenses and a custom Kodachrome. This created the doll world that came out of Mark Hogancamp's mind. Kim wanted each portion of the film to feel uniquely different, to help convey the realities that Mark was experiencing between his real life and his fantasy world.

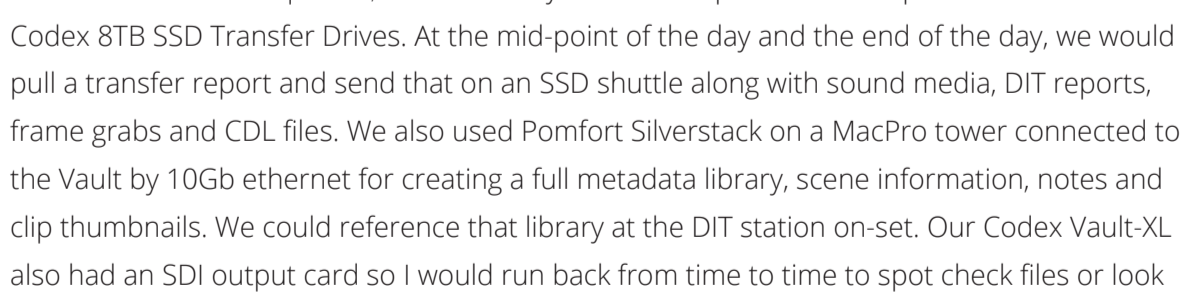
Kim wanted the Real world to feel less attractive, cooler colour palette and just more honest. And the Doll World would feel warm, vibrant with the look of a "feel good" 1950's movie hence the Kodachrome emulation. Later we took the footage into a remote grading session with legendary finishing colourist Maxine Gervais in a Technicolor LA. We sat in a P3 calibrated DCI 2K grading theatre and recreated the looks in a proper DI theatre so we could see how the image would look on a proper cinema screen. We also tested a fair amount of diffusion filters, and we both fell in love with one specific set that I'll let Kim reveal if he wants to. All this gave us confidence in what we would shoot over the two months of production. After our grading session, Technicolor did a conversion from the P3 colour space to the various flavours of grading LUT's that we would need for near-set, for dailies, offline editorial and the grading outs used on-set. I feel working from where the image will end up, and working backwards, gives the most precise and reliable outcomes. This also eliminates any possible colour pipeline issues later.

**What monitors are you using on-set? What scopes?**

I provided both Flanders Scientific CM-250 and Sony A250 25" OLED monitors calibrated to the REC709 standard. I have my own Spectrophotometer to check the monitors once a week for calibration. For our image analysing tools my go to is a Leader 5330 as our primary scope. We also used the built-in scopes on the OLED's, and in Live Grade, to double check results.

**Was HDR a consideration on-set for monitoring or were you working solely in ITU709?**

HDR was certainly a consideration but we were all in an agreement that it was really only practical as a finishing process, and not necessary for monitoring on set, as long as we protected the highlights when we thought it would be advantageous for HDR. Also carrying around a 65" Dolby Vision Pulsar monitor would have been difficult and not practical.



**What were the biggest challenges during production?**

The biggest challenge was our shooting schedule. Robert and Steve Carell like to work short days, who can blame them! We did what's called Pacific North West Hours, which meant we only really get 11 hours a day to setup, shoot and wrap. Though it was really nice to go home at a great time every day, we also had to have everything planned, and be as efficient as possible. This also meant zero down time due to technical issues.

Thankfully everything on the show went very well because of the amazing planning by Robert Zemeckis, and our amazing 1st AD Lee Gromett. We also had an internationally recognised top notch crew, so we wrapped a day early on the production schedule.

**How about locations? It seems like you were on stages but also outside, and lots of green screen. Did this present any production hurdles for digital imaging monitoring?**

This project was very tame when it came to difficult locations. Though we didn't have difficult locations precision was absolutely critically for Robert. The biggest hurdle during production was the Motion Capture component, where we had a massive array of images on set. For each camera feed we also had a live 3D animated preview of the doll characters, a composite of both the live action and 3D dolls where they placed the actors face to the CG dolls to see how the lighting and action would line up. At times we had up to 9 feeds going at once at 3 different villages. Our playback operator Justin Johns and his assistant Erica Fabian were working very hard indeed.

**Did you wire up directly to camera or use wireless monitoring with all of the Steadicam work?**

We really did a mix of hard wire and wireless. Anytime we could go hardwire we would as you just get a cleaner and more reliable image. I had some custom SDI repeater boxes made that allowed us to use up to 400-foot runs using copper cable so we often didn't have to use fibre. We did have a couple days where a splinter unit was shooting in the next stage and we utilised a fibre system to get to the set which was about 2000' away in the next stage. Our HD transmitters were a mix of Paralinx and Teradek which mostly worked well.

**Were there additional cameras used besides the A65? High Speed (Phantom or RED)? Alexa Mini?**

Every single frame that was live action in *Welcome to Marwen* was shot on the Alexa 65. We had an Alexa Mini on hot standby just in case we needed a small form factor camera but with Peter Wilkie our A camera operator and Chris Jones his dolly grip at the helm, we never had to jump to another camera platform. So, it's safe to say that 100% of the project was shot on the Alexa 65. It certainly shows! We also used the Alexa 65's in the Motion Capture stage to capture the facial performances from the actors. The CGI team would then incorporate the mouth and eyes onto the CG dolls. The only other cameras we used were an array of 6 Alexa XT cameras, frame synced together for capturing face element for CG texture mapping, and a little Sony handy cam for shooting a shot for a TV playback element.



**How did the Codex portion of the workflow work for you and the data management? What gear were you supplied in the end?**

ARRI Rental supplied our main unit, and our near set post office with a Codex Vault-XL, along with 6 8TB SSD Codex Transfer Drives, for transferring the footage to Post. Splinter Units and 2nd Units utilised a Codex Vault-S with the Alexa 65 specific hardware and software since there was only 1 camera. The Vaults also converted the footage from the native sensor data to an ARRI RAW file sequence, that is directly readable in post. That was processed on the Codex ARRI RAW Transfer Drives. At the mid-point of the day and the end of the day, we would pull a transfer report and send that on an SSD shuttle along with sound media, DIT reports, frame grabs and CDL files. We also used Pomfort Silverstark on a MacPro tower connected to the Vault by 10Gb ethernet for creating a full metadata library, scene information, notes and clip thumbnails. We could reference that library at the DIT station on-set. Our Codex Vault-XL also had an SDI output card so I would run back from time to time to spot check files or look at details that the SDI output from the Alexa 65 can't show in full 6K glory. In some occasions we would offload some 4K QuickTime files and frame grabs to look at certain files on set, if we expected any image artifacts due to moiré, aliasing or lighting flicker or phasing.

**Was this a fun production overall?**

I have to say that this was one of the best productions I have ever worked on. If anyone ever wanted to do a case study on the most organised, efficient, and professional production sets this would be it. If you IMDb this project you would be very surprised at the depth of experience our crews have. The biggest component to this was the fact we had Olympian level heads of department that worked and communicated with the crew with confidence, clarity and humanity. I don't think I heard anyone ever raise their voice or freak out once on this project. It's pretty normal on big projects for someone at some point will lose their cool. It was an absolute honour and a pleasure to work with some of the most talented people I have ever known in my 17 years in film. We really had an amazing team!

