

# FILM AND DIGITAL TIMES

## ARRI ALEXA Family 10th Annual Reunion



# FILM AND DIGITAL TIMES

## Art, Technique and Technology

*Film and Digital Times* is the guide to technique and technology, tools and how-tos for Cinematographers, Photographers, Directors, Producers, Studio Executives, Camera Assistants, Camera Operators, Grips, Gaffers, Crews, Rental Houses, and Manufacturers.

It's written, edited, and published by Jon Fauer, ASC, an award-winning Cinematographer and Director. He is the author of 14 bestselling books—over 120,000 in print—famous for their user-friendly way of explaining things. With inside-the-industry “secrets-of-the-pros” information, *Film and Digital Times* is delivered to you by subscription or invitation, online or on paper. We don't take ads and are supported by readers and sponsors.

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# ALEXA: Tenth Birthday and Family Reunion

A few weeks ago, ARRI Product Manager Marc Shipman-Mueller called with news that ALEXA's Tenth Birthday was coming in June 2020. He sent a timeline, fascinating photos of early ALEXA designs and a several pages of detailed notes.

ALEXA's age is figured from date of first delivery, not conception or inception—which began much earlier as we shall see in these pages.

ALEXA arrived in the form of three plastic mock-ups and a proof of concept sensor demo at IBC Amsterdam in September 2009. Camera deliveries started in June 2010.

But the nagging question was whether this was a tenth birthday or an anniversary. After all, ALEXA is a family. She began cinematic life as a single model now known as the Classic EV. She was joined by two siblings in the following two years.

Gestation was balanced between Micro Salons in Paris and NABs in Las Vegas. Over the years, the family grew and prospered and begat more siblings and cousins.

As to tenth birthday or a tenth family reunion, my instinct was to go with reunion.

Stephan Schenk, ARRI Managing Director, agreed. He wrote, "We have been discussing the ten year anniversary ourselves and feel that there indeed are two sides of the story.

"We know that after 10 years, Cinematographers are still using their first ALEXAs (Classic as we now call them) as their "A" cameras. This is a testament both to the image and build quality. So, it is definitely a tenth birthday of the ALEXA Classic.

"But what is a birthday party without your family? ALEXA is an ever-evolving camera system—all based on the same sensor photosite design. Cinematographers around the world mix and match all family members: standard ALEXA Minis work side-by-side with ALEXA Studios. ALEXA LFs have been mixed with ALEXA 65, and so on. Therefore, this can be called a tenth ALEXA family reunion."

So, let the reunion, retrospective, birthday, anniversary begin.

Norimichi Kasamatsu,  
JSC on *Ikari (Anger)*,  
starring Ken Watanabe,  
with ALEXA XT Plus.  
Feb 2016. Photo by  
Yasuhiko Mikami.







Cover of FDTimes September 2011.

Chris Menges, ASC, BSC on location in New York  
on *Extremely Loud and Incredibly Close*.  
Production began in October 2010.

Shown here with ARRI ALEXA, Codex ARRIRAW  
Recorder, Cooke 5/i prime lens, Transvideo  
CineMonitorHD, Cinematography Electronics  
CineTape Measure, Preston FI+Z Wireless lens  
control system, OConnor 120 EX head.  
Photo by Francois Duhamel, Warner Bros.  
Pictures.



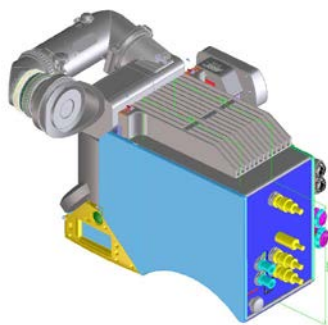
# ALEXA: The Short Story

**April 2001.** Franz Kraus raced into the central hall of NAB in Las Vegas waving a brand new Canon IXY Digital 2.11-megapixel CCD compact still camera that he had just purchased at a nearby big-box store. “This is the future of our industry,” he proclaimed. People looked at him with the kind of disbelief reserved for fortune tellers and over-eager stock brokers. Someone asked, “How long?” He answered, “2010.” Of course, he was right. Working models of ARRI ALEXA were introduced in 2010. But we’re getting ahead of the story.

Franz had joined ARRI in 1983 as technical Director of the newly founded ARRI Video Postproduction Unit. In 2007, he was appointed as Managing Director of Arnold & Richter Cine Technik GmbH. He was a visionary technologist at ARRI, with an infectious enthusiasm for image science, the way pictures looked, and a stubborn streak for perfectionism that suffered no shortcuts.



**2003.** The Arriflex 235 was the last 35mm film camera that ARRI would build and had my vote for the most elegantly styled camera of all time, with a dolphin-shaped magazine and graceful ergonomic design. Development of the Arriflex D-20 digital cine camera was now underway at this time.



D-20 early design

**2004.** Arriscan arrived. Its 35mm CMOS sensor could scan motion picture film up to 6K resolution. Films could be shot on film, digitized in real-time to data files, edited, graded, assembled and then printed back out to film with an Arrilaser (which had been launched in 1998). The invention of the Arriscan led to faster conversion of film images to data files. Faster speeds led to lower costs of digitizing.

The result was a creative revolution in the digital age of feature films that was previously restricted to the domain of high end commercials because of cost. Now, entire features could be affordably scanned as Digital Intermediates, with highly talented, rock-star colorists working with cinematographers on grading, power windows, secondary color correction, filter effects, smoothing selected areas, and so on.

Arriscan shared similar technology and the same sensor as the work-in-progress D-20 camera.

Meanwhile, Panavision’s new Genesis digital camera was being developed in 2004 with Sony and was released in 2005. It had a Panavision PV mount and a single Super 35mm 1920x1080 CCD sensor with a 16:9 aspect ratio.



**2005.** ARRI’s first digital cine camera, the Arriflex D-20, was introduced in November 2005. Its CMOS sensor had a look that was cinematic and a size that was familiar. The sensor had the same aspect ratio (1.33:1) and dimensions (24 x 18mm) as a traditional 35mm film gate—something most other companies failed to recognize and a decision that probably assured the success of ARRI’s digital endeavors that would follow.

Steps for the D-20 were tentative at first. It was to be a limited quantity experiment to test the digital waters, a rental-only camera, not for sale. One can imagine the discussions and questions management asked the engineers. Would a digital camera hurt ARRI’s market share in analog motion picture film cameras? Would the investment pay off? Would high-end productions accept images from a digital camera and could they be as good as film?

Franz Kraus explained, “People thought, ‘Because ARRI made film cameras, how could they possibly have a successful digital camera—that would have to be luck?’ No, it was hard work over many years, starting with the Arrilaser.”

**April 2006. NAB.** Disruption. Disruptive technology. Inside a red tent at NAB, a new company named RED Digital Cinema got the attention of the entire industry. The RED paradigm was a high-end digital SLR still camera that could record images at 24 fps. While others were pursuing uncompressed data on expensive solid state magazines, RED delivered a manageable, wavelet-compressed 4K image using small, on-board, off-the-shelf hard drives. Oh, and you could place a \$1,000 deposit for the RED One Camera, applicable to its delivery cost of \$17,500. To the delight of DPs, and to the absolute horror of establishment companies, RED not only delivered a year later, but presented impressive footage shot by Peter Jackson of a WWI epic short subject. It took RED a mere 15 months from concept to delivery. This was unheard of.

Inside a glass display case at the same NAB convention in 2006, Sony presented their prototype F23 CineAlta. It had a B4 mount and about 1 stop more dynamic range than their F900. It weighed about 32 lb. for body, lens, and recorder.

# ALEXA: The Short Story



There was another product announcement at NAB 2006. ARRI showed the Arriflex 416—their next (and last) Super 16mm camera. It combined the technology of ARRICAM with the styling of a 235, in a size reminiscent of the 16SR. Someone quipped, “The analog 416 has an image area slightly larger than a  $\frac{3}{8}$ -inch single chip 2K camera, with 12 minutes of uncompressed archival quality storage per magazine, each film frame capable of storing about 65 Megabytes of data, and one roll holding the equivalent of about 1.123 Gigabytes.” It was ARRI’s last analog camera. Digital cameras were advancing faster than predicted.

**April 2008. NAB.** Eighteen short months after the F23 shipped in December 2006, Sony showed their new Cinealta F35 camera system. Rental houses howled—many F23 cameras were not even paid off, and now rendered almost obsolete by the F35 which had a PL mount, a single 35mm CCD image sensor, and 10-bit 4:4:4 recording. The onboard SRW-1 recorded to HDCAM SR video tape.



Three years after the D-20 came out, ARRI redesigned and redesignated the camera as D-21. It recorded to HDCAM-SR tape on an external SRW-1 as well as to an external Codex Data Recorder. Still straddling the terms experimental and production-ready, the D-21 was intended for TV production so as not to interfere with sales of film cameras. Like the D-20, it was a bit cumbersome, a rental item only, later reluctantly for sale, but the images were very good. By 2008, there were 56 D-21 cameras at 13 rental houses worldwide.

A camera code-named Alexa was now in development at ARRI.

Marc Shipman-Mueller, Product Manager for Camera Systems at ARRI, said, “Film camera sales had been going strong, but in the Fall of 2008, film camera sales dropped off a cliff. Rental managers suddenly did not see a future in film anymore. My guess is this was partly caused by the global financial crisis and partly by the

threat of a SAG (Screen Actors Guild) strike. Anyone who wanted to still shoot used AFTRA (American Federation of Television and Radio Artists) actors, but their contract stipulated electronic cameras. That’s when the Alexa project really kicked into high gear. By that point we had enough digital competence and experience in house, but it was still an equally exciting and exhausting time.”

Dr. Achim Oehler had joined ARRI in September 1999, working on the Arrilaser film recorder, Arriscan film scanner, D-20, D-21, Alexa, and other projects. He explained, “The Arrilaser film recorder and the Arriscan film scanner bridged the gap between the analog and digital worlds. We came up with a 6K film scanner and we implemented 14+ stops of latitude. Our experience in image science, sensor technology, software development, manufacturing and service moved nicely from the Arriscan to other projects like the Alexa camera.”

Achim continued, “The story of Alexa began in the middle of the financial crisis of 2008. We were listening to our customers and monitoring the economic changes in the industry. Our sales department, product managers and business unit managers around the world discussed a next-gen camera. Michael Cieslinski and his team had developed a new sensor based on the experience with our existing products.

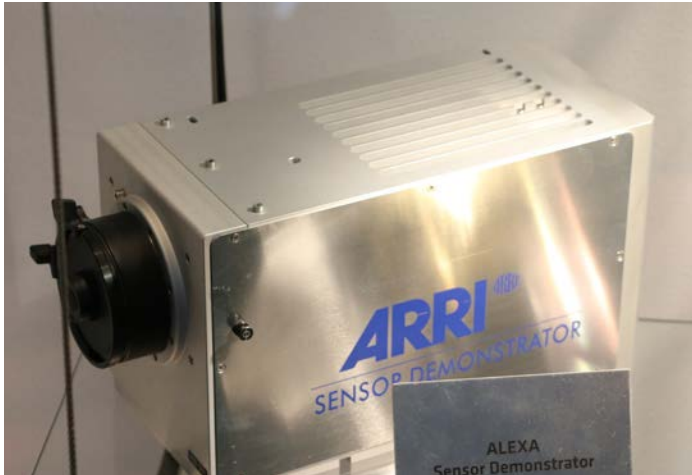
“But the economic crisis required us to rethink some things on the wish list and make a cost-effective camera. That was a challenge because, at that time, we already had decided on our newly developed sensor architecture. So we had to construct a camera that was cost effective to manufacture using that fancy sensor. Additionally, we had to have a viewfinder and a recording element. We really were very lucky that this big effort was possible because, at the height of the financial crisis, we were spending much more than we had ever imagined would have to put into that camera.”



**September 10, 2009. IBC, Amsterdam.** This was a pivotal moment. Some have said that ARRI bet the company on the new, still unnamed, code-named Alexa, digital cine camera. Sales of motion picture cameras were slowing, RED and Sony were gaining market share, and the lessons of Kodak’s failure to embrace digital still hung heavy. The ARRI booth was very quiet, very tense in the minutes before IBC opened. Would anyone show up? Would they notice the new sensor technology concept demo in the booth. Would they see three prototype ARRI digital camera “sisters” that were presented in a whisper room as wooden models, code-named Alexa EV, Alexa EV-Plus, and Alexa OV-Plus?



# ALEXA: The Short Story



The doors to IBC Hall 11 opened at 10am. Five minutes later, the ARRI team was smiling. Throngs of DPs and rental house managers were swarming the booth, peering at ARRI's Sensor Demonstrator proof of concept, and best of all, placing orders. By the end of the show the code name "Alexa" had caught on, and it seemed difficult to imagine calling these cameras anything else by the time they went into production starting mid 2010.

It was only then that ARRI started capitalizing the Alexa camera as ALEXA, something the New York Times Manual of Style and FDTimes resisted. Eventually, after several years, I relented. (The NY Times did not: Arri Alexa.) So, in the pages that follow, early Alexa eventually gives way to all caps ALEXA thanks to global editorial search and replace. But I digress.

The three new cameras seemed to satisfy the mantras of contemporary production: lighter, smaller, faster, cheaper. They were compact, lightweight, affordable and intended for every level of the television and feature film food chain. Prices were announced somewhere below € 50,000. This was astonishing in itself, considering that an Arricam fully outfitted could cost up to 10 times that amount.

The two entry level models (EV and EV-Plus) had a new ARRI electronic viewfinder and a 16:9 image area. The bigger-budget production camera (OV-Plus) had an optical viewfinder and spinning mirror, and continued ARRI's legacy of offering a 4:3 image area. All three cameras had frame rates of 1-60 fps.

There were a number of things in Alexas' favor. They looked and felt like ARRI film cameras: solid, rugged, ready to endure life on location. They were easy to use. The menu and buttons seemed familiar, not much different from an Arricam. Most important of all, the images had a film-like look. The dynamic range, the range of exposure, was similar. Highlights and shadow areas could be exposed in familiar ways, using a lightmeter instead of a waveform monitor if you liked. It did not look like video.

What really mattered was that cinematographers, directors and audiences liked the way the image looks. They found it pleasing. It matched their expectations during the transition from film to digital. It was comfortable. The controls were familiar. They felt at home.

The word "cinematic" came to mind. It was with good reason. Franz Kraus said at the time, "Without our Digital Intermediate products, we would not have had the D-20 and the scanner. And,

if the ARRI owners had not been convinced that the risk of developing the Alexa had a good chance of succeeding, maybe that would have kept ARRI out of building the next generation digital camera. To build Alexa cameras is not a trivial thing. We needed to have all the skills from the analog camera world combined with new talent to make it happen."

Representing the owners of ARRI, Christophe Stahl explained, "It was a disruptive moment in September 2009 when, in more or less five days, orders for film cameras collapsed and we did not have our digital camera ready. It was in development, but it was not ready for sale. It took about ten months without any camera sales, but we managed."

**February 2010. AFC Micro Salon, Paris.** The first working Alexa prototypes were hand-carried to the show. They had the vestigial hinged side door of a traditional film camera, like the Arriflex 235. DPs would have to wait until April to learn what would go inside.



**April 2010. LA and LV.** The big news at ALEXA's Los Angeles and Las Vegas debut in April 2010 was behind the gray camera body door. A transparent window hinted at the fact that this was not a light-tight chamber for analog silver exposure. There wasn't a cinematographer or camera assistant in the room who could restrain film-threading muscle memory from opening the gray door.

Instead of a geared film camera movement, there were slots for two SxS PRO Memory cards. The missing link that made almost everyone immediately comfortable was the Shoot>Edit paradigm, a simple link from camera to edit using familiar ProRes files that loaded directly into Final Cut Pro or Avid Media Composer without the need for transcoding or log-and-transfer. Furthermore, there was uncompressed ARRIRAW. ARRI ALEXA at NAB offered the potential to do for digital filmmaking what previous generations of Arriflex analog cameras had provided, with an ergonomic shape, beautiful image, and intuitive operation that ranged from simple "push the start button" to advanced menu choices.

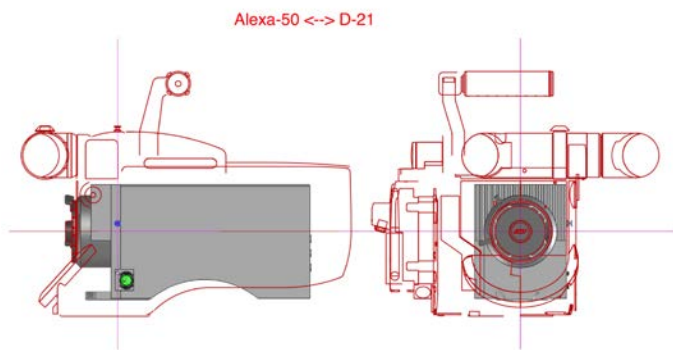
In this primordial period, ARRI was saying, "ALEXA is presented to the filmmaking community as a camera intended for HD television, commercials and a few features." They added, "Uncompromised and uncompressed 4K resolution will remain in the domain of 35mm film for some time to come."

That humble camera for "a few features" went on to become one of the most successful digital cine cameras of all time, capturing 80% of major motion picture productions by 2017.

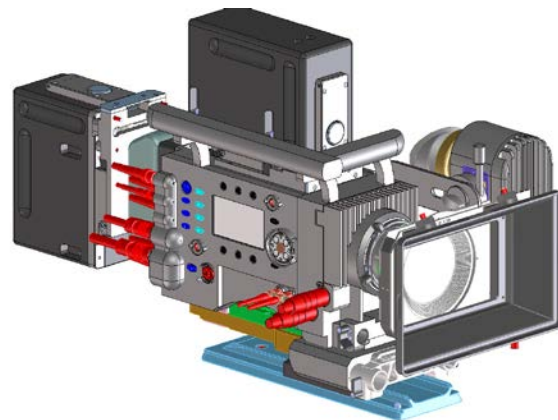
# ALEXA Timeline Chart by Marc Shipman-Mueller

Family	Model	First Shipped	Distrib.	Notes/ Features
<b>ALEXA Classic</b> 	ALEXA Classic EV	6/2010	sales	Demonstrator shown at IBC 2009 09, first prototype at AFC Micro Salon 2010 02, first camera at NAB 2010 04. Best overall image quality, robust & reliable, versatile workflows, 16:9 sensor, electronic viewfinder, records Apple ProRes to SxS PRO cards and ARRIRAW T-link output on SDI connectors, optional licenses for High Speed, anamorphic de-squeeze
	ALEXA Classic Plus	2011 04	sales	16:9 sensor, same as ALEXA Classic EV but with additional wireless remote control of camera and lens (Plus module); also shipped around that time: Remote Control Unit RCU-4, 3D cable set, Low Mode Set LMS-3
	ALEXA Classic Studio	2012 02	sales	Same as ALEXA Classic Plus but with 4:3 sensor, optical viewfinder and Arricam mirror shutter; delivery to selected projects in 12/2011.
	ALEXA Classic M	2012 04	sales	Like Classic Plus but with 4:3 sensor, separate head and body; developed with Cameron Pace. Prototypes delivered to CPG 2011 09, public sales started 4/2012.
	ALEXA Classic Plus 4:3	2012 05	sales	Same as ALEXA Classic Plus but with 4:3 sensor
	ALEXA HD Fiber Remote Camera Set (FRO)	2013 03	sales	Like ALEXA Classic EV, with fiber optic integration for TV: 16:9 HD only, 10 - 60 fps, Apple ProRes & SDI, Rec 709 only; Also in a Plus version or available as an upgrade to ALEXA Classic EV and ALEXA Classic Plus (ALEXA Fiber Remote Option FRO)
<b>ALEXA XT</b>  	XR Module Upgrade	2013 05	sales	Upgrade for ALEXA Classic cameras to most XT features. Existing sensor aspect ratio stays the same
	ALEXA XT EV	2013 05	sales	All XT models have 4:3 sensor, in-camera ARRIRAW, Open Gate 3.4K, internal FSNDs, XR Capture Drives, SxS PRO & CFast 2.0 cards, VMB-3, all licenses included
	ALEXA XT Plus	2013 05	sales	Same as ALEXA XT EV but with additional wireless remote control of camera and lens (Plus module)
	ALEXA XT Studio	2013 07	sales	Same as ALEXA XT Plus but with additional optical viewfinder & ARRICAM mirror shutter
	ALEXA XT M	2013 06	sales	Same as ALEXA XT Plus but with separate head and body
	ALEXA XT Plus B/W	2014 01	rental	Same as ALEXA XT Plus but without the Bayer Color Filter Array (CFR), therefore a pure B/W sensor
<b>AMIRA</b>	AMIRA	2014 05	sales	Not named ALEXA, but same sensor family. Designed for ENG-style single-operator use, 16:9 sensor, 200 fps, records Apple ProRes onto CFast 2.0.
<b>ALEXA 65</b>	ALEXA 65	2015 01	rental	ALEXA SXT boards with sensor 3x the area of 4:3 ALEXA sensor. Extra cooling, requires Vault; first used: "Mission Impossible 5" underwater.
<b>ALEXA Mini</b>	ALEXA Mini	2015 05	sales	ALEXA sensor family in small body, 200 fps, Apple ProRes to CFast 2.0 cards, licenses for 4:3 3.4K sensor area, licenses for Look Library and ARRIRAW.
<b>ALEXA SXT</b> 	ALEXA SXT EV	2016 09	sales	Apple ProRes 4K UHD (3840 x 2160 pixels), Apple ProRes 4K Cine (4096 x 2637 pixels), advanced defect pixel correction, optional noise reduction, faster fps for many formats (i.e. 16:9 Apple ProRes 3.2K: 30 increased to 90 fps, 16:9 Apple ProRes 2K Cine 4444 XQ: 60 increased to 120 fps), ALF-2, Rec 2020 output, support for SXR Capture Drives
	ALEXA SXT Plus	2016 09	sales	Same as ALEXA SXT EV but with additional wireless remote control of camera and lens (Plus module)
	ALEXA SXT Studio	2016 12	sales	Same as ALEXA SXT Plus but with additional optical viewfinder & ARRICAM mirror shutter
	ALEXA SXT W	2017 10	sales	Same as ALEXA SXT Plus but with additional integrated wireless video transmitter
<b>ALEXA LF</b>	ALEXA LF	2018 03	sales	Same as ALEXA SXT W but with a sensor 2x the area of 4:3 ALEXA sensor
	ALEXA Mini LF	2019 09	sales	ALEXA LF image quality in a small body, first use: 2x prototypes on "1917" in 2019 02 (Roger Deakins), started shipping pre-production cameras PP-1 in 2019 07, PP-2 in 2019 08

# Early ALEXA Concepts



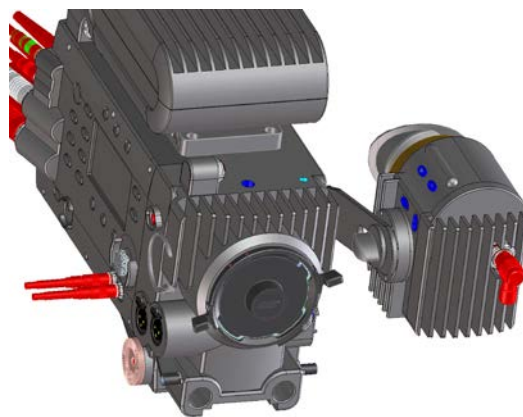
2008 Design comparing ALEXA to D-21.



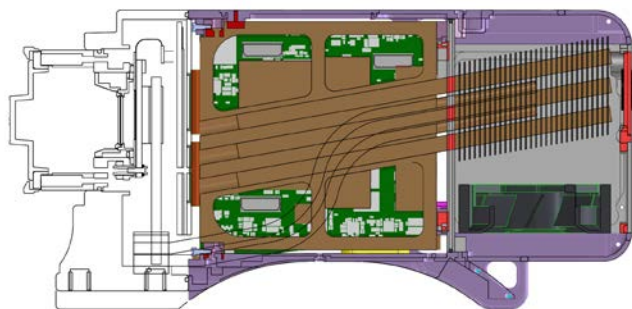
2008. Electronic Viewfinder, battery, recorder.



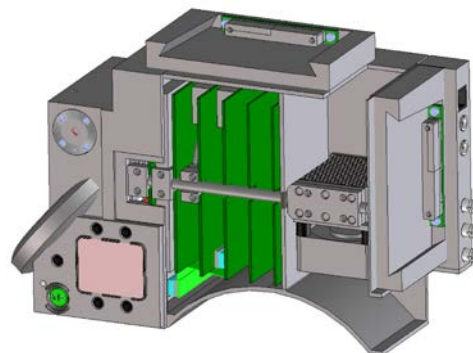
2009. Concept for onboard recorder.



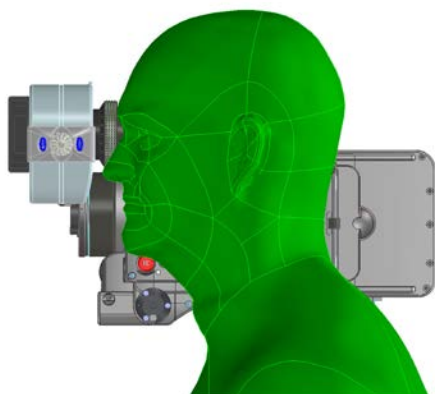
2009. EVF evolves.



2009. Cooling design.



Studio model, cooling design.



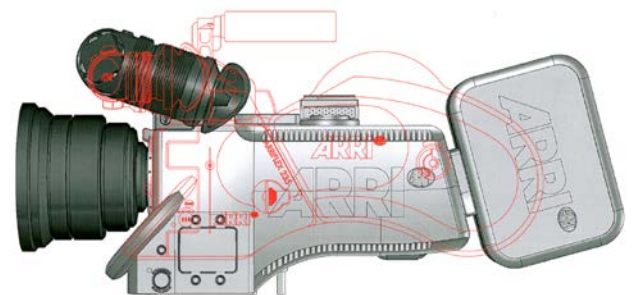
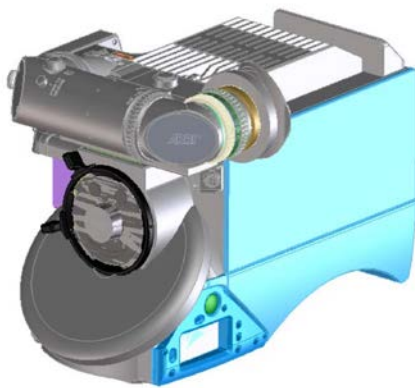
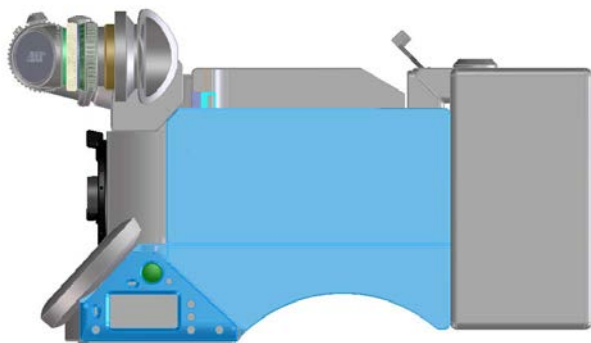
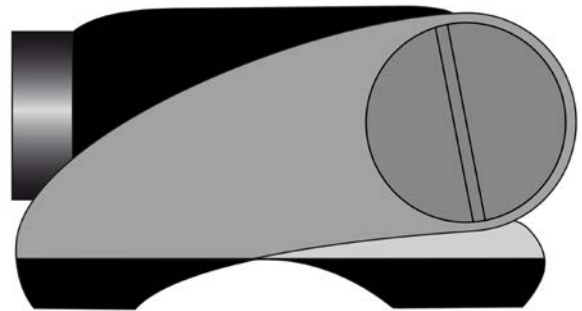
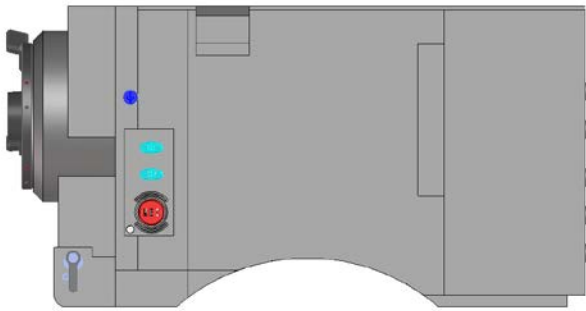
The ergonomics of shoulder resting.



Onboard recorder concept.



## ALEXA Camera Left Side Designs



# ALEXA: The Long Story

This special edition celebrating ten years of ALEXA started as a few pages and quickly grew to Dickensian proportions. I had been following ARRI's journey from analog to digital since the beginning. Or so I thought. There were more things in heaven and earth and 89 Türkenstrasse than would ever be shared with any loose-lipped DP. All kinds of planning was underway long before any mysteries would be revealed.

But, the digital writing was on the wall. You would not want to bet against Franz Kraus and his prediction at NAB 2001 that the future of our industry was foreshadowed by a mere 2.11 megapixel consumer digital still camera. By the end of that year, I unloaded all 99 cases of my analog ARRI camera package in anticipation of an inevitable digital transition whose start date was, as yet, unknown.

I have compiled and condensed (sort-of) most ALEXA articles from FDTimes since 2009. These articles are presented contemporaneously, as they were written at the time, and edited from an original exhaustive, exhausting 325 page count.

With the benefit of a rear view mirror, some of the things I wrote at the time are updated here. [These comments are in blue.](#)

Titles of people refer to what they were doing at the time. Quite a few have "graduated" at ARRI to other positions.

A very few have (gasp) actually left the company to pursue other endeavors. However, their jobs at the time are indicated.

As mentioned earlier, Alexa was originally the code name before the camera was christened ALEXA. I stuck with "Alexa" through February 2010, and globally searched and replaced to "ALEXA" from her April 2010 launch at NAB.



Alexa Family Announcement in September 2009



ARRI OV-Plus Camera  
with Optical Viewfinder,  
later named ALEXA Studio

### Three New Digital Cameras from ARRI

[I started this article in late August 2009 in preparation for the FDTimes IBC Edition to be released on September 10.](#)

A few weeks ago, I was lurking around Türkenstrasse like a stealthy automotive journalist with a giant telephoto lens at a test track in the hope of either spotting the new beasts or benefitting from rumors in one of the beer halls near ARRI headquarters. But secrecy was tighter than a closed studio set, and the collective ears and antennae of Clairmont, Nemenz and well-connected rental houses worldwide were beginning to wonder what they were up to in Munich.

[The phone rang on September 1, changing everything:](#)

Stop the presses! Blazing headlines: “Not One but Three New Digital Motion Picture Cameras” from ARRI, the company with the Blue Logo. Just when I thought it was safe to consecrate these pages to press, a torrent, no...a cascade of pictures, text, and information lands. It not only changes this entire issue but also has the potential for changing the nature of digital production.

We had heard cries and whispers about a new ARRI digital cine camera for a long time. But—*bango!*—just so!—faster than you can say “Tom Wolfe,” three new cameras, code named Alexa, will make their stunning debut at IBC. The screenplay of the story would imagine down-to-the-wire meetings in which the corpo-

rate tradition of unveiling no camera before its time, or it's time, weighs mightily against the ticking timeline of an arena in which life cycles (not these) may be more like butterflies, and camera specifications, prices, and delivery dates are enigmatic.

### Code Name Alexa

I doubt whether ARRI will conduct a competition for cinematographers to name the three new cameras. But, until new numbers (D-31?) or names are dreamed up, perhaps we can call them BLUE, after ARRI's Pantone Blue logo, True Blue Lights, Blue States, Jetblue, Terra Blue Chips, Blue Ribbon, or Blue Plate Special. The code name Alexa is a good one too. It reminds me of Billy Joel's song *The Downeaster Alexa*, from his *Storm Front* album.

### EV, EV-Plus and OV-Plus

The three new ARRI BLUE digital cameras being announced at IBC satisfy the holy trinity of contemporary production: lighter, smaller, faster, cheaper. Actually, that's four: a superfecta—even better than a trifecta.

The three cameras are compact, lightweight, affordable and intended for every level of the broadcast and feature film food chain. Prices are expected to start somewhere below € 50,000. The two entry level models (EV and EV-Plus) use a new ARRI electronic viewfinder and a 16:9 picture area. The bigger-budget production camera (OV-Plus) will have an optical viewfinder, and continue





ARRI FLCOS Electronic Viewfinder (EVF)

ARRI's legacy of offering a 4:3 sensor with a spinning mirror shutter. All three cameras will shoot 1-60 fps. The Plus models will have integrated wireless remote control for lens and camera operation.

It typically took 18 months from first whisper-room glimpse to actual production, but I'll bet they're working overtime on Türkenstrasse, because estimated arrivals are June 2010 for the EV, September 2010 for the EV Plus and December 2010 for the OV Plus. Early adopters and owners of Arriflex D-21 cameras will get first dibbs on the OV-Plus, and will even be offered an upgrade trade-in path. Dare we call it cash for cameras?

All three BLUEs use a totally new, single-chip, 35mm format CMOS sensor that promises higher sensitivity and dynamic range (wider exposure latitude) than what we've seen before. They will exhibit the same depth of field as 35mm analog film cameras and accept all 35mm PL mount lenses, including anamorphics. All three cameras have a base sensitivity of 800+ EI equivalent. Output options include on-board recording and multiple live HD and ARRIRAW feeds. The cameras' electronics are completely sealed for working in hostile, hot, wet, cold or miserable environments.

### ARRI Electronic and Optical Viewfinders

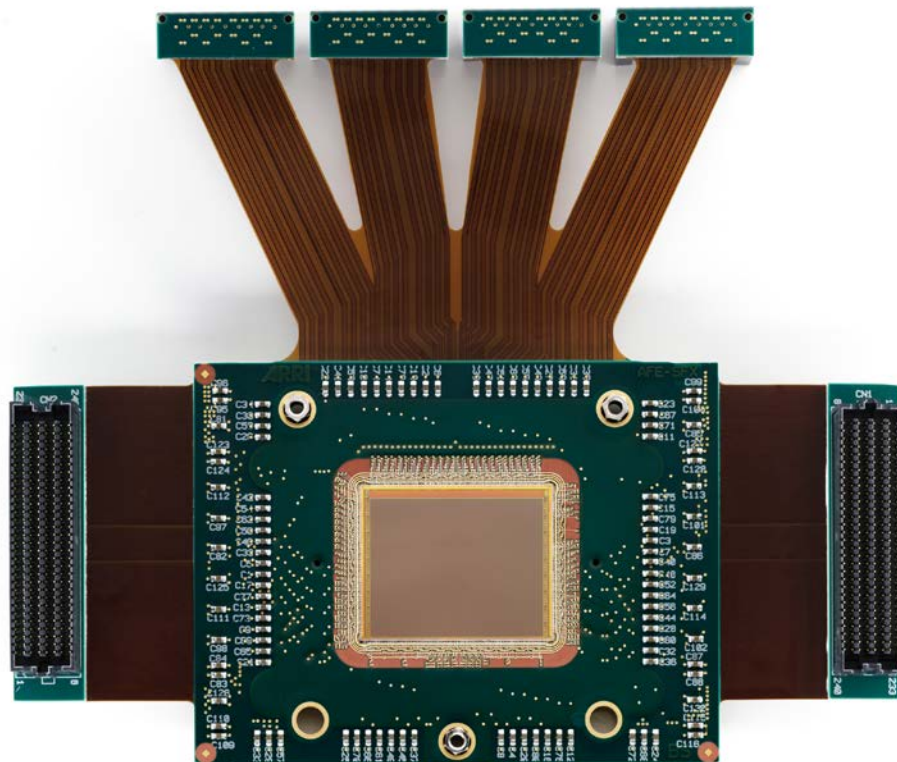
As we've seen with the D-21, some camera operators love it and others don't, but one sure thing is that optical viewfinders add

cost, complexity and weight. So, you have a choice.

Typically, ARRI introduced the top-of-the-line camera first: Arriflex 535 came before 535B; Arricam Studio came before Arricam Lite. But the 2007-2008 global financial crisis (subprime mortgages, banking meltdown, Lehman Brothers collapse, European debt crisis) led ARRI to introduce the affordable model first.

For the entry-level cameras, ARRI will offer high resolution ARRI Electronic Viewfinders. They use FLCOS (Ferroelectric Liquid Crystal On Silicon) microdisplay technology, with a resolution of 1280 x 720 pixels. The optical design and coated glass optics provide high contrast and low distortion with an evenly illuminated viewing area. The auto-calibrating, temperature controlled LED light ensures true and reliable color representation over a wide variety of operating conditions.

Because the sensor of the EVF-equipped cameras is 35mm 4:3, and the recorded image is a smaller 16:9 frame within, the electronic viewfinder can display an over-scanned viewing area that surrounds the frame, so you can see microphones creeping into your shot and C-Stands lurking at the edges. Zoom and other options are available to help you to judge focus and exposure. The small, self-contained finder is easily mounted in different positions: on the side for handheld, or in back for use with a geared head.



## ALEV III Sensor

I'm not sure why camera designers are naming their chips after people or conjugated Cirque du Soleil shows. ARRI's sensor is anthropomorphically anointed ALEV III. Is ALEV III the third monarch in a dynasty of distinguished silicon wafers, half-cousin of the ever-popular ALEXA? The new sensor is a 35 format, single CMOS, Bayer mask device with a 3.5K pixel count. ARRI's imaging technology consists not only of ALEV III, but also his entire entourage, including a high performance optical low pass filter pack, a powerful hardware imaging engine, advanced image processing firmware and a number of unique image processing steps.

## Pixel Size and Pixel Count for HD and 2K DI

A camera and sensor designer's goal, in addition to cute names, is to create cameras capable of images that look great, balancing sensitivity, latitude, color, and image sharpness. Therefore, pixel size and count have to be carefully considered.

ARRI is positioning these digital cinematography cameras for HD television, commercials and feature films whose current output formats are HD 1920x1080 or 2K data. ARRI feels that uncompromised and uncompressed 4K resolution, will remain the domain of 35mm film for some time to come.

I wasn't buying this until I noticed what was happening in the digital still camera world. A funny thing happened on the way to the trade show. The pixel race is slowing down. Look at the recently introduced Canon G11 digital still camera. At 10 megapixels, it replaces the previous model, G10, which boasted 14.7 megapixels. But the new camera is twice as sensitive (ISO 3200) and offers two more stops of performance.

Image quality is affected by pixel size: larger pixels have a higher

sensitivity and wider latitude, while smaller pixels provide better resolution with smoother stair-step edges. In addition, larger pixels output at lower data rates and can handle data more efficiently in the camera. Using larger pixels means that BLUE does not have to use data compression for its ARRIRAW outputs, and can provide uncompressed and uncompromised image quality.

In designing a single 35mm format 3.5K sensor with HD/2K output for the BLUE cameras, 8.25 micron pixels were selected. (Your hair is about 50 microns thick.) Think of sensors as buckets sitting out in the rain, and pretend the rain is a stand-in for photons of light. The larger the bucket, or sensor, the more light can be gathered. The smaller the bucket, the more buckets can be placed side by side (higher resolution), but they can't hold as much. From this 3.5 K sensor, the new cameras generate images in HD or 2K. It does this through oversampling, which means that more pixels are captured by the sensor than are required for the output format, and the image is downsampled by the image processor. For example, 2880 x 1620 sensor pixels are downsampled to 1920 x 1080 for HD output, and 3072 x 1728 sensor pixels are downsampled to 2048 x 1152 for a 16:9 2K DI. The A-OV Plus camera will be able to use even more pixels for 4:3 formats, with its total sensor pixel count of 3392 x 2200.

The way the camera manages to have a wider "exposure latitude" is with two 14 bit A/D converters that deliver separate high and low gain signals that are then re-combined into a single 16 bit high dynamic range image. This is very similar to the way the ARRISCAN works, exposing each frame of film multiple times for highlights and low light areas.

I'm looking forward to working with the new digital cameras from ARRI and finding out what their real name will be.





ARRI's Oliver Temmler and Marc Shipman-Mueller with design models of Alexa. Alex OV-Plus (Optical Viewfinder) model, below.



### What's in the Box?

ARRI's three new digital motion picture cameras arrived at IBC on September 10, 2009. They were called by their code-names: Alexa. By the end of the show the catchy name had caught on, and it seems difficult to imagine calling these cameras anything else when they go into production starting mid 2010.

A really special view was reserved for the lucky or persistent few. ARRI's "whisper room" provided a sneak peak inside locked Pelican cases.

### EV, EV-Plus and OV-Plus

Prices will probably start somewhere around € 50,000. The two entry level models (EV and EV-Plus) use a new ARRI electronic viewfinder and a 16:9 picture area. The bigger-budget production camera (OV-Plus) will have an optical viewfinder, and will continue ARRI's legacy of offering a 4:3 sensor with a rotating mirror shutter. All three cameras will shoot 1-60 fps. The Plus models will have integrated wireless remote control for lens and camera operation.

Estimated arrivals are June 2010 for the EV, September 2010 for the EV Plus and December 2010

## Alexa in Amsterdam



for the OV Plus. Early adopters and owners of ARRIFLEX D-21 cameras will get first dibbs, and will be offered an upgrade trade-in path.

All three Alexas use a single CMOS sensor (35mm format, totally new design) that promises higher sensitivity and dynamic range (wider exposure latitude) than before. They accept most 35mm PL mount lenses, including anamorphics.

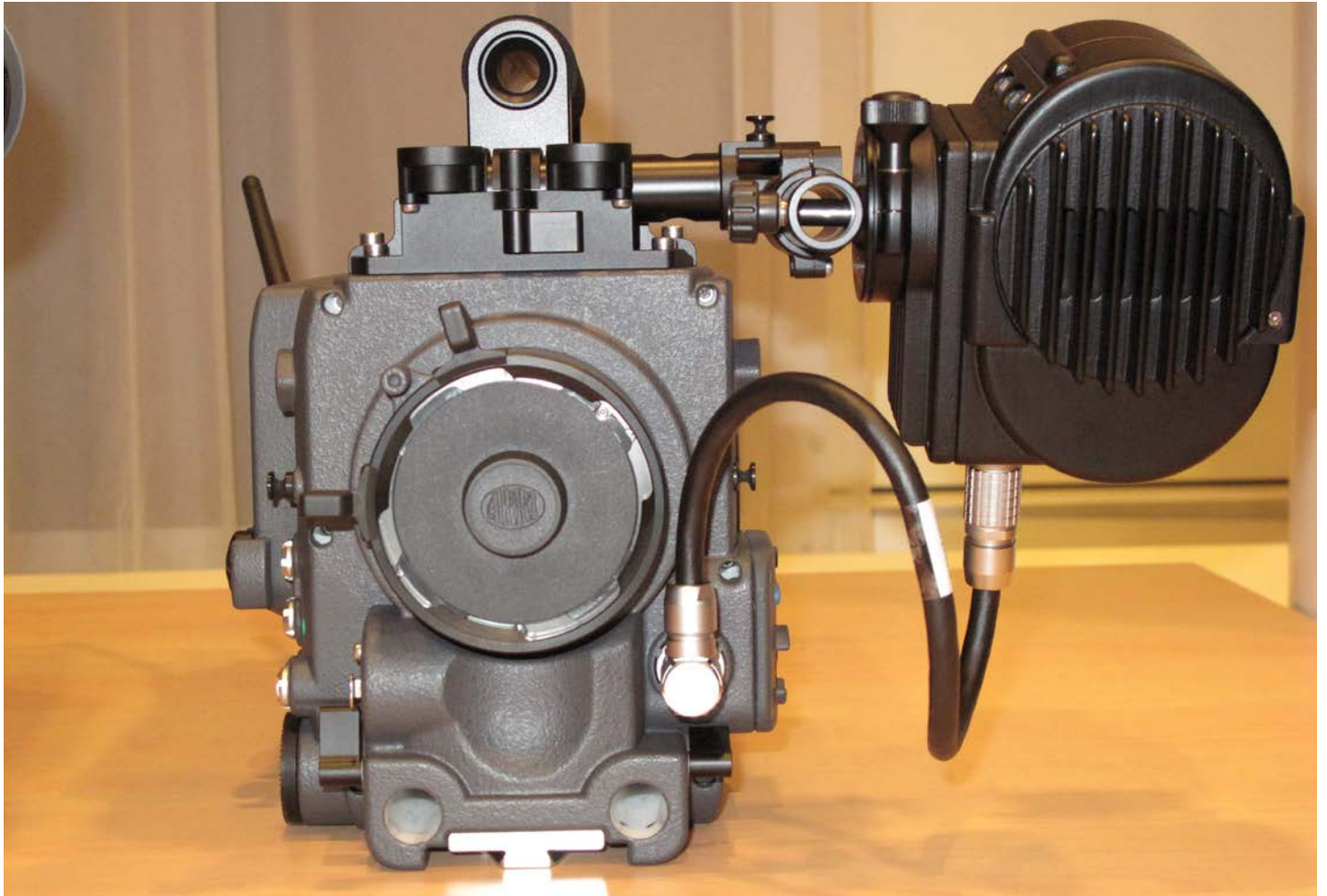
All three cameras have a base sensitivity of 800+ EI equivalent. Output options include on-board recording and multiple live HD and ARRIRAW feeds. The cameras' electronics are completely sealed for working in hostile, hot, wet, cold or miserable environments.

Three Amigos with Three Alexas. Left to right: Glen Kennel, ARRI Inc Chief Technology Officer (now President) with ALEXA EV, JF with OV-Plus, Marc Shipman-Muller, ARRI Product Manager Cameras & Lenses, with ALEXA EV-Plus.



t: Alexa Electronic Viewfinder with FLCOS (Ferroelectric Liquid Crystal Silicon) microdisplay technology. Image area of 1280 x 720 pixels. High contrast and low distortion with an evenly illuminated viewing area. Auto-calibrating, temperature controlled LED light for reliable color.





Above: front view of Alexa EV pre-prototype with electronic finder, and lightweight 15mm supports under PL mount.

Below: comparison of relative sizes of pre-prototype Alexa OV (left) and Alexa EV (right).





## Alexa EV 360° Design models: actual cameras may change







Here's our rogue's gallery of gearheads. Mug shots showing the ergonomics of the pre-prototype models we saw at IBC. Remember, these are not working cameras, but rapid prototypes made as part of the pre-production process.



Cooling. That was an interesting subject. The internal electronics are totally sealed against dust, salt, spray and dirt. Heat is blown away from the sealed capsule with a quiet, replaceable 20 db fan. Since the bearings of a fan motor are usually the first thing to go, you can pull out the entire fan and replace it with a new one. Because the electronic compartment is sealed, the fan is only blowing against a “radiator” that collects the heat from inside the electronic's compartment, and not blowing salt water, sand or dust onto sensitive components.



The electronic viewfinder model shown here (EV) is lighter and smaller than the optical viewfinder (OV) model on the opposite page. Essentially, the basic cameras are similar, but the OV version adds a spinning mirror and optical finder assembly in front. The electronic finder attaches to many places around the camera, depending on your operating needs: front, rear, right side, and so on.

## Alexa OV Plus Model



The optical modules of the Alexa OV-Plus add a few inches to the front of the camera. Notice the extra area around the ARRI logo and the familiar bulge of the mirror shutter. There's no room for molded 15mm lightweight support holes. Also, notice that the OV camera includes the "Plus" features of wireless remote camera and lens control—identified by the rear antenna and the lens motor receptacles.



Smaller and lighter than an ARRICAM Lite. Anton/Bauer and IDX style 14 volt on board batteries can be used. The camera will automatically switch between the 24V and the 12V power inputs. We noticed 12 volt and 24 volt accessory receptacles. Monitoring will be flicker-free, courtesy of image frame-store technology.



There's a convenient handgrip rosette on the camera right side. I hope there will be a handgrip rosette on the left side as well—as it is on the Arriflex 16SR. The optical finder will swing over to either side of the camera body, and extends in and out like an Arriflex 435.



## Feb 2010: ARRI Alexa's Premiere in Paris

The first working prototype of ARRI's Alexa was shown "out of competition" in the beautiful Renoir Salon auditorium of La Femis to a swarming crowd of camera groupies. This was a convocation of AFC cinematographers with credits longer to recite than an average ASC award acceptance speech.

Stephan Schenk, ARRI's Camera Unit General Manager, began the presentation by acknowledging that, having long followed



Stephan Schenk, ARRI's Camera Unit General Manager



Frank van Vught, Cinematographer

a path of laissez-faire in France, ARRI has joined the AFC as a sponsoring member, would exhibit at Micro Salon in 2011, would not open a rental house in France, and had just signed Natasza Chroscicki as Marketing and PR Consultant. He then introduced Frank van Vught, who practices shuttle cinematography between his residences in Paris and somewhere northwest of Munich.

This was the first of the three Alexa siblings: the A-EV, base model with Electronic Viewfinder. Last seen at IBC as a mockup and electronic breadboard, this was the real deal.

What astonished me was how easy it was to set up. Dare I say it? Menus easy enough to navigate that even a cinematographer can understand. Most of us were able to learn how to use the camera in about 5 minutes.

The commands and buttons are familiar, like a film camera: FPS, Shutter, EI (Exposure Index, ISO), and WB (Color Temperature). Real buttons control each function; you don't have to drill deep into menus. The display is intuitive, and you can see all your settings at once.

Alexa sits comfortably on the shoulder. Lightweight support rod receptacles are molded into the front of the casting.

You'll be able to use a 235-style baseplate or a video-style mounting plate. Shoulder pads attach to the bottom. The viewfinder is adjustable for almost any camera operator's comfort.

Good news for everyone who wants a camera that doesn't assume you're right-handed, right-eyed or right-shouldered. Two weeks





## ARRI Alexa's Premiere in Paris

after Micro Salon, we learned that they've moved the operating controls up, making room for a handgrip rosette mirroring the one on the camera right side. Last seen on the Arriflex 16SR3, I've been whining and pining for the return of the left handgrip rosette lacking on every camera ever since. A symmetrical camera once again. I find it much easier to attach left and right handgrips directly to the rosettes instead of the rods--much simpler, and they don't twist.

*At right, below, Angénieux CEO Philippe Parain, handheld with Alexa before she became ambidexterous.*





# April 2010: ARRI ALEXA's debut at DGA

By the time you read this, working models of Alexa (now named ALEXA) will have been presented on April 6th at the DGA Theater in Hollywood. The rest of the world will get to see her at NAB.

The pictures here are renderings, since an ARRI camera introduction like this is inevitably a race from Türkenstrasse to Munich airport just as they're closing the doors for Lufthansa's nonstop Munich-LAX flight 452, with the four ALEXA models coddled in four carry-on bags.

I can just see the scenario at security. "Are you carrying large laptops in your bags?"

ALEXA courier: "They are ARRI's new motion picture cameras."

Security agent: "Film or Digital?" (Munich is, remember, a company town.)

ALEXA courier: "Digital"

Security: "Oh, the new ALEXA. I read about her in *Film and Digital Times*. Can you please turn her on?"

Of course, ALEXA starts up immediately. These are working models, headed for an even tougher audience than airport security: Hollywood and Las Vegas.

Once there, ALEXA's main attractions will be heralded: image performance, production-to-post efficiency, flexibility, durability, and open and future-proof architecture.

Here are some things we haven't seen on earlier ALEXA prototypes.

Top Handles: the new 416-style Center Camera Handle CCH-1 will be accompanied by a Side Camera Handle SCH-1, which will be offset to accommodate third party on-board recorders.

Handgrip rosette on the left and right sides.

BNC covers: the right body housing has been extended to the rear in two places to protect the BNC connectors.

Viewfinder Mounting Bracket VMB-1: the viewfinder mounting bracket has been completely re-designed. It now can be moved up/down in addition to left/right and forwards/backwards. Attaching and removing the viewfinder from the bracket is done using a quick-release dovetail.

Viewfinder: the viewfinder is much smaller now.

Ethernet: there's a re-designed Ethernet connector below all the other connectors. It's a LEMO 10 pin that carries Ethernet and power. Built for the rigors of production, it is much more rugged than the precious RJ-45 connector, and there will be a LEMO to RJ-45 cable.

User-assignable buttons: camera left has three user-assignable buttons, labeled 1, 2, and 3. Camera right has one big user button that will lead to a screen with a further options.

What's behind the camera-left door? The whole left side is modular. ALEXA will come with one Removable Storage Module (RSM) attached. It will accept memory cards. When other memory card technologies seem better, faster, or more appealing, you can get a new Removable Storage Module and swap it for the existing RSM. With storage technology moving so quickly, it is good to have options.





## ALEXA's debut at NAB



No one knew what to expect with the introduction of ARRI's ALEXA. It was like a film premiere. The doors opened. Collective breaths were held. And then—NAB aisles almost looked like the running of the bulls. In this brave new era of electronic imaging, the combined chaotic pull of countless tweets, hits, pings, fans, and buzz drew massive crowds not seen since another camera was revealed a few years earlier in a red tent guarded by big bouncers.

There was scurrilous speculation that ARRI had bet the farm on ALEXA. I don't know about any farms, but the factory on Türkenstrasse surely is safe after all the reservations were taken for dances with ALEXA. In Paris, she was a risky debutante. She came a little late to the party, and appeared, at first blush...well...a bit modest. She didn't have the curves of the camera commended as the most sculpturally well-designed of all time, the 235. But, like Coco Hernandez, played by Irene Cara in Alan Parker's original "Fame" (shot by Michael Seresin, BSC), she skyrocketed from plain to fame.

I trust they're working in shifts around the clock at ARRI to fulfill the hundreds of orders taken for Alexas. It was the right camera at

the right time: economies swooning like a starlet's mood swings, studios looking for lighter, smaller, faster cameras to bolt onto 3D rigs, and interest in Brobdingnagian projection temporarily on hold because everyone is so engrossed in viewing films on paperback-sized iPads.

Is it a PL world? Not always. ALEXA comes standard with PL mount, but the press-briefing powerpointed to an open architecture with an "Exchangeable Lens Mount (ELM) system that accommodates PL, Panavision, and still camera lenses." Angénieux showed Optimos with Canon mounts and ZEISS showed their Lightweight Zoom with Canon EF and Nikon F mounts.

It's a curious thing. Tape and video were previously pushed as cheaper alternatives to film. But could it be possible that, as we migrate to a "Moore-K" world, with ever more voracious storage and archiving demands, that film may end up being if not the most enduring medium for high-end production, then also the most economical? The tortoise and the hare in the digital dilemma.





Arriflex 235



Alexa with Prototype Door



Behind Alexa's Prototype Door: two SXS PRO Memory Card slots

## ARRI Alexa: From Prototype to Production

The term “missing link” was used by geologist Sir Charles Lyell in his 1863 edition of “Geological Evidences of the Antiquity of Man”, referring to fossils that illustrate transitional evolutionary development. Charles Darwin had published “On the Origin of the Species” four years earlier, but lamented that the lack of transitional fossils were “the most obvious and gravest objection which can be urged against my theory.”

ARRI's February 2010 Alexa prototype shown at the AFC Micro Salon had the vestigial hinged side door of a traditional film camera, like the Arriflex 235, (top, left). Alexa's door wouldn't open. We were asked to wait until April to learn what would go inside.

The big news at Alexa's Los Angeles and Las Vegas debut in April was under the round gray door of the working prototypes. The Alexa prototype door (left, second from top) had a curious transparent window, telegraphing the fact that this was not a light-tight chamber for analog silver exposure. There wasn't a cinematographer in the room who could refrain from opening the gray door to thread the film...er...see two SxS PRO Memory cards. This design has changed on the production cameras (see bottom, left), but the readily-available SxS PRO Memory cards remain the same. Cards currently come in 8, 16 and 32 GB sizes.

The “missing link” really is the remarkable Shoot>Edit paradigm, a stunningly simple link from camera to edit. Michael Phillips of Avid said, “Avid Media Composer 5 is primed for a ProRes offline workflow and Avid DS supports the ARRIRAW format—creating a very rich and flexible conform solution. Having that choice in a camera will streamline many productions needing to deliver in a variety of formats.”

Alexa records all flavors of ProRes with audio, metadata and XML files. The QuickTime files load directly into Final Cut Pro or Avid Media Composer without the need for transcoding or log-and-transfer.

The transitional prototypes shown here demonstrate a thoughtful path taken by a long-established analog motion picture camera manufacturer into brave new hybrid film and digital worlds. The “missing link” may be a popular evolutionary term, but there's little missing in this exciting new digital motion picture camera as we evolve from film to files.



## April 2010 to March 2014: Camera Left Side Evolution



ALEXA Prototype Door. June 2009.



By May 2013, the camera left media bay had evolved into this. Shown with XR Module, Codex XR Drive and SxS Adapter.



ALEXA XT Plus with choices: Codex XR Drive, CFAST 2.0 adapter and SxS adapter. March 2014.



ALEXA XT Modules. Feb 2014



# June 2010: ARRI ALEXA in 5 Minutes

1. Insert lens, rods, follow focus, matte box and all the accessories you're used to installing on ARRI cameras.

2. Attach and plug in the electronic viewfinder. Diopter adjustment is in the usual place.

EVF: Push to get a menu in the viewfinder that lets you set up the viewfinder.

CAM: While looking in the viewfinder, this button changes important camera parameters (fps, shutter, EI, etc.) without having to walk around to the camera right display.

3. Insert lens. Comes standard with PL mount, but Panavision, Canon, Nikon and other mounts are expected.

4. You can choose between standard film-style base plates or video quick release plates.

User-assignable buttons will be programmable from within the main camera menu to allow one of a number of functions to be assigned, depending on the style of shooting and the Operator's preference—things like "MON OUT surround view on/off", "MON OUT frame lines on/off", "MON OUT status info on/off", "MON OUT frame lines color change", and others.

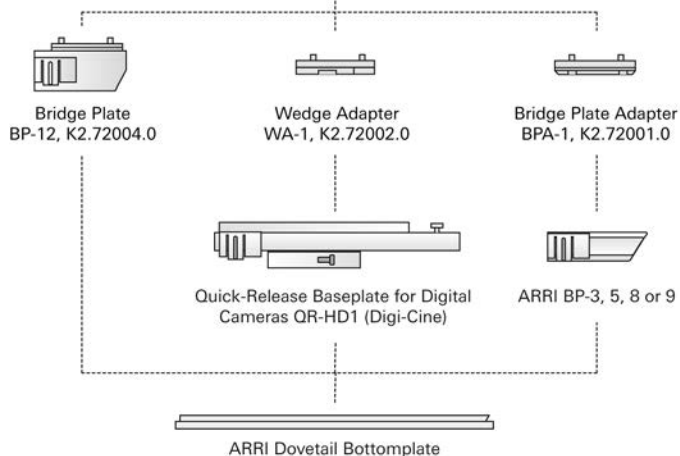
5. Insert two SxS PRO Memory cards.

8. REC: Push to record. Push again to stop.

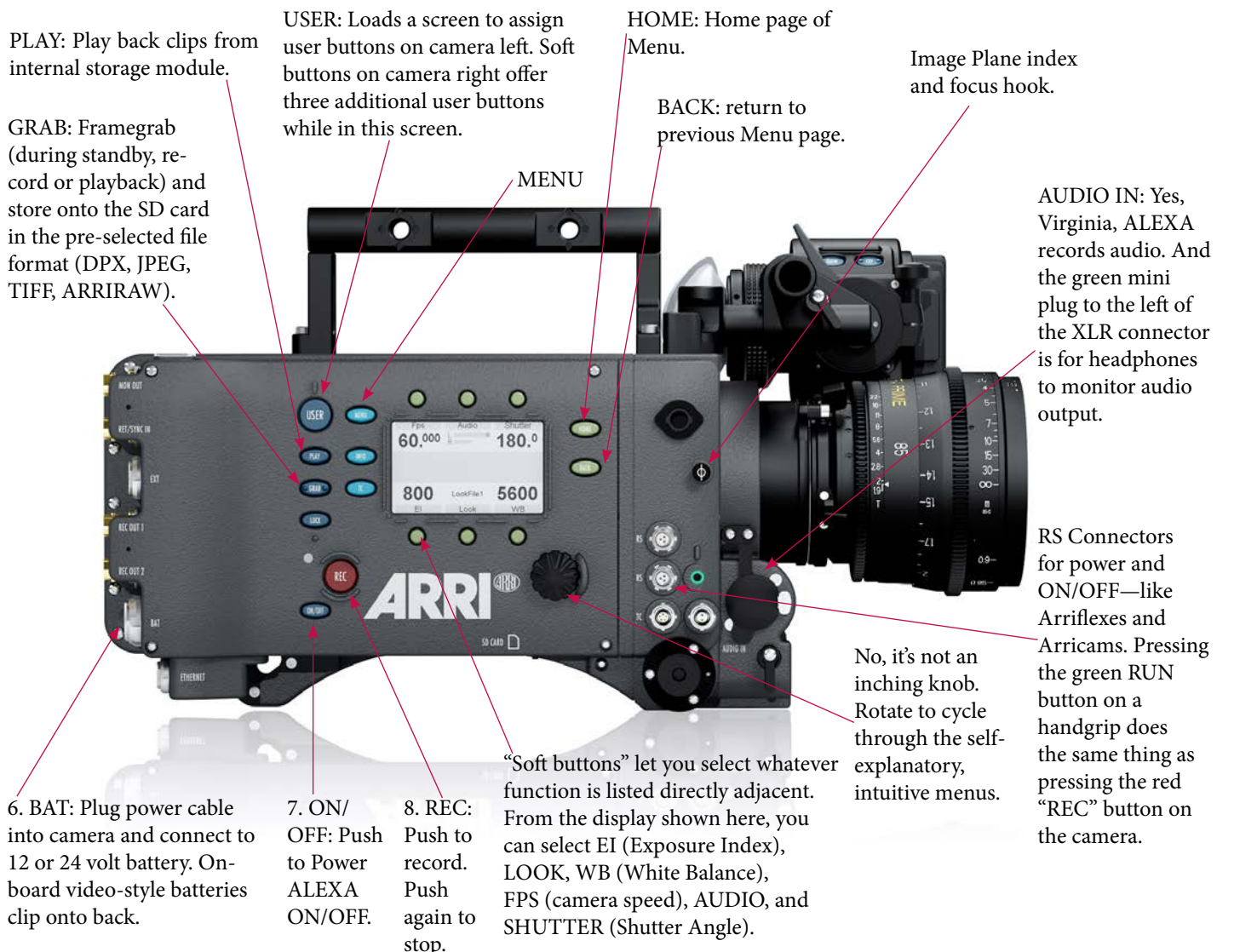
Note: ARRI tells us that some of the features described here may not be ready in ALEXA's first software release, but will be provided later.



The SxS PRO cards sit in a removable storage module. As technology progresses, expect to see ARRI supply other card modules for other storage devices.



# ALEXA in 5 Minutes







ALEXA Plus

## ALEXA Plus: Blue Two

ARRI is at IBC 11.F21 and Cinec 3-C1, on schedule with the second of the three promised and promising ALEXA siblings: ALEXA Plus. They also have new focusing LED lighting, ARRI/FUJINON Alura Zooms, Camera Accessories, Scanners and more.

It's been a year since we announced ALEXA's debut at IBC 2009. ARRI is probably working overtime to keep up with demand as Alexas go onto productions worldwide. The first Alexas delivered pretty much on schedule in the US to Pace, Clairmont Camera, Otto Nemenz International, Fletcher Camera, Alternative Rentals, ARRI CSC, The Camera House, Sim Video, Stargate Studios, TCS, VER, Videofax and Video MTL. Also, Abel Cine Tech has become an authorized ARRI reseller of ALEXA.

ALEXA Plus has all the features of the original original camera... PLUS... a new camera-right side electronics module that adds built-in wireless remote control (WRS), ARRI Lens Data System (LDS), a second MON OUT video output, a third RS power output and built-in position and motion sensors. The sensors provide information for visual effects work in post.

This modular approach is familiar territory— something like the FEM module for Arriflex 435 cameras, or the 416 Plus module for the 416. ALEXA Plus should be shipping in the beginning of 2011, available as part of a complete camera or as an upgrade.

ARRI LDS displays depth of field and lens data in the camera's

electronic viewfinder or on an external video monitor. To do this, ALEXA's standard PL lens mount is swapped for a PL mount with LDS electrical connectors as part of the upgrade. All LDS lens data can be saved as metadata, in ProRes, HD-SDI and ARRIRAW.

The Remote Control Unit RCU-4 is a compact cabled remote for the ALEXA and ALEXA Plus cameras. It mirrors the camera-right interface, and will be applauded by all camera assistants who work on the smart side of the camera (camera left). The RCU-4 controls all camera functions. It will prove helpful on cranes, 3D rigs, Steadicams, and almost everywhere else.

Ted Churchill must be smiling somewhere: the Low Mode Set LMS-3 has more holes than a Swiss cheese. It attaches directly to the camera's top for Steadicam or upside-down 3D rig mounting.

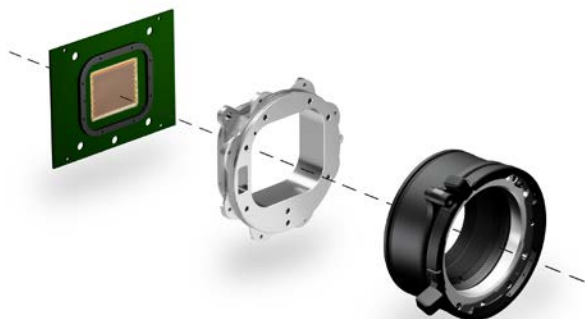
The Wireless Network Adapter WNA-1 lets you communicate with ALEXA by WiFi. This paves the way for camera remote control, metadata input and output, automated script notes, automated camera reports, and sharing information on set and on location. Since ALEXA cameras are designed as web servers using the Bonjour protocol, any iPad, netbook, laptop or other WiFi device with a browser can connect to the cameras automatically, without any configuration. Each ALEXA has a basic remote control web page built-in (Browser Remote Software: BRS-1). A camera control protocol will allow third party app developers to access ALEXA's functions and metadata.



ALEXA Remote Control Unit RCU-4

## Remote Control Unit RCU-4

Put the controls on the left side or on top or anywhere else you like. The Remote Control Unit RCU-4 is a cabled remote for the ALEXA and ALEXA Plus cameras. It has the same layout, display, and buttons as the control panel on the camera right side of ALEXA.



ALEXA Low Mode Set LMS-3

## ALEXA Low Mode Set LMS-3

The low mode plate attaches directly on top of ALEXA. It's helpful for Steadicam, underslung, and for 3D rigs. There are numerous 3/8-16 mounting threads, including attachment points for the Viewfinder Mounting Bracket, the ALEXA Camera Center Handle, 235, and D-21 low mode handles.







## From IBC 2009 to IBC 2010



IBC, Amsterdam, September 10, 2009: Three new prototype ARRI digital cameras are announced, promising to be lighter, smaller, faster, cheaper. Code-named Alexa, three models are planned: EV, EV-Plus, and OV-Plus. Left to right: ARRI (USA) Inc CEO Glenn Kennel; Jon Fauer; Product Manager Marc Shipman-Mueller.



AFC Micro Salon, Paris, February 13, 2010: The first working prototype of ARRI's Alexa is shown at the AFC Micro Salon in Paris. Stephan Schenk, General Manager of the Camera Business Unit, introduces Alexa to a packed auditorium in the Renoir Salon of La Fémis.



DGA, April 6, 2010: Advanced prototypes are introduced to the Hollywood production community right before NAB. Shoot>Edit is enabled with onboard SxS PRO Memory Cards, ProRes and uncompressed raw output. Another big surprise: two Alura zooms co-developed by ARRI and FUJINON. A week later, ALEXA is shown at NAB. ARRI is inundated with orders. Above: Haskell Wexler, ASC.



Cine Gear, June 2010: The first production models of ALEXA have been delivered. "Anonymous" has already wrapped, shot since March 2010 with the first two working prototype ALEXAs by cinematographer Anna Foerster and director Roland Emmerich. Candlelit scenes are exposed at 1280 EI.



Shepperton Studios, London, June 29, 2010: Seven ALEXAs begin production on Director Martin Scorsese's "Hugo Cabret," shot in 3D stereo by Bob Richardson, ASC (left), with first assistant Gregor Tavenner (right).



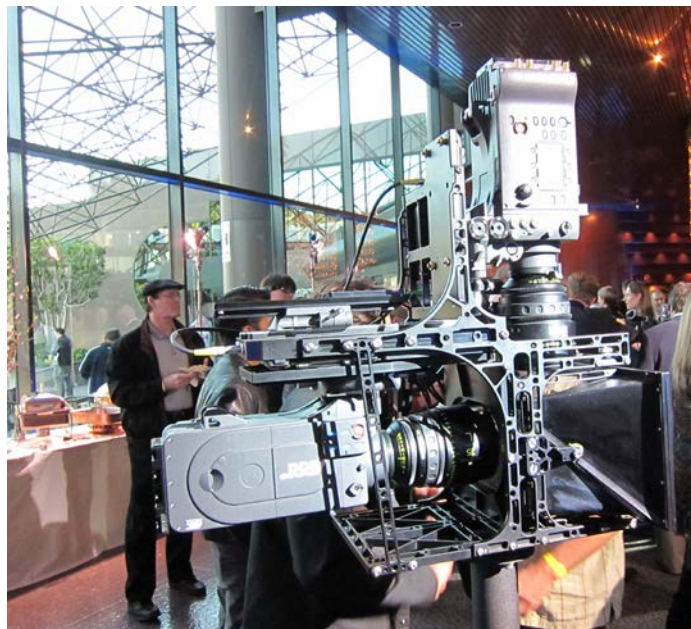
IBC, Amsterdam, September 10, 2010: One year later. Several hundred ALEXA cameras have been delivered. The second sibling, ALEXA Plus is introduced at IBC. By the end of the following week at Cinec in Munich, a large number of ALEXAs have been ordered.



## From IBC 2009 to IBC 2010



Accepting Cinec 2010 award (l-r) from presenter Denny Clairmont are: Marc Shipman-Mueller, Product Manager; Dr. Achim Oehler; and Michael Cieslinski.



ALEXAs on 3D Rig at DGA Premiere in Hollywood, April 2010



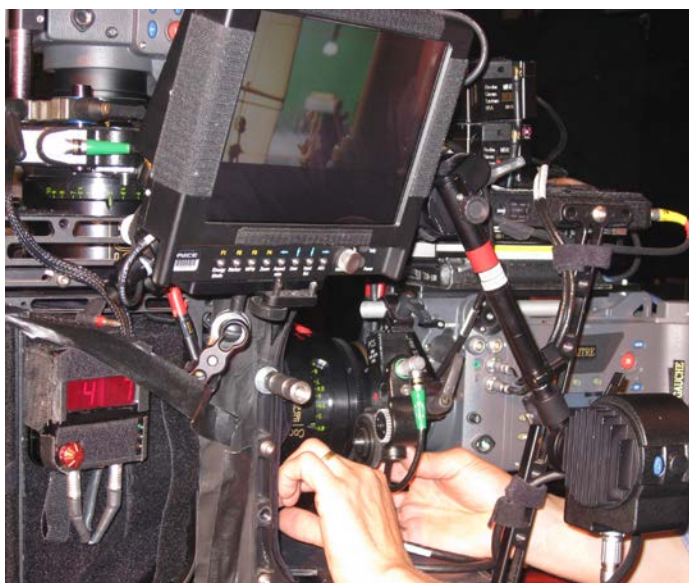
ALEXA Plus at IBC, shown with Remote Control Unit RCU-4



Stefan Ukas-Bradley, of ARRI Burbank, with ALEXA Plus, ARRI/FUJINON Alura 18-80 mm Zoom, and Codex Recorder



Seven ALEXAs on the Martin Scorsese 3D film "Hugo Cabret."



Chosen for "Hugo Cabret" because of high sensitivity (800 EI) and dynamic range



# A Cinematographer's Tour of ARRI ALEXA from Concept through Construction







The words we heard most often at IBC and Cinec were, “It feels like a film camera.”

ARRI ALEXA was designed as a high-end digital camera that looks and feels like a film camera, not a motion picture camera that acts like a video or still camera, nor a still camera that also shoots motion. In June 2010, I wrote, “ALEXA does for digital filmmaking what previous generations of ARRIFLEX analog film cameras did to revolutionize production: lighter, smaller, faster, handheld. ARRI ALEXA clearly demonstrates the thoughtful path taken by a long-established motion picture camera manufacturer into brave new hybrid film and digital worlds. ‘Missing link’ may be a popular evolutionary term, but there’s little missing in this exciting new digital motion picture camera as we evolve from film to files.”

The throngs of cinematographers, filmmakers and rental house personnel trying or buying ARRI ALEXAs at NAB, IBC and Cinec attested to the success of this new paradigm. Drawing on a long heritage of motion picture cameras, with an infrastructure of film, processing, editing, grading and printing, ARRI’s ALEXA is an evolutionary development from a company with intimate experience in the entire process.

Timing was important as well. ARRI promised to deliver the first ALEXA models in June. They did. ALEXA’s second sister, ALEXA Plus, was promised to debut in September. She did. This kind of punctuality inspired confidence, and the next thing you knew, customers were cajoling, pleading, whining and pushing to jump the line of orders.

Now, grizzled veterans of camera purchasing will remember that the typical turnaround time for first delivery of ARRIFLEX analog cameras was usually 18 months from the time it was first spotted under the counter at NAB or Cinec. You had to wait your turn for the camera to be built, carefully, at the rate of perhaps a dozen a month. Fast-forward to today, and they’re building ALEXAs at the rate of about one every couple of hours.

Why the rave reviews and enthusiasm? Above all, image quality. ALEXA’s film-like look comes from a masterful secret sauce created by ARRI’s scientists. The look is very similar to what we’d expect from film: highlights don’t blow out and shadow details are retained with very little noise. Colors are true and abundant; skin tones are gorgeous. ALEXA handles a wide 14 stops of exposure latitude, with a base sensitivity of 800 EI. The exposure index is adjustable from 160 to 1600 EI.

ARRI ALEXA rests comfortably on your shoulder like an ARRIFLEX 235 or 416, and is equally ergonomic on a head or Steadicam. ALEXA weighs about the same as an ARRIFLEX 435.

Controls are all in the right places, down to the Camera-Left Start-Stop button. (It’s red now, instead of green, and says “REC” instead of “RUN.”)

ARRI ALEXA can be operated like a film-style camera. The control panel is familiar to anyone who has used a recent ARRIFLEX or ARRICAM. You don’t have to drill down through layers of complex menus. An elegantly intuitive, Apple-like interface guides you through the essential choices. Test drive the menu system at your leisure with a simple, online demo: [www.arrydigital.com/technical/simulator](http://www.arrydigital.com/technical/simulator)

There’s something else. ALEXA is built like an ARRI. Which means it’s really robust, incredibly well made, and solid as a...well, solid as an ARRI. Join us on the next pages, as we are invited to tour the development and manufacturing facilities at 89 Türkenstrasse in Munich. This is where all other ARRIFLEX cameras have been manufactured. ALEXAs are made in the same place, by many of the same familiar faces. Seven years ago, I did a similar report on ARRICAM construction. This ALEXA tour was like a reunion. Camera movements may have been replaced by electronic sensors, and sprocket rollers have made way for miniature cooling ducts. But the attention to quality, detail, and careful construction remains the same.

# Origins of ALEXA: an Interview with Franz Kraus



Franz Kraus, ARRI Managing Director

**Jon Fauer: The ARRI ALEXA already appears to be one of the most successful cameras ARRI ever built. It didn't evolve out of thin air. Please tell us how it came about.**

Franz Kraus: The same group that designed the ARRISCAN and the D-20/D-21 cameras also designed ALEXA. Dr. Achim Oehler, who was head of the scanner project, took over the ALEXA project. So we had already collected the know-how in how images would need to look, and what image processing would have to be done to have film-like images coming out of digital capture. This also applied to manufacturing in the transition from the analog technology to digital. It may seem like a drastic change, but it is not that much. We had experience with film and digital cameras—the whole user interface, wireless control, micro controllers, CMOS sensors, FPGA based image processing—we had done that before. The new thing was to pull the image processing from the scanner, to reduce that significantly in size and power consumption, and to integrate it in an electronic box that could be carried around.

**And it's not so alien or foreign to anyone. This is a camera that any analog filmmaker can relate to.**

We really tried to use as much as possible from the 235 and 416, and we learned a lot when we designed this. Why should digital capture have a totally different user interface? Shooting takes place not for technical reasons but for creative ones.

**However, ALEXA has the familiar ARRI feel and quality.**

Actually, when we started to test the first prototypes of the ALEXA, we went back to where we started with the ARRICAM. With the ARRICAM, we put a very rigorous quality control system in place because many things had been new for us. The demand was very high, and we wanted to provide the very best camera to the industry. We installed extreme temperature and shaking tests. We shook the cameras at high acceleration rates. Not all the ARRICAMs passed, nor all the ALEXAs. They go

back, parts are exchanged, and then the same testing happens again. Each ALEXA undergoes a burn-in phase, undergoes the shake tests. Part of why we feel rather confident in shipping products that can be used immediately on production is because we are taking as much care as possible in-house to deliver something that won't break down in rough environments.

**When did this project first start? When was the first inkling that you knew you were going to do this?**

We knew when we started the D-20 and D-21 that we would learn as much as possible. The D-20 was designed in a very modular way, with a housing much larger than it could have been. This was so we could include many things one would not use for regular shoots, but were, at that time, considered somewhat crazy: to have several corrected HD outputs and raw capabilities, optical mirror shutter, and optical viewfinder. We wanted to evaluate as much as possible whether the D-20 and D-21 would deliver images that could inter-cut with film, and provide a filmic image.

The ALEXA project really started when we put some ongoing development resources into making the D-20 become the D-21. We collected ideas on what the next generation camera should be, and how to manufacture it in quantity. We learned about the requirements of what people would expect from Raw Data, what people would expect from seeing a decent REC 709 image, but at the same time recording log C. After evaluating the advances in technology on the sensor side, we started on the design of the CMOS sensor about 3 ½ years ago, as the major building block. We also worked on the analog front-end, because it's a rather complex sensor. When we started, we wanted to have the best image possible for a 2K/HD workflow.

With the DI systems that we started many years ago, we always had been 4K compatible. But we also learned that 4K was unfortunately not really used often in the film industry, for many reasons. In print distribution, there's very little that is left and as we know, in digital distribution, there is not yet a common practice to bring 4K to the screen, not even to a 4K projector if you cross off the data rates which are a part of the DCI recommendations as they are today.

There is not, unfortunately, a benefit in going for 4K DI today and for the next few years. Seeing how easy it was, and with rather little extra expense, 4K was mostly neglected in digital intermediates. That got us to thinking: "why should people think differently about capture?"

Sure, it's always nice to have reserves, to have over-sampling. But, the question was, "how much do you need to trade in?"

And we felt for the time being that we'd rather go for wide dynamic range, high sensitivity, very good contrast, and accurate color reproduction, rather than go for high resolution, which unfortunately today nobody is able to enjoy.

Beautiful filmic-looking images exceeding 2K don't come for free. We can enjoy them with today's technology both in analog distribution or digital distribution, unfortunately with the limits mentioned. That was the reason why we concentrated on making the best possible camera for 2K DI and for HD workflow.



# October 2010: Interview with Franz Kraus

## Is the sensor technology related to the scanner?

No, it's the next generation. The ARRISCAN has the same sensor technology that the D-20 and D-21 had. The scanner was released 2003. What we have done with the ALEXA, from the design and the foundry technology, wasn't possible then.

**ALEXA was pretty much your vision. How do you go from a vision, an idea, to actually making it possible to the point where you have the sensors designed to where production begins—down to intricate details like even custom-designing the workbenches?**

You need to have people who think in the same way. It's probably as much a sales effort selling products to the end customer as selling ideas to your team members, be it marketing or be it R&D. We have a team with a long history at ARRI. Marc Shipman-Mueller, on the product management side, worked on the ARRILASER as his first job when he came to Germany. He was there for the very first digital product ARRI ever produced. Walter Trauninger, head of the ARRICAM team, was responsible for the ALEXA manufacturing side. We wanted to have a product that was affordable and robust.

We knew that people expected ARRI to produce an innovative, dependable, rugged "best in class" camera that would live up to the reputation of our film cameras—to be used around the world, not just in selected production environments. Credit must also go to the ARRI owners, because they believed in ALEXA and spent a lot of money on development.

**This idea was hatching in your mind a long time. I remember, it was exactly ten years ago. You and I were at NAB with the latest little consumer digital still cameras. You held it up, and said this is the future. I asked, "how long?" You said, "2010." Your prediction was correct ten years ago.**

I think the technology roadmaps are there. An engineer can read that and know what will happen with consumer electronics and how much can become a tool for professional media production. Nobody should be surprised by that. One needs to put one's own strategy on it—not being part of consumer manufacturing.

Based on the success of ALEXA, we are very confident that we will have technology for the next generations of products, some of which will be different from what will come out of consumer electronics. I respect what they are capable of, whether it's backside illumination, ASICs, and so on. But they have approaches that must accommodate the needs of a very diverse group of users and hit rather low price points. That is where we need to get started in differentiating key technologies and features. Sometimes, you have to forego offering too many functions, but instead offer just the right ones in a well-conceived and reliable way.

**I think the other thing you have to offer is service.**

It's also a concept we tested with the D-20 and D-21. The concept we have is to carry as much of the positive attributes from the analog area to the digital world. Yes, we are expensive: that is probably not felt to be a positive attribute. But the investment is secured for many years. The difficulty comes with the electronic design.

We can't change Moore's Law; we need to watch very carefully

to benefit from Moore's Law. What can be done is to work in a modular fashion and in an electronics architecture topology, where we know we are going to have certain elements probably exchanged in two years. Our belief with the sensor is that it isn't following Moore's Law as faithfully because the demands are driven by other industries. The large common sensors probably will remain with a quality you can provide if you have put enough headroom; you'll need more processing. The concept we have in mind is that whoever buys an ALEXA will not be left on their own in future years. That means we need to have a service network making sure that whenever something happens, we are close by to help. We will also be available to make upgrades or add modules. And that requires trained service personnel who can look after service and upgrades.

**Please discuss size, weight, and cooling.**

The larger D-21 did not have a fan; it was passive cooling that takes space. We knew we would not get along with this concept with a more compact camera. It needed to become more compact, this was very obvious. So we decided to go with encapsulated electronics and a heat pipe system. That comes at a cost. It adds price, it adds weight, it adds power consumption. So it doesn't, unfortunately, come for free. But ultimately I am convinced it will be part of why ALEXA is so robust. We control the temperature of both the sensor and the image processing electronics. In the regular world, you would not need this. But in extremes, if you don't do it, probably the images won't be consistent. We decided which ingredients each and every camera with the ARRI label needs to have. Those are elements where we think we differentiate ourselves from others.

**Is the sensor a modular part that can be changed in the future?**

I think if it had been so easy, we would have an ALEXA sensor in the D-21. We would love to have this, but there are too many changes. We would really have to build completely new electronics into an old housing, which does not make sense.

**Where do you see the viewfinder going: optical or electronic?**

Without any question, high end cinematographers are asking for optical viewfinders—especially the ones who operate their own camera. They grew up knowing exactly what to expect when looking into an optical finder. It won't be large numbers, but it's a larger number than you would expect. We are close to a decision. We are reviewing it now.

**I vote for it.**

It might be likely. But it's not going to be a great business model for us. It is more like doing a service and getting the appreciation from cinematographers who go from analog to digital, to support them. Obviously, we can't make money on that approach, and so that difficulty will be target pricing and the numbers of cameras we can sell for that.

**What about film? What do you see as the role of film, or high end productions? What's the turning point?**

I think there are very many variables. If the motion picture industry has learned from the professional still photo industry, then probably the industry will be more intelligent, not dropping service, not over-pricing.

# Interview with Franz Kraus

Today, if you shoot a picture that is not 3D or relying heavily on CGI, probably the best thing is still film. It is future-proof. There are no archive issues. You can take it to any resolution. There are great DI tools. It's commonplace throughout the world. There's an established worldwide 4K capable workflow. So there is headroom. Why throw that away?

There are other productions, 3D features, TV drama or features with lots of CGI, where digital capture makes a lot of sense. It is interesting that we also see a small Renaissance of film (2 perf and Super 16) for TV programs in some countries because of the film look. Film has a unique look, and it probably doesn't make sense to work very hard to make digital look like film when you can simply shoot film instead.

## **How did you convert an entire area of your analog camera factory to digital production—almost overnight?**

We changed many things because we rely on many components. If we want to assure quality, we need to have extensive testing and certification. So, we invested a lot in that. In selecting very good suppliers, as we have with digital high-end products, we knew them from the ARRILASER, the scanner, the HD-IVS—all with components that are very compact. We knew who would be the right partners. I'm happy to say that the majority of partners are in Germany, and I'm proud to say it's a German-made camera. People may think, "Well, they have film cameras, how can it be that they have a successful digital camera? That's probably luck."

No, it was hard work over many years, starting with the ARRILASER. The design of the ARRILASER was started in 1995 and the product was launched in 1998. We had a great team, with very solid internal and external capabilities. Whatever we could develop from where we were to the next generation, we did. We have partners going back many, many years. They have grown as well.

## **What about the sensor development? How did you arrive at that? Did you start with describing the look that you wanted and then find the suppliers?**

We have a great guy in our R&D team who worked more than 10 years ago with a professor from the Munich University on the design of our first Cine format CMOS sensor and successfully carried it through several revisions. Regarding CMOS sensors and the imaging front end, we learned a lot from the D20/D21 and the ARRISCAN (which uses the same sensor, but in a black and white version). From 2003 on, when the first D-20s were supplied to film projects, we sourced as much information from production as possible in order to create an organic, filmic looking image from digital capture. All that experience, combined with substantial color science from another long-standing ARRI R&D member, led to the specification, characteristics, and structure of the rather complex but extremely powerful custom ALEXA CMOS sensor and the ALEXA imaging front end and color processing. The sensor is the key component but by far not the only one.