**What have you done since this production and what are you working on now?**

After *Welcome to Marwen* I was very fortunate to work with the Legendary Director of Photography Russell Carpenter on a Disney project called *Noelle* starring Anna Kendrick, Bill Hader and Shirley MaLaine to name a few. It was my first Christmas feature and comes out Christmas 2019 and had impressive set builds, and a challenging winter location. After that I worked on a number of commercials for Hyundai, Kia, Pfizer and many more. Then landed 2nd Unit on a Paramount Pictures project called *Sonic*, a live action adaption of the popular *Sonic the Hedgehog* video game produced by Paramount Pictures. I had the pleasure to work with Peter Collister on this project. Just recently I finished a Pilot for Fox Networks shot by the talented cinematographer and storyteller Checco Varese.



San Francisco for *Birth of the Dragon*

**Camera Negative:** Codex RAW

**Camera Type:** ARRI ALEXA65

**Camera Equipment Provided by:** ARRI Rental

**Digital Intermediate Services by:** Technicolor Creative Services

**VFX provided by:** Atomic Fiction and Framestore

**Miniatures provided by:** Creation Consultants



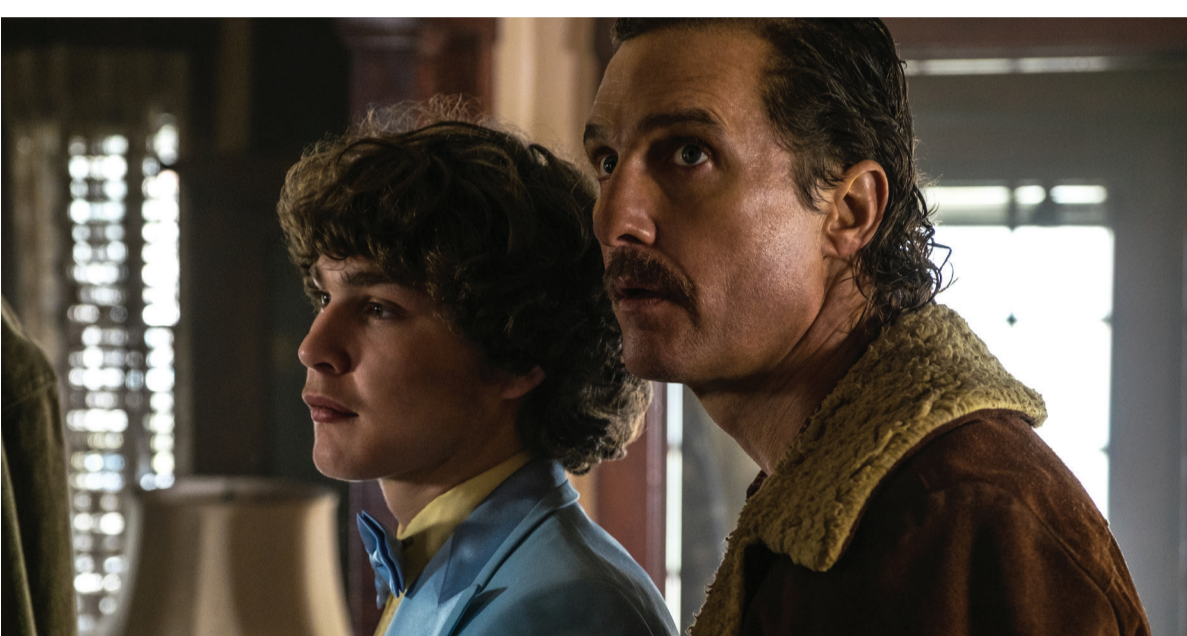
SUCCESS STORY: WHITE BOY RICK  
 CINEMATOGRAPHER: TAT RADCLIFFE  
 RELEASE: 2018

# CAPTURING 1980'S DETROIT

Tat Radcliffe contrasts a bleak Detroit with colour-rich Vegas on *White Boy Rick*.



**White Boy Rick translates the real-life story of a 14-year-old delinquent who was recruited by the FBI to infiltrate the world of illegal drugs in crack-infested 1980's Detroit.** Variety's Peter DeBruge described the look created for the film by director Yann Demange and cinematographer Tat Radcliffe as "scuzzy" and "tetanus-infected." The Wrap's reviewer, Peter Gilchrist called it "a frequently indelible experience, charged with unique energy and impact." The impressive cast features Oscar winner Matthew McConaughey and Oscar nominees Piper Laurie, Bruce Dern, and Jennifer Jason Leigh.



Radcliffe and Demange enjoy a longstanding creative association that has produced the U.K. series *Top Boy*, which earned the DP a BAFTA nomination, as well as *Criminal Justice* and *Dead Set*. Their film set in Belfast at the height of The Troubles, titled *'71*, took eight British Independent Film Award nominations, including one for cinematography.

For *White Boy Rick*, the duo found their way to a look during the course of location scouts, where Radcliffe shot stills, manipulated them with an app that mimics vintage camera stocks, and discussed them with the director. But Radcliffe places great importance on saving his options for the moment of photography.

**Everything is more robust and reliable. And because we were recording in ARRIRAW, we had a lot more latitude and color information**

Daniel Hernandez

"The stills are really just for texture and flavor, rather than for locking in a particular look," says Radcliffe. "We tend to leave things to the last possible moment because everything changes. We do storyboard – it's not a cavalier approach – but on the day of the shoot, all the variables come into focus. You have to think fast. I find that approach very exciting, and over the years Yann and I have developed a working method that is very timely, rather than planning a very specific look beforehand."

"They were, however, keen to shoot anamorphic, and a visit to Panavision led to a package that included C and E Series lenses, as well as a set of G Series that are less prone to flaring, which Radcliffe points out can be a distraction in the wrong situation. The cameras were ALEXA XTs and Minis, using a LUT created with DI colorist Tom Poole at Company 3. The data-rich ARRIRAW format, secured on Codex Capture Drives, would help the filmmakers maintain their improvisational shooting process in a range of unpredictable practical locations, which included actual crack houses and abandoned buildings.

"Yann and I started to think a while ago that our films didn't necessarily require an even, consistent way of shooting or lighting," says Radcliffe. "And I think that's especially true on this film, with this young white kid in a very African-American environment, these two completely separate worlds. We definitely wanted to show the bleakness of the world that was home – slightly desaturated, colorless. In a way, that was done more through the production design, where we removed as much color as possible. Then, when we got into Vegas, we really let rip with as much color as possible. We didn't hold back. We wanted the audience to see these two worlds, and feel the incredibly exciting vibe of light and color, from the perspective of Ricky."



Cleveland stood in for Detroit for tax reasons but offered an advantage in that unlike Detroit, the Ohio city is still lit with sodium vapor lamps. The cameras were often handheld or on Steadicam, and the focal length was often 40 or 50mm, with the 75mm used frequently on close-ups. The approach to blocking and staging featured many long scenes, and sometimes 360-degree coverage in the dingy locations.