## **ALEXA is a great success. How will you keep up with the demand?**

We are told that's a nice problem, but I need to say it's still a problem because it coincides with an increase in demand in the

IT industry. A year ago the supply was an easy one; today, we have turnaround times which have changed dramatically. And, we did not expect the large number of orders we received.

## **So, that's a good thing.**

It is a very good thing, but now the difficulty is to make sure not to disappoint customers who need a camera today. On the other hand, we don't want to jeopardize quality. The ramp-up is only limited by the supply of some of the essential components.

## **Are you flexible where you can add more people to the assembly if you had to?**

That is not a problem. The ARRI spirit is there, and that really helps. The younger people within ARRI all know we need to work very hard in this digital arena. We can no longer live just off analog cameras. And that is the reason for the changed mindset: the willingness to have a single flow assembly line like you would see in Japan. If this mindset had not changed, you would see work benches where they are working on one camera, one person at a time—which probably would never produce working digital cameras in the quantities needed.

## **Explain single flow assembly.**

With single piece workflow, we assemble the camera in three production lines. One line assembles the hardware, the second uploads the software and tests basic functions in a so-called "burn-in", and the third performs in-depth quality control.

## **When I come back next year, you'll have rival teams competing to build the most cameras in the shortest time? They win a prize?**

No, I have seen that in Japan. But that is volume production. For us, quality is top. I'd rather look for a camera where the people who build it are proud to sign their names on it. Each camera can be identified by people who put it into production, and are aware of their responsibility.

## **ALEXAs are built by some of the same people who were building ARRISCAMs. That's very reassuring.**

And there are people who had worked on the ARRILASER, the ARRISCAN, and on image processing software. It is not like converting a precision mechanical engineer to an electronic engineer. To build ALEXA cameras is not a trivial thing. You need to do things in the right order and to make sure that it works at the end. We need to have all the skill from the analog camera world combined with new talent to make this work.

## **In summary?**

I think it is valuable to look at our DI products. Without the DI products, we would not have the D-20. Without the laser, we wouldn't have started the D-20 and the scanner. And the success of the laser was the ground-laying part of our digital camera business. If the owners had not been convinced that this risk had a good chance to become successful, maybe they would not have gone this route, and would have asked "can't we brand another product and add value in distribution?" There had been several other opportunities, but none of them would have left ARRI in the position of owning and mastering digital technology. That is probably the most important achievement of these last years, looking at the long term success of ARRI as a company.



## Oct 2010: A Day in the Life of ALEXA Assembly



Türkenstrasse has changed. The once gritty Schwabing neighborhood is now one of the toniest in Munich. Mario's Restaurant, with its communal lunch tables, has evolved into a fancy delicacy shop. Former beer bars are now coffee bars with more varieties of espresso than ever imagined by Starbucks.

The entrance to 89 Türkenstrasse has been renovated. We enter the familiar main gate, checking in with the gentleman who surely is the industry's friendliest reception-concierge-guard (and is a helpful resource for getting directions or phoning for cabs).

The inner courtyard is a blend of styles from ARRI's ninety years in this location: stucco, glistening aluminum, stone and glass.

ARRI occupies an entire city block: Camera Sales, DI Systems Sales, Assembly and Service (ARRILASER, ARRISCAN, ARRICUBE), R&D, Film Laboratory, Movie Theater, Stages, Audio, Post, Editing, Camera Service, and Camera Assembly.

ALEXA Assembly: that's what I'm here for today. Up an elevator, onto the same floors where I've been before to see previous cameras being assembled: ARRIFLEX 16SR, 35-3, 35BL, 435, 535, 235, 416, and ARRICAM.

A day in the life of ARRI ALEXA assembly begins with the morning meeting for planning and discussion, attended by the heads of departments, below.







Dr. Martin Prillmann, ARRI Managing Director, [May 2009 - Dec 2014](#)



Stephan Schenk, General Manager of Camera Business Unit, Sales and Marketing. [Now Managing Director.](#)



Walter Trauninger, General Manager of Camera Business Unit, Production and Service—which, of course, includes ARRI ALEXA. Walter was the Project Manager of the ARRIFLEX 435 and ARRICAM.



Marc Shipman-Mueller, Product Manager of ARRI ALEXA. Marc was also Product Manager of ARRIFLEX 235, 416, Master Primes, Ultra Prime 8R and the Alura Zooms.







One hundred cameras...and counting. One hundred cameras were delivered worldwide earlier this year. This is part of the team that builds ARRI ALEXAs.





As Walter Trauninger guided me through the assembly area, I noticed that the former heavy, rigid workbenches were gone.

In their place are ultra-modern, flexible workstations that can be individually customized by and for each worker. This is key to the modern single flow production technique that contributes to the “lean” and efficient style of manufacturing.

About 90% of the components come from nearby or are made in-house. Quality control is key to production, and all parts are rigorously tested before, during and after assembly—as we shall see.

Tested parts are placed in bins, ready for the next step.





What's the big difference between ARRIFLEX 416 assembly (besides T-shirt, above) and ALEXA? Spools of wire everywhere.

Furthermore, anyone working on electronic parts is connected with an antistatic wrist strap to antistatic mat on the workbench. This safely grounds the person working on delicate electronic components.

Service technicians working on ARRI ALEXAs will, of course, be grounded. Owner-operators, who may be tempted to look under the side panels, should be sure to be grounded first in common sense—do not attempt high-technology repairs without thorough understanding of the complexities involved. Then, and only then, proceed with caution, and with a wrist strap of your own. You can buy one for about \$5 from Amazon, Radio Shack, or your favorite computer hardware store.

Printed circuit boards are tested on something that looks like a fast sewing machine—no photos here.

The board is held in place by a jig, while a testing needle rapidly checks over a hundred test points for connectivity, tolerance, soldering, resistance, capacitance, grounding, impedance, insulation, and so on. A bank of indicator lights come to life, showing that the myriad of test point measurements have passed the stringent standards.

Next, the various electronic functions are simulated. Again, over a hundred test points are rapidly measured. Some of the boards have as many as 18 layers of circuitry in a 1/2 millimeter thick wafer board.



# Assembly



The printed circuit boards are installed in slots at the base of the camera. An innovative “radiator fin” dissipates heat from the sensor and electronics. It works just like your car. Heat is transferred to the large backbone and then to the fins at the rear of the camera. A single, large, and almost silent fan draws cooling air across the radiator. Since the electronics and sensor are sealed in a weatherproof housing, outside air contacts only the radiator fins—never the printed circuit boards or sensor.

External contaminants like dust, dirt, salt spray, pollution, particles, humidity, small insects, and rain are isolated from the internal camera components. The closest they get is the fan and the radiator.

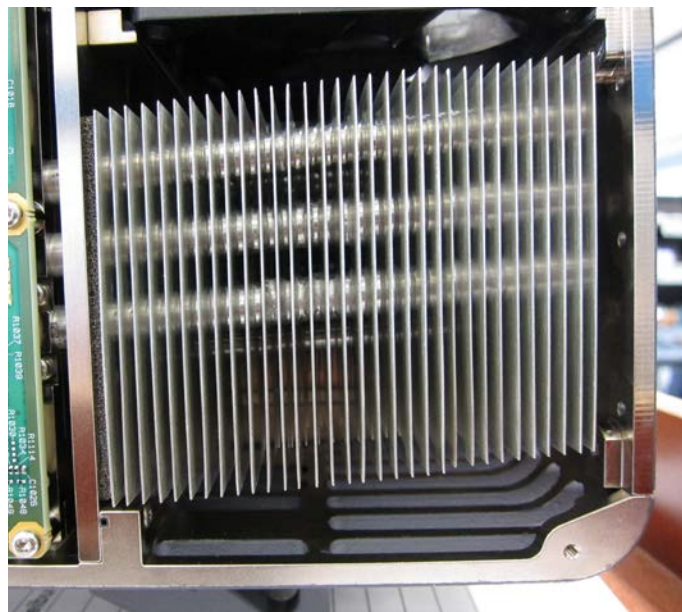
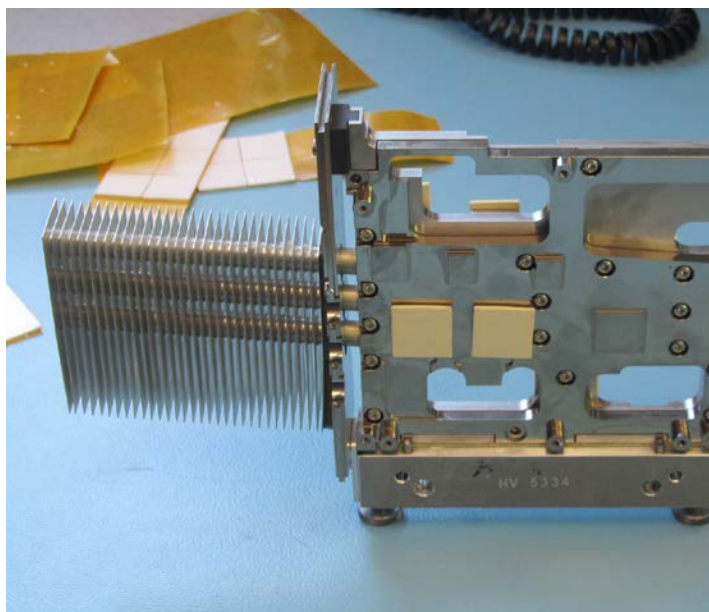
As bearings wear out, a fan can become noisier with use. Replacing an ALEXA fan is a relatively simple and inexpensive procedure for your local ARRI rental house or service center.

Assembly continues with installation of the cooling coil, analog to digital circuit board, system control board, and the power circuit. Then comes the signal processing, compression, picture, camera control, and HD-SDI / Accessory Circuit Boards.

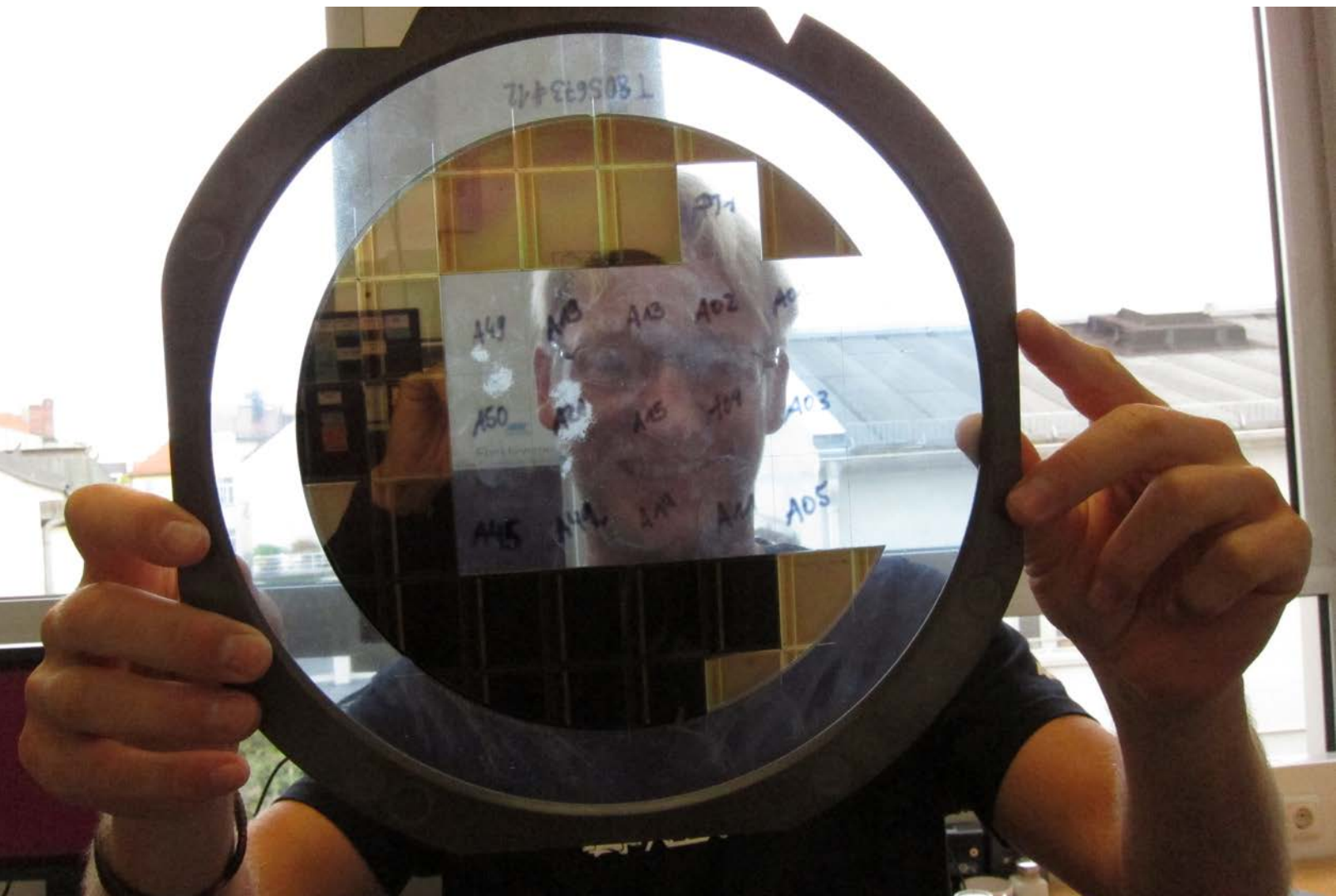
The rear fan is installed, followed by the lens mount and 3.5K ALEV 3 sensor.



Below: backbone and radiator fins







Above: sensors arrive from the foundry on a flexible carrier, arranged like a circular tray of ice cubes. They must be cut apart, mounted, connected and protected by a low pass filter pack, below.

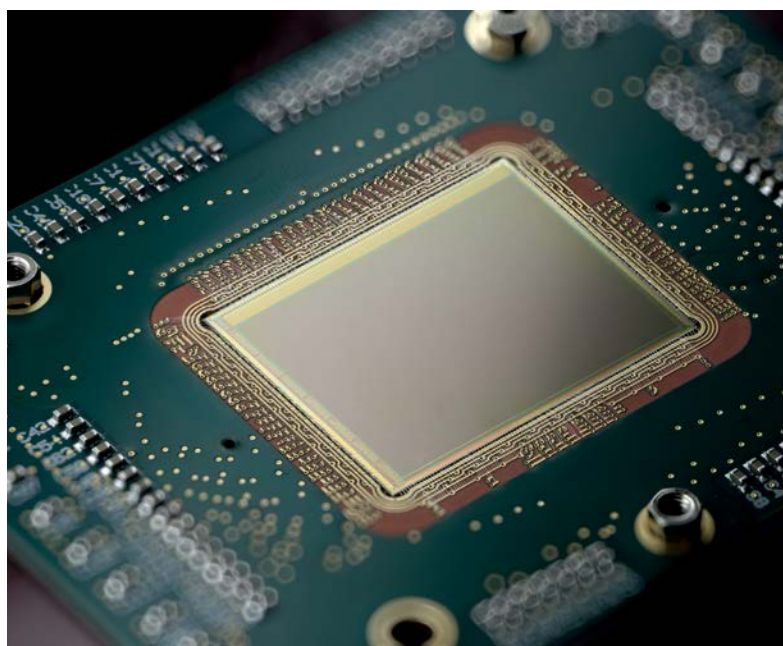
ALEXA uses a Super 35mm (16:9, 3-perf size, 25.344 x 14.256 mm) CMOS sensor. With a factory recommended setting of 800 EI, the ALEV 3 chip has a dynamic range of 14 stops, and can be rated from 160 to 1600 EI.

ALEXA's CMOS sensor and optical low pass filter are custom designed and fabricated. The 3.5K pixels oversample the image for 2K files or HD Video.

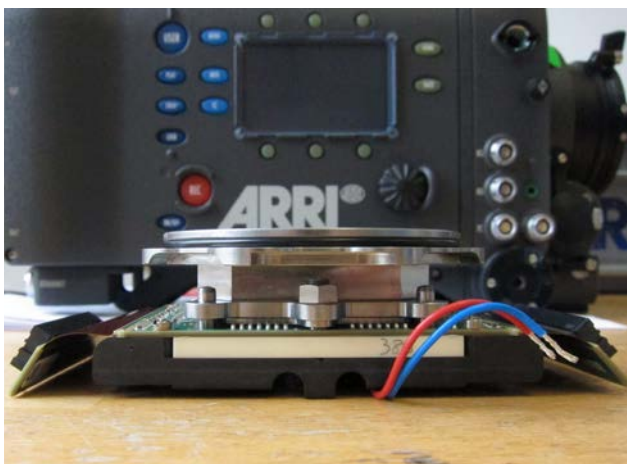
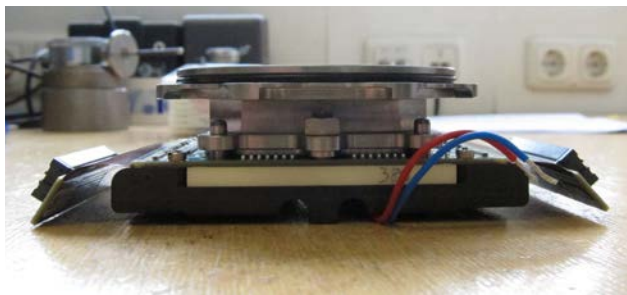
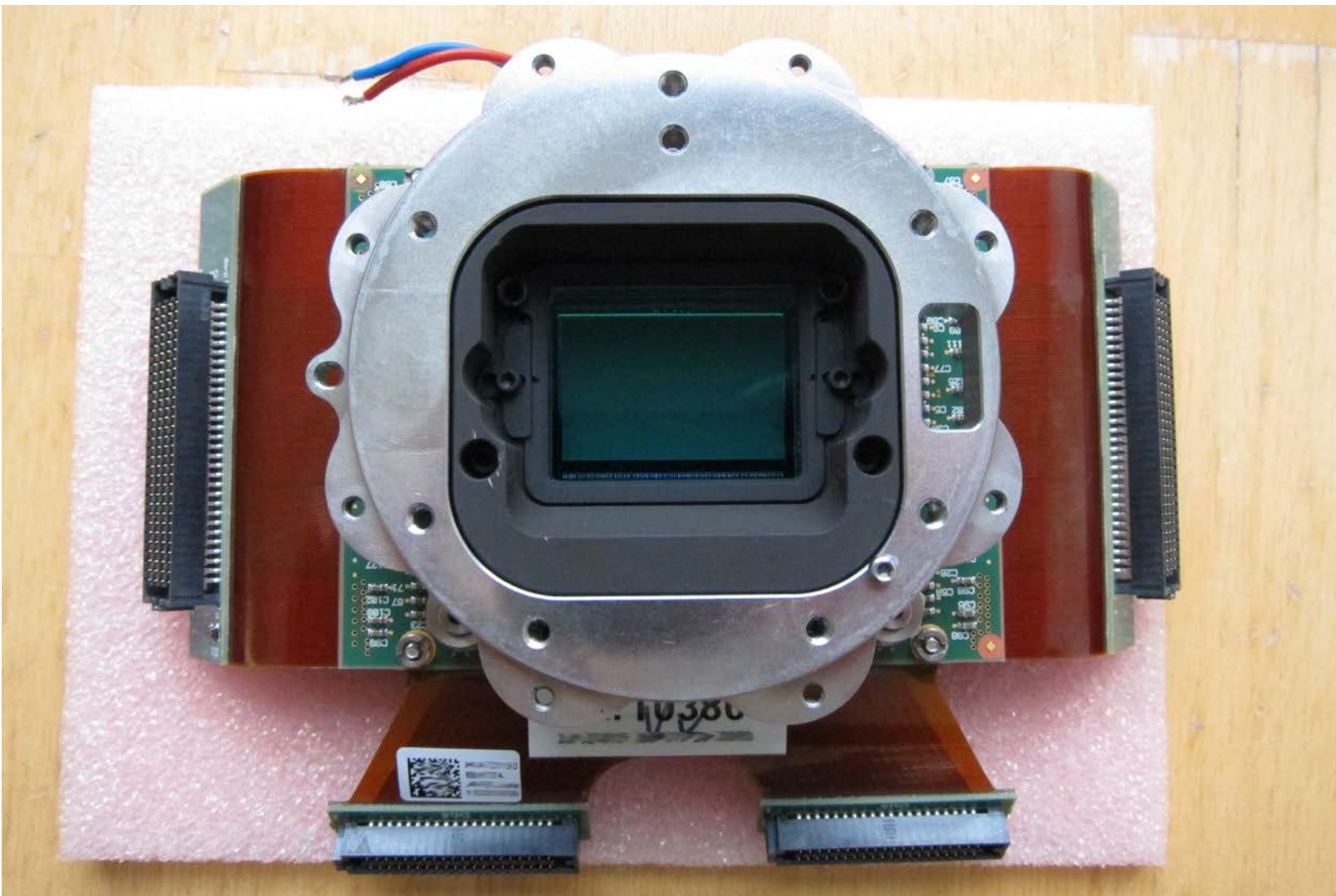
The sensor is only part of the story: imaging circuitry, software, processing algorithms, as well as proprietary components contribute to provide the filmic look, wide exposure latitude and familiar depth of field.

Specifications:

Mode	Dimensions	Ratio	Pixels
Recording ARRIRAW	23.76 x 13.365 mm 0.9354 x 0.5262"	16:9	2880 x 1620
Recording HD	23.76 x 13.365 mm 0.9354 x 0.5262"	16:9	2880 x 1620
Monitoring / EVF	26.136 x 14.702 mm 1.029 x 0.5788"	16:9	3168 x 1782







The sensor does a job similar to the emulsion on film. It gathers the light onto 8.25 micron photo receptors at the image plane. It is a thin wafer with flex cables on all sides like an octopus. It's mounted to a circuit board to keep it rigid, and a low-pass filter pack is attached. The low pass filter pack does much more than prevent aliasing. It cuts UV and IR, and is essential in keeping the sensor clean and free of dust.

If the low-pass filter pack were at the image plane, it would be like a dreaded gel filter in the gate: any dust or smudges would show up in the photographed image. Because the low pass filter pack extends away from the image plane, contaminants are slightly out of focus. However, they are still there, visible in the finished image. Therefore, whenever you change lenses, be careful about dirt or dust entering the lens cavity. Check the sensor the way you checked the gate on film cameras: with a lighted magnifier.

While there are as many opinions on low-pass filter cleaning, I like the longtime favorite for lenses, mirror shutters and eyepieces: Pancro Lens Cleaning Fluid. ([www.pancro.com](http://www.pancro.com))

The sensor assembly is attached directly to the rear of the lens mount assembly (instead of to the camera housing)—flange focal depth remains constant. ALEXAs come standard with PL mounts. However, because there's no mirror shutter in the ALEXA models, many varieties of flange focal depth can be accommodated: PV, Canon, Nikon, Leica, and so on.





The PL lens mount and sensor assembly is installed in the front casting.

Garrett Brown picked up on this and made a beeline for Dr. Prillmann and Walter Trauninger at IBC—asking whether sensor head could be separated from camera body to mount on his Steadicam Tango. It's a good idea, but until the heat dissipation issue is addressed, would certainly void warranty. You'd also have to manage the many high frequency connections between the front and back ends. Don't try this at home.

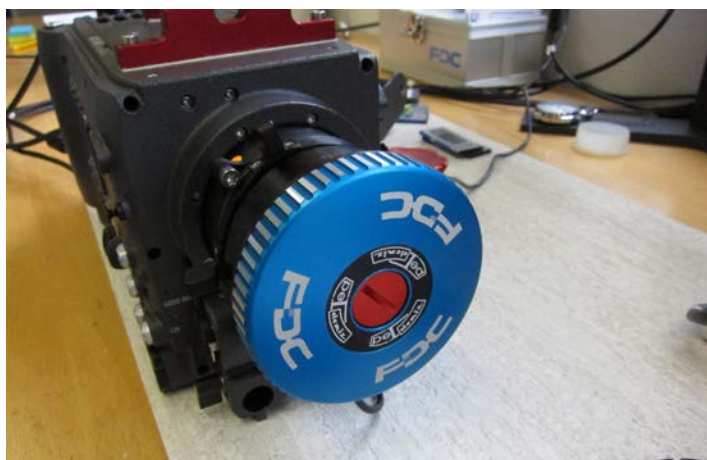
Adjustment of flange focal depth is done with the same reliable system of shims used on ARRIFLEX motion picture cameras.

The big difference, however, is that you cannot use your trusty set of depth gauges. One poke with the pointy-tipped depth gauge probe, and you're in for a replacement low-pass filter pack.

There are many ways of checking digital flange focal depth. Among other tests, ARRI uses the Denz FDC Flange Depth Controller on all cameras. This news will probably have many rental houses and owners calling Peter Denz in Ottobrunn, near Munich.

The FDC is affordable, easy to use, and accurate to 1 Micron.

To check flange depth, you attach the FDC as you would a lens in the PL mount of ALEXA. Connect the camera to a monitor. Two lenses in the device project two vertical bars onto the CMOS chip. Rotate the FDC's barrel, as if you were focusing a lens. This adjust the focal distance. When a vertical red line appears between the two green bars, the actual measured flange focal depth is displayed on the FDC's scale. Ideally, it measures 52 mm. If not, let the shimming begin.





# Electronic Viewfinder



For the camera operator, the window to the scene is the finder. ALEXA's EVF-1 color electronic viewfinder uses a 1280 x 720 pixel F-LCOS micro display and temperature-stabilized ARRI LED backlight. Color and contrast remain the same at all temperatures. Adjust the eyepiece diopter by rotating the finder barrel.

The viewfinder can be mounted on the camera's left or right side (the image flips). Frame line format, color and intensity can be called up from the main menu. The electronic finder displays a line of text above and below the image area for camera status information. It also shows an additional 10% view surrounding the scene, so you can see microphones and C-stands conspiring against your perfect composition.

Push the ZOOM button on the viewfinder to magnify the image 2.25x (1 HD pixel = 1 sensor pixel) for critical focus checking.







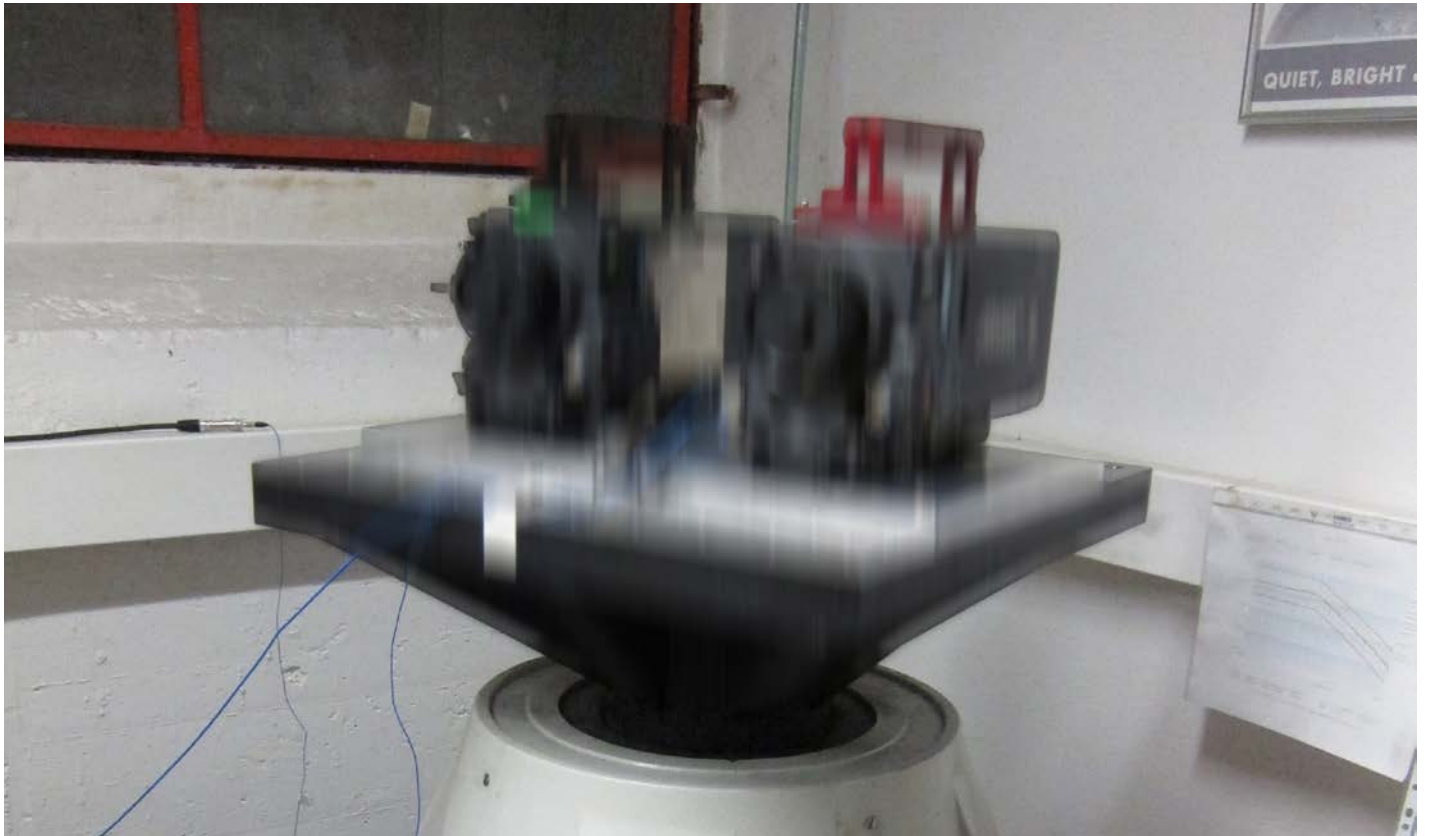
Next stop: the basement.

Every ALEXA is bolted to a shaker that sits on a giant slab of concrete. The cameras are then subjected to more vibration and G-forces than they may ever have to endure in the care of careless baggage handlers, tough teamsters, or the world's worst camera crews.

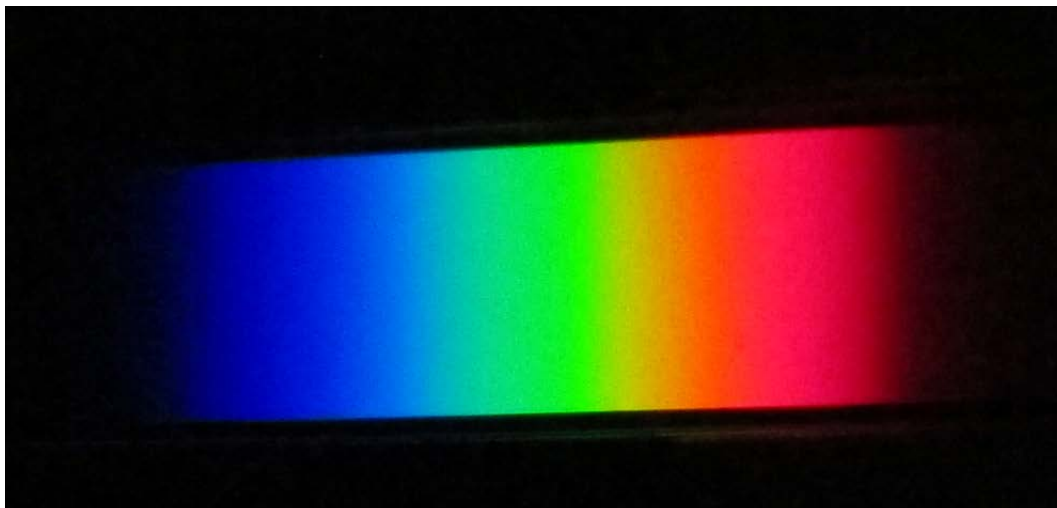
Actually, the tests are so tough that ALEXAs have come through where some analog cameras have failed.

After the filling-rattling shake test, the cameras are alternately baked and chilled.

The next step is back upstairs for a 24 hour burn-in. The camera is turned on overnight and allowed to heat up with limited fan cooling for an extended period of time.



# Image Testing

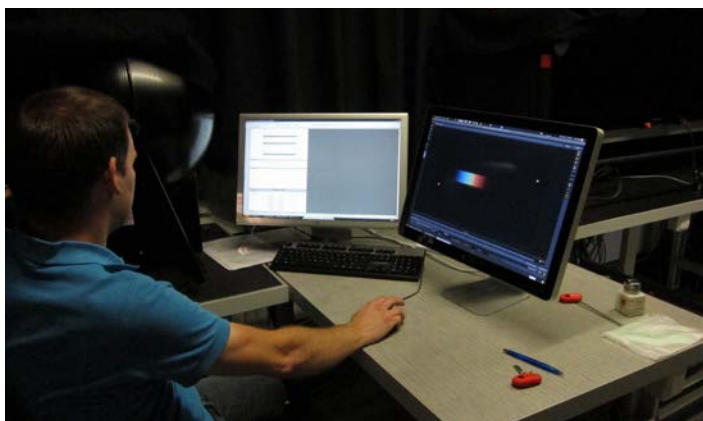
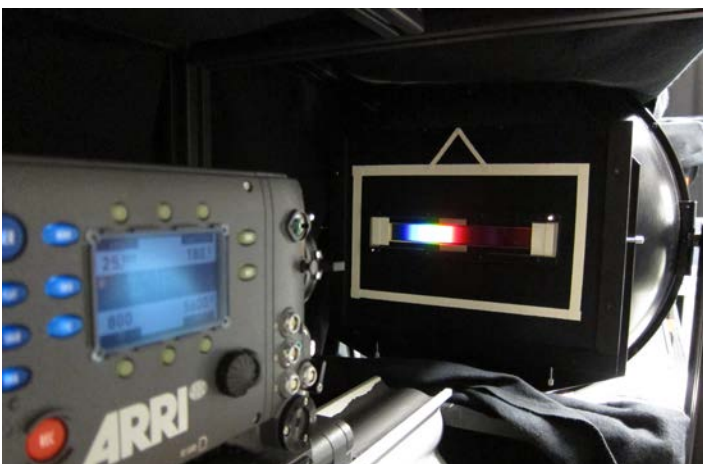


Dr. Hans Kiening, above, is Head of Central Quality Management and Image Analysis. He's familiar to many cinematographers for his lectures and tutorials on resolution ([www.arri.de/camera/tutorials.html](http://www.arri.de/camera/tutorials.html)). His department develops and performs all tests concerning ALEXA's image quality, stability and reliability.

Every ALEXA is tested for image quality: MTF, dynamic range, color accuracy, and more. The test area is covered with black light-proof fabric because the camera sensor is so sensitive, even stray light from digital watches or light reflections from clothing or skin can be picked up and skew the test results.

Dynamic range and sensitivity are checked with a new, custom designed test chart. ARRI's ultra precise spectroradiometer is capable of measuring 20 f-stops, representing a dynamic range of 1,000,000:1.

The benefit of all this rigorous testing is that every ALEXA will match: multiple camera scenes will intercut seamlessly, and twin cameras on stereo 3D shoots will be identical.







ARRI's comprehensive service department on Türkenstrasse is fully set up to handle any ALEXA problem.

Service technicians from ARRI facilities worldwide are receiving on-site training to bring authorized factory service back home.

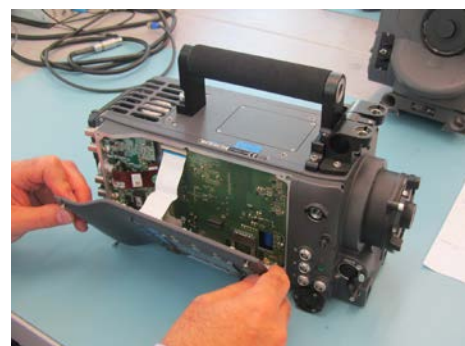
On critical productions (and whose production is not?) it is both essential and reassuring to know there are highly skilled service technicians ready to jump in and repair whatever damage has been done or, gasp, problem that has developed.

Fedex may be great, but when you have a mega-star on your call sheet, overnight will not cut the mustard.

Think of authorized service as your on-call camera emergency room.



Below, left: Günther Zoeh, Service Manager for many years and the best name for any camera owner to know at ARRI, has announced retirement. Right: Alex Vollstaedt will be the new Service Manager.





## Oct 2010: ALEXA now Shipping to a Production Near You



### ARRI ALEXA Camera Specs

35 format film-style digital camera  
Sensor: ALEV 3 CMOS  
Frame Rate: 0.75 - 60 fps, adjustable in 1/1000 increments  
Power: 11 to 34 V DC. 85 Watts.  
Batteries: V-Mount or Gold Mount Anton-Bauer

Length: 12.95" (332mm) body with PL mount  
Width: 6.02" (153mm) body only  
Height: 6.22" (158mm) body only

Weight: 13.8 lbs (6.26 kg) body only with DTE-SxS Module  
Electronic Viewfinder EVF-1 weight: 1.65 lbs (0.75 kg)  
Viewfinder Mounting Bracket VMB-1 weight: 0.56 lbs (0.25 kg)  
Camera Center Handle CCH-1 weight: 0.6 lbs (0.27 kg)

Standard Lens Mount: 54 mm PL mount, adjusted for Super 35.  
Shutter: Electronic shutter, adjustable from 5° to 358° in 1/10° increments.

Active pixels (including surround view): 3168 x 1782  
Image pixels (recorded area only): 2880 x 1620  
Image size after downscale: 1920 x 1080  
Recorded aperture: 23.76 x 13.365 mm  
Image aperture (incl. surround view): 26.14 x 14.701 mm







Test drive ALEXA with ARRI's online, interactive simulator: [www.arridigital.com/technical/simulator](http://www.arridigital.com/technical/simulator)

For the full screen version, go to:  
[www.arridigital.com/simulator/index.html](http://www.arridigital.com/simulator/index.html)

It's not an App but a fully functional, cross-platform live demo. Best viewed with iPad, because the touch screen works and you can twirl the rotary dial. For easy access: when viewing the full screen version on an iPad, tap the "+" symbol in Safari's top command bar, and choose "Add to Home Screen".

The control panel is familiar to anyone who has used a recent ARRIFLEX or ARRICAM. You don't have to drill down through layers of complex menus. An elegantly intuitive, Apple-like interface guides you through the essential choices. Push the green HOME button for Exposure Index, Frames Per Second, Shutter Angle, and Color Temperature.

Push the blue MENU button for other chores: Recording Format, Gamma, Frames lines, things like that.

The Remote Control Unit RCU-4 (left) replicates the main display and keypad functions of the camera right side. Attach it by cable to bring all controls to the left, "smart side" of the camera.





ALEXA (right) and ALEXA Plus (left). The second sibling, ALEXA Plus was announced at IBC as promised. Notice the antenna and lens motor receptacles of the Plus. It's an upgrade to the ALEXA camera, adding built-in wireless remote control, ARRI Lens Data System (LDS), additional video monitor outputs, RS power outputs, lens synchronization for 3D, and built-in position and motion sensors. ALEXA Plus begins shipping in the beginning of 2011, first as an upgrade to existing Alexas, and then as part of a complete camera package. Wireless remote control works with ARRI motors. If you're using Preston, Cmotion, Chrosziel or other wireless lens controls, you need their receiver/motor box. (arri.com)



### Remote Control Unit RCU-4

Put the controls on the left side. The Remote Control Unit RCU-4 is a cabled remote for the ALEXA and ALEXA Plus cameras. It has the same layout, display, and buttons as the control panel on the camera right side of ALEXA.



### ALEXA Low Mode Set LMS-3

The low mode plate attaches directly on top of ALEXA. It's helpful for Steadicam, underslung, and for 3D rigs. There are numerous 3/8-16 mounting threads, including attachment points for the Viewfinder Mounting Bracket, the ALEXA Camera Center Handle, 235, and D-21 low mode handles.





ALEXA Plus with Codex Onboard Digital Recorder, ARRI/Fujinon Alura 18-80 mm zoom, Anton/Bauer onboard battery.

Codex Onboard is a rugged, weather-resistant digital recorder that can be mounted directly onto an ARRI ALEXA, D-21, Sony F35, F23, and many other cameras. It records uncompressed or wavelet, HD or Data, along with audio and metadata, onto a single, removable data pack. Codex Onboard can record simultaneously from two 4:2:2 or 4:4:4 cameras—helpful for Stereo 3D shoots. It weighs 5.7 lbs (2.5 kg).

Codex Onboard records uncompressed or with visually lossless wavelet compression (compression ratios from 3:1 to 8:1). It also significantly reduces the storage requirements of a production.

Codex Onboard provides immediate full-frame playback as video. Used with a Codex Transfer Station, it delivers multiple industry-standard formats, generated on-the-fly for editing systems to use without importing. When shooting is done, Codex offloads material much faster than real-time—typically three to five times faster. (codexdigital.com)



# April 2011: ARRI ALEXA Studio

ARRI will preview the third ALEXA sister at NAB.

The current two cameras, ALEXA and ALEXA Plus, will be joined by the third expected sibling, ALEXA Studio, in late 2011. She is the eagerly-awaited star previously known in concept only as ALEXA OV (Optical Viewfinder). As the top of the line camera, ALEXA Studio will have an optical viewfinder, spinning mirror shutter and a full 4:3 sensor.

ALEXA Studio's name has significant provenance. Like the ARRICAM Studio, the ALEXA Studio is equipped with a quiet mirror shutter and an optical viewfinder. The new viewfinder has been specifically designed for ALEXA, and accepts both Arriflex 435 and ARRICAM style eyepieces and viewfinder extensions. Camera operators can look forward to looking at the live, optical, groundglass images.

Best of all, camera operators will be able to accurately judge whether the shot was in focus or not. A slight buzz in focus is not easy to see in any electronic finder, and requires careful monitoring and careful set etiquette in video village on a high resolution monitor with a sympathetic DIT or DP gingerly helping the camera operator determine whether another take might be required.

As any SOC member will attest, a shot is either in focus or out—you either do another take or move on. There is no waffling or discussion. The ALEXA Studio works to that studio-borne methodology.

For very dark night shots, remote head and Steadicam configurations, you'll be able to quickly remove the optical finder and attach an electronic finder—or no finder at all.

ALEXA Studio's full 4:3 sensor is the same size as 35mm 4-perf. This is rare among digital production cameras. With an image area the same as a familiar film ARRICAM or 435, ALEXA Studio can be used with 2x anamorphic lenses. (ARRIFLEX D-21's sensor is 4:3, 23.76 x 17.82mm; the Phantom HD Gold is 25.6 x 25.6 mm; Weisscam HS-2 MK II is 22.18 x 22.18 mm). Most other digital cameras, including ALEXA and ALEXA Plus, have 3-perf height—instead of 4-perf—image sensors.

Having a full 4:3 sensor is huge. I'll bet the boys at Vantage Film in Weiden, makers of Hawk Anamorphic lenses, will be first in line for ALEXA Studio cameras. Hawk V-Lite lenses come in 2x and 1.3x anamorphic. The 1.3x ratio nicely stretches a 16:9 3-perf image to the magical 2.40 projection format. However, a 2x ratio anamorphic lens on a 16:9 3-perf sensor must be composed as a cropped 4:3 frame within that 16:9 area. That's why the ALEXA Studio, with its larger image area and optical finder is unique.

What is it about anamorphic 2x? They have an elusively difficult to describe look and image quality that many directors and cinematographers love. Many of the great films of all time were shot in 2x anamorphic: *Apocalypse Now*, *Blade Runner*, *Chinatown*, *the Indiana Jones films*, *Alien*, *The Last Samurai* and the latest *Star Trek* film.

ALEXA Studio's full 4:3 sensor, optical viewfinder and other high-end features make this camera a bright choice. ARRI is at NAB Booth C4337. They'll have lots of other updates, including news of High Speed Mode to 120 fps for ALEXA, electronic anamorphic desqueeze, software 4.0 and lots more.



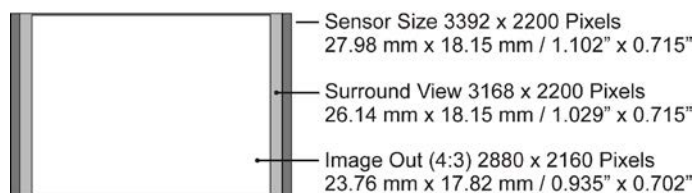
New ALEXA Studio with Optical Viewfinder and Mirror Shutter

Front of Lens Mount

Image Plane

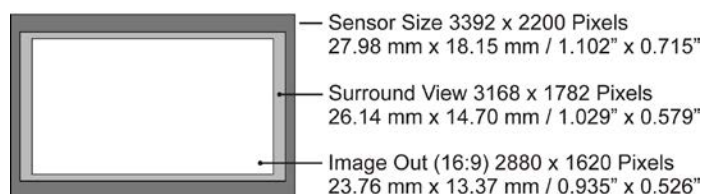


ALEXA with Electronic Viewfinder



Sensor and format dimensions. Above, ALEXA Studio.

Below: ALEXA and ALEXA Plus





## April 2011: ARRI ALEXA Studio



The new optical viewfinder has been specifically designed for ALEXA, and accepts both Arriflex 435 and Arricam style eyepieces and viewfinder extensions. It will have a lever to engage optical anamorphic de-squeezing.



Controls, configurations and buttons are similar to the ALEXA Plus

The Optical Viewfinder assembly can be removed for Steadicam and remote heads. You can also attach an Electronic Viewfinder.



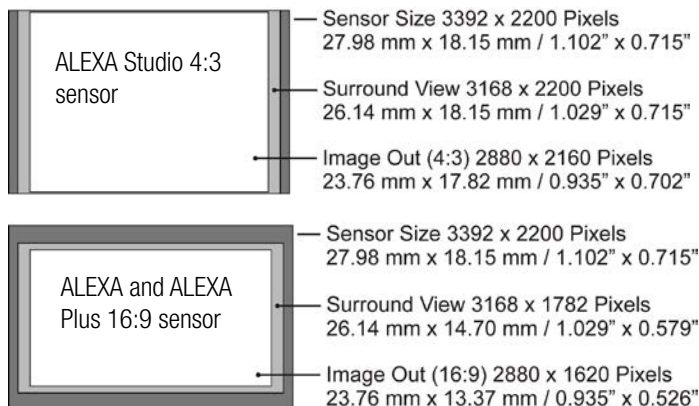
## ARRI ALEXA Studio

Previewed at NAB and Cine Gear, expect to see working prototypes at IBC. The ALEXA Studio, like the ARRICAM Studio, has a quiet, electronically adjustable mirror shutter and an optical viewfinder. The Studio's CMOS sensor is the familiar 4:3 (1.33:1) full frame format. ALEXA and ALEXA Plus are 16:9. ALEXA Studio is the only digital motion picture camera (beside ARRIFLEX D-21) with the equivalent of a full frame 4-perf gate.

This is going to be big for 2x squeeze anamorphic shows. The sensor's 4:3 image area is 23.76 x 17.82 mm.



Views and renderings of ARRI ALEXA Studio



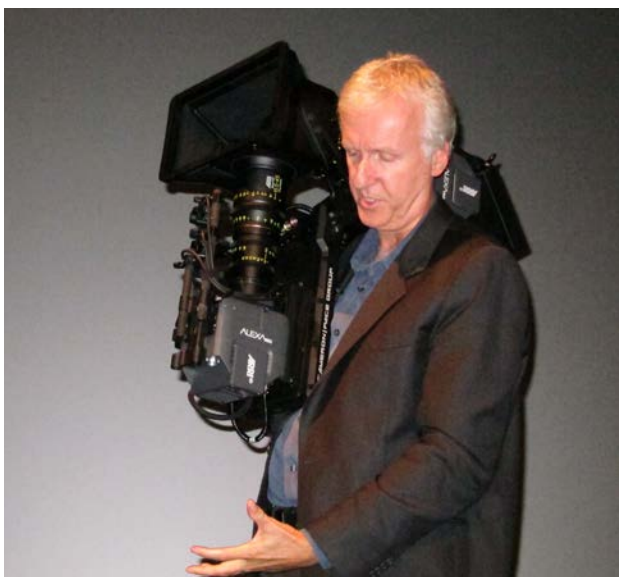
## 120 fps and 64 GB SxS PRO cards for ARRI ALEXA

All ALEXA cameras will run from 60 to 120 fps using new Sony 64 GB SxS PRO cards that have a write speed about 4 times faster than the current 32 GB cards.

The 120 fps upgrade will be part of the next ALEXA Software Update Packet (SUP) 5.0, subject to availability of Sony's 64 GB SxS PRO cards (SBP-65A). The 120 fps option can be activated with the purchase of a license. Each license is coded to a particular camera and is enabled by loading it into the camera from an SD card. Licenses can also be disabled by the owner or rental house.

ALEXA's High Speed mode can record slow motion images to 64 GB SxS PRO cards using all codecs up to ProRes 422 HQ. The 64 GB cards also allow ProRes 4444 at up to 60 fps in Regular Speed mode, even without the license. High Speed uses the same Super 35, 16:9 sensor area as Regular Speed, so the depth of field and the field of view of lenses will match between the two modes.

## ALEXA M



ARRI ALEXA M has a separate camera head and body connected with a fiber optic cable, intended for action, aerials, and 3D. James Cameron shouldered the ALEXA M / Cameron-Pace 3D rig at IBC.

ARRI ALEXA M is the 4th sister in the ALEXA family, with a separate camera head and body. It is intended for action and aerial sequences, remote heads, tight spots and 3D rigs. The head and body of the M are connected by a fiber optic cable, which in a hybrid form can also be used for power. The body provides various recording options like a standard ALEXA: images, sound and metadata can be recorded onto SxS PRO cards or external devices. ALEXA M has a PL mount.

Early prototypes of the ALEXA M are being delivered to James Cameron and Vince Pace, whose 3D company Cameron-Pace Group (CPG) is currently integrating ALEXA M cameras into its new compact 3D rig.

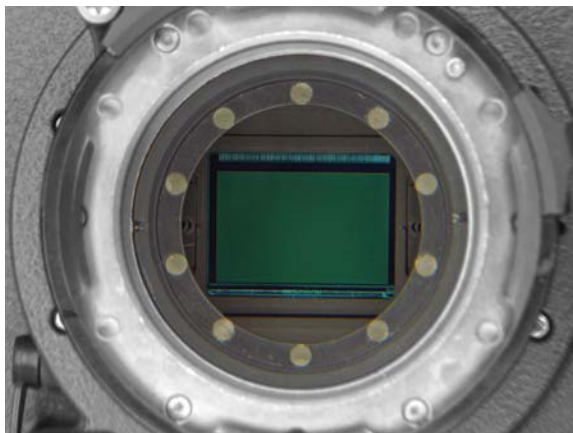
Feedback from Cameron-Pace will influence production models of ALEXA M, due to go on general sale in early 2012.



## Sep 2011: Clairmont's Behind-the-Lens Filters for ALEXA



Clairmont Camera's custom behind-the-lens filter holder for ARRI ALEXA. The round dots are magnets that hold the filter in place.



A Clairmont ALEXA with filter holder assembly in the lens cavity—in front of the CMOS sensor.



The custom filter and its filter ring is inserted with an Arricam groundglass tool.



Inserting a filter into the ALEXA lens cavity.

Our friends at Clairmont Camera never saw a camera they didn't want to improve. Is it Denny's California candy-colored streamlined need for speed from those first days at Fiasco Automotive, or an irresistible impulse to see how close they can come to voiding the warranty? No matter. Retrofit syndrome runs rampant at Clairmont Camera. ARRI ALEXA is the latest camera to undergo their expert ministrations.

Denny explains, "One of the things cinematographers appreciate most about the ARRI ALEXA is the excellent light sensitivity (1600 ISO and beyond). Working at higher ISO ratings can lead to lots of ND if you want to shoot wide open."

Working closely with Tiffen and Schneider, Clairmont Camera's Andree Martin and Alan Albert designed custom assemblies that hold interchangeable filters in front of ALEXA's CMOS sensor assembly (and behind the lens). The filters are optically correct, flat, and manufactured to Clairmont's exact specifications. The assemblies enable secure mounting and precise positioning of these custom filters behind the lens. These filter kits are an available option for all of Clairmont's ARRI ALEXA cameras. Modifying an ALEXA to accept these behind the lens filter kits is not difficult but needs to be installed by Clairmont's technical staff.

Currently the following filters are available:

- Optical Flat
- IRND 3, 6, 9
- IRND 3, 6, 9 with Black Promist 1/8
- Black Promist 1/8
- IRND 3, 6, 9 with Black Frost 1/8
- Black Frost 1/8

Each filter is permanently mounted in its own frame. Once the camera has been fitted with the internal mounting assembly, filters can be installed or changed in the ALEXA by the camera assistant in a few seconds using the Arricam Ground Glass tool included with the filter kit. The mounting assembly can remain in the ALEXA all the time, even if the behind the lens filters are not being used.

It is critical to remember that the Flange Depth of the ALEXA PL mount must be adjusted to compensate for back focus change caused by the additional glass in the optical path if the behind-the-lens filters are to be used. (The formula is  $\frac{1}{2}$  the thickness of the glass.) This adjustment is a shop adjustment and not something that can be done by the camera crew in the field. In order to keep the Back Focus consistent when no other behind-the-lens filter is in place in front of the sensor, an Optical Flat with the same refractive index as the filters is included with each kit.

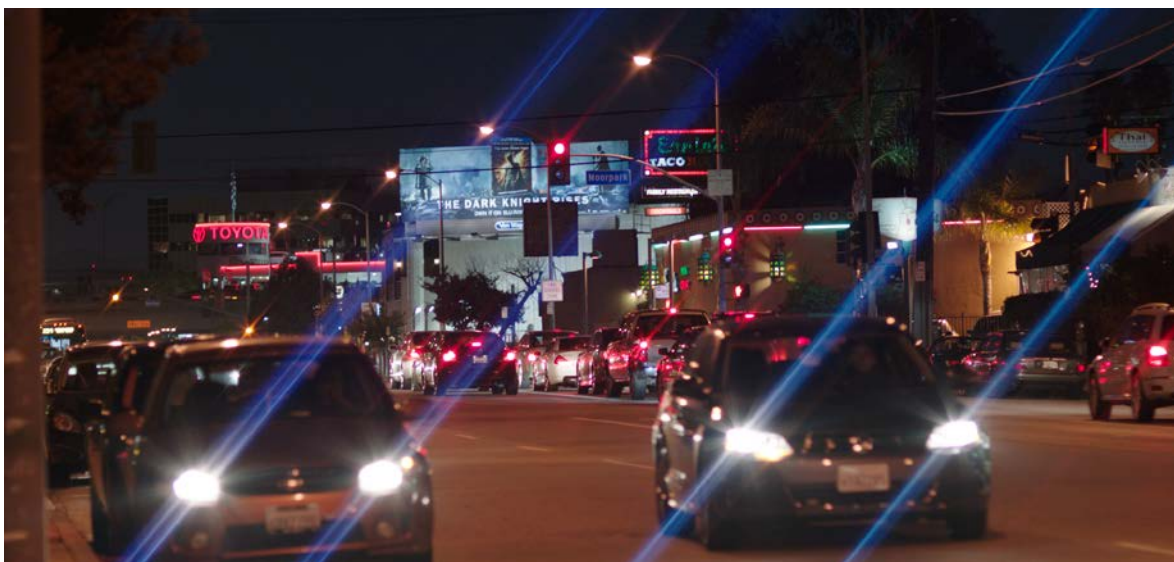
If this behind-the-lens filter kit is not desired by the DP for a project, Clairmont's Alexas will simply be rented with the Flange Depth set normally as if the filter retaining assembly was not installed (even though it is) in the camera and no filters will be provided.

Note: filters cannot be stacked. That is why combination filters are available: e.g. IRND+Promist, etc. This system reduces the number of filters in the matte-box, possibly reducing some potential vignetting problems, as well as one or two fewer filters that the AC has to deal with when going from one size mattebox to another.

Rene Ohashi, CSC, ASC, David Moxness, CSC, and Jan Madlener, General Manager Clairmont Toronto provided valuable input during the development of this project. Arturo Jacoby took the pictures shown here. Alan Albert and Mardrie Mullen worked on the text.



Clairmont Blue Streak Effect Filters on Cooke S4/i 100 mm lens.



*This page is out of chronological order, but placed here anyway.*

Designed by Clairmont's very own Andree Martin, these In-Camera Net Holders and In-Camera Blue Streak Effects are available to rent with Clairmont Camera's ARRI Alexas. The In-Camera Filter System will be available for purchase from Schneider in the near future.

Like the net holders, the Blue Streak Effect "Filter" is held in place magnetically, and can be used as a stand-alone effect or piggy-backed on any filter placed in the filter carrier.

Unlike streak filters used in a mattebox, no glass is used in the filter ring. Therefore, there is no focus shift or possibility of unwanted reflections caused by the filter being placed in the optical path. The filter ring can be rotated to any position desired during installation. This creative option allows the resulting streaks to be vertical, horizontal or anywhere in between on the photographed image.

The light reflects off the filament rather than illuminating the length of it—so if you want horizontal streaks, insert the blue streak effect filter with the filaments aligned vertically into your ALEXA.

More info: <http://tinyurl.com/clairmont-streaks>



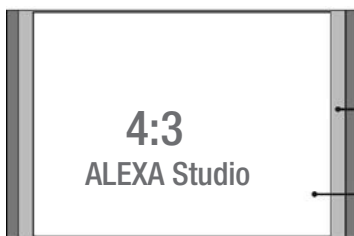
Left: Blue Streak Effect filaments in ARRI ALEXA.

Right: Clairmont In-Camera Blue Streak Effect with magnetic holder for ARRI ALEXA and insertion tool.





# Dec 2011: The Math of 4:3 and 16:9 Anamorphic Cinematography

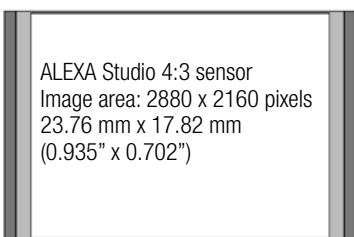


Sensor size: 3392 x 2200 pixels  
27.98 mm x 18.15 mm  
(1.102" x 0.715")

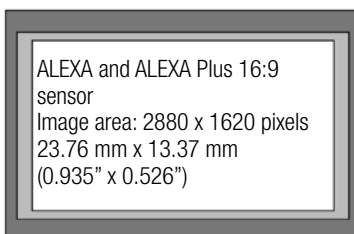
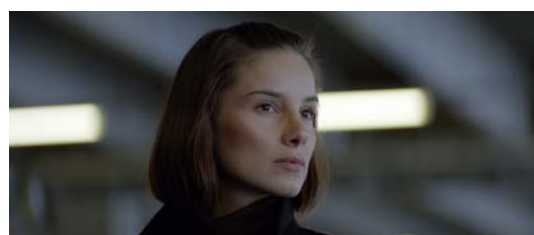
Surround view: 3168 x 2200 pixels  
26.14 mm x 18.15 mm  
(1.029" x 0.715")

Image area: 2880 x 2160 pixels  
23.76 mm x 17.82 mm  
(0.935" x 0.702")

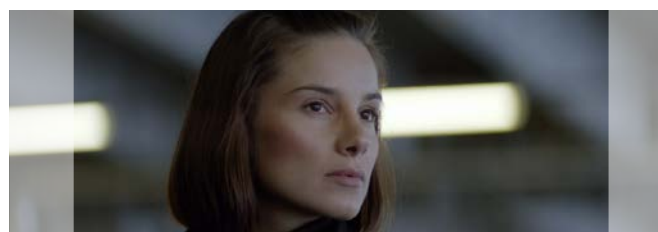
The official SMPTE anamorphic gate is 20.96 mm x 17.53 mm (0.825" x 0.690"). This is a 1.195:1 width to height ratio. (Multiply 1.195 by 2x and you get the projected width of 2.39.) To take advantage of ALEXA's 17.82 mm sensor height, you could mark your groundglass with a 21.29 mm width (17.82 mm x 1.195).



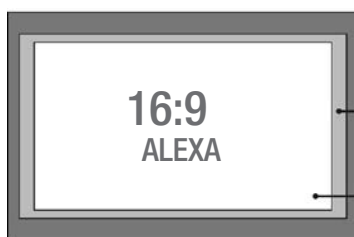
ALEXA Studio 4:3 sensor  
Image area: 2880 x 2160 pixels  
23.76 mm x 17.82 mm  
(0.935" x 0.702")



ALEXA and ALEXA Plus 16:9 sensor  
Image area: 2880 x 1620 pixels  
23.76 mm x 13.37 mm  
(0.935" x 0.526")



Above: Hawk V-Plus 180mm T3  
2x anamorphic squeeze. Images  
courtesy Vantage Film.



16:9  
ALEXA

Sensor size: 3392 x 2200 pixels  
27.98 mm x 18.15 mm  
(1.102" x 0.715")

Surround view: 3168 x 2200 pixels  
26.14 mm x 14.70 mm  
(1.029" x 0.579")

Image area: 2880 x 1620 pixels  
23.76 mm x 13.37 mm  
(0.935" x 0.526")

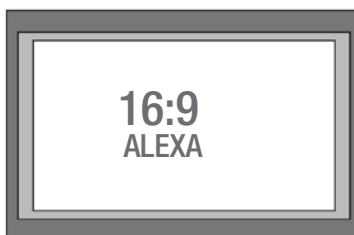
## 16:9 2x

How will 16:9 sensor cameras like Sony F65, F3, FS100, Canon C300, Red Epic, Scarlet deal with 2.39:1 widescreen? Compose a 4:3 squeezed image onto the 16:9 format sensor. Your groundglass would have vertical pillars on left and right: you are using a smaller part of the sensor's image area. The picture is cropped (appears tighter) than the same image with the same lens on a 4:3 sensor camera. This has to be "blown up" more in DI or projection to fill the same size print or screen. It works—but you sacrifice resolution and familiar lens focal lengths.

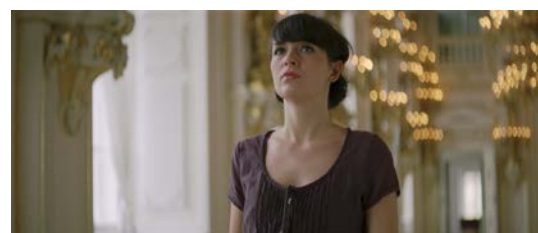
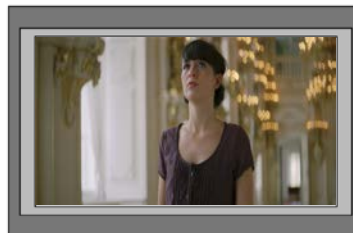
**16:9 Spherical**...Or you can shoot with regular lenses, but some say that isn't the hallowed "anamorphic look": an almost stereoscopic sense of depth from the combination of different horizontal and vertical focal lengths in one lens, with oval bokeh and shallow depth of field.

## 16:9 1.3x

Hawk 1.3x anamorphic lenses from Vantage Film offer another choice by "gently" squeezing the widescreen 2.39:1 image onto a 16:9 sensor. Bokeh and look are not exactly the same as 2x squeeze, but still very pleasing. The adventure continues.



16:9  
ALEXA



Below: Hawk V-Lite 55mm  
1.3x squeeze T2.2. Image  
courtesy of Vantage Film.

# ALEXA Studio and her 4:3 Sensor



This is a big deal: as we've belabored before, ARRI ALEXA Studio is the only digital motion picture camera (besides the Arriflex D-21) with the equivalent of a full-frame 4-perf gate and optical finder.

ARRI ALEXA Studio was shown at IBC in Amsterdam, and made her USA debut in Hollywood on October 8. Two working ALEXA Studio cameras were set up in the ASC clubhouse for hands-on scrutiny. Richard Crudo, ASC opened the festivities with an introduction, followed by words from ARRI VP Bill Russell and ARRI Managing Director Franz Kraus.

ALEXA Studio is the third sister in ARRI's latest family of 35mm digital motion picture cameras. This is the one with a spinning mirror shutter, optical finder and full frame 4:3 35mm sensor. ALEXA Studio can accommodate 2x anamorphic widescreen as seamlessly as Arricams or Panaflexes. (16:9 sensors require either 1.3x squeeze or cropped sides.) And sure enough, one ALEXA Studio had a Panavision Anamorphic G series 75mm lens with Panavision mount. The other Studio camera had a PL mount with a Hawk Anamorphic from Clairmont Camera.

ALEXA Studio's spinning mirror shutter and optical viewfinder "feels" similar to an Arricam, but it's a new design. However, many existing groundglasses and eyepiece extenders will fit.

Famous anamorphic films include *Apocalypse Now*, *Blade Runner*, *Chinatown*, the *Indiana Jones* films, *Alien*, *The Last Samurai*, and the latest *Star Trek* film.

Historically, anamorphic widescreen has followed every big wave of 3D. I think ALEXA Studio will help history to be repeated again.



Above: ALEXA Studio with Codex Onboard recorder at IBC.  
Below: Bill Russell and Larry Parker with 75mm Panavision G Series Anamorphic.





# Feb 2012: ARRI ALEXA Studio Jumpstart

The new ALEXA Studio cameras have an adjustable mirror shutter, optical viewfinder, and 4:3 sensor.

Horizon level lock button and adjustment knob works just like the ARRIFLEX 435. In fact, the eyepiece design is similar to later generation 435 cameras

DIMMER for Frameglow brightness

Image plane, tape hook

REC Start and Stop recording button

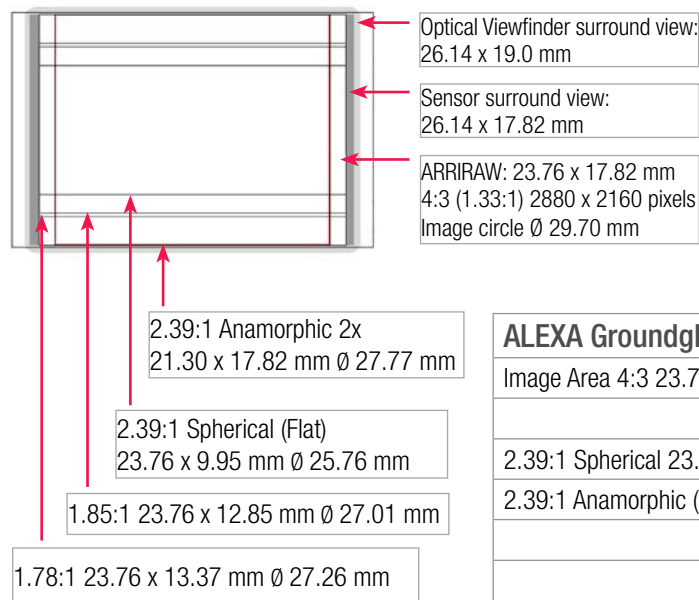
Handgrip rosette on left side of camera—and there's another one thoughtfully included on the right side as well.

VIEW: Push to start the mirror shutter spinning. Push again to stop the shutter. When you change lenses, it's a good idea to be sure the mirror has stopped to reduce chances of dust blowing onto the sensor, and to reduce chance of breaking it if you unwisely forgot that some lenses, like Optimo DP zooms, are not meant for mirror shutter cameras.

GATE: Push to clear the mirror shutter to check the gate, clean the sensor. Push again to start the mirror shutter spinning.

Both LEDs will glow when Mirror Shutter is spinning

## ALEXA Studio 4:3 Sensor & Framelines



## Groundglass

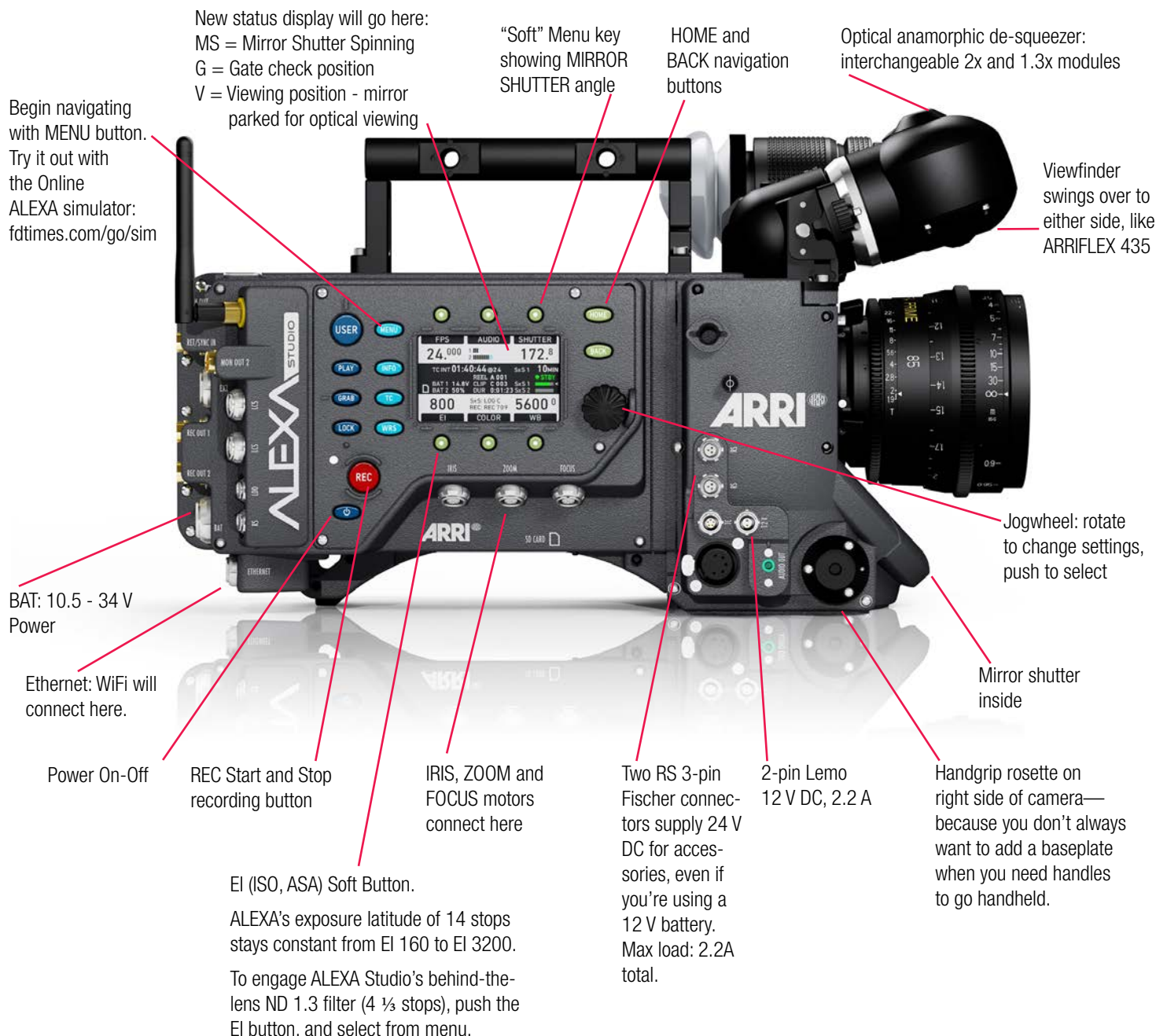
The metal frames holding ALEXA Studio groundglasses and glow masks are the same as the ones used in ARRICAM film cameras.

However, the dimensions of ALEXA's scribed frame lines are ever so slightly different than ARRICAM's. We're talking about the difference of the width of a line, so...

The good news is that 2.39:1 Anamorphic 2x squeeze framelines are the same on both cameras: 21.30 x 17.82 mm

ALEXA Groundglass	ARRICAM Groundglass
Image Area 4:3 23.76 x 17.82 mm	Camera Aperture 4:3 24.9 x 18.6 mm
	ANSI S35 projected area 1.33 (Silent) 24 x 18 mm
2.39:1 Spherical 23.76 x 9.95 mm	Clairmont 2.39:1 Spherical 24 x 10 mm
2.39:1 Anamorphic (2x) 21.30 x 17.82 mm	2.39:1 Anamorphic (2x) 21.3 x 17.82 mm
	<i>Of course, there are these for ARRICAM as well:</i>
	2.35:1 Anamorphic (2x) 21.3 x 18.0 mm
	2.40:1 Anamorphic (2x) 21.30 x 17.74 mm

# ALEXA Studio Jumpstart



## Viewfinder

Viewfinder accepts 8x and 10x (magnification) ARRIFLEX 435 and 8x ARRICAM eyepieces, finder extenders, and heated eyecups.

The optical viewfinder quickly comes off and can be replaced with an ALEXA EVF-1 Electronic Viewfinder for dark nights, Steadicam, remote heads, and rigs.

For their technical assistance, thanks to Marc Shipman-Mueller and Guenter Noesner of ARRI; Andree Martin and Arturo Jacoby at Clairmont Camera; Mitch Gross and Andrew Shippides at AbelCine.

## Power

ALEXA Studio accepts 10.5 - 34.0 V DC on any power input. Most 14.4, 24 and 26 Volt batteries and power supplies work, but must supply at least 90 W for average 24 fps recording to SxS PRO cards. (without accessories).

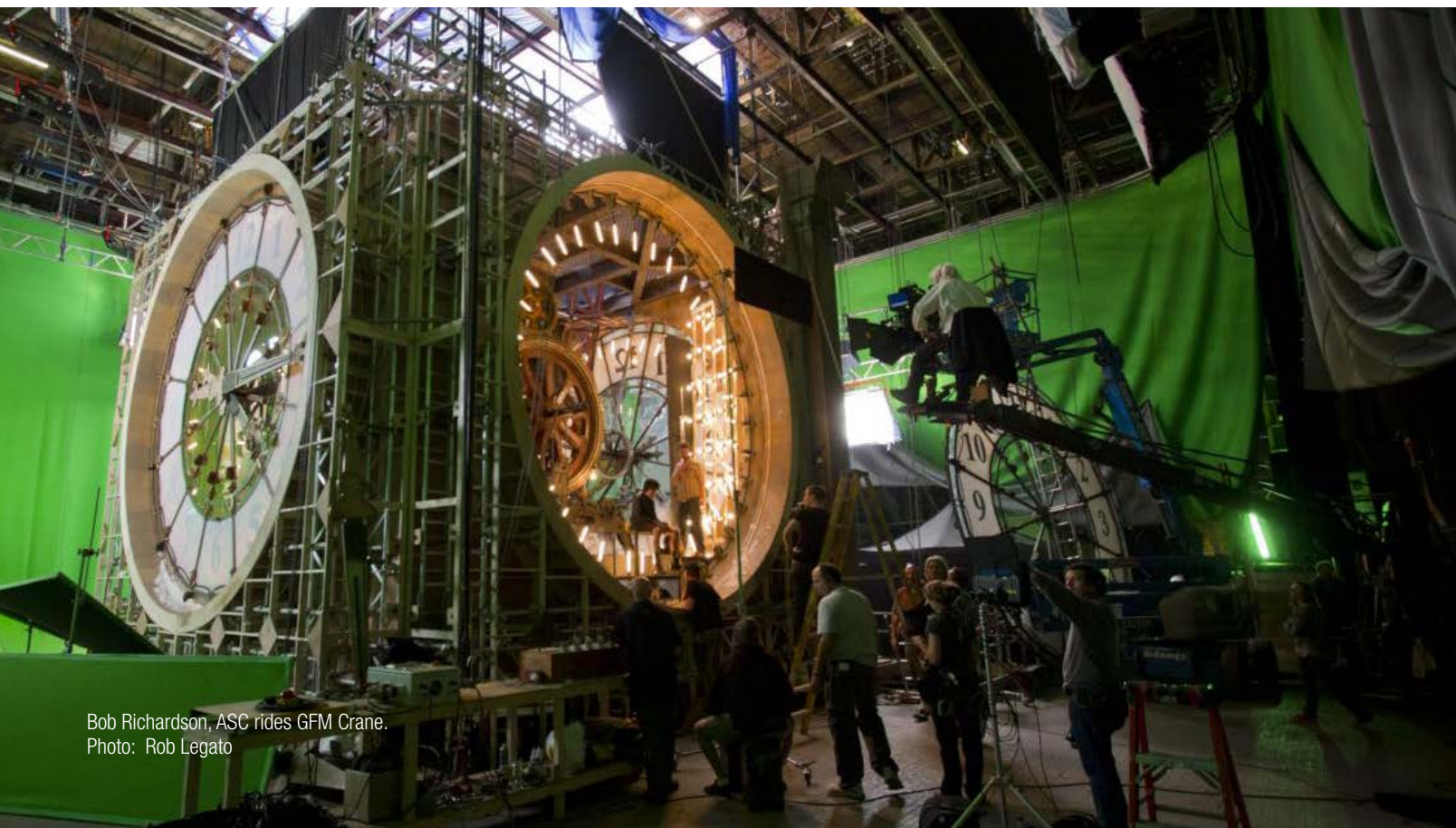
When running over 30 fps with mirror shutter on, voltage of 18V or more is recommended.

12 V batteries may work, but are not recommended because they can quickly discharge below the 10.5 V limit. 30 V batteries work, but are not recommended because they often go above the 34.0 V limit when fully charged.

Bottom line: I'd recommend using a 24 V battery. It is more efficient than using a 14.4 V source since ALEXA uses 24 V internally.



## Feb 2012: Moving *Hugo*



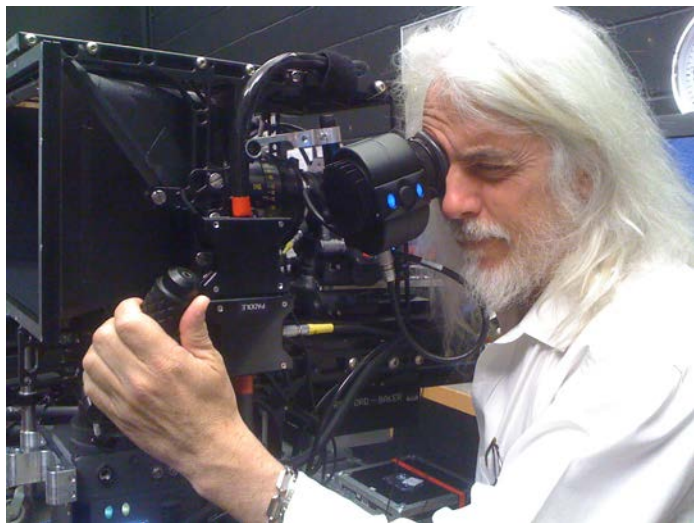
Bob Richardson, ASC rides GFM Crane.  
Photo: Rob Legato



Louma 2 Crane. Cool overhead top light  
with strong, warm backlight.  
Photo: Rob Legato



## Richardson on the Look of *Hugo*



**Jon Fauer: I first saw *Hugo* at the DGA Theatre in L.A. Many in the audience said it was the best 3D they'd ever seen.**

**R**obert B. Richardson, ASC: There is an immediacy to the actors, and a relationship to the actors and the sets. We shot it in 3D, with 3D monitors in front of us. Unlike post-convergence, live 3D is going to become an even better tool in the future. At the present time, I believe, if you're attempting to do something as an artist, why wouldn't you use a tool that's there for you to craft your film, rather than to wait for someone to hand it to you later in post? Today's schedules don't allow for 2D to 3D conversion, as you can probably well imagine, with directors editing literally to the day before the release.

I can't even imagine seeing this motion picture in 2D. I don't know how to do it. A friend of mine went to see it in 2D the first time. And I said, "What are you doing? Go back and see it in 3D."

**You had a big 3D rig. You were often on a crane. You're lighting and operating. How do you view the image?**

I basically ride most of my shots. I was using the ARRI ALEXA eye piece. I was basically looking through only one camera as opposed to two. When you're shooting and operating in 3D, unless you have a monitor—which I used in a couple situations if they were extremely difficult moves to get to—in general, I would use the 2D image in the eyepiece.

I looked through the fixed camera on the rig. The other camera moved to adjust IO and convergence. But I noticed, even with that, I would frame a shot, and my image would not be exactly what I was framing. I noticed it was shifted slightly left or right.

Demetri Portelli, our stereographer, was pulling IO and convergence, and was working the way a focus puller does essentially. His job was to make it a more comfortable experience in 3D.

**Talk about the gorgeous shot in the National Film Library, with the shafts of light streaming through the windows.**

Weren't they stunning? It was natural light. It's a real location, the Bibliothèque Sainte-Geneviève. We were very fortunate that we had these shafts. We lit outside each window in advance, and then the real sun came streaming in. The shot you're talking about was, for both Marty and myself, an extraordinarily remarkable moment. I set up two dollies simultaneously, knowing the speed at which the sun was going to come, so we'd get a series of shots

when the sun was there. And I set one closer for the medium shot and one further back for a wider shot. And then, on top of that, we had the crane on the left hand side move one, two, three, as rapidly as possible, to keep the sun in its proper place to match.

It was fascinating that, as I was setting the shot up, I looked and I saw what you just described. And it was, for me, almost a spiritual event. Because the light became solid. And it made me think of where we sit in this world. When we think that something is not real and may not exist or matter, it is in fact filled with solid elements, regardless of size.

Marty and I noticed that the beams of light were like solid beams. They almost looked like they were made of wood. You felt the solidity of it, and you knew that you were walking through it, seeing people walk through it. Yet you knew it wasn't solid. There's a remarkable transformation that takes place in your brain. That, for me, was one of the major moments of the 3D, in terms of something I hadn't seen to that point.

In the bookshop scene, when the kids first walk in, it's just a simple 3-shot from the floor looking up. But the entire book store had dimension and weight. You could feel the weight of the books. I could feel the weight and how powerful this place was in terms of Isabelle's life. And for her to bring Hugo there was just remarkable when you see these small things that, in an ordinary shot, would have meant so little. Rob Legato did the visual effects to work with depth in 3D. The influence in 2D cannot be the same. The quality and the mystery is different. What he created was a way to give you depth, and knowing he had 3D, how it would work, and when you could fool or not fool.

**Tell me about dailies, post and DI...**

We had a timing suite at Shepperton. It was a small DI room where we timed all of our dailies. Greg Fisher was the timer here and he took it all the way through the finished film.

This took away the question marks. The thing is, it's vital for a director to see this, especially when you're working with something pretty new. We went into the timing suite every day. Financially, we had the projection room anyway. So we had the room set up. All we were really adding was an individual to do the timing. We were not hiring another company to do the work to finish it. We did it on a Baselight.

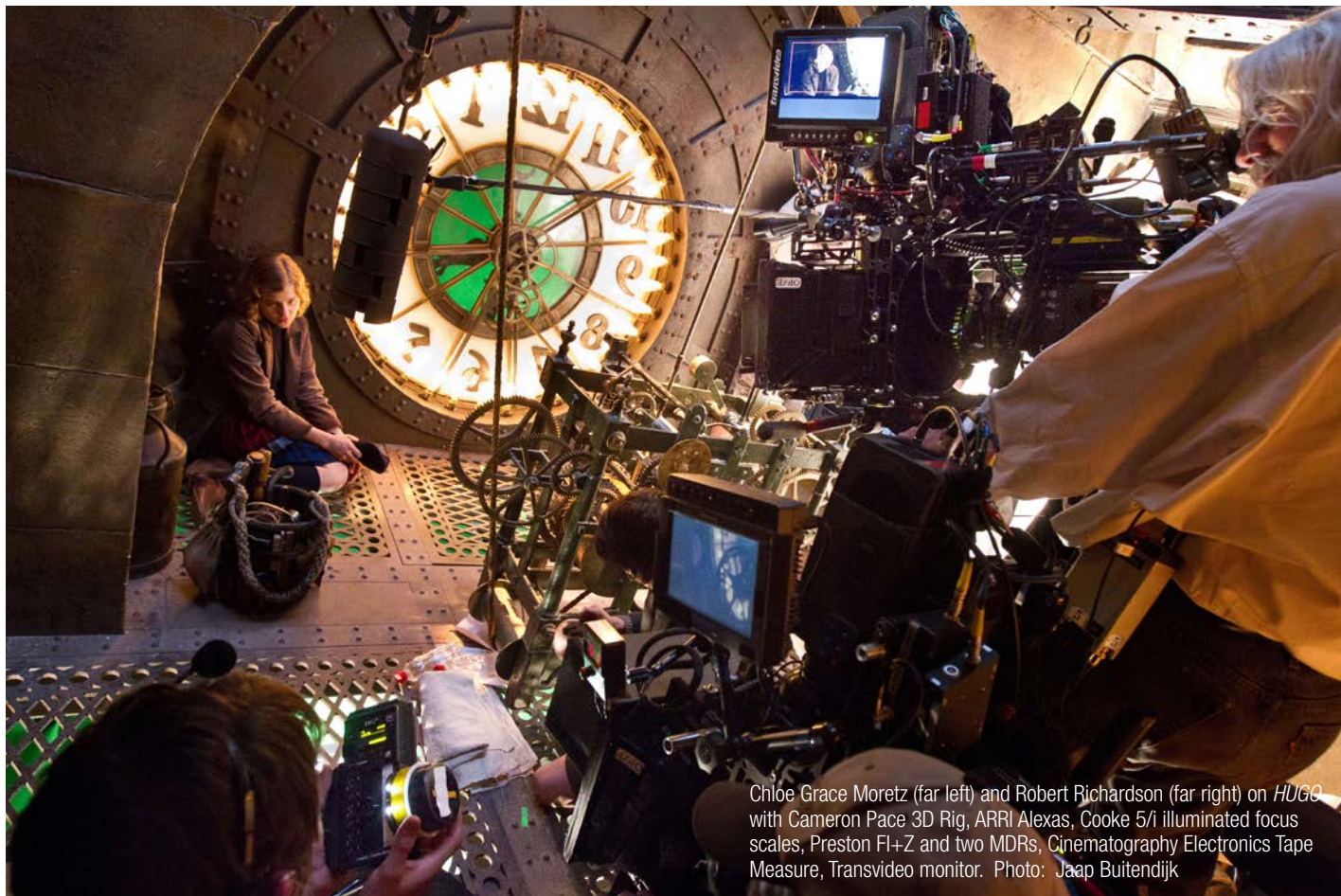
That all worked quite well for me. I was able to work digitally with Greg and keep in the loop. Marty could see the dailies and give feedback on what he felt would work better or what could be improved. That became a faster way of finding what the look of the movie was, so there was less necessity at the tail end to refine, because we were already well within the ballpark.