Radcliffe says that DIT Daniel Hernandez was "absolutely vital" on the project. "Working with him was the first time that I really understood how useful and valuable the DIT can be," he says. "I'm operating, so I don't usually have time to sit at the monitor and pay close attention to what we're getting. But all the time, I know that Danny's got his eyes on it, and he can warn me if things go a little bit awry."

Hernandez controlled exposure and made adjustments to color and contrast using LiveGrade. Files were downloaded from the Codex Capture Drives to local RAIDs that were then sent to EC3 for dailies, along with stills and CDs with his adjustments. The dailies colorist was Adrian Delude at EC3.

"The weather was wintry and cold, so the color adjustments were often to give it a cooler look," says Hernandez. "Also, there was some variation in the lenses in terms of color and the way they handled flares, so some matching was needed. Sometimes, if the lens was a little too soft, we'd add contrast, or soften them a bit if they were too sharp. We had several lenses designed by Panavision with less coating, which meant they reacted differently to light, especially if there was backlight from a window. I'd talk to Tat if the windows were getting too washed out, and maybe we'd switch over to a more contrasty lens."



Hernandez has been depending on Codex gear going all the way back to 2008 when he was working on *Avatar*.

"Back then, we were using Codex drives for playback, because that was the only thing that could handle 3D," he says. "Ever since then, it's been a very reliable way to go. You record to the mag, bring it back, and download it – you don't even have to think about it anymore. Everything is more robust and reliable. And because we were recording in ARRIRAW, we had a lot more latitude and color information, and more flexibility later."

In the truck, Hernandez had the ability to show his colleagues the actual ARRIRAW image immediately after download – an important advantage when judging nuances in exposure and lighting. "Everything is smaller now, so we could set up in very tiny spaces, and stay close to the set," he says. "Tat could shoot, and go right into the next room to check the image. With a normal, full-sized DIT cart, in some situations, I would have had to stay outside. Being mobile, with the versatility to adapt quickly, was important in some of the situations we were shooting in."



The digital intermediate was done over the course of two weeks in New York with Tom Poole.

"It was one of the easiest and most pleasant DITs I've ever worked on," says Radcliffe. "Tom had done a fair amount of work when I arrived, and from there it was just tweaks and nudges. It was just lovely to have that time to finesse little details because basically, the main work had all been done."

Radcliffe and Hernandez went on to shoot HBO's *Lovecraft Country* on the ARRI LF with Panavision lenses. Hernandez is working on the live-action adaptation of *Lady and the Tramp*, destined for Disney's streaming service. After appearing at Telluride and Toronto, *White Boy Rick* hit theaters on September 14.

**Cameras:** ARRI ALEXA XT, ALEXA Mini  
**Lenses:** Panavision G, C, E Series  
**DIT:** Daniel Hernandez  
**Post Partners:** Company 3



# SWAMP THING RETURNS

Codex goes behind the scenes with DIT Andy Bader on bringing DC's latest comic book hero to the small screen.

**Swamp Thing is a fictional superhero from the comic books published by DC Comics. A humanoid plant and elemental creature, created by writer Len Wein and artist Bernie Wrightson, the Swamp Thing has had several humanoid and monster incarnations in various different storylines over the years.** The *Swamp Thing* character first appeared in *House of Secrets* back in 1971 in a stand-alone horror story set in the early 20th century. *Swamp Thing* then returned in a solo series set in the contemporary world of the general known DC universe. The character is a swamp monster that resembles an anthropomorphic mound of vegetable matter that fights to protect his swamp home, the environment in general, and humanity from various supernatural and terrorist threats.



The character found perhaps its greatest popularity during the 1970s and early 1990s. Outside of an extensive comic book history, the *Swamp Thing* has inspired two theatrical films, a live-action television series, and a five-part animated series, among other media. IGN ranked *Swamp Thing* number 28th in the "Top 100 Comic Book Heroes" list.

*Swamp Thing* appeared in his first live adaptation in the 1982 film. Dick Durock portrayed *Swamp Thing* while Ray Wise played Alec Holland. Durock rose again from the swamp in the sequel film *The Return of Swamp Thing* along with playing the role of Alec Holland. Durock reprised the role once again in the 1990 television series. The new *Swamp Thing* is being produced by James Wan. Wan previously produced the feature films of *The Conjuring Universe*. In this new incarnation, *Swamp Thing* will be played by Derek Mears with Andy Bean playing his human form Alec Holland. The new television series currently in production will launch on the new video-on-demand service operated by DC Entertainment and Warner Bros. Digital Networks.

**Codex had a chance to go behind the scenes on the new series with DIT Andy Bader, to gain a deeper understanding of the workflow utilised for this project and working with the new ARRI ALEXA LF camera.**



Cinematographer Pedro Luque (*Jacob's Ladder*, *Extinction*) shot the pilot and set the shows look. DP's Fernando Argüelles and Nate Goodman have been alternating the rest of the season adding their own personal treatments to each episode.

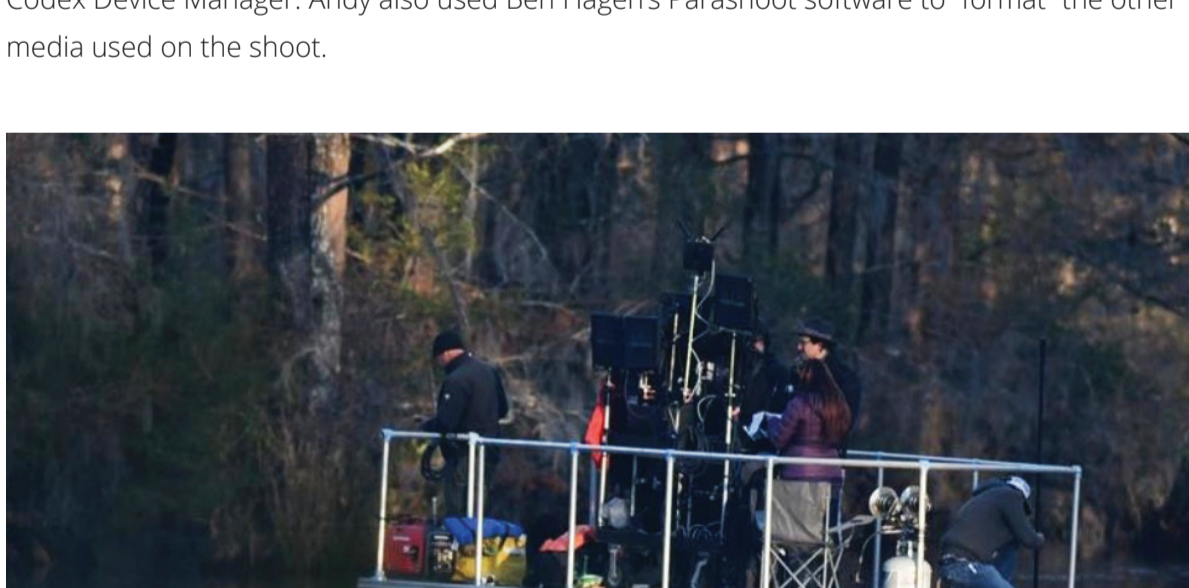
The DP's have all been using the ARRI ALEXA LF camera and shooting in a 2.2:1 aspect ratio with Panavision T-series anamorphic lenses. Capturing in 4.5K Open Gate mode (4448 x 3096) in Apple ProRes 4444 to 1TB Codex SXR Capture Drives. Colour correcting direct from the live Log C legal range image through a LUT provided by the show's colourist and post facility. Andy used Pomfort LiveGrade Pro to set looks and to save the CDLs that were shuttled along the camera footage to the near-set dailies team provided by Sim Digital to process and transcode the editorial footage.