**You had a luminous golden color in many scenes. How did you achieve that?**

With the aid of a look up table, I lit the Méliès apartment with only tungsten lights. In other scenes, I would have cool overheads, as if the daylight were coming in. And then I would add various colors on the ground, depending whether it was going to be white or warmer than white.

For Hugo's apartment in the station, there was a combination of lights. We put gels on the units to give it the look. We used blue top light, blue beams, with white light on the bottom that was





Chloe Grace Moretz (far left) and Robert Richardson (far right) on *HUGO* with Cameron Pace 3D Rig, ARRI Alexas, Cooke 5/i illuminated focus scales, Preston FI+Z and two MDRs, Cinematography Electronics Tape Measure, Transvideo monitor. Photo: Jaap Buitendijk

down on the dimmer about 40 percent. I would change my color temperature directly on the ALEXA camera, depending upon the amount we were searching for. So you might be looking at something that was shot at 3200 or 4500 or even 2300. It would depend on which scene.

#### **How did you rate the ARRI ALEXA cameras?**

ALEXA is an 800 ASA camera. But essentially we were shooting at the equivalent of 400 ASA because the mirror took away one stop.

#### **Is that why you went with Cooke 5/i (T1.4) lenses?**

I gravitated toward the notion of starting with the very best. We can fully remove quality later. But it's virtually impossible to add quality back once it's gone. But, we went with Cooke 5/i primes for another reason: to use the metadata. We were pulling /i data from the lenses. It was early on, but we said we should try this because was available to us. Anything that helped the visual effects, we did.

#### **What kind of monitors did you have?**

We all had JVC (GD-463D10 46-inch 3D LCD) HD monitors. They were all consumer monitors. We did the best we could to keep them consistent. Greg Fisher calibrated them. They were checked regularly. Sometimes, Marty would ask, "Well, why does it look like this?" Because we were now looking at an almost finished product. For a director, the quality of output in HD is superb. It isn't flickering. We've all been accustomed for a long time to flickering on video assist monitors when shooting with film. The quality of motion picture film standard definition video

playback has generally been quite miserable for most people. ARRI has made strong headway with their HD video assist. And now with the ALEXA or other cameras that are being used, you have extremely precise images.

#### **Talk a little more about the look of *Hugo*.**

One of my decisions, at the very beginning, was this: I was not going to shoot the ALEXA to make it look like film. I did not want to use the film look up table. I wanted to work with the ALEXA as ALEXA. What its strengths were, its merits, what its weaknesses were, that was what I wanted to incorporate into this project. If its color space was here, I was going to use that color. If it could give me these types of colors, I was going there.

I decided right away, looking on the Baselight, not to use the look up tables that told me I was shooting on film, you know, on 5248 or '93. I don't want any of this. I said, "Let's stop now. I don't want to have a film look up table that emulates film. We're doing digital cinema. We're shooting a digital cinema production." And people were nervous. They were saying, "Oh, but we have 2D releases, releases on film." But Laser Pacific did an astounding job showing us that we were on the right track.

#### **You did some very intricate close-ups of the clocks and the automatons in 3D...**

Those were all done with long lenses: very tight, macro work on the gears. We ended up using 135 mm close-focus Cooke S4/i lenses. Sometimes we added a diopter on them. It took a bit of work to find the right combination. What's complicated in doing





Robert Richardson (left, behind camera) and Asa Butterfield (center) on *HUGO*. Production stills pp 14-16 , 21 and 24 courtesy of Paramount Pictures and GK Films. © 2011 GK Films, LLC. Photo: Jaap Buitendijk

close-up shots in 3D is getting two lenses to match exactly, and coordinating the focus and everything else. So, when we had those tight shots, generally it'd be a 135 mm lens or something like a 135 with a  $+\frac{1}{2}$  diopter or  $+1$  at most.

**Because you were doing moves, your assistant was pulling focus the whole time. It was also an incredible job.**

Yes. Gregor Tavenner is a remarkable focus puller. Not all those shots had diopters on them. Some of those shots were moving down following the hands, or were very small moves. But, what Gregor does is he generally will anticipate focus ahead of time.

When he sets focus he anticipates. You know, everyone works off of a remote focus unit now, pretty much. He marks the lenses so that when he adds a  $+\frac{1}{2}$  diopter, for example, he already has focus discs pre-calibrated for the remote focus device. He'd just put the focus disc on for the  $+\frac{1}{2}$  diopter. And when we went to the  $+1$  diopter it would be a different ring. We had to experiment to see how close we wanted to go in 3D, which is sometimes just hard to do. Marty would make an alteration in the shot to accommodate the close focus.

What I was going to say about camera assistants is that many of them are now working off of HD monitors to see focus. The difficulty with that is, number one, you don't always have a monitor, for example if you're doing Steadicam, or more complicated moving shots, where you have to actually ride or be a part of the system.

If they rely too much on the monitor, they may lose their eye for distance. I worry that they may lose some of their art or skill. What happens if you shoot on film next and you don't have HD video assist? Not every show is going to be on an ALEXA. Plus, the reaction time can be a little bit delayed if they're looking at a

monitor, because by then it could be too late. Of course, one of the values of the monitor is that if there's a little buzz, they can see it.

**What about you, looking through an electronic viewfinder?**

I find that looking through an electronic viewfinder is complicated. I can't really see focus as clearly as before. But, more than that, what did take place was that I was quite worried at the very beginning, would I be able to light? Would I be able to light through its small television eye piece? Because the electronic viewfinder is really a small eye piece that's a television. So, what I began to realize is that when I was doing initial tests for darkness and sensitivity I would have a camera with me, an Arriflex 435, a regular ARRI film camera body. And I used the same lens. I put it up next to the monitor on the dolly. And I trained myself.

I would check if I was seeing the same thing through both cameras. At a certain point, I stopped. I didn't need the film camera anymore. I just worked off of the ALEXA. In combination with 3D and being able to go off the monitor, I was also seeing things I had never seen before. And so, that changed my perception on how to light.

***Hugo* is a story and a film that works on many levels.**

What we need to recognize is that this movie is for kids. Kids can experience this movie, which is a tale of an older time, and enjoy the older times. They're watching older films within the film. I love when kids come out and they are mesmerized that it's the early works of a pioneer from the turn of the last century. We have a hard enough time getting kids to watch films from the '70s. How do we get people into movies and to love them?

But also the tale is so brilliant. It works on all levels. Marty did a fantastic job by turning some of the early Méliès works into 3D at that final premiere.





by **Gregor Tavenner**, First Camera Assistant on *Hugo*

*Portions of this article previously appeared in these pages as notes from location, a work in progress. Now that the film is complete, here's the complete story.*

There were a lot of firsts being made on *Hugo*.

It was the first major motion picture shot with Cooke 5/i Prime Lenses and the first to use all three sets of Cooke lenses: 5/i, S4/i, and Panchro/i. The first 3D movie for Martin Scorsese and Bob Richardson, ASC. The first major 3D movie shot with ARRI Alexas. The first major movie really using /i Technology (metadata) and Transvideo CineMonitorHD /i monitors.

In the beginning, Martin Scorsese said to Robert Richardson, "I want to shoot this movie in 3D." And Bob turned around and said to me, "How am I going to shoot in 3D with a beamsplitter that cuts out 1 stop of light...and take my ASA 400 film stock down to effectively 200?" Enter ARRI ALEXA, with a sensitivity of 800 ASA. Next challenge: dealing with these huge sets in Shepperton, and he really needed lenses that would open to T1.4. With a PL mount. So we looked at what was out there.

We had heard about the new Cooke 5/i lenses. I was lucky to see the first set in the US—at Clairmont Camera. They were absolutely gorgeous. They had a beautiful feeling. We ended up testing 3 sets. What we saw was incredible consistency among those 3 sets. We tested other fast lenses, but loved the Cooke Look.

I shouldn't say this, but...there is such a thing as a Cooke Look. You may laugh, some people may laugh, but connoisseurs have nailed down so many different flavors and nuances in wine. If you're a connoisseur of the image and lenses, you can do the same thing. For me as a focus puller, I enjoy that. I wouldn't call it a gentleness—that would be a Speed Panchro—I don't know how to put it—what we got on screen and on the video monitors was not so much on or off in terms of focus. I wouldn't say more depth of field because that would be wrong—but the way the forward and backward drifts on and off is so attractive.

The ALEXA was incredible. They started talks long before the movie began, and they chose us for one of the first batch. They were delivered as promised on time.

We used Cameron|Pace 3D mirror rigs. Larry McConkey was employed early on to co-design a Steadicam rig for the Alexas.

Larry helped them take it to a higher level. They've made 3 or 4 of them now, and they're going onto other shows.

Funny enough, illuminated focus scales on the lenses were a low priority on my list when I first heard about it. I thought, "Nice idea, but I'll never use this." But, guess what? This was a perfect job for it. We had two cameras inside a crowded and often dark 3D rig. As I pull focus with the Preston FI+Z, I look at the lens barrel to make sure the Preston is on. No matter how dependable it is, I still check the lens directly. We've got two lenses, so it's even more important to be sure they're matching.

Furthermore, if I used a Maglite inside the rig, that would have added further risk of reflection off the beam splitter. And if I had two Maglites—one for each lens—that would have been worse. So these dimmable Cooke 5/i illuminated focus scales eliminated all the risk and let me see focus perfectly. Bob Richardson operates the A camera. He had his own monitor close by, so he could immediately get feedback on what he did. The Cooke /i data cable plugged into the Cameron|Pace system which had the ability to record all the metadata for every frame of every shot. It tracked focus, iris, IO data, convergence, readouts, what was where, and stored it.

It's a big plus to be able to plug the /i connector into the 5/i lens and extract all the data, and display it. The Transvideo monitors plug right into /i connectors—so I get a full readout of all the lens data on screen.

Making *Hugo* involved a lot of accessories: two Transvideo CineMonitorHD8 Monitors, Cinematography Electronics Cine Tape Measure, Preston Cinema Systems MDR, OConnor 120EX head.

Why two monitors? I purchased an 8" HD Transvideo monitor which appears in numerous photos. Pace then bought another, and they were both mounted to the 3D rig. These monitors were chosen for their superior image quality, still my favorite. We used two monitors for two reasons: QC check for me—so I can see both cameras to check focus and image quality. Also, so many creative conversations and decisions happen right at camera—so why not a monitor on each side? I have done this on 2D as well and it just helps everybody.



Photo: Jaap Buitendijk





## Jon Fauer: When did you start on *Hugo*?

Larry McConkey: I got a phone call at about 4 in the morning in late April, 2010. A voice said, “Larry, you have to get on a plane.” “Who is this?” I asked. “You have to be at the airport in like an hour and a half, so get going” was the reply. I recognized the voice—it was Bob Richardson calling about a 3D film with Martin Scorsese. I immediately flew out to LA and started working with the great team at Cameron|Pace.

That trip was critical, both in helping design a 3D rig that was practical—light enough, small enough and self-balancing—but also in redesigning my Steadicam to handle the weight and power requirements of the 3D rig with two Alexas. I was determined not to let my operating be compromised by the equipment. Cameron|Pace was really responsive and did a brilliant job, and I went to work on my own gear. I’ve flown several IMAX cameras, but this was heavier. It was so heavy that my Steadicam arm was bending sideways from the load. I took power connectors and threw away the metal casings and potted them in epoxy to make them lighter, bought new lightweight monitors and video recorders, re-wired the sled and added additional battery mounts and a hundred other little mods. Finally, Gregor put together a set of the Cooke Panchro/i primes for me that matched our S4/i and 5/i lenses very well and were much lighter. That made a real difference.

## What was your most challenging Steadicam shot in the movie?

It was definitely the end sequence, in Méliès’ apartment. In most of the films I’ve worked on with Martin Scorsese, there’s been at least one sort of signature long Steadicam shot.

## Take us through the end shot.

Bob wisely let me know well ahead of time that I would do the shot, so I had time to prepare. For a long shot to succeed, every idea has to lead seamlessly to the next one, every moment needs to have meaning, and every detail has to be nailed down. I have learned to take responsibility for everything, rehearsing all the critical parts endlessly. This shot required even more.

Marty wanted me to meet George coming down the hallway and follow him into the party, and I thought, why not start outside the building and fly through the window—evoking that amazing opening sequence? The set was a couple of stories above the floor of the studio, so scaffolding was needed for the track (I rode a dolly, then stepped off into the hallway. The window was added later by visual effects). All of the main characters were at the party and Marty wanted to see each of them.

It was complicated by one other specific request: near the end of the scene, as Chloe sat down in the far corner of the room, Marty asked me to circle all the way around her as she began writing in her notebook—writing the story we have just seen. This required one additional film magic trick.

Special effects built a large dolly and attached it to the far side of the first wall so it could be flown out of my way. The second wall was an outside wall, and the estimate for the additional scaffolding and rigging was \$20,000 dollars. Production strongly suggested that I find another solution. The special effects team built a very low profile dolly for the chair, with rails that were sunk into the floor. After the first wall was pulled, Chloe’s chair



## Feb 2012: McConkey Moving on *Hugo*

began to slide away from the corner. I slowed my circular track but continued the pan until I had room to move around her. It had to be a perfectly smooth slide and perfectly timed for the cheat to work. I asked for a witness camera in the corner above the set for cueing and we put several hundred pounds of weight on a sled dolly 2 floors below, connected by steel cables to the sliding chair. My excellent dolly grip, Keith Mead, did that job.

In addition, a bureau was in my way, and then there was the table, right in the center of the room. I could have removed it, but I loved the look of that small room packed full of people and furniture. Crew members doubled up as extras in the party. Two of them picked up the table after I entered the room and danced it around just out of shot, and another pulled the bureau out of my way. Finally, the chandelier was rigged to fly up as we crossed underneath. I wanted it to look so crowded it would be impossible for a camera to get through, and make it look effortless, nonetheless.

I also liked the idea of making a complete circuit of the room, but half way around I had already seen almost everyone. I needed to fill out the second half of the circle with meaningful action. I brought the band in and worked with Sacha the way I had worked with Ray Liotta in the Copacabana. He improvised a brilliant little scene with them as he guided his new girlfriend back towards the doorway, leading me to discover Asa, and then, off his look, I panned to Chloe.

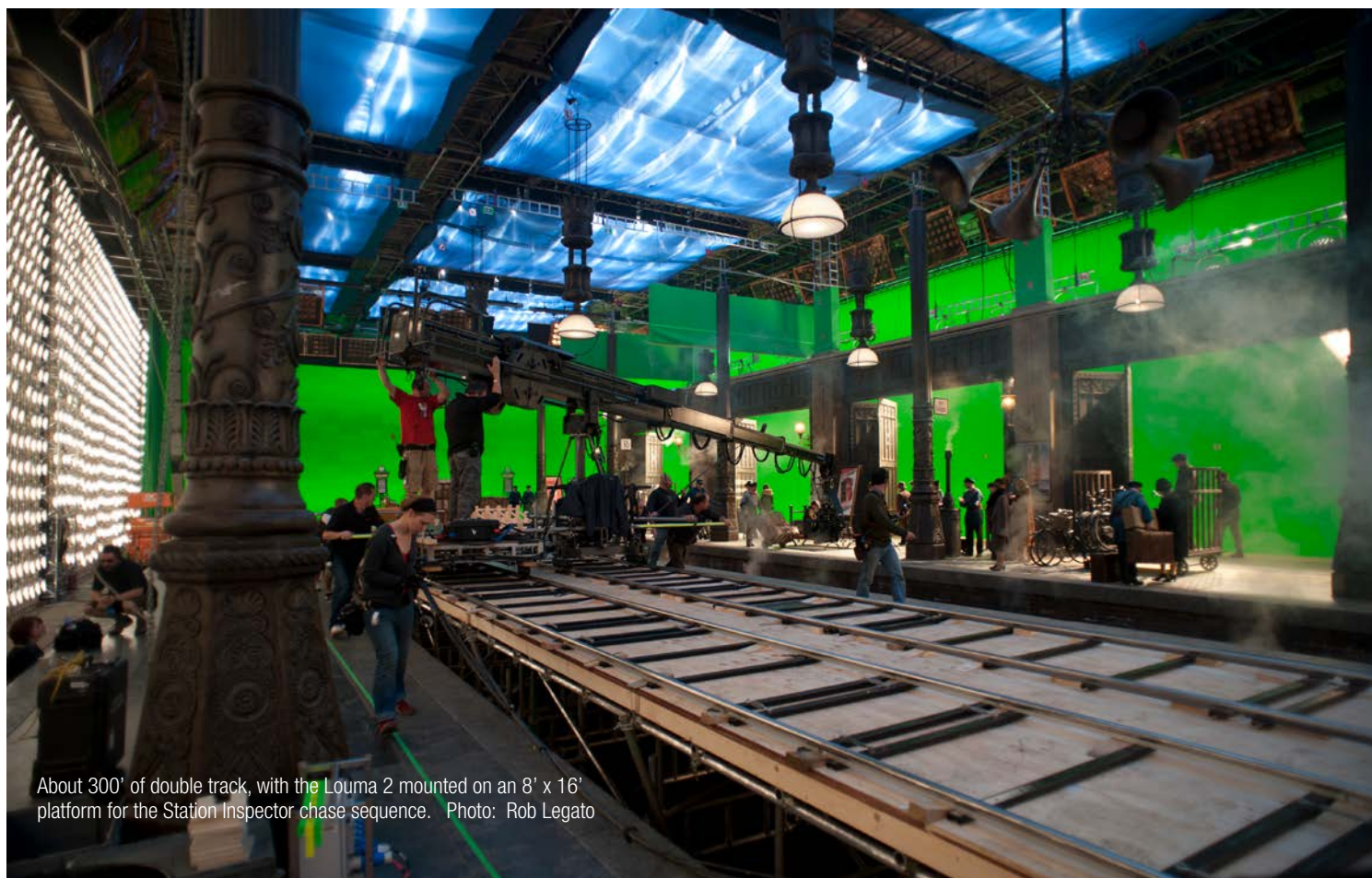
The other dance in the scene was between Demetri, Gregor and

me. The dance of 3-D. Every part of this complex shot required Demetri to make adjustments and I had to take each of those into account as the rig reacted. I modified my moves for him and he worked on merging his changes in IO and convergence with my moves. Gregor's focus pulls had to be accommodated as well. We were interacting with each other throughout.

Working in the new and different environment of 3D was a challenge, but having such a great crew to work with, while telling such a wonderful story, so beautifully shot by Bob Richardson, and led by the great Martin Scorsese, made *Hugo* the most satisfying job of my career.



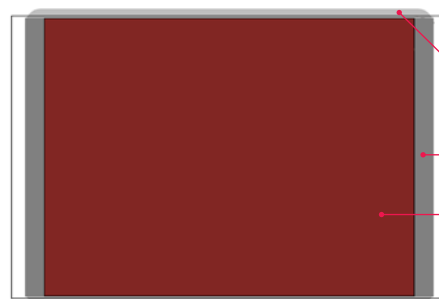
## Moving *Hugo* on Louma 2



About 300' of double track, with the Louma 2 mounted on an 8' x 16' platform for the Station Inspector chase sequence. Photo: Rob Legato

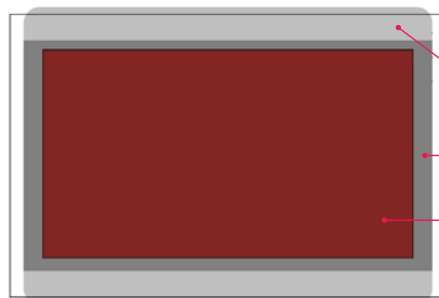


## 4:3 (ALEXA Plus 4:3, ALEXA M, and ALEXA Studio)



- Sensor Size 3392 x 2200 Photosites (1.54: 1)  
27.98 x 18.15 mm, Ø 33.352 mm
- Surround View Optical Viewfinder (Studio only, 1.38:1)  
26.14 x 19.0 mm, Ø 32.32 mm
- Surround View EVF-1/MON OUT 3168 x 2160 Photosites (1.47:1)  
26.14 x 17.82 mm, Ø 31.64 mm
- ARRIRAW 2880 x 2160 Photosites (1.33:1)**  
**23.76 x 17.82 mm**  
**Image circle Ø 29.70 mm**

## 16:9 (ALEXA, ALEXA Plus, ALEXA Plus 4:3, ALEXA M, and ALEXA Studio)



- Sensor Size 3392 x 2200 Photosites (1.54: 1)  
27.98 x 18.15 mm, Ø 33.352 mm
- Surround View Optical Viewfinder (Studio only, 1.38:1)  
26.14 x 19.0 mm, Ø 32.32 mm
- Surround View EVF-1/MON OUT 3168 x 1782 Photosites (1.78:1)  
26.14 x 14.70 mm, Ø 29.99 mm
- ARRIRAW 2880 x 1620 Photosites (1.78:1)**  
**23.76 x 13.37 mm**  
**Image circle Ø 27.26 mm**

Jump cut to NAB 2012. ARRI spawns another ALEXA sibling: ALEXA Plus 4:3. She joins ALEXA Studio and ALEXA M as members of the family with 4:3 (4-perf size) sensors.

Shooting 4:3 format with 2x anamorphic lenses for 2.39:1 (aka 2.4:1 and 2.40:1) widescreen distribution squeezes the horizontal image in half. The aspect ratio on the sensor, or film, is 1.195:1. (aka 1.2:1).

Most current digital sensors are natively 16:9 or wider. Since 2x anamorphic shooting on 16:9 is like fitting a 1.2:1 almost-square box inside a 16:9 rectangle, you wind up cropping the sides of the 16:9 sensor. This results in a much smaller “exposed” sensor area

and a cropped, tighter angle of view.

ALEXA Studio, M, and now Plus 4:3 let you shoot anamorphic in the full 4:3 aspect ratio. This is big news.

Additional news for 2012: ARRI has announced new features for the Alexas, including ProRes 4:3, ProRes 2K, DNxHD 444, vertical image mirroring for upside-down camera stabilizers, post-trigger, card-spanning and Cooke /i Technology support.





Above: Roger Deakins CBE, ASC, BSC behind ALEXA Studio; Judi Dench (center) and Director Sam Mendes (right) on *Skyfall*. Photo: François Duhamel.



Director Sam Mendes and Roger Deakins  
in the Old Vic Tunnels on *Skyfall*.  
Photo by François Duhamel.







Above: Roger Deakins, CBE, ASC, BSC and Camera Assistant Andy Harris on location in Glencoe, Scotland for MGM Pictures/Columbia Pictures/EON Productions' *Skyfall*. Photo: François Duhamel. All photos in this article ©2012 Danjaq, LLC, United Artists Corporation, Columbia Pictures, Inc.

### Interview by David Heuring

Roger Deakins, CBE, ASC, BSC was Cinematographer on *Skyfall*, the 25th James Bond film, directed by Sam Mendes. Roger worked with two ARRI ALEXA Studio prototypes.

#### Tell us about the decision to go with the ARRI ALEXA.

It seemed like there would be a lot of low light photography and situations where I'd want to work with practicals. I suggested to Sam that he look at the tests I had done and some of what I had shot on *In Time*. He was quite impressed, and we decided that would be the way to go.

#### What were your initial impressions of the ALEXA Studio?

We had two prototypes of the Studio on the movie, literally the first ones out of the factory. The optical viewfinder makes a huge difference. I think that over time you get quite a lot of eyestrain off the electronic viewfinder.

But apart from that, I like to be able to look through the camera without anything interfering. I've always lit through the viewfinder, and nothing's changed that way. I do look at the monitor from time to time, but I still basically work the same way as if I were shooting film.

#### How did you find the Alexas for handheld work?

It's a good balance. The problem is, at the moment, if your camera goes too light, the heaviest thing becomes the lens on the front. Lenses seem to be getting heavier and heavier, so you need a good balance, and in that regard, I think it's very good. It could be a bit lighter. I found I couldn't really do an extended amount of handheld with the Studio because of its weight. But ergonomically, it's very well designed to sit on the shoulder. I would shoot with the Plus when I was doing handheld, and then the Studio when I was on a dolly or whatever.

#### We heard rumors of a 19-camera shot.

We did some big stuff. A lot of times, we'd just shoot two cameras or even one. Often we'd shoot handheld, and I would do the main camera, and my friend Pete Cavaciuti (B Camera Operator/Steadicam Operator) would do the second camera, and we'd maybe have another camera somewhere.

But for just about all the drama and the dialog, we probably shot with one camera. We'd shoot a lot of the action handheld, or on all sorts of different equipment depending on the shot. There was one big stunt where a big set had been built and we had one go at it. I think we set 11 cameras, all Alexas. It was a one-off, and it went fantastically well. They used every camera angle, and the action that takes place within it is extended, because every camera actually worked really well. That was quite successful.





Above: *Skyfall* Scottish moor scene with ARRI ALEXA suspended on cables. CineTape sticking out in front. Photo: François Duhamel.  
Below: Ben Collins driving from pod on top of Land Rover, with Naomie

Harris at the wheel, and Alexander Witt (2nd Unit Director) strapped to the side, on Metro-Goldwyn-Mayer Pictures/Columbia Pictures/EON Productions' *Skyfall*. Photo: Jasin Boland (Nikon D4)







by **Thierry Pouget, Cinematographer**

*Gibraltar* is the real story of a man named Marc Fievet in the 80's. He was a French guy who tried to start a new life in Gibraltar. The French customs and border patrol got to him and asked him (less "asked" and more "blackmailed") to be an official informant: he will warn them about all the deals going on around Gibraltar.

In his bar, he is supposed to hear about drug deals and dealers. Quickly, he finds himself in a "war" between French, English and Spanish customs departments. He becomes a very close friend of the biggest Italian Mafia boss. He makes some mistakes and delivers drugs by himself with his own boat and gets arrested by Canadian customs. He stays in jail for 10 years, and the French customs never recognize him as an advisor.

The director was Julien Leclercq. (*Chrisalys, L'assaut*). I worked with him on *L'assaut*. On that film, we decided to be handheld, to be very nervous with the camera (as if the camera were a hostage inside a plane). For *Gibraltar*, we decided to use the camera completely differently. Opposite. The camera is very static, very calm. Framing is completely graphic, precise, *millimétrique*. Of course, anamorphic was the obvious choice.

Anamorphic was the best format to film the locations. The sea, for example, is a very important character in the movie. Also, filming the main character, Marc Fievet, in anamorphic format was a good way to show how much he will lose, alone, in the events he finds himself. Everything is too big for him. He didn't expect, never imagined, what would happen to him. The deal is too big for him.

From the beginning we decided to shoot real anamorphic. We first made tests with the RED Epic with a Panavision mount and anamorphic lenses. The out of focus bokeh's were very important for me, because of digital, of course. But in France, at that time, nobody was able to process the RED RAW file (That was November 2011; now that has changed!) I was also a bit worried by the viewfinder. I love the Epic, and I love to use it by framing with a good monitor, but for this project (very bright sun in Spain and on the sea) it was not possible.

Then, in January 2012, my friends at Vantage Prague told me they had the ALEXA Studio. I was excited to be able to shoot 4:3 format with anamorphic lenses, with a mechanical shutter, and with a viewfinder I know from film cameras. The optical finder brings you a fantastic comfort: no delay, clear, bright, live. This is extremely pleasant and safe.

I called Vantage Paris and Panavision-Alga to find out about their deliveries of the ALEXA Studio. Vantage Paris was fantastic and they got me a camera for testing with Hawk lenses. The result was really interesting. The quality of the motion blur, because of the mechanical shutter, was really amazing. I think that's why people want to shoot with ALEXA Studio even without anamorphic lenses. Mechanical Shutter and Real View Finder: these are 2 very good reasons.

Then Alga Panavision also got an ALEXA Studio. And from that time on I was able to choose which lenses I would like to use. I decided to use Panavision G Series lenses on this show. I love the "sensuality" of the image they create, soft but contrasty, deep, the quality of the out of focus bokeh's. Panavision G series anamorphic lenses include: 25, 30 35, 40, 50, 60, 75 mm T2.6 and 100 mm T3.0. Close focus is under 3 feet.

The references for the look of the film were *American Gangster* and *Zodiac*. *American Gangster* had the color we liked: brown, dark images, you never feel the lighting. Everything seems simple and natural. I come from the commercial business and it was important for me to lose my "usual" way of working. I work for beauty, and often use a lot of lights. *Zodiac* influenced us in a wider way. Locations, art department, camera movements, lights—we looked at this movie quite a lot, let's say.

I shot the entire movie with a chocolate filter n° 3 (exterior), and chocolate n° 2 (interior). For nights, I used an "antique" filter. I used on the set the rush management system that Patrick Leplat from Panavision France built for us. So I was able to work on the grading of the image on every sequence, at each locations, immediately on set.

I decided to buy my own camera during prep. Because the ALEXA Studio was very new, it was going to be difficult to get 2 cameras on set, and we needed 2 bodies because we were shooting abroad (Spain and Canada). Panavision and Vantage were ready to rent us an ALEXA Plus for the second body. But for me, it was not a good compromise. I knew that the second body would be used as the "B" camera, the second camera (for helicopter, stunts, sunset, sunrise) and I didn't want to have some images in 4:3 anamorphic and some images 16:9 spherical. (That was before the ALEXA Plus 4:3 came out.) This was not the project to make such a compromise. So I decided to buy my own camera. I have to say it was already in my mind to do so. Natasza Chroscicki from Imageworks had already prepared a price quote for me in September, and now I was ready.

Digital today is a new way to work. We have lost some parameters that film had offered, for sure. But with digital, I also won some things. You can work directly on set and check your continuity (we shot our exteriors in Spain and our interiors later on in Canada), and I felt more free to try, to be playful, to explore.

A big point: I developed a very strong working relationship with my gaffer, Daniel Chretien. This was the first time I worked with him. He was really involved, and he was in front of our monitor all the time, because the quality of digital can offer this. He was my visual memory. Because of digital, it was easier to explain my point of view for each scene. Daniel quickly understood what I liked, and to where I wanted to go. □

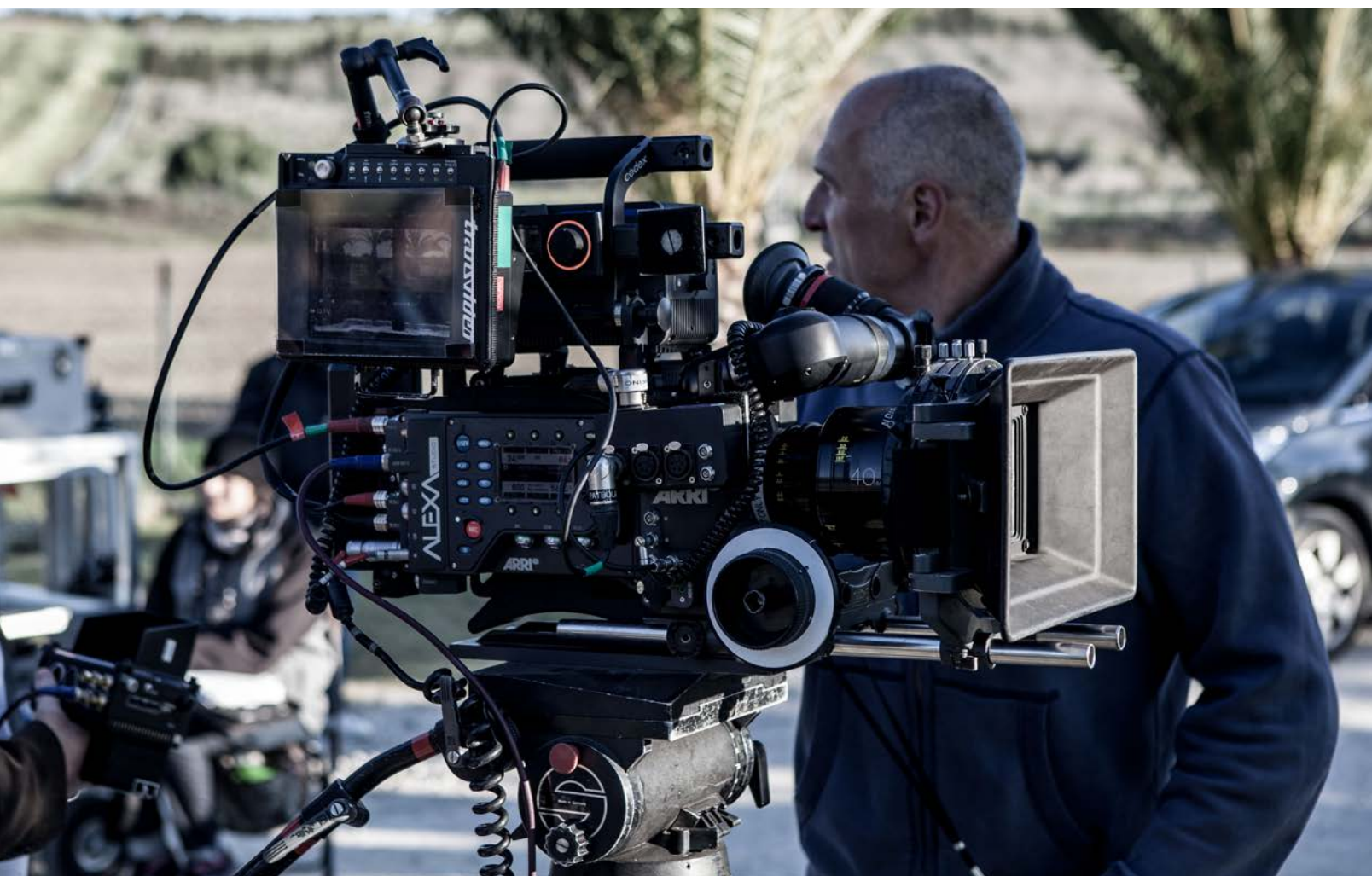


*Gibraltar*



*Gibraltar* — Directed by Julien Leclercq  
Cinematography by Thierry Pouget  
Cameras: Two ARRI ALEXA Studio cameras

Lenses: Panavision G Series Anamorphics  
Starring: Tahar Rahim, Gilles Lelouche, Riccardo Scamarcio  
Photos: Copyright Chapter 2 - Mika Cotelon







ARRI/ZEISS anamorphic prototypes have been seen for the past three years, as Marc Shipman-Mueller, Thorsten Meywald and others grilled many of us on look, feel, myth and reality of the legendary anamorphic look. But there prevailed a sense of gloom and doom because the projected numbers of potential customers were puny while the estimated costs were prohibitive, even for the most powerful potentates of the world's rental kingdoms.

Several things have changed in the past three years to make anamorphic more affordable: more 4:3 digital cameras and ARRI's announcement, at this IBC, of 4:3 ProRes anamorphic recording onto its internal SxS PRO cards.

The new ARRI/ZEISS Master Anamorphic Prime Lenses are a combined effort of the long-time design, technical and marketing partnership between Munich and Oberkochen. ARRI will handle exclusive marketing worldwide, and retains the official brand name, "ARRI Master Anamorphic," as they do with ARRI Master Prime and ARRI Ultra Prime. The lens barrels show the partnership: ARRI and ZEISS.

At IBC, both ARRI and ZEISS have working prototypes of the new 50 mm T1.9 Anamorphic lens on ARRI ALEXA Studio cameras in their booths. The new lens is smaller and lighter than the blue-barreled concept model we saw at NAB. We'll also see mock-ups of the new 35 mm Anamorphic.

The look of these lenses is also a nice surprise. Thorsten Meywald, Product Manager, explained, "We designed these lenses completely from scratch. Bokeh's are determined by optical design, contrast, and other factors. Sometimes the out of focus area is more important. These lenses have a pleasing anamorphic oval bokeh. The Master Anamorphic lenses do not look clinical. In addition to superb design, they have optimized anamorphic bokeh's: oval highlights. To get a perfect oval, you need a lot of blades. The Master Anamorphics have irises with 15 blades. Master Primes have 11 blades."

Designing anamorphics is like putting two different lenses into

one barrel. For example, a 50 mm anamorphic will have the vertical characteristics of a 50 mm spherical lens and the horizontal characteristics of a 25 mm. When you think about designing such a lens, there are essentially two completely different focus mechanisms. Both have to be combined. A new focusing mechanism has been designed to travel different distances at the same time; it is mechanically quite advanced.

Many anamorphic lenses in the past were made from a prime lens with a cylindrical element added in front. This creates oval bokeh's. Most anamorphic zoom lenses have cylindrical elements at the rear. With a rear anamorphoser, you get round bokeh's and the depth of field is the same as a comparable spherical lens.

The anamorphic squeezing is done by 'spreading' the cylindrical element around throughout the lens—not in front, not in back, but in several places. They are not based on existing lenses."

And they have streaks. BLUE STREAKS!

Geometric distortion is low—around the same level as the Master Prime spherical lenses. Anamorphic distortion typically has been 6 - 12%. Anamorphic lenses have often gone to great lengths to avoid severe image breathing and mumps. Mumps are vertical distortions. For example, when you focus from infinity to 4 feet, a person's face tends to become fat as you focus closer. These Master Anamorphics are expected to be as good as Master Primes when it comes to breathlessness and lack of mumps.

The Master Anamorphics were designed with digital cameras in mind. They are nearly telecentric (parallel rays) with minimal color fringing and shading (vignetting) at the corners.

Here's the current road map. Prototypes of the 35, 50 and 75 mm Master Anamorphic lenses at NAB 2013. Delivery by Cine Gear 2013. Prototype of 100 mm around Cine Gear. Introduction of 40, 60 and 135 mm at IBC 2013. Delivery of full set by end of 2013.

The lenses will be available to purchase from ARRI and their distributors worldwide.



Left: Marc Dando, Managing Director of Codex Digital. Above: ALEXA with Codex Onboard Recorder.

### **Jon Fauer: Please explain Codex and your virtual file system—starting from what comes out of the camera?**

Marc Dando: We record anything that comes out of a digital camera into a Codex intermediate format. Some other recorders will record only, for example, a DPX file. They're wrapping it in a header format, whether it's ARRI or whether it's DPX, and they're actually confining that data immediately to a file format. The problem is, if you want to make any modifications, you have to open and close every single file. With Codex, we basically capture metadata, picture data, and audio data into the Codex. When you want to deliver files, Codex creates the files on the fly.

Here's an example that shows why this is important. Invariably on set, in the heat of the battle, and let's face it, film sets can be like war zones and we all know that stuff goes wrong—a roll might be mislabeled. You might have two rolls labeled "52" for example. That may not get spotted on the set, but it has to be spotted by whoever's doing the QC. Somebody has to see it and fix it because it can have vast implications further down in post production. With some other systems, the only way to fix the roll number would be to open up every single file in the roll and change it. That could be thousands of files.

In the Codex environment, everything is editable until you actually write to tape or you actually commit to a standard file format. Dynamic metadata is probably one of our most powerful features. People don't realize how powerful it is until they don't have it. That's the most important thing about our file system. We have a transcoding engine which allows you to go to the standard formats—ARRI, Avid DNxHD, Apple ProRes, DPX, OpenEXR ACES files. We also have an XML file on a per-shot basis that contains all the metadata.

### **How did you come up with this idea?**

It seemed like the most obvious way to manage these files. When you capture a vast amount of data, and bear in mind, when we started in 2004 or earlier, a terabyte of storage was a massive amount of storage. We don't even think about it anymore. Going back to those days, capturing frames that were 7 MB each, at 100 or 200 odd megs a second, was a lot of data. Now it's not, of course, and everybody's very blasé about how much data they have. It not only made sense to be able to edit the meta-

data, but also to create the deliverables on the fly, because why store all these different versions when you don't need them?

For example, with the virtual file system, if you had a visual effects shot, dealing with a 4K file for a compositing system could slow things down. Being able to make a lower resolution file would help. You can say, "I eventually want DPX 4K fully processed files, but I want a 1K version of that for visual effects so they can start working immediately."

The other benefit is if I've got a 50,000 frame shot, and I want frame number 37,015, I can just go there and get it. I don't have to render the whole thing up first. I think we could say the virtual file system is something that's one of the crown jewels of our IP.

### **How did Codex begin?**

I've been involved in the industry in various forms for about 23 years now. I did the original plan for Codex with Delwyn Holroyd, who's our chief engineer, and we went to somebody who could raise money. Things went in a certain direction and they decided to go ahead and do it and I went off on my own. That's when I started doing digital workflows. In July or June of 2009 it became apparent that I was going to be able to join and move Codex forward. They had already had some success with the studio recorder, which was an 8U 19-inch rack-based recording system.

When I became involved in 2009, I immediately saw that the recorder needed to be much smaller so it could be mounted on a camera, although I think it had many strengths. We really focused on that and also on supporting ARRIRAW, which put us in a great position when the ARRI ALEXA really took off for feature film production at the beginning of 2011. We learned from our mistakes.

When television production started moving to HDCAM-SR tape, they didn't have any sales people at Codex to actually take advantage. A portable Codex at that time could have completely taken over all those TV shows, and we could have gone to file-based workflows with Sony F23 and F35 cameras way earlier. But of course, post-houses and this industry just loved their tape. I think people felt that if they had a piece of tape on their desk, then they had something that was secure. I personally disagree, having been involved with high-performance computing for many years.





Codex Onboard Recorder



Codex Onboard S Recorder

I'm not saying that you shouldn't have solid secure workflows, but some of the lengths that people go to are ridiculous compared to what they would have done with a 35mm film.

Our focus is on streamlining this business. Recording was a way in for us and we've been very successful at it but we have no illusions about the current style of recorders. They will not continue forever, because, anybody who makes a new camera will start to consider inboard and on-camera recording in the same way RED and Sony are now doing. It's Moore's law. That's why we've been very focused on workflow technology. We are focused on post technologies for set.

Having a very heavy visual effects background, and many people at Codex do, we are constantly thinking about the metadata that people require to make shows easier to do. There still is a massive divide between post and set...about the priorities of the different crafts. Your camera crew is going to be on a different show by the time you're into post. The post people don't seem to think the camera crews care enough about post—although that's not usually true. The role of the DIT has expanded to try to bridge the divide.

### **Is the industry ready for 4K? Some think not.**

There are several things. Originating in 4K doesn't mean that you're finishing in 4K. Resolution isn't everything. If you want my humble opinion on this, ProRes is great, but it's an editing format. It was designed to edit. Anybody who's shooting a quality television program, something that they may want to resell in the future, they should be shooting RAW. And then what you do is you archive that. I'm not saying have a RAW workflow. Make ProRes 444, make DNX 444, whatever. That could be your working deliverable, but just get the RAW in the can for the future.

### **Like a film negative.**

Absolutely. So that's what Codex is all about. And yes, AJA will have a 4K compressed recorder to go with the C500. It's not what Codex is going to do. We are fully, fully behind getting the highest quality we can out of that camera and then producing your working deliverable to suit your budget. A Codex workflow doesn't have to be expensive. We don't control how much our customers charge to rent out Codex equipment but sometimes we scratch our heads.

### **Conclusion...**

At the end of the day, Codex is all about making products that perform and are robust. We believe that anything we design should be elegant in form and function, but clearly function is always more important than the design. We think the ergonomics of the user interface and the touch and feel of any product is very important. Human beings are tactile individuals. We touch. That's why things like iPhone have been so successful, because that's how we work.

We're completely dedicated to making sure that we get the best we can from the technology we use - it's got to be robust. We want to support the industry and we make sure that we've got people on our team who understand why our users want to do certain things. We have to try and remain one step ahead the whole time.

### **Where are we heading? Where would you like it to be?**

I think 4K is a stepping stone to a certain extent. It's an obvious next step, isn't it, from where we are right now. I don't think that it's the be all and the end all. I can see us having much higher resolutions than that to be quite honest.

I think you probably need 8K to get great 4K for cinema.

Cinema has definitely got to jump to the next level. I think the new Dolby Atmos sound system is a big step. Distributors have got to figure out a better experience for customers. If they want people to keep going to see cinema, they've got to take the cinema experience to the next level.

We have to be realistic about what money people have got to spend and how they spend it, and right now we can get higher frame rates with the current projector systems at the cinemas we've already got. I think we should be making full use of what we have right now. It will be interesting to see what the take up is on The Hobbit and 48 frames per second. I personally like it. I'm not sure that 48 or 60 fps is enough. I think we need to be getting closer to 72 fps, maybe even higher. I'd like to see 120 FPS recording and we're working on a project to do that right now. Now, I hear a lot of people saying they don't like it because you get this kind of ultra real look. People say it looks too much like video but I'm not actually sure it does look too much like video. Maybe it's personal taste and what we're used to. □



Codex Vault. As shown in this and the adjacent two images, the Vault is scalable. It grows according to your platform, needs, hardware, drives...

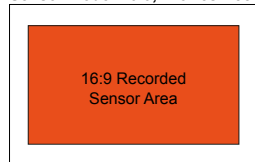


If you don't have a Vault (but you should), the Transfer Station M for Mac OS X will wrangle your data from Codex Datapack on top to Codex Transfer drives on bottom, and to connected hard drives as well.

## ARRI ALEXA Updates - Sept 2012

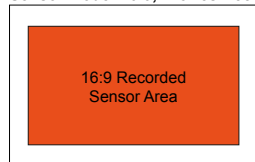


### Sensor Mode: 16:9, ProRes Recording Resolution: HD



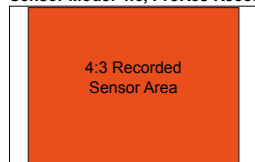
- ProRes HD  
2880 x 1620 → 1920 x 1080
- DNxHD  
2880 x 1620 → 1920 x 1080
- ARRIRAW  
2880 x 1620

### Sensor Mode: 16:9, ProRes Recording Resolution: 2K



- ProRes 2K 16:9  
2868 x 1612 → 2048 x 1152
- ARRIRAW  
2880 x 1620

### Sensor Mode: 4:3, ProRes Recording Resolution: 2K



- ProRes 2K 4:3  
2868 x 2150 → 2048 x 1536
- ARRIRAW  
2880 x 2160

## ALEXA Software Update Packet SUP 7.0

The ProRes 2K 4:3 part of SUP 7.0 will allow anamorphic 4:3 productions to record in ProRes 2K onto the ALEXA's internal SxS PRO cards. Productions shooting ARRIRAW (anamorphic or spherical) will still record to a Codex Onboard Recorder.

"I think ProRes 2K 4:3 is going to change the game for anamorphic shooting, making it much more affordable. Previously, you had to use ARRIRAW with 4:3. Now it becomes as simple as using an HD SxS PRO card," said Marc Shipman-Mueller, ARRI Product Manager of Camera Systems.

ProRes 2K 4:3 also has advantages similar to shooting in 4-perf instead of 3-perf, but without any added cost. The extra headroom on top (and bottom) provide added space to repo your frame up or down. If a microphone boom dipped into your only good take, ProRes 2K 4:3 might save the day.

There are many more details to SUP 7.0. For further information, visit ARRI at IBC, Cinec, or online: [www.arri.com](http://www.arri.com)





This image is a rendering.  
Production models may have  
minor changes.

## eXtRa: ALEXA Upgrades

“Extra! Extra! Read all about it!”

This month's Stop the Presses call came from Türkenstrasse.

**Existing ARRI ALEXA cameras can soon be upgraded with internal ARRIRAW.**

ARRI and Codex worked together to develop a new XR Module (Xtended Recording) side cover for ARRIRAW uncompressed recording right where your SxS PRO card previously went.

It's as if the five ALEXA sisters, as if they weren't already fit enough, enrolled in Zumba class for a major workout in a timely move by their product managers to provide precisely what practitioners have been asking for: ARRIRAW inside. These upgrades are huge technological leaps that won't leave owners and rental houses howling about obsolescence or poverty. Your current ALEXA sisters continue to work faithfully.

Any of the five current siblings can be upgraded: ALEXA, ALEXA Plus, ALEXA Plus 4:3, ALEXA Studio, ALEXA M.

When you take ALEXA to an authorized ARRI service center, the camera will get new processing hardware to allow for the increased image data and a new camera-left side cover. It adds a mere 8 mm to the width of the camera when compared with the current dual-slot SxS PRO card cover.

The new ALEXA XR side cover opens to reveal a single slot that accepts a 512 GB XR Capture Drive. ARRI will sell these XR drives exclusively.

So equipped, Alexas can record ARRIRAW at up to 120 fps. One XR Capture Drive will record 55 minutes of ARRIRAW at 24 fps and 11 minutes at 120 fps. Alternatively, it will record 2:12 hours of ProRes 4444 at 24 fps. DNxHD for Avid will be available at a later date.

You format the XR Capture Drive either for ARRIRAW or for ProRes. SxS PRO cards have not been forgotten. An adapter with a single slot accommodates an SxS PRO card. (SxS-1 and SxS PRO+ cards are not compatible with ALEXA.)

The hardware is made by ARRI, in close cooperation with Codex. Software and capture drives come from Codex. The drives are special industrial-strength solid state memory. The engineers tell us that they have confirmed an 860 Megabyte per second data rate on the XR drives. That is 6,880 Megabits per second—6.7 Gigabits per second. These could be the fastest drives on the market.

Workflow is navigated 3 ways:

1. Simplest is a single, hockey-puck shaped capture drive reader, called the Single Dock, that connects to a computer via USB 3.0.
2. The Dual Dock comes in a 19" rack mountable unit with the Codex Virtual File System and 2 slots that can download and make clones.
3. Codex Vault has, by now, become a standard of the industry, with reliable and quick downloading, cloning, copying to shuttle drive, backing up, and more.

Marc Shipman-Mueller, ARRI ALEXA Product Manager, discussed how all this came about. “Cinematographers were telling us that they liked shooting in ARRIRAW but wished it were inside the camera instead of attached as an external magazine. Codex works extremely well, and most high-end features were using Codex.”

## eXTtra: New Alexas

But what if you happen to be one of the few people on the planet without an ALEXA, having just returned, let us say, from seven years in the Pantanal, a grueling expedition on which all your analog camera equipment was ravaged by man and beast, and you don't have any camera, let alone an ALEXA to upgrade?

ARRI is enhancing the ALEXA camera line with new ALEXA XT (Xtended Technology) models.

The only camera remaining from the original line will be the original entry-level ALEXA (16:9 sensor). There will be four new XT Cameras: ALEXA XT, ALEXA Plus XT, ALEXA Studio XT, ALEXA M XT.

They all have the XR module and new processing hardware built-in.

They all have a 4:3 sensor (2880 x 2160 for anamorphic 2x).

They will have a new in-camera filter system called IFM (In-camera Filter Module). A line of high-quality ARRI IRND filters will be introduced. They work like the Clairmont in-camera filter system; a difference is that the magnets are on the filter frames, not in the camera.

The cameras will all be equipped with LDS contacts at 12 and 3 o'clock positions in the PL lens mount. The mount itself is 130 g lighter.

A new cooling fan runs even quieter than the current one. There's a new VMB-3 viewfinder bracket that is more stable and uses two 15 mm rods as part of the design. These are in the same position as the lightweight rods, just above the lens instead of below, and ideal for attaching lens motors and other accessories.

The new cameras include an anamorphic de-squeeze and 120 fps high speed license.

XT cameras will be available first in the 2nd quarter of 2013. XR Module upgrades for existing cameras will be available a few months later.

Stephan Schenk, ARRI General Manager of the Camera and Digital Intermediate Systems Business Unit, summarized the imminent makeover and refresh of ARRI ALEXA cameras.

He said, “The cooperation with Codex has been great all along, starting with *Anonymous* and continuing through countless productions, whether HD uncompressed in *Life of Pi* or *Hugo*, or ARRIRAW in *Marvel's The Avengers* or *Skyfall*. Integrating their recorder into the ALEXA has improved the collaboration even further. The winner is the customer, who benefits from the combination of Codex's and ARRI's tested and proven technologies.”

Codex Digital Managing Director Marc Dando said, “ARRI has been a great partner for Codex and we've been fortunate enough to work on some great projects together with the world's leading cinematographers, including several Academy Award nominees this year. This is the next step in our collaboration and it was developed in direct response to the feedback we got from our mutual customers.” □







Left to right: Roberto De Angelis, Cyril Dufaut, Fanny Coustenoble and Christian Abomnes.  
Photo: Simon Noizat

By Natacha V and Natasza C, ImageWorks

This story began at Camerimage 2012. Michel Abramowicz, AFC and Stephan Schenk, ARRI General Manager Business Unit Camera & Digital Intermediate Systems, discussed ideas for Micro Salon. They both agreed to present the first images shot with the first Anamorphic ARRI/ZEISS Master Anamorphic lens in the Micro Salon screening room.

In early January 2013, ARRI entrusted a single 50 mm ARRI/ZEISS Master anamorphic lens to Roberto De Angelis, accompanied by Michel Abramowicz, AFC. The shoot took place in Paris for three days and reunited a great team of professionals.

These images were shot with an ARRI ALEXA Plus and Studio 4:3, recorded on a Codex Onboard S, and downloaded and cloned with a Codex Vault. Most of the exterior and interior shots were filmed on location with a Steadicam. Running shots in Paris, day and night, were done with a Scorpio Arm from Next Shot.

The story of the film “A Trip to Remember” takes us into Paris with two young tourists who enjoy going out and partying. They forget the classic tours of the city and its monuments. A few hours before their departure they make up for lost time and take pictures of the

monuments as souvenirs.

**FDTimes:** What do you think of anamorphic?

**Roberto De Angelis:** For me, Anamorphic “scope” is Cinema. I’ve done comparisons with Super35 in the past and anamorphic has a depth that spherical does not have. The anamorphic perspective reminds me a little of 3D. Also with anamorphic, focus becomes an important narrative element because you can tell two stories in the same frame. At night, the quality of out-of-focus highlights and points of light in the background (bokeh) bring us additional artistic possibilities. When shooting with digital cameras, anamorphic brings us closer to the look of the film.

I was amazed by the lack of distortion with the Master Anamorphic 50 mm lens and that we could do the entire film with this lens. Also, it is beautiful wide open, and it has the great advantage of being very light and compact.

**FDTimes:** Michael, can you describe the characteristics that you found with this lens?

**Michel Abramowicz:** At the moment I have not yet seen the images projected on a large screen and I still can not make definitive conclusions as the entire process is not finished. But at first glance



Michel Abramowicz, AFC  
Photo: Simon Noizat





# Master Anamorphic



Camera Car and Scorpio  
Arm from Next Shot.  
Photo: Simon Noizat

the ARRI/ZEISS anamorphic is very beautiful, it is made with great care. We used it at full aperture. I was surprised that it was difficult to have flares. The lens is very well made, giving it both advantages and disadvantages because the image is structured and without distortion. The scope format is very interesting, out-of-focus blurring is more pronounced.

Today digital is what it is, but with a Codex (ARRIRAW recording) and an anamorphic lens, we come back to a cinematic image. It is a pleasure to meet Cinemascope again.

**FDTimes:** Etienne Bertrand, you worked on this production as DIT. What was your workflow?

**Etienne Bertrand:** On this job, we had a Vault—which is a device made by Codex that allows us to upload and/or clone the recorded images. The Vault has different modules that can be added or removed as needed. There is an internal memory module of 8 TB. You can also add an LTO module for archiving. I find this modular configuration interesting because you can set up a Vault according to different requirements of a production.

For my part, working on this production with a lab in Germany, I received the Capture Drives from the Codex Onboard S. I inserted these into the Vault to make a first copy onto the internal hard drive of the Vault. I also used the Capture Drive to make a copy of the .ARI files onto an external RAID5 array. This was done in a single operation, which is handy, as the Vault is programmable to chain such operations. The transfer time is fast.

You can also make a copy of the Capture Drive onto a Transfer Drive which will go to the laboratory where it is unloaded and checked. The lab gives us a green light on location so we can erase and reuse the Capture Drive. The lab returns the Transfer Drive to us; it is like a shuttle disk.

I think a tool like the Vault is essential when we shoot far from the laboratory. It lets us make copies in native format and/or store images internally or even on LTO. The fact that it can receive different types of media allows a single device to copy and transfer from different sources to different deliverables. Currently, the Codex Vault accepts Data Packs from OnBoard M, Capture Drives from Onboard S, and soon, SxS cards. □



Photo: Anastasia Durand





ALEXA XT



ALEXA XT M



ALEXA XT Plus



ALEXA XT Studio

ARRI has updated the ALEXA camera line with four new XT (Xtended Technology) models: ALEXA XT, ALEXA XT Plus, ALEXA XT Studio, and ALEXA XT M. The only camera remaining from the original line will be the original entry-level ALEXA (16:9 sensor).

They all have the XR module and new processing hardware built-in. The distinctive physical difference is that ALEXA XT cameras have a new camera left panel that is about 8 mm thicker. This is called the XR Module, co-developed with Codex. Open the “door” and the two SxS slots are gone. Instead, there’s a single slot that accepts special Codex XR Capture Drives and records ARRIRAW inside the camera. Alexas are streamlined and lightened. It’s like removing the Thule ski rack from a BMW and carrying your skis inside.

rying your skis inside.

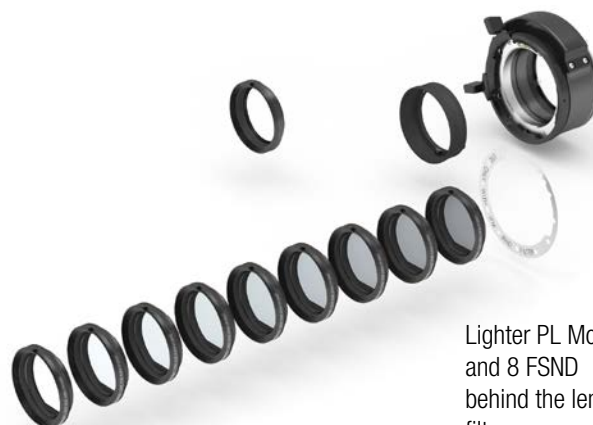
Alexas can now capture ARRIRAW up to 120 fps onto the new 512 GB XR Capture Drives. You can also record ProRes. (Be sure to format your drive in advance.) Software updates will enable DNxHD and ProRes 4444 up to 120 fps. With an SxS Adapter,

you can record ProRes or DNxHD to a single SxS PRO card.

The new ALEXA XT cameras all have a 4:3 sensor (2880 x 2160 photosites). It’s the same size and shape as a 4-perf Super 35 mm film gate: 23.76 x 17.82 mm (29.70 image diagonal). This provides a max-headroom sensor height of 17.82 for 2x squeezed anamorphic: 21.38 x 17.82 mm (27.77 mm diagonal). To do the math, divide 2.39 by 2 (squeeze) to get 1.2. Multiply 17.82 (height) by 1.2 = 21.38. This is more real estate than most other sensors.

The new cameras include an anamorphic de-squeeze and 120 fps high speed license. They will all be equipped with LDS contacts at 12 and 3 o’clock positions in the PL lens mount. The mount itself is 130 g lighter.

The new IFM (In-Camera Filter Module) includes a line of high-quality ARRI FSND filters (Full Spectrum Neutral Density). Magnets on the filter frames hold one of eight filters, ND 0.3 to ND



Lighter PL Mount and 8 FSND behind the lens filters

# ALEXA XT and XR Upgrade



Stephan Schenk at the Paris Micro Salon ALEXA XT launch

2.4, in the lens cavity. A new cooling fan runs even quieter than the current one. There's a new VMB-3 viewfinder bracket that is more stable and uses two 15mm rods as part of the design. These are in the same position as the lightweight rods, just above the lens instead of below, and ideal for attaching lens motors and other accessories.

Existing ARRI ALEXA cameras can soon be upgraded with the new XR Module (Xtended Recording) side cover for ARRIRAW uncompressed recording right where your SxS PRO card previously went. Any of the five current siblings can be upgraded: ALEXA, ALEXA Plus, ALEXA Plus 4:3, ALEXA Studio, ALEXA M. XT cameras and XR Upgrades should be available in May 2013.



VMB-3 Viewfinder Mounting Bracket



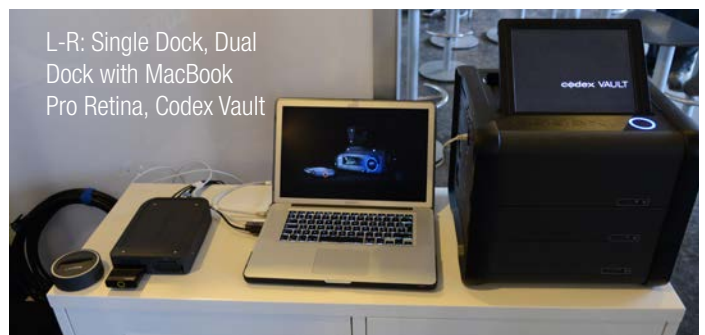
VEB-3 Viewfinder Extension Bracket

When you take an ALEXA to an authorized ARRI service center for the XR Module upgrade, the camera will get new processing hardware to allow for the increased image data and a new camera-left side cover.

With a new XR Capture Drive, Alexas can record ARRIRAW at up to 120 fps. One XR Capture Drive will record 47 minutes of ARRIRAW 16:9 at 24 fps and 9 minutes at 120 fps. Alternatively, it will record 107 minutes of ProRes 4444 at 24 fps.

The drives are special industrial-strength solid state memory. The engineers tell us that they have confirmed an 860 Megabyte per second data rate on the XR drives. That is 6,880 Megabits per second—6.7 Gigabits per second. Workflow is navigated 3 ways:

1. Simplest is a single, hockey-puck shaped capture drive reader, called the Single Dock, that connects to a computer via USB 3.0.
2. The Dual Dock comes as a stand alone unit with the Codex Virtual File System and 2 slots that can download and make clones.
3. Codex Vault does reliable and quick downloading, cloning, copying to shuttle drive, backing up, and more.



L-R: Single Dock, Dual Dock with MacBook Pro Retina, Codex Vault



# April 2013: Anamorphic Math

The lines were long at NAB to get on waiting-lists for new anamorphics. But there's a catch. Although film cameras are mostly 4:3, only one line of contemporary digital cameras takes full advantage of this 2x anamorphic 4:3 format: ARRI ALEXA. I hope ARRI will not wince when I exhort the other camera manufacturers to remember their history lessons. The math that made Panavision, Technovision, JDC and others famous somehow seems neglected recently.

Here are diagrams and numbers explaining how the anamorphic 2.39:1 format benefits more from a larger sensor than spherical 2.39:1, and why 4:3 sensors are better than 16:9 for anamorphic.

Figure 1 shows an image area of 234 sq mm<sup>2</sup> for Super 35 spherical widescreen 2.39:1 — the same area on both 4:3 and 16:9 sensors. The top and bottom are “thrown away”—letterboxed.

Figure 2 shows an image area of 376 mm<sup>2</sup> for anamorphic 2.39:1 format on a 4:3 sensor. Much bigger.

Figure 3 shows how 16:9 sensor cameras crop the image by a factor of 1.8x and have much less resolution than 4:3 sensors shooting anamorphic 2x squeeze format.

FDTimes has discussed and will continue to examine the different aesthetics of Hawk 1.3x anamorphics on 16:9 sensors. Meanwhile, the prevalence of 2x anamorphic lenses available from all companies today, with more planned this year, make a compelling argument for additional 4:3 sensor cameras.

4:3 Sensor with 2x squeezed image



16:9 Sensor with same lens and same 2x squeezed image: the smaller sensor size crops image by a factor of 1.8x and Linda gets a haircut



Fig 1. Spherical 2.39:1 on 4:3 ALEXA Sensor

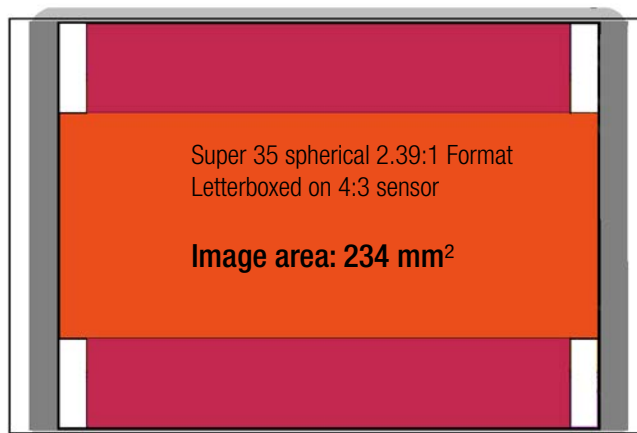


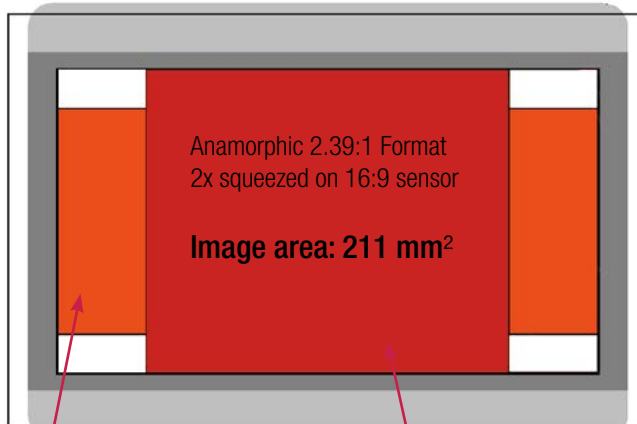
Fig 2. Anamorphic 2.39:1 on 4:3 ALEXA Sensor



**2.39:1 Spherical (Flat) Super35**  
2868 x 1200 Photosites  
23.66 x 9.90 mm (Width x Height)  
Ø 25.65 mm

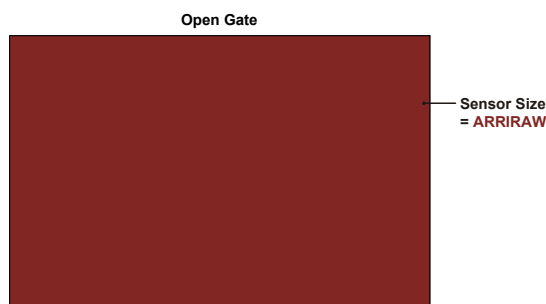
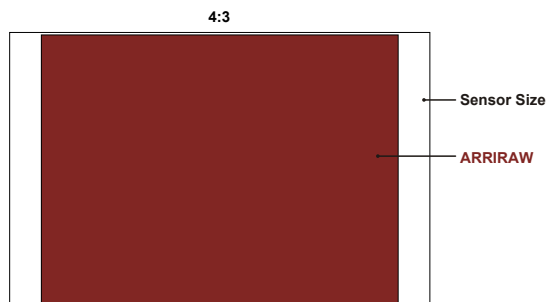
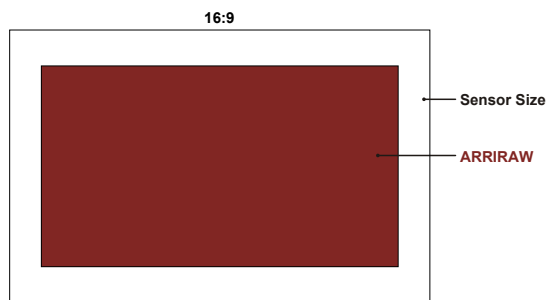
**2.39:1 Anamorphic**  
2x squeeze (1.195:1)  
2570 x 2150 Photosites  
21.20 x 17.74 mm (W x H)  
Ø 27.64 mm

Fig 3. Anamorphic 2.39:1 on 16:9 ALEXA Sensor



**2.39:1 Spherical (Flat) Super35**  
Image area: 234 mm<sup>2</sup>  
2868 x 1200 Photosites  
23.66 x 9.90 mm (W x H)  
Ø 25.65 mm

**2.39:1 Anamorphic**  
2x squeeze (1.195:1)  
1926 x 1612 Photosites  
15.89 x 13.30 mm (W x H)  
Ø 20.72 mm



Check the gate! This should be a good way to squeeze more pixels out of your ALEXA XT cameras.

ALEXA XT Open Gate is currently being tested. Up to now, ALEXA sensors maxxed out at 2880 x 2160 photosites for ARRIRAW 4:3. Soon you'll be able to shoot using 3424 x 2202 ALEXA photosites.

I can only imagine the conversation at Tuerkenstrasse: "Walter, these new XT cameras have more processing power—what if we take some of the surround view and other pixels and make them active?"

With Open Gate, ALEXA XT cameras will be able to take advantage of the entire sensor area, all 3424 x 2202 photosites, to record ARRIRAW to XR Capture Drives. This experimental mode will have a 1.55:1 aspect ratio. "What's the point of that?" you may ask. "Unless we're reviving an obscure, long-lost silent era projection format..."

There are several good reasons: repo, blow up, digital image stabilization, tilting. There never was a shot in the history of commercials where the agency art director resisted the urge to zoom in on the product or logo. The current ARRIRAW format (2880 x 1620 for 16:9 and 2880 x 2160 for 4:3) will probably remain the standard formats for ALEXA RAW capture, but shooting Open Gate may win you agency and VFX friends.

So, Open Gate uses a larger sensor area than the traditional ALEXA formats: 3424 x 2202 photo cells cover 28.25 x 18.17 mm.

By way of comparison, a 4:3 ARRIRAW frame (2880 x 2160) measures 23.76 x 17.82 mm and a Super 35 film frame is 24.9 x 18 mm.

You can switch back and forth between 2.8K and Open Gate sensor modes with a reboot of the camera, similar to switching between 16:9 and 4:3 modes.

With Open Gate you lose surround view. You also have to use lenses that cover an image circle of 33.6 mm. Rusty Gates, legendary World's Worst Assistant, will have to be on his toes to avoid vignetting with Open Gate. "But Dude," he's thinking. "A little vignetting isn't the end of the world. After all, isn't Open Gate supposed to be all about blowing things up anyway?"

## Experimental Open Gate Specs

**Sensor's active photosites (requires ALEXA XT/ARRIRAW capture)**

- 3424 x 2202 photosites
- 28.25 x 18.17 mm,
- 1.55:1 aspect ratio

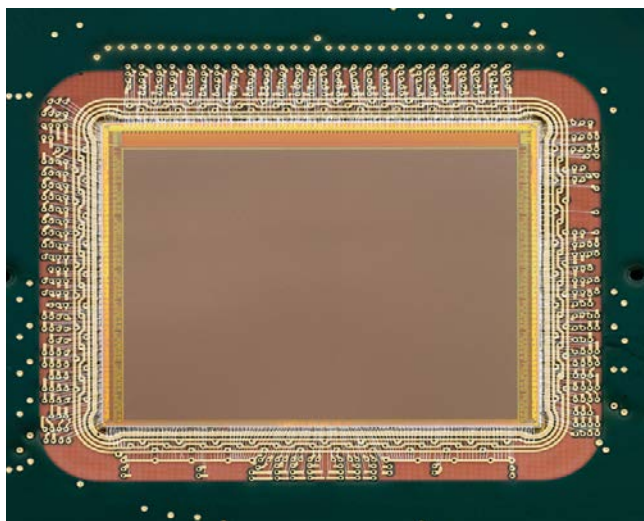
## 33.6 image circle requires attention to lens selection

**The following lenses will cover 33.6 mm image circle:**

- ARRI Ultra Wide Zoom UWZ 9.5 - 18/T2.9
- Leica Summilux-C Primes
- ZEISS Compact Primes and Compact Zooms

**The following lenses cover with the following cautions:**

- Many primes lenses 20 mm and longer could cover
- Zoom lenses cover at the longer end of their range
- Alura Lightweight Zoom 15.5-45 T2.8 covers from 17 mm to 45 mm





## Sep 2013: ALEXA and CFast 2.0 cards



Adapter lets you use CFast 2.0 cards in:  
ALEXA XT cameras  
ALEXA Classic cameras with XR Module upgrade

- 350 MB/s write speed
- ProRes 4444 up to 120 fps
- CFast 2.0 cards will come in 60 or 120 GB capacities



At IBC 2013, SanDisk introduces CFast 2.0 memory cards. At the same time, ARRI launches a CFast 2.0 Adapter for ALEXA.

Flashback to Photokina a year ago. Sandisk announced that they were working on a new generation of Compact Flash Memory Cards. They would be based on the new CFast2.0 specification introduced at that time by the CompactFlash Association (CFA). The CFast2.0 specs provide performance up to four times faster than current CompactFlash memory cards. The CFA was established in 1995 ([compactflash.org](http://compactflash.org)), with more than 80 major companies cooperating, including Canon, GoPro, Hasselblad, Leica, Nikon, Sony, and ARRI.

At IBC 2013, ARRI is introducing a CFast 2.0 Adapter that slides into ALEXA XT cameras or ALEXA Classic cameras with an XR Module upgrade.

The combination of ALEXA and CFast 2.0 cards offers the same workflow as SxS Pro cards and the same codec options: ProRes in 16:9 HD, 16:9 2K or 4:3 2K and DNxHD in 16:9 HD.

CFast 2.0 card recording also has the same safety net as SxS Pro recording. Files are closed continuously, so accidentally removing the card or losing power during recording will not render a card corrupted or unreadable. With ALEXA Software Update Packet SUP 9.0, both SxS PRO and CFast 2.0 cards will also support pre-recording and self-healing metadata.

Because of their high data rate, CFast 2.0 cards support higher frame rates than SxS Pro cards, enabling recording of ProRes 4444 up to 120 fps. The 120 GB CFast 2.0 cards have about twice the recording capacity of 64 GB SxS PRO cards. Moore's Law seems to be at play in camera memory.

As I write this, SanDisk is ringing the opening bell at the NASDAQ in celebration of their 25th anniversary. They worked with the camera manufacturer members of the CompactFlash Association to develop the CFast 2.0 standard. Certainly Shuki Nir (Sandisk Senior VP) stirred up interest in the high-end motion picture community when he said, "With the CFast2.0 specification's unparalleled performance, flash memory can now enter new markets such as high-definition TV and even cinema production."

The card promises to be rugged and able to withstand extreme temperatures, shock, vibration, and other perils on location. The Sandisk Extreme Pro CFast 2.0 cards will be available in 60 GB and 120 GB capacities with write speeds up to 350 MB/s, which support the highest ALEXA frame rates in ProRes and DNxHD codecs.

### ALEXA XT and XR Media Choices

Recording	XR Capture Drive 512 GB	CFast 2.0 Card 120 GB	SxS PRO Card 64 GB
ARRIRAW recording and playback	✓		
ProRes recording and playback	✓	✓	✓
DNxHD recording and playback	✓	✓	✓
Maximum frame rate ARRIRAW 16:9	120 fps		
Maximum frame rate ARRIRAW 4:3	90 fps		
Maximum frame rate ProRes 4444 HD 16:9	120 fps	120 fps	60 fps
Maximum frame rate ProRes 4444 2K 4:3	48 fps	48 fps	48 fps
Recording capacity ARRIRAW 16:9 at 24 fps	47 minutes		
Recording capacity ARRIRAW 4:3 at 24 fps	35 minutes		
Recording capacity ProRes 4444 HD 16:9 at 24 fps	107 minutes	53 minutes	29 minutes
Recording capacity ProRes 4444 2K 4:3 at 24 fps	70 minutes	35 minutes	19 minutes

# Sep 2013: ALEXA and her Sisters



ALEXA

16:9 sensor

7.7 kg /16.9 lb

ALEXA XT

4:3 sensor

8.0 kg /17.6 lb

ALEXA XT Plus

4:3 sensor

8.7 kg/19.2 lb

ALEXA XT Studio

4:3 sensor

10.5 kg /23.1 lb (OVF)

ALEXA Fiber Remote

16:9 sensor

6.3 kg/13.8 lb

ALEXA XT M

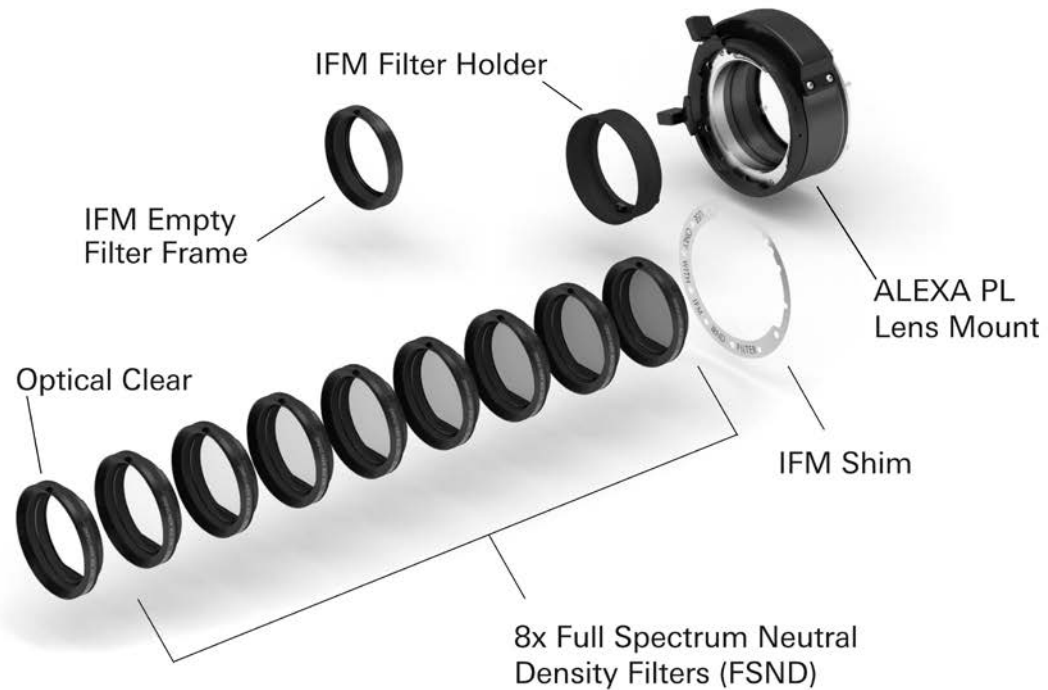
4:3 sensor

5.8 kg/12.8 lb

*Partial group portrait of current ALEXA family. Weights are approximate and may include camera body, SxS module, Electronic or Optical Viewfinder, and Viewfinder Mounting Bracket. Configurations vary. Shown for comparison only.*







FSND (Full-Spectrum Neutral Density) filters can be used in the Internal Filter Module (IFM-1) of ALEXA XT cameras or ALEXA Classic cameras with an IFM upgrade. ALEXA XT Studio and ALEXA Studio have spinning mirror shutters and cannot use the IFM. (Both have their own motorized ND system.)

The ALEXA XT Internal Filter Module is compatible (so far as we know) with all ARRI 35mm format lenses. However, just in case—the filter sets include a depth gauge that you can use to make sure a lens fits.

FSND filters sit relatively far away from the sensor, so if there are small specs of dirt on the filter, they probably will not show up in the image at most common T-stops.

When using FSND filters, be sure the IFM shim has been installed in ALEXA's PL mount. Using any filter between the lens and the sensor increases the flange focal distance by 1/3 the thickness of the glass, and this shim accounts for that. Once the shim is installed, you will always need some kind of filter between lens and sensor: either an FSND or an optical clear filter, which ARRI also provides.

The basic filter set includes: IFM Optical Clear, FSND filters 0.6, 1.2 and 1.8, IFM Shim, Filter Insertion Tool (the familiar Ground Glass/Frameglow tool K4.52722.0) and a case with spaces for 8 FSND filters.

The full filter set includes the IFM Optical Clear, FSND filters 0.3, 0.6, 0.9, 1.2, 1.5, 1.8, 2.1 and 2.4, the IFM Shim, the filter insertion tool (the Ground Glass/Frameglow tool K4.52722.0) and a case.

The FSND (Full Spectrum Neutral Density) filters used with the IFM-1 use a number of high-tech manufacturing methods that are different from common mattebox filters. A neutral color balance at all densities is achieved with a broadband absorptive coating that attenuates the full spectrum. To maintain high contrast, an anti-reflective multi-coating reduces internal reflections. A sharp image is assured by using water-white optical glass that is precision polished to create perfectly parallel surfaces. While all ALEXA XT cameras come with the IFM filter holder installed,

the FSND filters themselves are available separately in 8 densities from ND 0.3 to ND 2.4, plus an optical clear. ALEXA XT cameras come from the factory, and can be used, without a filter. When it's time to use FSND filters, the IFM shim has to be installed.

ALEXA has an EI of 800, which is great when shooting at night, by available light indoors, or in studios. However, in bright sunlight or when you prefer shallow depth of field, it's time to use ND filters. Having an ND filter inside the lens mount can have a number of advantages over external ND filters:

Internal ND filters avoid nasty reflections you can get with multiple filters in the mattebox.

They reduce narcissism, which is the ghost-like effect you get when light reflects back from the sensor, onto the rear lens element, and then back to the sensor.

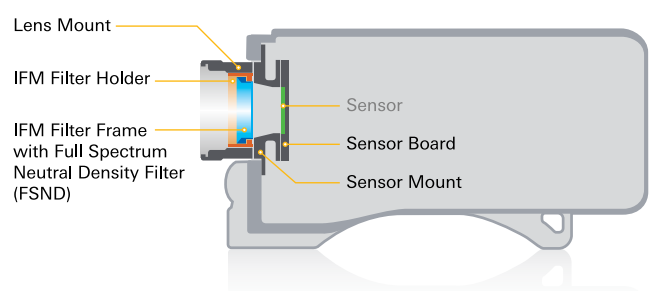
An internal IFM ND or clear filter protects the sensor from dirt, dust, mist, and other contamination during lens changes.

Internal ND filters are smaller and lighter than external filters.

These new filters are completely different from current external ND filters: they use a new coating technology that has only become available in the last couple of years.

The IFM filter holder is only compatible with ARRI FSND filters and not with Clairmont's in-camera filter system.

ARRI IBC booth 11.F21. [www.arri.com](http://www.arri.com)





ALEXA Classic 16:9 sensor

ALEXA XT Studio 4:3 sensor



ALEXA XT 4:3 sensor

ALEXA Fiber Remote 16:9 sensor



ALEXA XT Plus 4:3 sensor

ALEXA XT M 4:3 sensor



More media, more metadata, improved ProRes recording, Open Gate, Lens Metadata support, Pre-Recording—those are some of the highlights of ARRI ALEXA Software Update Packet (SUP) 9.0.

## More Media Choices - CFast 2.0 Support

From SUP 9.0 on, all ALEXA XT cameras and all ALEXA Classic cameras with the XR Module upgrade can use ARRI's new CFast 2.0 Adapter to record and play back with CFast 2.0 cards. These cards offer high data rates up to 120 fps ProRes 4444 16:9 HD.

## ProRes Recording: Higher 4444 Frame Rates

The maximum frame rate of the highest quality ProRes codec, ProRes 4444, is increased to 120 fps in 16:9 HD mode. This is made possible by the increased processing power of ALEXA XT cameras or ALEXA Classic cameras with the XR Module upgrade. These higher data rates are available on either XR Capture Drives or CFast 2.0 cards.

## Pre-Recording

Pre-recording is the ability to record from an earlier point in time, even if you're late pushing the start button. ProRes pre-recording comes for most ALEXA cameras (not ALEXA HD or ALEXA HD Plus).

When pre-record is enabled and the REC button is pushed the first time, the camera will store picture, audio and metadata to a temporary ring buffer. This is a section of memory on the actual recording medium (XR Capture Drives, CFast 2.0 cards or SxS PRO cards). When the REC button is pushed a second time, the camera will keep everything that was stored in the buffer and continue to record from there. You can capture events that occurred in the past—very metaphysical.

The amount of time captured in the buffer depends on codec, aspect ratio, resolution, and frame rate. The buffer can be set to short, medium or long. The camera will calculate and display the corresponding buffer time. For example, with a 4:3 aspect ratio, shooting 2K ProRes 4444 at 24 fps, the buffer can store up to 14 seconds.

## Better DNxHD 444 Recording and ALEXA XT/XR Support

DNxHD is available in 444 for all ALEXA cameras with a DNxHD license, including ALEXA XT cameras and ALEXA Classic

cameras with the XR Module upgrade. Developed in cooperation with Avid, DNxHD 444 delivers master quality images.

## ARRI LDS and Cooke /i System Metadata

Support for the open source Cooke /i system as well as ARRI's Lens Data System (LDS) is already implemented on ALEXA XT cameras and ALEXA Classic cameras with the XR Module upgrade. This is now be extended to ALEXA Classic cameras with an LDS-PL mount (but not ALEXA HD, ALEXA HD Plus, ALEXA M and ALEXA XT M).

ARRI LDS and the Cooke /i system supply ALEXA cameras with focus, iris, and zoom settings, serial number, and other metadata that is recorded with each frame of picture. This information can be shown on ALEXA's main display, sent via HD-SDI to the director's monitor, or sent wirelessly for the script supervisor's notes.

## Alura 1.4x and 2x Extenders

The new Alura 1.4x and 2x Extenders have "smart" LDS-enabled PL mounts. Alexas with an LDS PL mount will be able to "see" that an extender has been attached to an LDS lens (or a non-LDS lens used with the Lens Data Archive). The camera will recalculate and display the new lens metadata values.

## LDS Source Switch

The lens data source switch improves flexibility in using the ARRI Lens Data System. It lets you choose the source of the lens data: either the encoders built into LDS lenses or the CLM motor encoders along with a Lens Data Archive table.

## Self-Healing Metadata

ALEXA will detect an incomplete metadata file, compare it with the frames actually recorded and reconstruct the metadata accordingly. This "self-healing metadata" will work on most ALEXA cameras and with all three supported recording media (XR Capture Drives, CFast 2.0 cards or SxS PRO cards).

## Additional WCU-4 Operation

The Wireless Compact Unit WCU-4 offers an even tighter integration with most ALEXA cameras, including display of pre-recording status, the ability to switch from regular speed to high speed and a software switch for lens motor direction.





Marc Shipman-Mueller (left) is ARRI Product Manager of Camera Systems. Henning Rädlein (right) was Head of ARRI Digital Workflow Solutions, and is now ARRI Head of Marketing, Partner Program & Workflow Solutions, BU Camera Systems. We talked about ALEXA's new SUP 9.0 and how it fits into current production and post production procedures. A few additional explanatory notes about Codex technology and files [in brackets] come from Sarah Priestnall of Codex.