**I love working with multiple DP's on the show. It keeps things fresh and interesting**

Andy Bader

Andy handled the data management at his own DIT cart. Preferring to handle the data management directly allows Andy to have access to the archives in case any captured footage needs to be checked, reviewed or regraded. This also allowed the camera department utility to be free to help the entire department and not just running back and forth to the camera truck all the time. Using a Codex SXR Capture Drive Dock connected to a 2018 Macbook Pro with an Apple TB3 to TB2 adapter, Andy made clones of the ProRes material and verified each Capture Drive, copied properly to the external shuttle drives provided by production. Andy has assembled his own custom DIT cart over the years, fully equipped for almost any set-up, with OLED monitors and waveform and vectorscopes. The Codex SXR Capture Drives and the Capture Drive Dock for this show were provided through Panavision Atlanta with the rest of the camera package.

Shooting a healthy mix of stage and practical locations, the cart and setup that Andy designed allowed him to move seamlessly between the varied locations used for the show. "The production art department, led by production designer Bill Davis and art director Jason Bistarkey, did an incredible job of creating the swamp on Stage 10 at Screen Gems in Wilmington, NC." The entire stage is a huge water tank with moveable land masses to create different "areas" within the swamp environment. Most of the swamp is just a few feet deep but there is a section in the middle that is deeper for more demanding water work. Several regular sets have been built on the other stages as Stage 10 is dedicated to the swamp scenes. Production also made use of a few visually interesting locations around the town of Wilmington, North Carolina. Shooting at a quirky little artist's retreat, which looked great in context to the shoot but was actually rather demanding both physically and logistically for the production. The show has also shot some of the larger-scale boat work on nearby Greenfield Lake. Andy had to have his DIT cart positioned on the lake, on a barge, which was "a first and only slightly nerve-wracking." To keep it simple, Andy made use of Codex SXR Capture Drives to easily mount the SXR Capture Drives and to erase and format them once finally archived. Andy used Pomfort's Offload Manager to transfer and verify the footage presented by the Codex Device Manager. Andy also used Ben Hagen's Parashoot software to "format" the other media used on the shoot.



Monitoring HD on set with a pair of Sony PVM-A250 25" OLED monitors and routing the SDI signal through a Blackmagic Ultrastudio, Andy uses Scopebox software to make sure exposure was correct and that nothing was clipping or crushing in the blacks. When required, Andy would ride the iris as much as necessary but this was only required on special occasions as *Swamp Thing* wasn't really a "day exterior show" with the sun going in and out of the clouds but was more of a controlled set environment. Most shots were set at a fixed T-stop and usually the lighting and atmosphere were kept at a consistent level between set-ups. That said, Andy had to pull iris for all three DPs when necessary.

Pedro Luque, the pilot's cinematographer came to the show with a film emulation LUT provided by the colourist that he worked with in the past. That one LUT was used throughout the show as the base look. Using Pomfort LiveGrade Pro, Andy performed primary only CDL colour corrections on the Log C images, shading these CDLs through the show LUT and saving these looks per shot for the dailies colourist. Andy would use Davinci Resolve at times to regrade CDLs on previously shot footage.

"I love working with multiple DP's on the show. It keeps things fresh and interesting. Fernando and Nate have different styles of lighting (both artistically and technically) and I have had to approach colouring for them differently. Fernando goes with his gut and his eye, whereas Nate lights with a meter. With Nate, I make sure to give him exactly what he expects when he leaves the set and arrives at the monitor, and then we colour from there; with Fernando, I've gotten to know him well enough where I can go ahead and start forming him what he wants as he's lighting, with just a tweak here and there after the fact. I like being kept on my toes, and it's nice to be a touchstone to keep the look consistent." *Swamp Thing* has also had a guest DP (Peter B. Kowalski) who came into shoot episode 107, and I was actually surprised to see how much we had the look of the show dialled in from the levels and contrast to the atmosphere levels, colour, etc. It felt great to be able to let him light and compose shots without having to worry too much about matching shots."

*Swamp Thing* will arrive on the DC Universe streaming service on May 31, 2019. Filming is currently underway. Watch behind the scenes:

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**Original Network:** DC Universe  
**Based on:** *Swamp Thing* by Len Wein and Bernie Wrightson  
**Production Company:** Warner Bros. Television  
**Camera Rentals provided by:** Panavision Atlanta



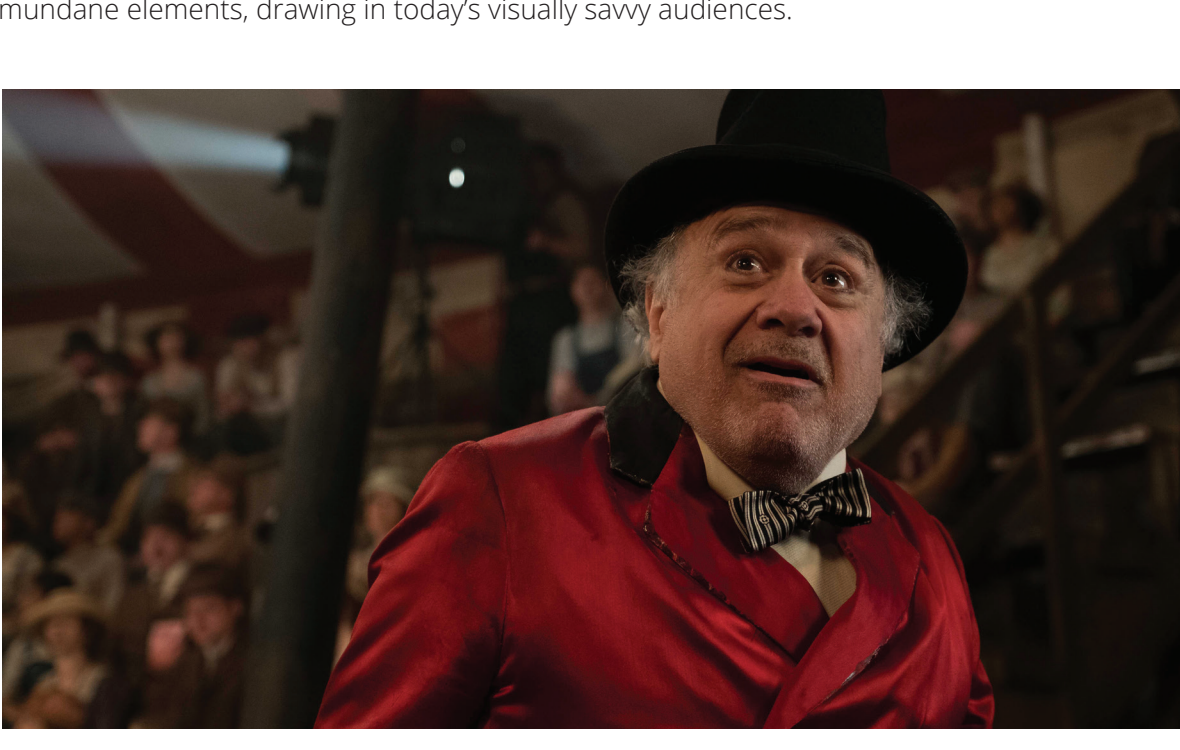
CAPTURED ON  
**CODEX**

SUCCESS STORY: DUMBO  
CINEMATOGRAPHER: BEN DAVIS, BSC  
RELEASE: 2019

# A FLYING BABY ELEPHANT IN THE CODEX RING

Ben Davis, BSC brings Tim Burton's impressionist retelling of *Dumbo* to life using the ALEXA 65 / Codex workflow.