## Jon Fauer: Marc and Henning, what's new in ARRI Software Update Packet (SUP) 9.0?

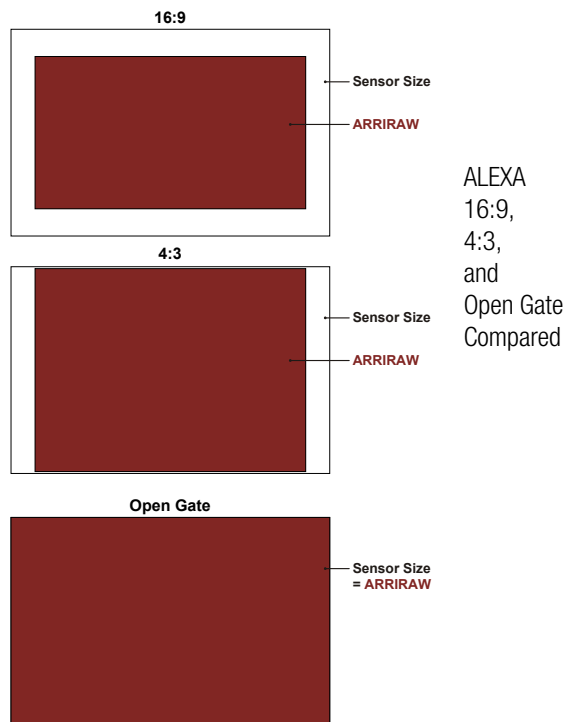
Marc: Let's begin with support for ProRes. With SUP 9.0, we can now record with the XT camera, ProRes 4444 (4x4) up to 120 fps. Previously ProRes 4x4 only went to 60 frames a second. With SUP 9.0 on the XT cameras, it's up to 120 frames a second as long as you record to XR Capture Drives or CFast 2.0 cards.

Another update is that we now have DNxHD on all cameras, Classic Alexas as well as ALEXA XTs, and we've added DNxHD 444.

I think a large portion of customers record on ProRes 4444 Log C and I always say if we would have known this we probably could have avoided doing some of the other flavors of ProRes. So much stuff is done 4x4 Log C. That is the standard. What we saw at the beginning of 2013 was an increase in ARRIRAW productions, but people didn't like the fact that they needed to use an extra recorder on top of the ALEXA. When the ALEXA XT came out a lot of people who wanted to do ARRIRAW got the chance to record it internally. We're seeing ARRIRAW on some of the not so high budget feature films now, as well as on high-end commercials. Because with the ALEXA XT camera, ARRIRAW recording is all included in the camera.

## With SUP 9.0 supporting the CFast 2.0 card, are you seeing more people using them on Alexas?

Marc: That's starting very slowly. The cards are just coming to the market. I think we've just received our first adapters from Codex for the CFast 2.0 cards. They are the same cards that the Amira uses. I actually think very little is going to happen on that front with ALEXA until the Amira hits and then some people with both cameras are going to choose to buy CFast cards. Right now the advantage of CFast cards on ALEXA is recording ProRes 4x4 at 120 fps, whereas on the SxS Pro 64 GB card you can only record up to



60 fps.

## Let's talk about the ALEXA XT Open Gate in SUP 9.0.

Marc: Open Gate works only for ALEXA XT, XT Plus and XT Studio cameras in ARRIRAW. ALEXA XT M support is planned for Software Update Packet 10, which, by the way, we're working on right now. Open Gate on the XT cameras uses the sensor's entire active image area of 3414 x 2198 photosites.

We think that most people will continue to shoot most of their footage in 16:9 for spherical or 4:3 for anamorphic shows. I don't think people are going to shoot a whole show on Open Gate, even though it's an interesting industry and anything is possible. I think Open Gate will be used for visual effects, wide angle establishing shots, things like that. They may record those scenes in Open Gate, and then switch back to whatever their regular format is for the rest of the show.

## How do you switch from regular to Open Gate if you are a camera crew in the field? Do you have to send it back to ARRI?

Marc: It depends what kind of camera you have. If you an ALEXA XT made before December 1st, 2013, the camera actually has to go into ARRI service for a special adjustment. You have to have Software Update Packet 9.0 installed. If you have an ALEXA XT that was built after December 1, you just have to make sure it has SUP 9.0 and then there's just one switch in the menu. You select from sensor mode 16:9, 4:3, or Open Gate. It takes about 30 to 40 seconds and then you are in Open Gate and you can record ARRIRAW. One thing is important to note. Since we are using the whole sensor, you now have an image circle of about 33.5 mm. So you must be sure to test, especially with wide angle lenses, to make sure that they cover the entire image area. We found with our wide angle Master Primes and Ultra Primes the boundary is somewhere around 18 to 21 mm. Our 9.5-18 mm Ultra Wide Angle Zoom covers fully. With other zoom lenses, it's all over the



ALEXA XT Studio

place, so be careful.

## **In post production, how do you know that it's Open Gate? Is it in metadata?**

Henning: Yes, it's in metadata. We are currently updating all the SDKs out there and informing all our partner companies about this new format. The ARRIRAW converter is available and able to process it. Very soon all the tools will be able to understand automatically that this is another format. They can downscale, or we'll offer options in another menu. I think most people will process without downscaling. They'll do their effects work or pan-scan, and then downscale to the HD or 2K deliverable format or up-scale to 4K or UHD-1.

## **What does Open Gate look like in dailies? Do you see it in a new aspect ratio with black on the sides?**

Henning: You will get a pillarbox image if you do 16:9 offline editing which is probably the preferred way. So you will have right and left black bars if you want to see the full height of the image. The important thing is that you see all that has been shot. The aspect ratio of Open Gate is 1.55:1.

## **At what stage does an editor do the repositioning of an Open Gate image?**

Henning: I talked earlier today with somebody in India who said they want to shoot the whole film in Open Gate. I also hear that several studios in the US are planning to do so. In this case, they will probably downsize to the final 'Scope or 1.85 ratio for editing in dailies and pull the original Open Gate to discuss VFX work. It's a different situation for each production.

Marc: We have another guy who wants to shoot in the Himalayas right now – not a very easy location – they're thinking Open Gate, wide landscape, big sky. As I said, it's an interesting industry and sometimes we are surprised how far filmmakers go with the tools we provide.

Henning: When I see the superb quality of ARRIRAW I would stay with that pixel count for most of the production. You can go with the Open Gate format for those shots that really make sense. This is definitely a handmade visual effects scenario. Of course, you have to reposition and alter the frame lines.

Marc: There are user rectangles you can set. We have frame lines

for most of the common formats that are built in. The one thing you can't do is set user frame lines. Those are custom lines you can make. Open Gate doesn't do audio. It's not quite as fast as 4:3 in terms of maximum frame rate. So there are some disadvantages you inherit when you do this.

I've talked to a number of people who said, "You know what, I don't necessarily want 4K. I'd just like a little more, a few more pixels for repositioning, rotating, stabilizing, that kind of stuff." Those people are mostly car shooters. I think to them that would be a great option because you don't incur the data weight penalty you have with 4K. You can still shoot uncompressed, unencrypted ARRIRAW and have a few more pixels around the edges.

## **Q: Explain the new Pre-Recording feature of SUP 9.0.**

Marc: Prerecording for ProRes essentially uses the storage space on the media: SxS Pro, CFast 2.0 or XR Capture Drives as a ring buffer. When you go to prerecording mode the camera will continuously record the footage and store between 8 and 60 seconds depending on your frame rate and codec.

When you push the record button it'll actually keep a certain number of seconds before you started recording. So you can capture an event that happened before you push the record button.

## **Before you get eaten by the tiger that's about to charge at you when you're doing wildlife photography.**

Marc: You know, I was talking to a nature cinematographer who spends most of his time filming owls. They will sit for hours on a branch and then all of a sudden take off. The owls, not the cinematographers. If you don't push the button at just the right time you miss it and the whole day is wasted. So if you give him the option to be able to capture the ten seconds before the owl takes off, his day would be saved. That's a new feature of SUP 9.0 and that works for all the Alexas: Classic as well as XT cameras, and Classic cameras upgraded with the XR module.

Henning: Is it actually buffering in the camera or on the card?

Marc: It's buffering on the recording media. We didn't have enough storage in the camera so we're buffering out to the recording media, which has an advantage. If you use a slim codec you can buffer up to a minute—much more than most other cameras.

## **What else is new on SUP 9.0?**

Marc: We have extra features for the Wireless Control Unit, WCU-4, so you can see what the pre-recording status is. You can switch from regular to high speed. There are some new motor functions. And we have just introduced a new user button, the Phase button, which I'm sure you remember from the film cameras, where you push the PHASE button to remove the Television scan line from the picture. Not a lot of people are shooting with CRTs or real projectors, but there still are some.

There's one more thing that I think is important: protecting data. One of our philosophies is that the image is holy. We always need to make sure that you can record a good image. In fact, most of our software is in layers and the holy layer is concerned with recording the image. Accessories and other things are in an outer layer, so if anything goes wrong you're still going to be able to record an image. We protect your images. So if you examine the progression of our ProRes recording, here is what happens: the camera



SUP 9.0 supports  
LDS and /i Lens  
Metadata

Cooke S4/i  
/i Data contacts

ARRI/ZEISS  
Master Prime  
LDS contacts



opens the QuickTime wrapper, starts recording footage into it, and every second it closes the wrapper. Then it opens it again, adds another second of footage, and closes it again. So if your battery goes down—you experience a power loss. If the wrapper were still open while the power was lost, everything recorded into the open wrapper would be lost. But with our system, you just lose the last second because the previous wrapper was closed.

Now this works really well and we've had that all along. But then we found that the metadata sometimes got scrambled when we had a power loss. Your footage was still OK, but the camera wouldn't allow you to record onto the card anymore because it couldn't make sense of the metadata. With SUP 9.0, if the camera finds a card with scrambled metadata it'll look at the actual footage, analyze the footage, look at the metadata and then rewrite the metadata based on the footage so you can still continue to record on that card.

Henning: We have a good name for that: Self-Healing Metadata.

### Let's talk about metadata in 9.0—LDS and /i support.

Marc: We now have built-in /i system support for all the ALEXA cameras. If you put a Cooke /i lens or an Angenieux /i lens on the ALEXA it will be able to read that data through the lens connector and store the metadata. Our philosophy with the ALEXA is we're happy to take all the metadata we can get, and put it everywhere we can. So the ARRIRAW has the metadata. QuickTime ProRes and MXF DNxHD contain metadata. The HD-SDI stream contains metadata on the Rec-Out, as well as the Monitor Out. There's an application called Lightcraft where they take the ALEXA metadata that's included in the HD-SDI feed and they process it in real time. I know that Transvideo gets metadata out of the HD-SDI stream and they are displaying it on their monitors, along with graphical depth of field read-outs. Metadata has always been a chicken and an egg situation, as you know. You've talked about metadata for decades. We thought if we provided it as widely as possible, somebody will find an application for it. And we're seeing that slowly happening.

### How does the Codex Data Logger One external metadata recorder attach?

Henning: Codex Data Logger One is aimed for people who are not delivering their metadata through the camera. They are

thinking about this as a post production center along with the Vault that's getting the image and the data from other lenses. You can marry everything in the Vault and prepare that for further deliverables in editing and copies and proxies and also export it into databases. So Codex is more system driven, able to handle a huge amount of data and also different camera types. [The Codex Data Logger One also captures additional information such as inertial data and GPS. It supports /i Squared, is integrated with other devices such as Preston and provides consistency across cameras and lenses.]

Marc: You might not need that with an ALEXA because data is integrated on the ALEXA. But let's say, gasp, you use a non-ALEXA camera. You could use the Data Logger box with a camera that doesn't have the ability to capture the lens data inside the camera. With the ALEXA we're trying to integrate everything. The LDS capture is integrated in the camera. We're capturing all the camera information. And with the Plus camera, even the remote control ability is built into the camera so you don't have to attach extra boxes. With other cameras you may need an external box to record the lens data and then you need another external box for wireless follow focus. With the ALEXA XT Plus, for instance, all that is already integrated into the camera so you have fewer boxes, fewer cables, fewer breakdowns.

### If you're archiving to LTO, does the metadata go along as well?

Henning: Yes. With ARRIRAW, the metadata is in the ARRIRAW header, and it stays there. Last week we published the ARRIRAW DPX multi chunk header description [which was developed by Codex]. Before that, DPX files were a big problem because, although they were a standard in the industry, there was no standard to put metadata in DPX. We created a chunk header which actually copies the entire ARRI header into the DPX file and makes a description so that, for example, The Foundry (Nuke) and other companies can use it and display the metadata even if the ARRIRAW was converted to DPX by another vendor. If somebody changed the Metadata, we can see the original and what was changed. Keep it transparent!

For example, let's say you're working with the ARRIRAW file converter and you see a file that was not processed with the 800 ASA setting but with the 200 setting for whatever reason. Or someone changed the white balance. The operator can see something was wrong. There was no system with that luxury for the VFX world up to now.

I talked to the effects supervisor on "Life of Pi" and he told me how Claudio Miranda ASC, the DP, might be looking for a scene shot with a 25mm Master Prime. So they looked in their database for all the occurrences of 25mm Master Prime shots, and they found it very quickly. This is a tool that can really help the Visual Effects people, an industry not making enough money. LDS and intelligent handling of metadata is something that can help them. It is a boring issue and it is not fancy or sexy, but if you use it intelligently, you can save a lot of money, time and effort in searching and set up.

### You both know I'm a huge advocate of metadata, but it seems like few are using it to its proper advantage.

Marc: It's coming. Here's a lovely, recent example. I visited the folks shooting *Game of Thrones* in Ireland. They're very inter-

esting because they're HBO. They're not beholden to any regular studio so they kind of came up with their own procedures. They're using the metadata a lot. They're shooting with ALEXA onto Codex Recorders. When a digital magazine comes off the Codex they put it in a special Codex Onboard M in the post suite that has its recording disabled. They go through it and they make sure all the metadata is correct. They've found that if any metadata right at the beginning is wrong, it will propagate throughout all the deliverables, all the proxies, and then you can never fix it, never get it right. So before they do anything else, even before they do a backup, they check metadata. I've never seen this before—actually making sure the metadata is correct as the very first step.

[Using Codex, they can take advantage of the dynamic metadata capability of the Codex Virtual File System (VFS). The VFS is a part of all Codex products: one of its benefits is that metadata can be viewed and edited.] Then they do the backups with the correct metadata, do the dailies, and then everything else follows from there. This shows how important metadata is to their workflow.

**Many productions are editing with Avid, conforming ARRIRAW as DPX files and then color correcting DPX files. Are you using DPX files as well at ARRI Film & TV?**

Henning: We're doing DPX also. Sometimes clients have gone to Open EXR – more visual effects driven companies. We have to say that we get very, very good color correction results from the DPX format, which means that one does the ARRIRAW processing before conform and grading. So there's actually no need to debayer live during color grading. You can do that, but you get the same result, in our opinion, when you first convert to a DPX file and then color correct from there—because you're ending up both ways in the same Log C wide gamut color space and grade based on this, hopefully using a Look Up Table.

**But you're throwing out metadata at that color grading stage?**

Henning: When we have integrated output to DPX with metadata it would not be lost. The most important thing is that the processing is done with the right white balance and a right exposure index. This is directly out of the ARRIRAW file. Then you go into the DPX file which only contains the preprocessed image for the color timing.

**Wouldn't it be good for metadata to go all the way through to grading? The DP is in the DI grading suite and can't find the meticulous notes jotted down for Scene 105, Take 6. It was supposed to be a little warmer with a little help to pull down the sky. The camera reports can't be found.**

Marc: I think you're right. However, I see a new trend now, which is to do color on the set. I traveled the U.S. this year and went to a number of sets, including *X-Men* and *Godzilla*. On all these shows the DIT was acting like a colorist on the set. The DP would constantly tweak the image to get essentially a color corrected image on the set or, at least a preview color correction. The CDL would then go with the footage for the dailies creation, and would be applied so that the dailies had the same color correction as they were seeing on the set. They would also sometimes use that CDL as a basis for the final grading. I've seen this in two versions. Version one is you just do the primaries on the set, that goes into CDL, travels to dailies, travels to the final grading. And there's a

second version, which I've seen on some of the high end feature films. The DP would go into a special trailer at the end of the day to do color grading with primaries, secondaries and power windows, even render out the DPXs so the special effects people would get proxy DPXs that already have the color timing the DP wants. When they do their special effects they already know what the end result really is going to be. I've heard a lot of DPs say that they're not invited to final color grading sessions or they don't have enough time and so they're trying to do as much as they can on the set now.

**That's a very good point, especially if you're not invited or don't have time or are working on another show.**

Marc: The result is they're grading on the set now. There's so much of it that the DIT has become the on-set grader for a lot of people. We're supporting that with the XT camera in that you can actually load the CDL from the DIT's laptop via an Ethernet connection and attach it to the ARRIRAW file.

**How is that attached, as metadata or...**

Henning: We have some space free in the metadata header. We gave the ARRI header specifications to all the partners, including Codex, and they write the information into the ARRIRAW file which goes all the way through until the end.

**Is this only possible if you're using a Vault or can it be done with anything?**

Henning: You have to use the Codex virtual file system. It's not about the Vault hardware box. It is about the Codex virtual file system [which is an integral part of all Codex products].

Marc: It works with the Vault, with the single dock if you have a license for the Codex virtual file system, and it works with a dual dock. Those are the three download hardware platforms that would support that.

**What are the most DITs using for grading on set or near set?**

Henning: In my opinion, most of them are using Resolve. It's a very good system. It's cost-free. It's an incredible tool. The Lite version can be downloaded for free. I looked it up today and it does almost the same as the big version. It doesn't have support for de-noising, stereo 3D, or the big panel, and is limited to UHD. Many of the big guys are using Colorfront OSD. It is a very common tool, although the strength of Colorfront is actually to make the deliverables and dailies.

Marc: On *X-Men* they were using EFilm Colorstream software. Other jobs had Pomfort LiveGrade. The hardware all the DITs seem to be using is the Blackmagic Design HD-link.

Henning: It's a box and it applies the 3D Look Up Table they have just generated so that it can be shown on the monitors around the set and in the video villages.

**It's true, every job is different.**

Henning: You know, this is the problem with workflows. If you write a paper and give some workflow recommendations, they are probably wrong because somebody is already working on another system. Or they are seeing everything in P3 or they're talking about ACES or they have to deliver visual effects pulls to a company that wants it in ACES and Open EXR. There are so many different configurations worldwide that now our thinking is that it's



better to describe the single components. Do not tell them they have to do it this way or that.

### Where do you do the software?

Marc: It's all German software. A lot is done right here in Munich. A lot of our camera is software, but the thing that really surprised me is how much we have to do in testing. With our film cameras we had a testing department with maybe three or four people. We now have a huge testing procedure that goes in steps. When a piece of software is written it goes first to the research and development internal testing department. They do the first testing. If anything is wrong, it goes back to the programmers. Then back to the R&D internal testing department, until they find it OK. Then it goes to the second stage testing, with some people in Henning's group who are more practical and try to break it. They're very good at it.

Henning: Yes, we are good. R&D hates us.

Marc: When they find bugs, it goes back to the programmers. When Henning's people think it's okay then it goes to the quality control department who do their own round of testing and look at everything. In reality, some of this happens in parallel, but all software goes through the whole process.

A camera cannot have a software crash on set or on location. That's why you don't want to cut any corners and all these testers are there to make sure. It's tedious. You change one thing, you have to retest everything over and over again.

### In Europe, what are people using mostly for editing?

Henning: It depends on the market. Commercials and broadcast are very much Avid driven. Adobe is getting stronger, mainly in the broadcast industry. Documentaries and low budget productions are using Adobe Premiere and Final Cut Pro.

Marc: I think editing in Hollywood and on high end features happens in Avid, but that's mostly as proxies. The idea of mastering onto a compressed format really started with ProRes. It is slowly starting to take a foothold with DNxHD.

### Are they mastering in DNxHD?

Marc: There are some productions mastering in DNxHD, but it's a slow start. We were actually surprised. We thought there would be many more people doing this. Now in SUP 9.0 we have DNxHD 444, which is the highest quality DNx, we think there will be more people mastering that way.

### You think they'll be mastering on the Avid or are they still going to finish traditionally?

Henning: I think most are finishing traditionally. But we would like to see DNx productions shooting in Log C. DNxHD 444 is a big improvement and quite equal to ProRes 4x4. It also has the possibility of providing very good keying capabilities. It's 10-bit and the data rate is high.

### What are most of the high-end jobs, commercials and features, finishing on right now?

Marc: Most high-end commercials and feature films are going ARRIRAW and the rest are ProRes 4x4 (ProRes 4444) Log C.

### How are they finishing the ARRIRAW jobs?

Henning: DaVinci Resolve is getting stronger and stronger. Many conform and color grade in Resolve. It's actually ARRIRAW cer-

tified now since Version 9.1 and Version 10 and has a very good image quality. We like it very much and think it has the same debayer quality as the ARRIRAW converter.

Many people are using Resolve for ARRIRAW finishing, but this depends on what the post production company has installed. The ARRIRAW SDK is also used on Autodesk Smoke, Flame, Lustre, Scratch, Clipster, Nucoda, and Pablo to easily process ARRIRAW in the best quality. Also, many use the Codex debayer or finish in Baselight. Those tools are also ARRIRAW certified.

Marc: SDK (Software Developers Kit) means they have our debayering engine and put it in their product. Resolve has written their own debayering engine which we consider on par with ours.

### What are you using at ARRI Film & TV Services?

Henning: At ARRI Film & TV it's historically like a mixed drugstore. A while ago, I bought Digital Vision Nucoda systems because I felt that traditional color timers coming from the film lab would feel comfortable with their system. It was the easiest to understand. Lustre was, at that time, very expensive. However, we had the first Lustre in Germany and still have two, but they were more complicated and harder to understand. Commercial people like Baselight very much, so we got those as well. So it's a mixed bag. Then our workflow crew and I brought in Resolve and built up a good relationship with Blackmagic Design.

### What are you using for online mostly?

Henning: When we do camera tests and that kind of stuff, we're doing that all on Resolve.

### You're doing the assembly and the color grading on Resolve?

Henning: Yes. You know, it's kind of an automatic process. The assembly takes about the same amount of time for me to get a quick coffee and then it's done. It is always nice to leave the dark room.

### Are more people just buying new ALEXA XT cameras, rather than upgrading to the XR?

Marc: More than we thought. At first, more people upgraded. But now we see it's the other way around. More people are buying the new ALEXA XT cameras. The really interesting thing is they are not selling their old cameras, as we thought they would. A lot of rental houses buy the XT cameras on top of the existing Classic cameras. They want to use the ALEXA Classic camera for lower budget shows. And the XT cameras are for those productions that demand the latest equipment. I also think what's happened is that unfortunately shooting film has dropped off. So all those people in the 30% of the market that still had been shooting film now also need digital cameras. I think there is a demand for more digital cameras to come to the market to replace the film cameras. The XT cameras have been a huge success.

### And a lot of productions are shooting with more than just one camera. They are shooting with multiple cameras for every scene. So you'll see features with 3 to 9 cameras on many set ups.

Henning: Pity the editors.

### But good for you, selling a lot of cameras.

Marc: I am in the process of updating the website. We now have 11 cameras with 3 licenses and 5 different modes, sensor sizes, high speed, low speed. We need really good overview charts. We're do-

# Rädlein and Shipman-Mueller

ing those right now and they will be online by January 2014.

We also have posted 50 short videos explaining the ARRIRAW converter. We discussed writing a manual, but we decided to do these videos instead.

We can guide people directly to a link to a short video that answers their question. For example, “How do I extract metadata from an ARRIRAW file?” I send them a link, and they spend 2½ minutes watching and then they know.

## What do you have in store for us for Software 10?

Marc: Well, we're still looking at that. There is still some haggling going on. I have a huge list of over 500 feature requests. They keep coming in and that is good. Many customers send me ideas, or somebody from the Testing Department comes to me and says, “Marc, we could put this menu item here and do this and it'll all be a little easier.”

## April 2014: ARRI ALEXA SUP 10.0

ALEXA Software Update SUP 9.0 in 2013 added CFast 2.0 card support, ProRes 4444 at 120 fps, DNxHD 444 and ProRes pre-recording. ARRI released SUP 9.1 in March of 2014 for DNxHD at 96 fps (XR Capture Drives) and 90 fps (CFast 2.0 cards).

And now, here is a preview of SUP 10.0

### 180° Image Rotation

The image can be rotated 180° in the EVE, on REC OUT, on MON OUT, and sets a metadata flag. The recorded image is not rotated, but that can easily be done in post or automatically with the metadata flag when using ARRIRAW Converter or Codex software.

Image rotation helps Steadicam operators, who can quickly flip the Steadicam upside down without having to mount the camera in low mode. It is also good with the ARRI UWZ 9.5-18 lens, whose image is normally seen flipped 180° (upside down).

### Clean Log C Output

In 16:9 format at regular speeds, ALEXAs provide two independent video outputs. One is usually a Rec. 709 signal with superimposed framelines and camera status for the on-board monitor. The other output is a clean Log C signal that usually goes to the DIT for on-set coloring and tweaking. With recent high speed, ProRes 2K, 4:3 and Open Gate updates, this independent second HD-SDI output has been sacrificed to free up processing power in the camera and the REC OUT becomes a MON OUT clone. ARRI is working on an independent clean Log C output for REC OUT in SUP 10.

### Quick Change between Regular and High Speed

Switching from regular speed (0.75 to 60 fps) to high speed (60 to 120 fps) takes about 40 seconds. This can be painful when the sun is setting or the producers are breathing down your neck.

### Open Gate for ALEXA M

Open Gate mode (3414 x 2198 photosites) has been available since SUP 9.0 for ALEXA XT, ALEXA XT Plus and ALEXA XT Studio. With SUP 10, the ALEXA XT M will work in Open Gate.

So I collect all these suggestions and I think it's great that people make all these suggestions. Whenever we have a new software update we clearly have a limited budget and I'll try to see what's the most important thing to put into the new software upgrade. Then we assess how much it will cost, what the risk is, who has to work on it, and how long it'll take, and then we make choices. Right now we are in the process of that and we'll probably have a finished plan for SUP 10 in January or February.

We've gotten feedback from a number of people saying it's good to see that ARRI continues to provide significant features. We love our cameras and want to make them as good as they can be. And from a slightly less romantic angle I think that makes the business model represented by ALEXA something that really works: long product cycles.



## ARRIRAW Converter ARC 3.0

ARRIRAW is ALEXA's uncompressed file format that is popular on feature films and commercials. The ARRIRAW Converter (ARC) is a stand-alone software program for Mac OS X for viewing, coloring and rendering ARRIRAW files into various output formats. It can be downloaded free of charge from the ARRI website. New features of the ARC 3.0 released in March 2014 include:

- Support for ALEXA XT Open Gate sensor mode
- Support for ALEXA Black and White camera (available from ARRI Rental Group and ARRI Rental Partners)
- Uprez to DCI 4K or UHD-1
- Support for user pixel masks

## ARRI Meta Extract

ARRI Meta Extract is another Mac OS X free software download from the ARRI website. With it, you can export camera metadata from a QuickTime/ProRes clip, DNxHD clip or ARRIRAW file. ALEXA and Amira cameras store metadata such as clip name, reel number, fps, shutter angle, timecode, user information, LDS lens data, and other information that's useful in for VFX, script notes, and camera reports. The ARRI Meta Extract tool has been updated to work with the latest ALEXA Software Update Packets and with Amira.





Stephan Schenk, Managing Director ARRI Cine Technik, responsible for the Business Unit Camera Systems ((Sales, Product Management, Workflow and Service)

**JON FAUER:** IBC 2014 is the 5th anniversary of ALEXA's 2009 prototype debut in Amsterdam. It was like the premiere of a film or opening night on Broadway. The ARRI booth had a working ALEXA sensor in a display case shaped like a telephone booth and three prototype models in a packed conference room at RAI. ALEXAs began delivery in June 2010. It's been quite a success story.

**STEPHAN SCHENK:** We really appreciate the great feedback we got from all around the world and are very happy that ALEXA has become almost the de facto standard in high-end TV drama, commercials and feature films. If you look at the US box office at the end of July 2014, you will find 9 of the current top 15 features had ALEXA as their A-camera: 3 of the others were animated, 2 were shot on film, and 1 was with another digital camera.

Of course, there is no direct link between the camera's performance and the box office. But if you look at the cinematographers of these features who chose to work with ALEXA it does say something. Nevertheless, we are not resting on our laurels. We are in a constant dialog with professionals world-wide and get a lot of advice on where to improve and how to take changing production methods into account. ALEXA's flexible architecture makes it possible to continually improve the camera with updates. That way we can provide major new features to keep ALEXA up to date and our customers and users happy.

**You talked about the success in feature films, but when ALEXA was introduced, it seemed that the intention was TV and commercials, and not necessarily features. What changed?**

We announced 3 models, and the first one certainly was aimed at

TV drama and commercials. ALEXA is the camera of choice for TV drama, especially in the US and Europe. But I think the whole industry's very willing to experiment. Our customers decide what camera and what lens they need for their particular project, and when they think the equipment suits their needs, they use it no matter how a manufacturer intended it. From the start, they used ALEXA for features as well. But certainly, the later models of the ALEXA range are aimed at feature film productions.

**Whom do you consider to be responsible for the breakthrough in feature films?**

There was not a single person or show, but a number of milestones. Roland Emmerich's *Anonymous* was the first major feature. Anna Foerster was the cinematographer, and Marc Weigert the VFX Supervisor, and they started the journey.

The real breakthrough came when Roger Deakins expressed his opinion after using ALEXA on *In Time*, saying how much he enjoyed using it. Since then he has captured all his features on ALEXA, including *Skyfall*, which I, and many others, think is the best Bond ever. I definitely should also mention Bob Richardson and Rob Legato who paved the way when they won the Oscar for Best Cinematography and Best Visual Effects on *Hugo*.

The next year it was *Life Of Pi* with the Oscar for Best Cinematography going to Claudio Miranda and Best Visual Effects to Bill Westenhofer. This year, an Oscar went to Emmanuel Lubezki for *Gravity* along with an Oscar for VFX for Tim Webber and his team. Again, it's not the camera, but it's the cinematographer and the creatives who get the awards. We are certainly proud and thankful that they all used ALEXA.

# ALEXA 5th Anniversary

In terms of box office, the biggest ALEXA success was certainly *Avengers*, which is still the third-biggest box-office hit of all times. Here you also find 3 features captured with ALEXA amongst the top 10. *Iron Man 3* is number six. *Skyfall* is number nine. But I do not want to create the impression that we only look at Hollywood. Cinematographers all around the world are relying on ALEXA, and we value all their contributions and support to keep ALEXA running.

## As they say in Hollywood, this camera has legs.

STEPHAN SCHENK: Yes, we wanted to make sure that ALEXA has a long product cycle. This is good for our customers, who can safely invest and get a long return on their investment. This is also good for us, as it allows us to continuously refine the camera.

So we designed the camera in a way that we can easily upgrade hardware and software, and our product policy is geared towards continuity rather than constant product replacement. When more and more people started shooting Arriraw, for instance, we could have just made a new camera and left it at that. But in parallel to the introduction of the ALEXA XT cameras, which provide 120 fps uncompressed Arriraw in-camera, we also made a new affordable side cover available so customers can upgrade their existing ALEXAs.

We also constantly work on Software Update Packages, which you can install most of them free of charge. We just made Software Update Package 10 available with some really useful features like ProRes 4444 XQ. I can confirm that SUP 11 is already in the making—again with some substantial new features especially for the ALEXA XT range.

Rental houses and owner-operators appreciate the value of their ALEXA investment with over 4 years of usage. The camera keeps running and running and is used no matter whether the application is a Music video or a \$250 million VFX-heavy blockbuster, no matter whether the deliverable is HD, 2K, UHD, 4K or IMAX.

## Here comes the 4K topic. I think you also had some opinions on the economics of home televisions.

A lot of marketing is done these days to sell more TV sets following a substantial decline after all of us had equipped our living rooms with flat screens. In order to sell more TVs, 3D was pushed heavily, and now its 4K, or UHD as it rather should be called for the TV industry.

To make it very clear, ARRI never was and still is not against 4K or UHD, although some people might have that impression. We just want it for the right reasons. We feel that there is too much hype and marketing and too little education on what is real and doable.

Certainly, there are benefits to higher spatial resolution but this is only *one* aspect of getting a better image. Better dynamic range, better colors, higher frame rates, and a number of other factors also come into the equation. They all interact. For instance, higher resolution in motion needs higher frame rates. What is great for sports live coverage is not necessarily great for a feature film or a TV drama. At ARRI, we aim to improve and to deliver the best *overall* image quality.

## What about the future in lenses? Will there be other formats?

That's a very good question. 2013 has been another record year

for Ultra Primes, Master Primes and our Alura zooms. The question is how many more PL-mount cameras will be introduced, and how many more of those cameras are additional cameras? Will the current PL-mount cameras stay on the shelf or will they be used for other applications? And if a new kid comes on the block, what lenses will it use?

Most of the new cameras support PL mount, so all those cameras need PL-mount lenses. They have a common size. People want to have a standard wherever they go in the world. If they are in the middle of a shoot and need an additional 12mm or 180mm lens on their project, they want to be sure that they can rent it. This is what they get with UPs and MPs and increasingly with the Alura zooms as well. I think we will still see continued sales of PL-mount lenses.

It would be tough if somebody decided to create a new format for mainstream applications. But we are always open to new requirements. For example, we have developed the new Ultra Wide Zoom 9.5-18 for the requirements of sensors that need an extended image circle like the ALEXA Open Gate mode. The new UWZ is the first rectilinear zoom lens with little to no image distortion and uniform high performance from the image center up to the corners in a never-before-seen image quality.

## What do you think about the trend of cinematographers using vintage lenses? Is this here to stay?

I think it will depend on the application. There will be features where they are relevant and others where they are not. If you look at *Gravity* or *Life of Pi*, those films preferred the look and performance of the Master Primes. Many cinematographers value the ability to shoot wide open at T1.3 with available light only and very few aberrations. But if you shoot a romantic period movie, you might prefer vintage lenses to give it a special look in certain scenes. Different styles, different lenses and more choices are great for all the creative people of our industry.

## Speaking of style, what's your feeling about anamorphic? Is that going to be as big as I think it will be?

Yes, I definitely think it will because shooting anamorphic is one of the best ways to give your film that special cinematic look. If you look at the current films in the theatres, anamorphic is already big today. Actually, our Product Manager Marc Shipman-Mueller and you predicted that there would be an anamorphic era coming, since historically, there was always a rise in anamorphic after every wave of 3D. The question now is, since anamorphic always disappeared after a while, is it here to stay? Or is it another wave and it's going away?

## I'm not sure if it ever went away.

True, but from what I learned it was rather cyclical in the past and also different in each region. Actually, when I started at ARRI five years ago, I was discussing the different lens types and asked, "Who is shooting with anamorphic lenses?" I was told that anamorphic is especially big in India. On my next trip to India, I visited our customers there and spoke with Tarun at Anand Cine Service about it. I asked, "Tarun, I heard India is an anamorphic country." But he said that this was gone and that there were hardly any anamorphic shows. But now we see it's back more or less everywhere. I believe it's here to stay this time on a broader regional basis and we have defined an anamorphic set of lenses that



will contribute to that. When we started the question was, what defines anamorphic? The immediate answer often was, "It's the flares and the special look." But which flare? Which special look? We did intensive tests. Marc Shipman-Mueller, Product Manager for these lenses before Thorsten Meywald took over, went all around the world. And you, as well, right?

**Yes, that was in October 2007. Marc was doing research on anamorphics. Beginning January 2007, he had been compiling a catalog of anamorphic characteristics, viewing anamorphic films, and talking to DPs. Marc picked me up in Berlin. He put me in his car and drove me to Jena and then to Oberkochen for a three-day anamorphic captive-audience lens discussion road-trip. All we talked about was anamorphic.**

That was the beginning of the Master Anamorphic lenses. From discussions with you and many DPs, it was clear that people were talking about a certain look. But when we started talking about flares, you couldn't nail them down to a single flare or two or three or four. The only thing they all had in common was that they loved the oval out-of-focus highlights, and the shallow depth of field that separates background from foreground.

This was incorporated in the design, which was done by our partners from ZEISS. But lacking consensus on a definitive flare and knowing how powerful post tools are these days, we did not favor one particular flare. We believe that you have to start with a good and uniform optical performance over the entire lens range. VFX is getting more and more important. Breathing, distortion, mumps and other characteristics of classic anamorphic lenses sometimes are wanted but in many cases result in a lot of costly work in post. But, the signature look with depth of field and focus fall-off is something that you ideally have from the start.

What people who used the Master Anamorphics love is their beautiful, unique anamorphic look with almost no distortion, mumps or other optical aberrations. It is so much tougher to work around distortion and flares than to intentionally add them in post. With the Master Anamorphic lens series, we have a set of anamorphics that give cinematographers more freedom to compose the image: where to compose the main object in the 2.39:1 frame and whether to shoot wide open at T1.9 or stop down in a more classical way to T5.6. But again, it's all about choice. All the different anamorphic lenses will coexist.

### **Is it price-driven?**

Yes and no. Of course, anamorphic lenses require a bigger budget. But what is a big budget feature that can afford Master Anamorphics? If we're talking about a three, four, five million Euro budget, it's rather small for the U.S. For the rest of the world, that's a great budget, and they use these lenses. If you look at the difference in comparison to the total budget of a project, then the budget for the camera equipment is very, very small. The more important question is, "What look do I want to achieve, and in particular, how cinematic do I want my images to look?"

### **Which big rental houses have the MA lenses now?**

In North America, ARRI Rental, Camtec, Keslow, Radiant Images and Trudell were first. But they have been ordered right from the start. In Asia and Europe as well. They are shooting anamorphic even in countries you wouldn't expect, like Taiwan or the Philippines. They have ordered the Master Anamorphics because they

want to have the latest and best lens technology to position themselves in a future-proof competitive position. And more orders have been coming in after the extremely positive feedback from the first projects. Some bigger feature projects are scheduled, and commercials like the new Ford car campaign are already using them.

**Speaking of rental houses, is the rental market changing for you? Or the way you perceive rental houses around the world. Is the role of the rental house changing? Are more individuals buying the cameras or is it still rental houses that are supplying them?**

I think the biggest trend here is that rental houses are merging to be able to keep up with the investments needed for equipment and the converging needs of the different applications. In the film days there were a certain number of rental houses who supported the big feature film projects and who could afford the necessary equipment. It was a dedicated approach to this part of the industry. People knew each other for a long, long time. It was kind of a small family.

Now in the digital age, the same cameras that are used on a feature film are used for many other applications as well. Consequently there are many former video rental houses that were not into the feature film market before but are now more and more capable of supporting these needs, too. Also, more individuals are able to buy cameras. More cinematographers and assistants are buying cameras and subrenting or consigning them to rental houses when they are not using them between their jobs. Nevertheless, the role of the rental houses remains very important.

### **Can small rental houses compete? Or will they be gobbled up?**

Again the answer is yes and no. Is there a chance for BMW to survive against General Motors and Volkswagen? I believe yes. BMW is having one record year after another, and they are much smaller than GM and VW. I believe there is room for these particular high-quality brands that may be smaller as companies but deliver better products and services for their customer. It's all about positioning and knowing what your customer wants. But neither BMW nor ARRI nor a rental company can sell their products or services to everyone who wants a car, a camera or equipment for a project. Price-wise you can't, because you cannot make a BMW or an ARRI camera for the price point of all competitors. It's just not the same animal. The same applies to rental houses, you will get a certain level of service only with professional high-end rental houses. This is not a question of size alone.

### **What about your market in Asia? Is it growing most rapidly?**

Yes, it definitely is. We just moved into bigger offices in Hong Kong and Beijing as both were not suitable anymore for the growing number of employees and services. We have been doing a lot of business already for a long time in Japan, China and Singapore/Malaysia/Thailand.

The biggest growth currently is in China. I just returned from a trip to Hong Kong, Shanghai and Beijing. The speed and aggressiveness there is very high, and they are also looking for the latest equipment. They were among the first to order and use Master Anamorphics, they shoot Arriraw on ALEXA XT, work with the WCU-4, have ordered our new Studio Matte Box SMB-1, and were also among the first ordering and receiving AMIRAs. But other countries in Asia are also getting more and more important.



Walter Trauninger, Managing Director ARRI Cine Technik, responsible for the Business Unit Camera Systems (R&D, Production and Supply Chain)

**JON FAUER:** Walter, this may be the fourth time you've given me a tour of camera assembly. And every time the technology has taken giant leaps.

**WALTER TRAUNINGER:** We experienced a big technology change when we went into production of ALEXA cameras in June 2010. Before that time, we produced about 30 film cameras per month, and then we had to change to producing 200 ALEXAs per month. That meant re-engineering the manufacturing process from the ground up. Luckily, we have really good people who took on the challenge. Christian Hartl, our Head of Camera Assembly, and his whole team did a fantastic job. Now ALEXA assembly is running very smoothly and we are facing the next task, how to add AMIRA into the mix. The business environment for the whole company has also gotten more challenging as the market is becoming more dynamic. More competitors are appearing on the market with more low-cost products. Our goal is to optimize and reduce the time it takes to get from the first product idea to the first customer shipment. Our product cycles are still relatively long because our business model is to produce cameras that our customers will be able to use for more than four or five years.

The time to market is important for us. We are working to improve the process we did with ALEXA for future cameras. At the same time, we also have to take care not to lose sight of the values that are expected from ARRI products—reliability, robustness, ease of use. Those qualities are expected, but they also expect our products to become more affordable.

**Who are “they?”**

Producers, rental houses, owner/operators and sometimes people who compare data sheets more than the overall image quality.

**What about image quality?**

We have always said that it is the overall image quality that is important, not just one parameter. Image quality begins with the design of our sensors: starting from the D-20 to the ALEXA and now to the AMIRA. Each is another generation of a similar sensor principle. The sensor is our unique design and has led to some great looking images, and I think our customers appreciate this obsession with image quality that we have.

**How do you explain why the life cycle of ALEXA has been so great in this era of Moore's Law?**

I think there are two reasons. First of all, a professional motion picture camera is not a consumer product, but an investment. Different rules apply. For rental houses, the ultimate utilization they can get out of the equipment is more important than flashy features or a cool marketing campaign.

And second, we design our products so they can last and have long product cycles. For ALEXA, we are going to announce new features at IBC. Demand remains high.

At the beginning of the year we got more orders for ALEXAs than in the same period last year. The ALEXA XT is more in demand than the Classic.



**Are more people buying new XTs or are they upgrading their existing cameras?**

Both, but we are actually selling more new ALEXA XT cameras than upgrades. Some are upgrading their Classic ALEXAs, some are selling them, but a surprising number of rental houses are keeping their Classics and buying new ALEXA XTs as well. Another good indicator of a product's value is the price for a used cameras, which has stayed stable and high for ALEXA cameras.

**How many ALEXAs are out there, approximately?**

Well over four thousand.

**What's your expectation for AMIRA? Is it going to be as much?**

At least as much, I think.