**Dumbo is the latest iconic Disney treasure to make the leap from beloved mid-century cell animation to live-action feature film for the new millennium, joining *Snow White*, *Pinocchio* and *Sleeping Beauty*, to name but a few. Among the many underlying motivations for Disney's trend,** beyond marketing savvy and estimated profits, is the mere fact that it's possible. The evolution of visual effects and other production technologies has reached a point where the fantastic – say, a flying baby elephant, for example – can comfortably and convincingly share the screen with humans and other relatively mundane elements, drawing in today's visually savvy audiences.



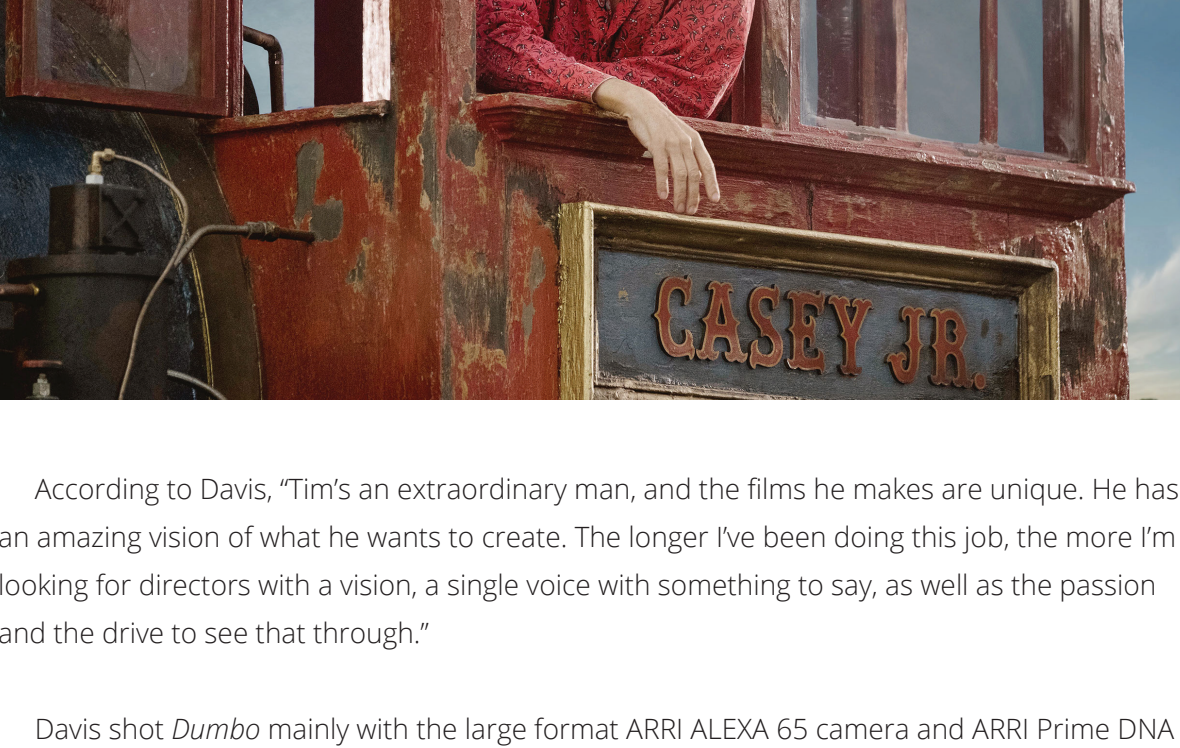
Richard Stammers of MPC in London served as visual effects supervisor on the new *Dumbo*. His experience includes work on various *Harry Potter*, *X-Men*, and *Chronicles of Narnia* features, as well as *Robin Hood*, *Prometheus* and *The Martian*.

**The ability to shoot RAW, with as much data as possible, definitely plays a part in how flexible we are when we actually do the visual effects work**

Hubert Maston

"The digital era has certainly made the process simpler, even though we still strive for the filmic look and dynamic range of film emulsion," Stammers says. "But one thing that has made a big difference is the way that captured images today have so much detail, sharpness and clarity, with no loss of generation through the process of the digital effects pipeline. What you end up with on screen can be nearly identical to what's captured. Despite all the advancement in technology, the way we composited shots 20 years ago is not massively different from what we do now. We've got better tools that allow the artist to work quicker and more efficiently, and maybe the aesthetic has improved. But essentially, the processes are incredibly similar. I think we're just able to do better work with better capture and carry through the process to the very end without any diminishment of what was captured on the sensor."

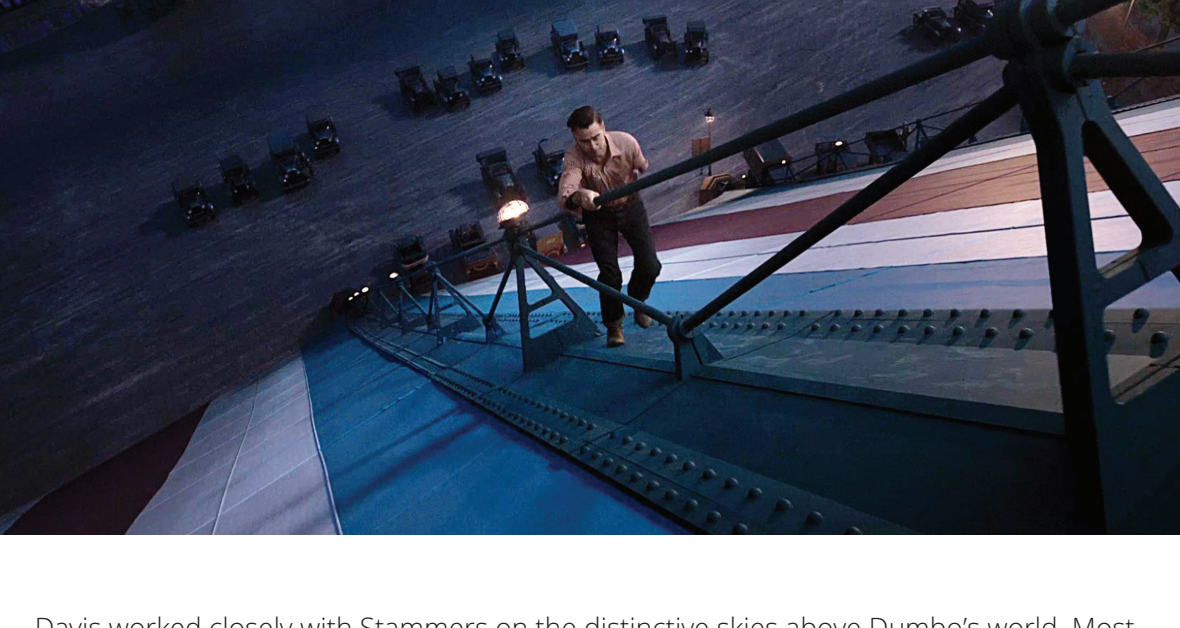
Stammers, along with director Tim Burton and director of photography Ben Davis, BSC decided very early on that retelling the *Dumbo* story would require stepping back slightly from perfect photographic reproduction. At the heart of the story is the elephant, of course, a CG creature with exaggerated eyes and facial expressions. The world he inhabits, therefore, should have a slightly impressionistic twist. Under Burton's practised eye, this mindset extended throughout the production, affecting choices in the design of the effects, the lighting, the sets, costumes and beyond.



According to Davis, "Tim's an extraordinary man, and the films he makes are unique. He has an amazing vision of what he wants to create. The longer I've been doing this job, the more I'm looking for directors with a vision, a single voice with something to say, as well as the passion and the drive to see that through."

Davis shot *Dumbo* mainly with the large format ARRI ALEXA 65 camera and ARRI Prime DNA lenses, which use older glass to achieve a warmer, softer feel. He chose a 1.85:1 aspect ratio to better frame the Big Top and the elephant. The ALEXA 65 uses an A3X CMOS sensor to capture at 6560x3102 resolution in Open Gate – an image roughly equivalent to the 5-perf 65 mm film frame. The uncompressed ARRIRAW files are written to Codex SXR Capture Drives, which were offloaded quickly, at full resolution, to the Codex Vault XL workstation by DIT Tom Gough.

Davis says that in spite of the huge amounts of data, the workflow is solid and smooth. "It took a while for digital cinematography to settle itself," says Davis. "There were a lot of problems initially with discrepancies between what the camera team was seeing and what was being delivered to visual effects departments and editorial. Now, that's not a problem. In terms of workflow, I've gone back to my film roots. I'll have one LUT, which represents my one film stock. I don't do any grading or CDLs on the set at all. I light and expose how I want something to look. I avoid the DIT tent, and I'm back where I was when I shot film – on the set, on the camera, where I have the joy and privilege to watch great actors work. The dailies colourist balances under my instructions, and we do projected rushes in the morning, which I find much more informative and inspiring – seeing it in the format that we're aiming for in the released movie."

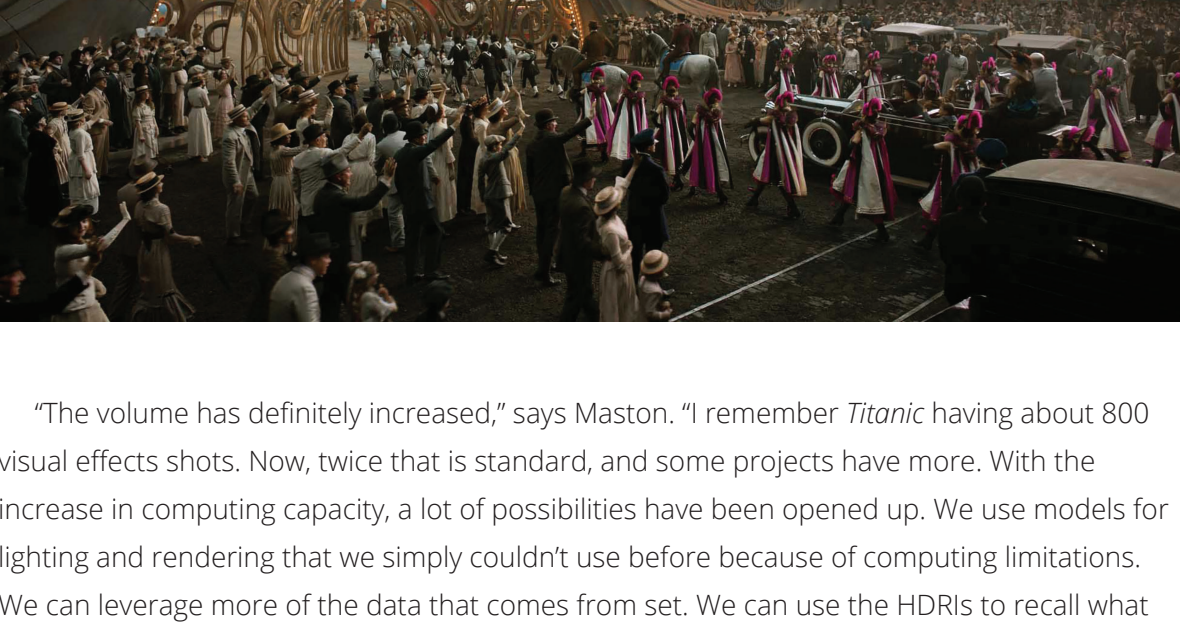


Davis worked closely with Stammers on the distinctive skies above *Dumbo*'s world. Most scenes take place in exterior situations, almost always filmed on stages at Pinewood. Stammers' team shot more than 300 sky domes, many consisting of 90 tiles stitched together. The HDR stills comprising these 360-degree sky domes combined to deliver the equivalent of about 50K resolution. These skies we sometimes augmented with cut-and-paste cloud and colour elements to achieve Burton's vision of a more "storybook" feeling, while still working in harmony with Davis's close lighting design. In some cases, Davis could see on-set live composites as he lit and shot, choosing the right sky with Burton and Stammers.

The main set was the theme park where *Dumbo* lives. Massive sets were built, and made bigger still through set extensions generated from Framestore. Hubert Maston oversaw Framestore's contributions, which required gathering extensive HDR LIDAR scans of existing sets and lighting setups, along with lens, exposure and other metadata captured by the ALEXA 65 camera system and recorded with the picture data. When it came to compositing the visual effects scenes, seamlessly blending a flying elephant into a real world, the data-rich ARRIRAW image files were crucial.

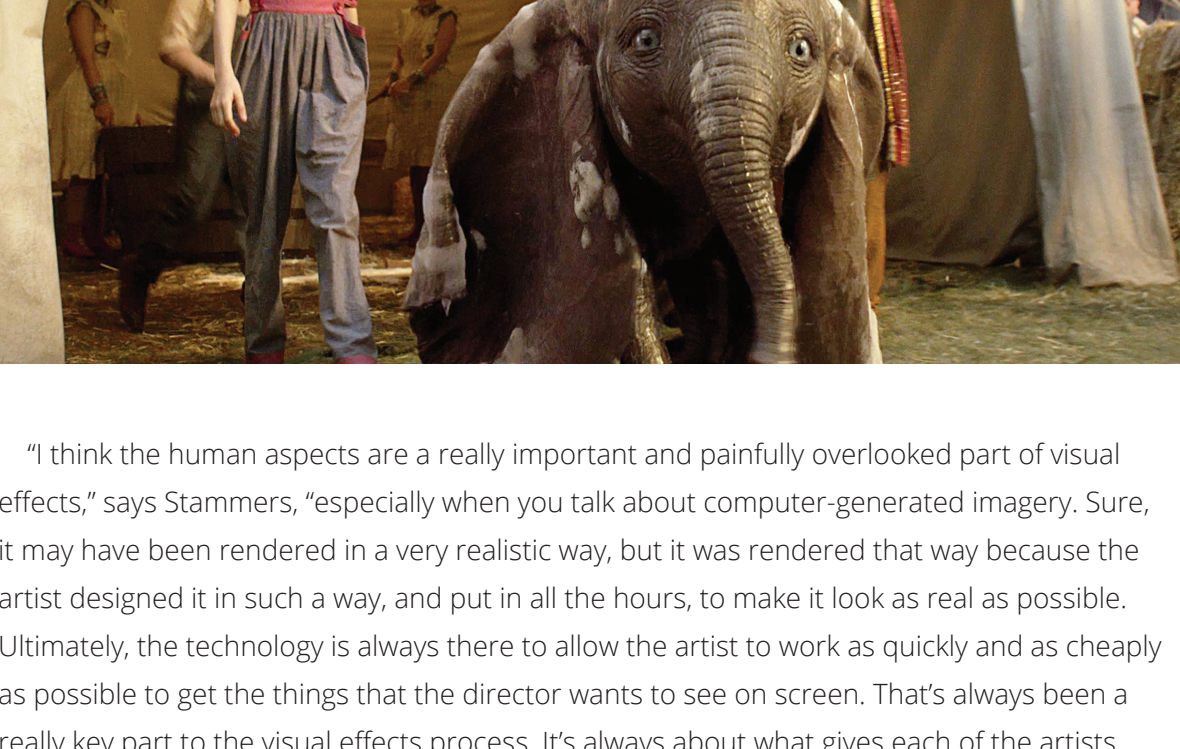
"The ability to shoot RAW, with as much data as possible, definitely plays a part in how flexible we are when we actually do the visual effects work," says Maston. "It also plays a part in what we can actually leverage from a plate. If it has a very wide gamut, we can do more."

Richer data can also lead to greater efficiency – enabling the vast expansion of what can be done with a given budget and schedule and making possible endeavours like Disney's big push into live-action.



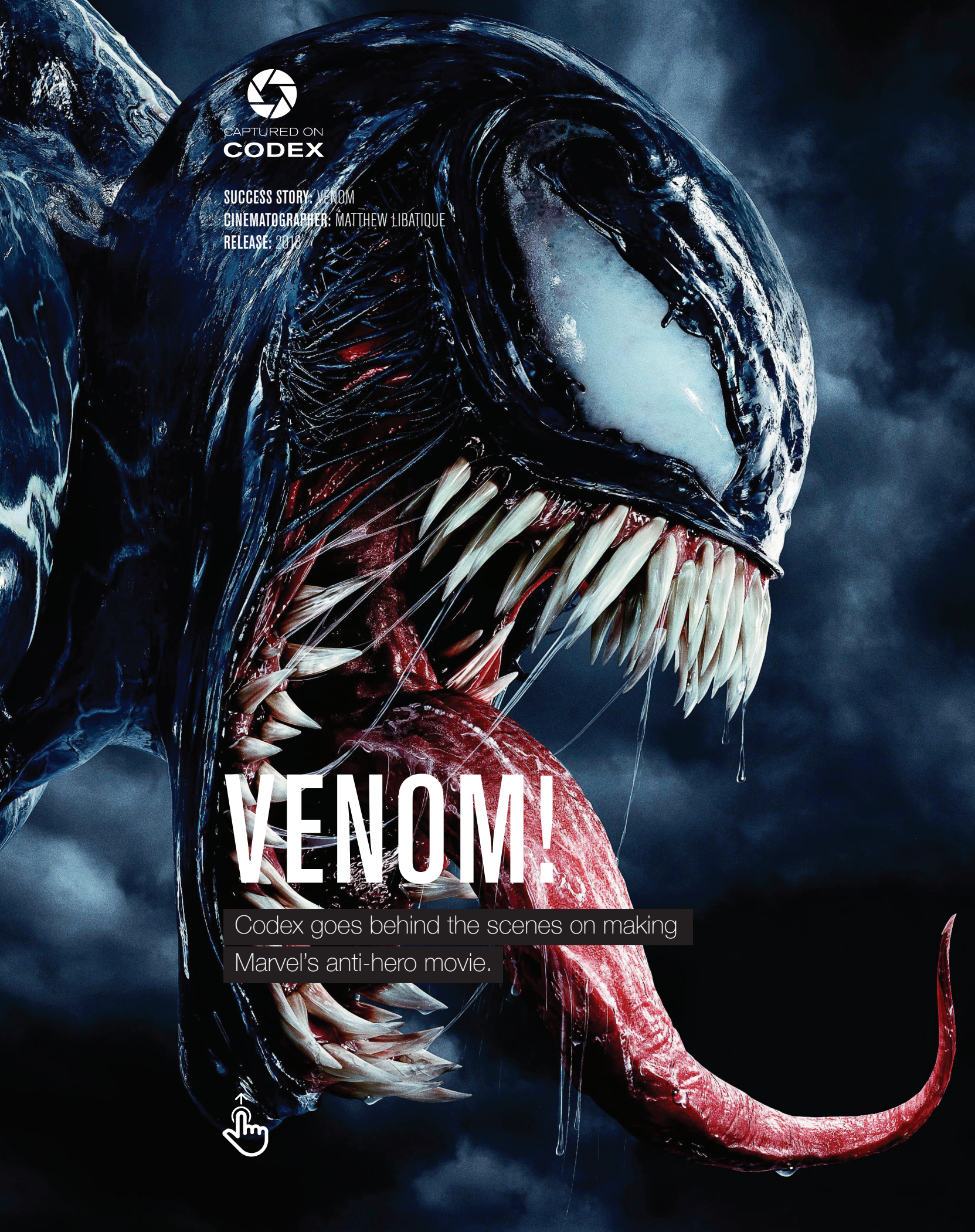
"The volume has definitely increased," says Maston. "I remember *Titanic* having about 800 visual effects shots. Now, twice that is standard, and some projects have more. With the increase in computing capacity, a lot of possibilities have been opened up. We use models for lighting and rendering that we couldn't use before because of computing limitations. We can leverage more of the data that comes from set. We can use the HDRIs to recall what the state of light was on the set, and we can use realistic materials to better simulate the look of an object. In the past five or ten years, there's been an important transition from a more ad hoc rendering approach to methods that rely much more on physical material and accurate translation of light. In the theatre, it becomes more and more difficult to sort out what's real and what's not. At the same time, it's been an evolution for our industry to be able to cope with the tremendous amounts of data that we create – literally terabytes each day. There's been so much backline work making sure that data flows are efficient."

Codex has been at the vanguard of this evolution in data management, devising ingenious solutions to the technical challenges presented by today's filmmakers. But the company's success is due in no small measure to its understanding of the interpersonal side of filmmaking, which can get lost amid all the ones and zeros. The tools are used by people.



"I think the human aspects are a really important and painfully overlooked part of visual effects," says Stammers, "especially when you talk about computer-generated imagery. Sure, it may have been rendered in a very realistic way, but it was rendered that way because the technology allowed it in such a way, and put in all the hours, to make it look as possible. Ultimately, the technology is always there to allow the artist to work as quickly and as cheaply as possible to get the things that the director wants to see on screen. That's always been a really key part to the visual effects process. It's always about what gives each of the artists the best creative feedback, and the ability to iterate as many times as possible to get where we need to get to in the given amount of time. The technology exists to support that human aspect of the work."

**Camera Type:** ARRI ALEXA 65  
**Camera Rentals by:** ARRI Rental  
**Lenses:** ARRI Prime DNA  
**VFX Services by:** MPC



CAPTURED ON  
**CODEx**

SUCCESS STORY: **VENOM**  
CINEMATOGRAPHER: **MATTHEW LIBATIQUE**  
RELEASE: **2018**

# VENOM!

Codex goes behind the scenes on making  
Marvel's anti-hero movie.



**Venom**, a Sony film that has been in the works since the anti-hero's villainous cinematic debut in 2007's *Spider-Man 3*, finally hit theatres this year. With various intentions for *Venom*'s creative content, it was confirmed that it would exist in the shared universe of Marvel characters which Sony owns the rights to due to a deal between Sony and Marvel Studios (eg. *Spider-Man*, *Morbius*). Directed by Ruben Fleischer (*Zombieland*) from a screenplay by Scott Rosenberg, Jeff Pinkner, and Kelly Marcel, *Venom*'s principal photography was shot October 2017 in Atlanta, New York City, and San Francisco.



The film follows journalist Eddie Brock who obtains his superpowers after being bound to an alien symbiote whose species plans to invade Earth. Brock is played by Tom Hardy and co-stars include Michelle Williams, Riz Ahmed, Jenny Slate, and Woody Harrelson.

Codex caught up with digital imaging technician (DIT) Nicholas Kay for an interview about his work on *Venom* and how Codex has helped him with other shows.

**Codex helped me by supporting my workflow and needs like they always do**

Nicholas Kay

"Working on *Venom* was a busy job, Director of Photography, Matty (Matthew Libatique) liked to move fast, so we're always going. Honestly, that's how I like it, I like to be very busy and constantly going, so I had a really great time working with him. We also had five bodies, all of which could go into play at any time, in all kinds of scenarios. We were doing multiple lens formats so there was a lot of bouncing back and forth," says Kay. Various cameras were used including the ARRI ALEXA Mini, ALEXA XT, and for some scenes, the RED Monstro 8K VV.

On lenses, Kay describes what they used to create the scenes and look for *Venom*, "We shot with Todd AO's for our Anamorphic look and Cooke S5's for the cleaner and more VFX intensive flat look for the SXT and Mini and used the RED Monstro for many larger *Venom* intensive scenarios where Matty wanted the right resolution to give to VFX. I was generally on top of switching the cameras back and forth with setting formats and dealing with the two-colour pipelines of Log C and converting IPP2 to Log C."

"I really enjoyed the thought process and reasons for the choices that Matty made for every setup. His knowledge and execution to the reason behind his decisions were really refreshing and it was great to be a part of it supporting. I learned a lot so I always love jobs like that," adds Kay.



"Codex helped me by supporting my workflow and needs like they always do. We were using MacBook Pro's with RAID's as the hardware, running full licensed Vault software, which was great for my needs. We downloaded everything including the RED footage from the Vault software and while running that system, I find that the download and checksum process is the fastest. We also used ARRI Meta extract to pull all the camera lens and Pan Tilt info for VFX, which was helpful since it was all encoded per frame. We used the Cooke S5s for most of the heavy VFX shots, so all that data carried through very clean and easy."

Kay is also no stranger to working with Codex tools. "I've been using Codex since it came out, and was working with Marc Dando to help productions transition from tape to solid state recording before it became the standard we know it as now. My favourite Codex jobs are the ones with custom workflows. On *The Dictator*, a long time ago, we would download and archive our footage, since there weren't enough magazines in the world to support the job at the time when we had to use BRU PE and make our own scripts and catalogs."

"*Passengers* was one of the first full ALEXA 65 features done with a heavy budget restriction, (and the first job to combine Pary 70 series glass on the ARRI 65), so we had to find the most efficient way to deal with the footage. Since there is a checksum from the sensor to the magazine to the Vault, we qualified Codex sleds as an original negative. At that time, we kept a sensor RAW and ARRIRAW sled for redundancy, and used the Vault's ability to mount an external volume in its environment and the generate command to push downloads to a high-speed Thunderbolt drive to send to the lab, which was a very quick and cost-effective way to deal with lots of footage and turnaround, without needing to add a lot of camera magazines to the order waiting for turnaround."



When it comes to filming, Kay believes that RAW recording is the best way to go for VFX heavy productions with large budgets such as *Venom*. "For a feature film, the power of veterans who always prefer is substantially greater. I've spoken to many VFX supervisor veterans who always prefer the least compression to work with when it comes to very large budget VFX movies, so it answers the call for that need."

Kay can't fully talk about what he's working on now, but he seems to be keeping busy with a few Codex productions in the pipeline. "Most of the jobs I can't really discuss, but I'm happy to be fortunate enough to be busy. I'm doing *Central Park 5* right now with Bradford, which is on the ALEXA LF, and we are using Codex Vaults on that. I'm about to start the *Joker* with Larry Sher, which is ALEXA 65, LF, and Mini so far, which will employ the same workflow that we used on the *Passengers* movie, and recently the new *Godzilla* movie, which is how I like to deal with ALEXA 65."

Being a DIT certainly has its challenges, but Kay feels that being able to have a collaborative workflow with cinematographers makes the job more fruitful. Also, being able to work on productions that gain him access to innovative, cutting-edge tools in the industry is a big plus.



"What I like most about being a DIT is the growing trust that productions and cinematographers have given to me which allows me to have more room to be technically creative on an ongoing basis. Whether it's with imaging workflows, or data workflows, or camera management workflows, I love to constantly be playing with the latest toys and working with manufacturers to update and push the envelope toward products that are more robust. I also like being at the forefront of some of these products that are making their debut in many production environments. I like to have that constant change, so I think that goes hand in hand with being a DIT. I also enjoy the fact that you can be both an artist and a technician which, I think, is an understated and underappreciated aspect of the position. It's its own art form and expression."

*Venom* made its debut in US theatres on October 5, 2018. According to The Hollywood Reporter, it was IMAX's biggest opening in the region, with \$10 million of the movie's China box office coming from IMAX screens.

It is now the seventh-highest grossing film of 2018 with a gross of over \$676 million worldwide, setting several box office records for the month of October.

**Cameras:** ARRI ALEXA Mini, ALEXA XT, RED Monstro 8K VV (some scenes)  
**Lenses:** iPrime and Zeiss Ultra Prime Lenses, Cooke Anamorphic, iPrime, Zeiss Ultra Prime, and Angenieux Optimo Lenses  
**DIT:** Nicholas Kay  
**Post Partner:** Company 3  
**Camera Equipment Provided by:** Camtec Motion Picture Camera Systems