**That's quite a success story. Can we go back to the beginning of the Walter Trauninger story? You worked on the Arriflex 765?**

The Walter story—okay. It goes back to '86 when I was asked to join a small, new company, ARRI Austria in Vienna. It was 100% owned by ARRI. Seven of us started there. Some came from the Eumig camera company. I was one of the mechanical design engineers. My task was to calculate and design the movement of a new 65 mm film camera, the Arriflex 765.

The 765 ended up being manufactured in very low numbers for our rentals. It's still used for specialty projects or when a high speed 65 mm shot is needed, as it goes up to 100 fps. Ultimately, the 765 won a Technical Oscar.

**Do you think the small numbers of 765 cameras was because Kodak improved their film stocks?**

Kodak improved film emulsions and invented T-grain. It's ironic that this pushed 35 mm cameras, started a renaissance of 16 mm cameras, but this did not help 65 mm cameras. Of course, 35mm was always the cinema-style format. We finished that project after four years—1986 to 1990.

Parallel to that, ARRI Austria started to develop accessories. I was the project manager of the first ARRI lens control system. Then we developed the Arrihead, which was introduced in 1988 in Brighton. That was my first trade show with ARRI, presenting the Arrihead.

**Wasn't the Arriflex 765 the first camera where the movement was separated from the spinning mirror shutter?**

Yes, and it was synchronized electronically. But our main task was to get a very short transport angle. The combination of a big mirror of 200 mm, with the new movement, 100 fps, and the mass of 65mm film was a challenge. We needed new methods like finite element calculation, which was introduced at that time.

In a finite element calculation, you break the complex geometry of a film camera movement into small, finite parts. This allows you to reduce the complexity and calculate the results of any change in design pretty accurately. That was a new concept that we implemented at ARRI.

We also introduced CAD at ARRI Austria in 1986. That was very early computing. We had to work in shifts, because the computer systems were so expensive.

At the beginning we had three shifts, then two shifts. Three or four years later, everybody had their own personal computer. But



Above: 11 years earlier at ARRI, different camera, shorter haircut. Walter Trauninger with Arricam LT.

it was revolutionary at that time.

After the 765, we designed accessories and then the Arriflex 435. I was the Project Manager and also calculated the movement for the 435, which is very similar to the 765. The 435 was designed and tested for 180 fps, but we released it as a 150 fps camera. That gave us some headroom and ensured that it would work in all environments, cold, hot, humid, you name it.

**Wasn't there a model that was supposed to go faster?**

Yes, and that is a tragic story. In 2007 we were working on a new 435 that could go 250 fps. We even had a functioning prototype—you should have heard it at 250 fps, it sounded great. But then towards the end of 2008 the market for film cameras disappeared. With a heavy heart, we stopped this development and started on the ALEXA instead. But we were able to save some of the work from the 435 HS: the ALEXA user interface was originally developed by Marc Shipman-Mueller for the 435 HS, and the ALEXA Studio viewfinder was based on the newly developed 435 HS viewfinder. So, in a very real sense, the ALEXA does have film camera DNA.

**The Arriflex 435 camera was a great success.**

In 1993 I took over as Head of Development here in Munich and Vienna, and together with both teams we developed the 435. The 435 was the first project I did as the Head Of Development, and it did pretty well in the market.

**When was the 435 first delivered?**

We delivered the first cameras at the end of 1995. In 1997 we started co-development with Moviecam and Fritz Gabriel Bauer, and we created the Arricam.

**Your job was Project Manager?**

Yes. And also co-designer. The concept came from Gabriel. It was



Stephan Schenk and Walter Trauninger on the top floor of ARRI, overlooking Munich

a combination, to take the best of both worlds. Moviecam and ARRI. I would say it had the electronics, drive system and robustness of ARRI, with the general layout, mechanical concept and user interface of the Moviecams.

After the Arricam we designed the Arriflex 235 and the 416. I was Head Of Development.

The Project Manager was Klemens Kehrer.

The Product Manager was Marc Shipman-Mueller. Marc had been working for ARRI in the US for a while, but getting more and more involved with our camera development. From the US, he had helped on the 435 and designed the user interface of the Arricam. In 2001 he moved back to Germany and became the Product Manager for all cameras, lenses and accessories.

In 2003 I took over as the Head of the Camera Business Unit, and I was in charge of manufacturing and camera, service and quality control. In the meantime I have been with ARRI more than 28 years. So, for more than half of my life I have been working here.

**The ALEXA Studios have optical finders. Is this the future or have we turned the corner for electronic viewfinders?**

The electronic displays are getting better. And you want to see what the sensor sees. An optical viewfinder doesn't always show you what the sensor really sees.

**Are legendary DPs, who said they will always want an optical finder, starting to change their minds?**

Some are and some are not. We have a product for each. Those that want the optical viewfinder have their ALEXA Studio cameras and they will still use their Studios with optical viewfinders. It's what they grew up with, what they're used to, and they're making good films.

**From your position in development, where do you see the future for our end of the business going for cinematography in terms of cameras, lenses, sensors, acquisition—all that?**

We just want to maintain and expand the position we have in the market: the knowledge of application, of our customers and of our customers' business models. We are not planning a change of direction. We have a very good position in the high-end market. We'd like to improve products for workflow and as you might say, to become more of a one-stop shop.

There are a lot of discussions about data formats, output formats, and which recording devices to use. Our team here is in close contact with our customers. I think that is one of the advantages of ARRI. We are still listening to our customers. It's difficult to say which products will be coming next. It depends on technology and it's not only about hardware anymore.



**The consumer electronics world is changing rapidly. Is the high-end a little more secure?**

We can never say if something is secure, but certainly a four year product cycle for ALEXA that is still going strong indicates a certain stability.

**Film cameras would often work for more than 10 years. Sometimes they lasted the entire lifetime of the DP. What is the life cycle of an ALEXA digital camera?**

The ALEXA will probably exceed five years. What's important to us is that our products have a long product cycle.

**Why is that?**

Because it is our job to ensure that our customers can make a living with our products. And you can only do that if you have a reliable product that lasts for a long time. With the ALEXA we achieved that through an open technology and hardware platform that can be easily upgraded with new hardware and software. Since we delivered the first ALEXA, we have consistently improved the camera's functionality, sometimes with major new features like ProRes 2K or ProRes 4444 XQ.

**You said that a core value of ARRI is understanding.**

It's the close contact with our customers and knowledge about the demands of what they do. We have two kinds of customers. First we have the working professional, the cinematographer, director, operator, assistant and DIT. They want to make the best image possible with the least amount of fuss. The other is the company who buys the cameras and rents them. We are taking care of both groups. The rental house needs a very reliable, robust camera, which can be used for nearly every application. The camera operator or DP wants a product they can rely on in the desert, in the snow, the cold or wherever. We know about all these different applications and how to handle them.

I also want to add another point about ARRI—our employees are very loyal to us, and we are very loyal to them. During the financial crisis in 2009, we did not lay off anyone in production. That helped our employees, but it also helped us, since we were able to maintain all that know-how of our employees.

**That was 2009. How far into ALEXA were you?**

Development was at full-speed. We had to reduce labor hours at the beginning of 2009 and by springtime some of the departments that used to make film cameras were still on short labor hours. And soon after, we immediately ramped it up into overtime.

**IBC 2009 was toward the end of the financial crisis. That was pretty scary.**

Yes, having such a major technology change in the middle of a global financial crisis was scary. But once we started to deliver ALEXAs, things looked up for us. We started delivering the first 40 cameras in June 2010, and then we really ramped things up.

**In the very beginning it seemed almost as if ALEXA was a tentative step, like walking in a digital outer-space. The first step was in TV and commercials, but not for high-end features, because it seemed that ARRI didn't want to hurt their hold on analog film cameras for high-end features. And then, all of**

**the sudden, it was as if someone had turned a switch and the next thing you knew, ALEXAs were on all the high-end movies. What changed?**

I think the cinematographers were the first to recognize that we provided a tool very similar to film, in its use and in its image quality. They could use it like a film camera. I think that was the first comment of Anna Foerster when she shot "Anonymous." It felt like a film camera. I think it took a while until the studios recognized it.

Also the switch from two-third inch to a 35mm image sensor was a big advantage for us. Starting with the ALEXA Studio, our sensor aspect ratio of 4:3 for anamorphic gave us a boost. You know, the ALEXA is still the only camera with a tall sensor, which works best for anamorphic lenses.

**What was the reason for the switch from two-thirds inch to 35mm for TV?**

I think it's the look. They wanted to get better images with less depth of field for television shows.

**How many product managers are there now?**

We have five product managers now. Since 2001, when Marc Shipman-Mueller was the only Product Manager, we have added a greater number of more complex products, and this would have been too much for a single person. So with a growing portfolio, we have grown our Product Management department.

Marc Shipman-Mueller remains the Product Manager for high-end cameras like ALEXA. Markus Dürr is Product Manager for AMIRA, Thorsten Meywald for lenses, Hendrik Voss for wireless or electronic control systems, and Philip Vischer for Professional Camera Accessories (PCA) Mechanical. In addition, we have started a whole new department called Digital Workflow Solutions, headed by Henning Rädlein. They are essentially in-house workflow consultants that have been of tremendous value to us and to our customers.

**In closing?**

I think I would like to underline that ARRI kept their employees from the film-camera era, and it paid off because we did not lose this experience and knowledge. When you visit, you will find that many of the same people who were building the analog cameras are now building the digital ones.

Ergonomics and user interfaces are important. The camera has to tell you if something is wrong, especially if you can't see it. Our film cameras were good at alerting you to potential problems because with motion picture film, you sometimes didn't see the dailies until days later. Now you see it on the monitor, but you don't see everything. There's still great value in the camera that tells you if something is wrong, so you don't have a repetition of the same problem when you go to your next location.

In both the film and digital ages, nobody likes a re-shoot.

## ARRI ALEXA Software Update 10

ALEXA cameras get support for Apple ProRes 4444 XQ, the highest-quality version of ProRes to date, in the new Software Update Packet SUP 10, which should be available by IBC.

Marc Shipman-Mueller, ARRI's Product Manager for Camera Systems, explained, "ProRes 4444 XQ has a higher target data rate (500 Mb/s) than ProRes 4444 (330 Mb/s)."

Henning Rädlein, ARRI's Head of Digital Workflow, said, "ProRes 4444 XQ is a good choice for high-end mastering and archiving. It offers 12-bit RGB encoding with a low compression ratio of 1:4.5 and maintains the tonal range of Log C, while providing the speed, ease of use and familiarity of ProRes."

Final Cut Pro version 10.1.2, DaVinci Resolve 11 and Colorfront Exd 2014 and OSD 2014 support ProRes 4444 XQ now. ARRI ALEXA XT cameras and ALEXA Classic cameras with the XR Module will gain ProRes 4444 XQ capability with ARRI's Software Update Packet SUP 10. ALEXA XR/XT cameras will support ProRes 4444 XQ in both HD and 2K resolutions.

### ProRes Review

**ProRes 4444 XQ** is the highest-quality version of ProRes with a very high data rate. ProRes 4444 XQ preserves dynamic range several times greater than Rec 709. Like standard ProRes 4444, this version supports up to 12 bits per image channel.

**ProRes 4444** is a high-quality version of ProRes. It features full-resolution, mastering-quality 4:4:4 RGB color with a lower data rate than uncompressed 4:4:4 HD.

**ProRes 422 HQ** is a higher data rate version of ProRes 422 that preserves visual quality at the same high level as ProRes 4444, but with 4:2:2 color subsampling. Supports full-width, 4:2:2 video 10-bit, and is visually lossless through many generations. **ProRes 422** is A high-quality codec offering nearly all the benefits of ProRes 422 HQ, but at 66% lower data rate for better multistream, real-time editing performance.

### ProRes Recording in ALEXA XT cameras with SUP 10 (and Classic cameras with XR module)

Sensor Mode	Recording Format	Format Setting	Output Resolution	Color Coding	Data Rate @ 29.976 fps in Mbit/s
16:9	ProRes HD	422	1920 x 1080	10 bit YCbCr	147
		422 HQ	1920 x 1080	10 bit YCbCr	220
		4444	1920 x 1080	12 bit RGB	330
		4444 XQ	1920 x 1080	12 bit RGB	495
	ProRes 2K	422	2048 x 1152	10 bit YCbCr	168
		422 HQ	2048 x 1152	10 bit YCbCr	251
		4444	2048 x 1152	12 bit RGB	377
		4444 XQ	2048 x 1152	12 bit RGB	566
4:3	ProRes 2K	422	2048 x 1536	10 bit YCbCr	223
		422 HQ	2048 x 1536	10 bit YCbCr	335
		4444	2048 x 1536	12 bit RGB	503
		4444 XQ	2048 x 1536	12 bit RGB	754

## Additional SUP 10 Features

### Support for Sony SxS Pro+ Memory Cards

ALEXAs can record ProRes or DNxHD to 64 GB and 128 GB SxS PRO+ memory cards in ALEXA Classic, XT and XR cameras.

### 180° Image Rotation

180° image rotation is especially helpful for Steadicam operators when they flip their rig upside down for shooting in low mode.

180° image rotation is also good when using the new ARRI Ultra Wide Zoom UWZ 9.5 - 18 (which has an inverted image).

When enabled, the image is rotated 180° in the EVF, REC OUT and MON OUT. A metadata flag is set in Arriraw and ProRes files. The recorded image is not rotated, but can easily be rotated in almost all post software. Arriraw Converter or Codex software can automatically rotate the image based on the metadata flag.

### Short List of SUP 10.0 Features

- Apple ProRes 4444 XQ
- Support for SONY SxS PRO+ cards
- 180° Image Rotation
- Open Gate for ALEXA XT M
- REC OUT = Clean MON OUT
- Arriraw 4:3 Cropped (96 fps)
- Fast regular/high speed switching
- User interface improvements

## ARRI ALEXA 3.2K ProRes for UHD

ARRI ALEXA cameras will soon be able to record 3.2K ProRes for seamless up-rez to UHD/4K in post. ProRes 3.2K for ALEXA cameras will be available in a software update (presumably SUP 11) scheduled early next year. ProRes 3.2K allows a similar up-sampling in post to UHD as Arriraw Open Gate does to 4K.

For TV productions working in UHD, ALEXA XT cameras and Classic cameras with an XR Module will be able to record ProRes 3.2K. The data rates will be well below uncompressed Arriraw (ProRes 4444 3.2K is expected to be around 700 Mbit/s, which is 1/3 of Arriraw Open Gate's 2.17 Gbit/s).

The ARRI Amira upgrade announced last week offers ProRes UHD recording in-camera and in real time to CFast 2.0 cards up to 60 fps. This in-camera up-rez is possible because Amira has a powerful processor. Amira's UHD uses the same 1.2x up-sample filter that ALEXA's Open Gate mode employs to up-rez in post for 4K distribution.

ALEXA ProRes 3.2K is a 16:9 format. Image diagonal is 29.74 — so almost all 35mm cine lenses will cover. Where do the extra pixels come from? The ALEXA HD image area is 2880 x 1620. The additional width comes from the 5% extra surround view area of the sensor, which is also used in Open Gate.

### Numbers, Facts and Figures

- ALEXA ProRes 3.2K is 3168 x 1720
- Amira UHD is 3200 x 1800
- UHD is 3820 x 2160
- Arriraw Open Gate is 3.4K
- ProRes 3.2K for ALEXA XR and XT cameras will be available in ProRes 422, 422 HQ, 4444 and 4444 XQ





Imagine this pitch to a studio executive:

*“Hamlet meets The Greatest Story Ever Told. Around the World in Eighty Days, South Pacific, Ben-Hur, Exodus, West Side Story, Lawrence of Arabia, Mutiny on the Bounty, It’s a Mad, Mad, Mad, Mad World, Cleopatra, My Fair Lady, The Sound of Music, The Agony and the Ecstasy, Lord Jim, Grand Prix, 2001: A Space Odyssey, Ryan’s Daughter, Patton...”*

A litany of the greatest 65/70mm films of all time should be rewarded with an immediate green light. There is, however, one minor setback, a single word, “film.”

These greatest of all films, in their epic 65mm format, demanded epic logistical effort, 70+ pound temperamental cameras whose movements sometimes required oiling after every take, and setups that were not, shall we say, swift. Film, processing and dailies could average around \$2500 for a 10-minute roll.

Nevertheless, large format 65mm cinematography has continued to inspire as the aspirational format, the object of desire, for almost every cinematographer, director and producer. There is magic in it, perhaps in the same way that Richard Avedon once described large format still photography. “It requires you to think, to compose, to slow down and create more carefully,” he said.

Now there’s a new, large format 65mm digital motion picture camera from ARRI, the new ALEXA 65. The aspirational part of that sentence is 65; the enabling part is *digital*.

Imagine an ALEXA (35mm) camera with a sensor that is 3 times larger. It has a familiar ALEXA body style, about the same size and weight, a little bit wider, with a digital 65mm format sensor. And new 65mm lenses.

There will be three groups clamoring to be first in line to try these new rental-only cameras. Creative minds will conjure epic scenes and awesome effects to benefit from the ALEXA 65’s high resolution and large format, shallow depth of field. The images I saw recently were so stunning you felt as if you could reach out and touch them in ways more appealing than any current 3D projection.

Technical types will revel in the ALEXA 65 camera’s 6K resolution and seamless familiarity with existing ALEXA 35mm systems.

Producers, distributors and exhibitors will rejoice in the reboot of a format that historically has enticed audiences out of their living rooms and back into the theaters.

As Lawrence said in the greatest large format film of all time, “I think this is going to be fun.”

Sep 2014 Cover, Issue 65

Cover of September 2014 FDTimes Special Report, published at Cinec in Munich, conveniently numbered as Issue 65.



**ALEXA 65**





*If Financial Times can have a column "Lunch with the FT," then Film and Digital Times would stake its claim on "Dinner with the FDT." A few weeks ago, Franz Kraus, Managing Director of ARRI, Martin Cayzer, Neil Fanthom and Michael Cielinski invited me to dinner at the Theresa Grill Restaurant in Munich. This interview began over steaks and chops and continued by phone and email in the weeks that followed.*

**JON FAUER: Let's begin with the concept for the ALEXA 65 camera. When did the idea originate and why?**

FRANZ KRAUS: Following the success of the ALEXA we wanted to build a camera for the most demanding applications in filmmaking and envisioned a true 65mm format camera, sharing as much as possible the technology and imaging attributes of ALEXA. This consideration began shortly after the introduction of the ALEXA but materialized not more than one and a half years ago.

We wanted to maintain the dynamic range, colorimetry and all the successful features of the ALEXA. But we also wanted to add as much resolution as possible and to revisit a format we already had brought to market 25 years ago with the Arriflex 765. And we wanted to have a true 65mm sensor.

**I think Vittorio Storaro was one of the first to use the original Arriflex 765 camera on "Little Buddha." Let's go back 25 years. It was very exclusive format. How has 65mm changed in the digital era?**

It was sad that shortly after the 765 was introduced, 70mm film projection disappeared from the cinema. 35mm film prints with DTS and DOLBY digital 5.1 sound systems were able to replace the high-quality 70mm print with their magnetic soundtracks. It was a time where the industry focused very much on cost savings like with high-speed film printers, with results not always to the

advantage of the cinema audience. And without 70mm distribution there was limited demand for 65mm film capture.

A digital 65mm capture system is far less complex and expensive than the 65mm film version. It is more or less just the expense for the dedicated 65mm camera and its lenses. No expensive film stock, processing, reduction printing or scanning; only sufficient storage capacity and data handling.

**Why is there so much interest in the format, then?**

There is probably little demand today, but I think everybody who had shot in the larger format, be it IMAX, 65mm or VistaVision, indulged in the beauty of the large real estate of the format. When you have more of the same good pixels it makes a difference, just as it does when you have a larger area with the same fine grain structure of film.

Size matters in digital times too.

You'll probably remember when we did the experimental film with Bill Bennett, ASC "As Good As It Gets" 10 years back. It was meant to be a reference film to measure and compare where digital capture stands and how it evolves. The footage was used on many early 4K displays all over the world, as digital capture at that time was far inferior and there was no other quality source than large format film. The target for the ALEXA 65 was to meet and surpass 65mm film.

**I know you have a great interest in color science and how an image looks with your background in image technology. What parameters did you establish?**

Probably the most important factor for ALEXA's success are the wide latitude photosites. We tried to come as close to motion picture film negative, or even exceed it, because we knew about the value of having this wide exposure latitude. It makes shooting easier and it provides better images in the end. Another important factor is color reproduction; both parameters are of equal importance and go hand in hand. Some of the dynamic range needs to be traded for good color reproduction. If you don't do that, you might lose color consistency in the low- and highlight areas.

**Because we DPs are always obsessing about look, how would you define the look of this new large-format camera? Is it the fact that it's a different depth of field, that it has greater dynamic range, higher resolution or better color rendition?**

It has all the good attributes of the 35mm ALEXA and matches its images perfectly. In addition, it captures lots of fine detail. Aside from the resolution all other imaging attributes are identical to those of the ALEXA camera family.

In terms of resolution our focus was on minimum alias to achieve the most authentic reproduction of complex real world scenery. As film - due its random grain structure - lacks of alias by design, 65mm film images were the reference for the design of the optical low pass filter.

If you have enough photosites you can design an optical low-pass filter where you give away some of the resolution and thereby avoid any aliasing. You could have higher resolution of detail, but that would produce some aliasing.

This is a trade-off each manufacturer needs to address. And if you look at available cameras, you'll see differences in all of them.

## **What about new digital still cameras without low pass filters?**

For still images you can get by without an optical low pass filter if you have enough pixels. Capturing stills is far more forgiving than moving images. In a slow camera pan without OLPF over fine detail the sensor could not resolve any structures and would instead generate coarse low frequency patterns that are very obvious and disturbing to the eye. With a static camera, the pattern would be static and difficult to see.

## **How did you come up with the name for the new camera?**

ALEXA 65, that is a simple one, because by its nature and build it is a true ALEXA and 65 because it is a digital replica of a 65mm film camera, where 70mm was the distribution format.

## **How will this 65mm digital format be distributed?**

It's the same file as an ARRI ALEXA (35mm) file. It just has more data. It's very compatible with the ARRIRAW workflow. It will be a RAW-only camera, because we are opting for the highest possible quality, not only highest resolution, but best color rendition and best dynamic range, without any compression artifacts.

The camera will generate a serious amount of data. Handling that will not be easy, will not be inexpensive and that might limit the number of projects that will be able to afford it.

## **Please explain the workflow.**

The ALEXA 65 is a camera system, comprising of a camera body, a dedicated 65mm lens package and a dedicated Codex Vault image processing & storage unit. The Vault will handle RAW data from regular ALEXAs as well as from the ALEXA 65. Offering a complete capture system as a rental package ensures best overall performance and quality of service. We want to provide a complete system rather than offering bare bones camera and then forcing everyone to add various building blocks.

## **This is a turnkey system?**

It needs to be. And for the first productions, there will be an expert on set to make sure that everything works to its best performance level with the minimum amount of technology based distraction.

## **Will there be an opportunity in the future to add additional lenses, perhaps with different mounts?**

I think that all depends on how well this camera system is received by the industry.

## **Will this larger digital format influence the way digital pictures are projected? Perhaps the DCI specifications may change?**

The original DCI Specification, if I remember correctly, were issued in 2005. Although it seems like yesterday, in IT terms this is ages ago. At that time PCs, storage media and data rates were quite different to what they are today. Projection technology has also evolved significantly since then. Also the digital cinema was specified when film was still the predominant reality and its legacy limitations had to be respected.

Concerning resolution, today's specified data rates for 4K are the same as for 2K. That means that fine detail - for which 4K would be required in the first place - is lost in the JPEG 2000 codec due to the limited data rate.

Looking into the future, without the restrictions of film, I think higher screen illumination, larger contrast and higher projection frame rates - as an option but not a general setting - should be revisited. Of course, to accommodate a higher resolution, higher frame rates and higher dynamic range the permissible data rates need to increase.

## **You said before that this camera would cost more for a production. Is most of this cost in post production and is it a significant amount more?**

Most of the DI facilities say they are prepared for 4K. But if there is a lot of CGI and VFX shots, different versions, and everything done in 4K, and if you bring them tons of terabytes, then I think they will ask for some more money to deal with this volume of data.

## **Is the special effects world changing? Up to now they were mostly saying they wanted to work in 2K, but it seems like there is a lot of interest from the special effects world in this new camera.**

The high resolution, low noise image free of artifacts will be very suited for plate shots, because it allows for reframing, zooming or stabilizing. Things that have been done in the past with VistaVision can be done digitally now, and I dare say, with even better quality.

## **I can imagine some very high end commercials would also like to use this because agency art directors always love to blow up the image.**

I am quite confident about this application. I also see good opportunities in special venue productions like launch films for automobiles or in fashion, where perfect images need to fill huge screens.

## **Will the ALEXA 65mm camera be rented only from ARRI? Are you possibly going to offer it for sub-rental from the major rental houses?**

The ALEXA 65 will be marketed as a complete system from the ARRI Rental Group exclusively. There will be a Business to Business rental model, as we also want to service our customers, who usually buy our products. But again it will be the complete system.

## **You'll never sell this camera?**

Never say never. But seriously, when we first started looking into the market for such a camera, the interest in purchasing was very small. Almost all of the rental houses said, "Well, if you do it, and if we have shows, it would be great if we could sub-rent." But the interest from our customers in actually investing in and owning a 65mm camera was non-existent. And that was the reason why we offered the project on an exclusive basis to our rental group. They committed to and financed the project.

## **How does this camera position ARRI in the current business?**

At the risk of repeating myself, the ALEXA 65 is building on the success of the ALEXA, adding in a huge amount of alias-free resolution. If, for example, you want wide opening shots that stay on-screen for a long time, then this camera will truly "show off." Giving directors and cinematographers the ability to create that unique beautiful 65mm look and also to enable extreme VFX - these are the use cases the camera was designed for. We want to make sure that we have an offering for the very high end of filmmaking.





L-R: Martin Cayzer, CEO of ARRI Rental and Neil Fanthom, ARRI Rental Executive for Technical Marketing

*At NAB this past April, I received a cryptic text message: “Meet in the back of the ARRI booth at 12 noon.” Usually I welcome any excuse to avoid waiting on line for what passes as lunch at NAB—but this sounded ominous. High noon in a desert city. A disgruntled manufacturer? Had an FDTimes article offended someone in Las Vegas, a city with a certain reputation? The De Niro character beating up a hapless reporter in Luc Besson’s “The Family” came to mind.*

*I was escorted up the stairs and into the nether regions of the LVCC. Fortunately, Martin Cayzer, Neil Fanthom and Dana Ross had something altogether different in mind. After pledging to zipped lips and NDAs to end all NDAs, I was invited to visit Munich in the summer to learn about a bold new adventure.*

*Cut to: Türkenstrasse in Munich. A rainy day in July. Interior, top floor attic garret at ARRI, a veritable skunkworks of software, sensors, computers, R&D, wires, models, sleep-deprived engineers and an industrial-strength espresso machine. Martin Cayzer is the CEO of ARRI Rental Group of companies. Neil Fanthom is ARRI Rentals’ Executive for Technical Marketing. The topic was ARRI’s new ALEXA 65, which didn’t even have a name at the time. It was code-named AUSTIN. I think ALEXA 65 is a better camera name than a Texas town or a spy spoof character.*

**JON FAUER: This is a long way from the back corridors of NAB.**

**MARTIN CAYZER:** When we first started talking about future camera technology we took a step back and said, “What’s the long term future for our ARRI Rental Group of companies and for our

industry? One of the first questions that we asked ourselves was, “What’s going to be the future trend with feature film, TV drama and TV commercial production worldwide?”

There’s been some recent mixed press about box office results. We took a look at where we think the industry is trending and what new technology is driving. It’s been very interesting. In our Rental Group we’re in many more discussions now than ever before with visual effects supervisors, post-supervisors, as well as continuing our traditional relationships with cinematographers, crews and directors. We’re very much being drawn into the technology discussion from a wider perspective than just image capture.

What we see is that there is an increasing demand for large-budget visual effects-led blockbuster feature films.

Will that continue and how are we going to best service the needs of that type of production? We looked at some analysis. If we look back to 2013, 91 of the top 100 films, in terms of global box office, were live-action. The total global box office was up to U.S.\$ 34.9 billion, a 4% increase compared to 2012. The significant trend we can see is that the international, non-USA. box office is now around 70% of the global total.

**Of that, U.S. domestic is how much?**

**MARTIN:** U.S. domestic box office for 2013 was just under U.S.\$ 11 billion.

**That seems relatively small. And here’s a scary statistic: I heard breakfast cereals are an \$80-billion industry in the U.S.**

**MARTIN:** Overall, the picture that we’re seeing is that there is a lot of strength in large, live-action, visual effects-driven films and we need to be up-to-date with the technology these productions are looking for: a large format, high resolution, and also a seamless integration into current capture and workflow standards.

And not just for theatrical release; the conversations we’re having now is that TV is leading the 4K drive.

**What are your thoughts on TV image acquisition?**

**NEIL FANTHOM:** It’s ironic that TV may be driving 4K.

**MARTIN:** Acquisition, archiving, and visual effects. In terms of sophistication of equipment, technology, as well as the quality of content, we see traditional TV and new content providers such as Netflix and Amazon leading the way in many areas. We’re seeing those key, especially high-end, TV drama markets being critical for ongoing technology development and innovation.

**With whom are you partnering on the ALEXA 65 project?**

**MARTIN:** The camera is built by ARRI and developed through the ARRI R&D Group with Achim Oehler as the project leader. We can’t take credit for that! But, ARRI Rental did have significant input into the camera’s specifications and to make it into a system. To include Codex as a workflow partner, to have IB/E Optics as a lens partner and for us to develop a system, that’s very much part of what we are managing through ARRI Rental. With the input from all the teams around the world, ARRI Rental as a company is able to bring this project to life.

That’s a little bit of background as to how we got to the point of, “Do we develop a major piece of technology such as the ALEXA 65?” The confidence was there.

# Martin Cayzer and Neil Fanthom

The first thing we did was put a toe in the water with the ALEXA XT B+W in November of last year. This, once again, was a similar strategy to the ALEXA 65, in that the technology was developed but was not going to be practical to turn into a sales product. The quantities would just be too small. However, it is a unique technology with a unique look and as a rental product the ARRI Rental Group was able to bring it to life. This is exactly the type of innovation and technology the TV commercial clients want to see, as they are often first adopters of new ideas and equipment.

## **Please take us through the ALEXA 65 development.**

NEIL: For the ALEXA 65, we touched on the question of our initial launch, and the extent of the camera system's capabilities looking to the future. The essential message is quite simple—it's a 65mm large format digital camera based on ALEXA technology. It's exclusive to ARRI Rental. We've commissioned that product from ARRI Munich. ARRI Rental have collaborated with IB/E on the lens development, and the workflow is a Codex collaboration. The whole system is tailor-made to make 65mm capture an obvious and viable choice for high end productions.

## **Tell me more about the sensor in the ALEXA 65.**

NEIL: The "big chip" really is the beating heart of the camera. The new sensor has a larger imaging area than the camera aperture on an Arriflex 765. It is 54.1 x 25.6 mm in fact, very wide, very tall, and of course very high resolution. It is very important for us to have that additional "room" in the image, to cover wide, expansive vistas which will be a look which the cinematographers will love, as well as tall shots where the VFX supervisors need a lot of wiggle room.

Being able to cover both the wide and the tall is certainly a differentiating point, hence the comparison back to a full 65mm film gate. In terms of the camera ergonomics, the size and weight is similar to an ALEXA Studio, it clearly has a major usability advantage over a 65mm film camera. And because we are recording uncompressed Arriraw in-camera, the whole package will appeal to those demanding the best in uncompromised image quality coupled with a much higher degree of flexibility on set than they would get with a 65mm film package.

Overall, to set the perspective, some might consider the camera to be just an ALEXA XT with a 65mm sensor. But to be fair to the R&D team, that is quite an understatement since from a technology perspective it's a very, very complicated camera, as you can imagine. And then, as Martin mentioned, we're introducing a new range of 65mm format prime and zoom lenses, which are based on Hasselblad stills lenses. The lens elements are rehoused in a ground-up-designed set of lens casings with new iris designs and focus/iris/zoom adjustment mechanisms intended to make them perfectly suited to 65mm cinematic capture.

## **What is the roadmap for the camera?**

NEIL: As soon as we launch—day one—we know that the first questions to come back from clients will be, "Will the ALEXA 65 shoot at higher frame rates?" and "What about extended recording times?" We've considered a strategy for that, and we'll just paint a very simple picture to cover those two key points.

ALEXA 65 has a very similar performance sustainability roadmap to ALEXA. And everybody knows what happened with AL-

EXA over time, in terms of moving to higher frame rate capture and support for larger, faster recording media.

We've got a similar level of modularity in the camera compared to an ALEXA XT. We will be able to, and plan to, exchange the XR capture drive recording module to allow the next level of recording technology to be added to the ALEXA 65, and this will be the first deliverable on a roadmap of feature extensions.

## **Do the ALEXA 65 and the ALEXA XT have similar recording specifications?**

NEIL: In 16:9 mode, ALEXA XT can record uncompressed Arriraw at up to 120 frames per second. That in itself is quite a feat. Calculating 16:9 Arriraw, 2880 x 1620 resolution at 12 bits per pixel at 120 frames a second, and allowing for a little headroom you get to the 860 Megabytes (not bits) per second figure. If you can imagine running an ALEXA flat out at 120 frames a second, all the time, that's kind of what we're dealing with in the ALEXA 65 at 24 fps in its launch format. We will be adding extended functionality over the coming months addressing frame rates, recording capacity and formats.

## **Tell me about the workflow.**

NEIL: There are essentially two configurations of the Vault that we're investing in. One is a new turbo-charged version of the Vault S, with new Solid State Device (SSD) storage modules to make the Vault run a lot quicker than before. The write speed to spinning disk will not be a limiting factor in the workflow any more, so the XR Capture Drive offload can be made really quickly. Securing the digital negative quickly is a big part of the workflow for this camera. It underpins the performance of the rest of the workflow.

And then there is a new version of the Codex Vault XL which Codex are performance testing now. We're going to call it the Lab 65. In addition to faster SSD drives, the vault XL will have 24 cores of CPU power, which will really rip through the processing tasks involved in the ALEXA 65 workflow. The idea being that the new Vault S is a device that you can take on set anywhere, more likely to be for second unit usage in remote locations or for splinter unit work where just one or two cameras are shooting. But for near-set, studio-based productions where several cameras are shooting to a high daily workload, the Vault XL will probably be used near set to really manage the heavy data lifting and we will get close to a real-time workflow with that version of the Vault.

## **Very exciting. Congratulations.**

MARTIN: It's exciting and terrifying at the same time.

NEIL: A labor of love.

MARTIN: But you're right, people are passionate about the format. People are very passionate about the 65mm digital successor.





Dr. Achim Oehler

*Dr. Achim Oehler was head of the Arriscan project, project manager for the D-20 and D-21 digital cameras, and managed the ALEXA project through first customer deliveries. He is currently the project leader of the new ALEXA 65 camera.*

**JON FAUER: When did you begin work on the original 35mm ALEXA?**

ACHIM OEHLER: The ALEXA camera grew out of the very early Arriflex D-20 and D-21 era. Those were the exciting times when we started to do digital cameras. But ARRI was working in digital even before that time.

The Arrilaser film recorder and the Arriscan film scanner bridged the gap between the analog and digital world. When I was project manager of the Arriscan, I remember having many discussions with customers in Hollywood and around the world to hear their opinion about resolution. We came up with a 6K film scanner and the images were really stunning in resolution and also dynamic range. Even though we did not have a 6K sensor at that time, we developed a unique method to generate true 6K resolution from a 3Kx2K sensor. In addition we implemented 14+ stops of latitude by using double exposure.

Although I do not want to elaborate on the Arriscan now, you can see our motivation always has been to deliver the most impressive images.

You can imagine how our experience in image science, sensor technology, software development, manufacturing and service has moved nicely from the Arriscan to other projects like the ALEXA camera.

**When were the first hints of ALEXA 35mm camera? I remember it was introduced at IBC 2009.**

Here is the story of the ALEXA. After the Arriscan was finished,

I took over the D-20 project when ARRI decided to prepare it to be sold as the D-21. I remember the financial crisis very well, at the end of 2008. When the D-21 was brought to market in 2007, it was never planned to enter the market that way. (The D-20 was initially a proof of concept camera, and the D-21 was to be for rental only.) Selling it meant we had to squeeze in additional features like on-the-fly pixel correction and really tricky things.

For the next camera, the one that would become ALEXA, we listened to our customers and monitored the economic changes in the industry. Our sales department, product managers and business unit managers around the world discussed how to develop our “next gen” camera. It was concluded that we needed a camera that would do ProRes and many more features that were collected in a wish list. At the same time, we had developed a new sensor based on the experience of our existing products.

The economic crisis required us to rethink some things on the wish list and make a cost-effective camera. That was a challenge because, at that time, we already had decided on our newly developed sensor architecture. So we had to construct a camera that was cost effective to manufacture using that fancy sensor. Additionally, we had to have a viewfinder and a recording element.

We really were very lucky that this big effort was financed because, at the height of the financial crisis, we had to start investing a lot of money, much more than we had ever imagined we would have to put into that camera. The advantage at ARRI was that such things were possible. And I think we succeeded with the ALEXA camera. Later, an idea came up to a do large-format camera based on that sensor. That was the initial idea for the ALEXA 65.

**When you say large format, you’re talking larger than 35mm?**

Exactly. As large as possible. And especially because Mr. Franz Kraus, our CTO and Managing Director, has wanted to have a large-format camera since forever.

What is interesting, and I am coming back to the Arriscan for a second, we do have a 65mm Arriscan in our ARRI Film & TV services department. It is a unique piece of art and was developed to serve the large format market, because we really love large format. It is like a passion for most of us.

So to be able to capture hi-res large format images, it was clear that we had to develop a new sensor. We love challenges and we decided this would be a new story we could create. Without going into too much into detail, our new large format sensor is produced using a very sophisticated process and has the size of approximately three ALEXA 35mm sensors.

**Was the D-21 sensor the same technology as the D-20, and is the ALEXA sensor technology the same as the D-21?**

The D-20 and D-21 sensors are the same. The main thing that changed was the processing chain in the D-21.

**What is the technology change of the ALEXA sensor ?**

The ALEXA sensor is a sophisticated high dynamic range sensor using a relatively large pixel. It is an analog sensor, i.e. the Analog-to-Digital (AD) converters are off-chip. This way, less space is used on the reticle than what you would need if you put the AD converters on the chip. The additional area we gain is used for a larger pixel field.



## **Is the AMIRA sensor the same as the ALEXA sensor?**

The AMIRA sensor is essentially the same as the ALEXA sensor, just slightly modified. It's running at a higher clock rate and faster read-out time, which allows the AMIRA to go 200 fps.

## **Let's fast-forward to the new ALEXA 65 camera project. When did you first start working on that?**

The sensor was started in 2012 as a feasibility study. And then the project was outlined in April 2013, and funded. The camera program started with a sensor proof of concept phase which ran until December 2013, where we just put the sensor into operation with an experimental camera, which you saw in our laboratory.

At the start of 2014, we began working on the complete camera. There was a little bit of overlap, because we began preparation of the main electronic circuit boards in 2013. Otherwise we could not have achieved such a fast time to market.

## **When you do a proof of concept camera, does the sensor fabricator send you some test samples of sensors?**

Yes, the normal thing is that you get 10 to 12 wafers. It's called an engineering run, and these wafers are handled like the production wafers. You just have to dice, or cut, it and to put it into a package. What we do is kind of special. Normally you get good sensors in the package from your design house. They live from putting the sensors in packages and selling you the complete thing. What we buy are just the bare dies, and we put them in our own package. The complete yield tracking and a lot of things that are normally handled by the design house are in our hands.

## **And you put the cover glasses on in the ARRI clean room as well. I saw that yesterday.**

It's very good to have it all in one place. Otherwise, you have to send it back and forth to the assembly house.

Also the direct communication is crucial for our success, instead of having video conferences we just walk over to the department and clarify open questions directly.

## **Achim, tell us a little about your background? How did you get started in this?**

That's a good question. I'm a planetologist.

## **Excuse me?**

I'm a geophysicist who went into planetology. I did six years of comet research.

## **A rocket scientist?**

Rocket scientist. In Hollywood I always announce myself as a rocket scientist. I once had a very nice chat with someone in Hollywood. They thought I was doing something wrong, and they were angry with me. And they said, "What are you, some kind of rocket scientist?" And I said, "Well, yes, before getting into film, as a matter of fact I worked for 6 years in an ESA project dealing with basic research for the Rosetta comet mission and in the course of the Mars Pathfinder project the results of my thesis were used by NASA's Jet Propulsion Lab for a better understanding of the digital images shot by the Mars rover."

That kind of ended the discussion.

## **Were you also involved in the ARRI/Lockheed Blue Herring Project?**

No, I was working on the Arriscan film scanner project at that time.

## **When did you join ARRI?**

September 1999. My career at ARRI has been Arrilaser film recorder, Arriscan film scanner, software group leader, D-20, D-21, ALEXA, and now ALEXA 65.

## **You probably brought some of that technology and sensibility from the scanner and laser to the camera sensor?**

Yes, it's been a coherent kind of "camera-related" career, because when I was doing the planetology stuff I always dealt with remote sensing—using cameras sensitive in the optical and near infrared spectrum.

It started with the Giotto Project, where we had the fancy camera in a robotic spacecraft that flew by Halley's Comet and it was the first time for close-up observations of a comet. That was really fascinating, we also did the Mars camera with Professor Neukum, with really stunning 3D images. That camera was started in the early 1990s. And then I did a few years of free-lance software work for camera and spectrometer manufacturers.

## **How did you get into "the glamor and excitement" of the film business?**

That was one of those things that just happen: by a coincidence I met ARRI's lead color scientist Harald Brendel and finally I started working here.

## **Working on the large format camera, who's on your team? There is a color scientist, there is a sensor designer...**

I work closely together with Michael Cieslinski, who is the inventor of the sensor. I sit next to him, and we kind of manage and coordinate the whole thing. He is an analog expert, and he's able to design sensors from an architectural standpoint. It's really a very rare discipline that people can decide what to put where on a chip, and so on. These are a very small structures, so you have





Opposite: the ALEXA 65 development team. Above: with concept “box” and completed ALEXA 65 camera .

to think in completely different terms than a normal electronics engineer. Michael also designed the Arriscan sensor, by the way. And he’s, in a sense, the technical lead.

We have a digital designer, Reiner, and the digital designer is really so important, but most people underestimate the discipline. Digital design means putting code into FPGAs or doing ASICs, so it’s one of the most important disciplines here at ARRI. And he’s a really great engineer.

Then, we have two more software engineers. One is a specialist for calibration procedures, and the other is a very good hardware engineer.

We have an electronics engineer, and then we’ve got David, who brings a lot of camera usability expertise into the team. David worked for ARRI Rental before joining our team here.

One engineer, Alois, is doing nothing but sensor optimization, in other words, tweaking the sensors day and night. Sorry for not mentioning all of the team members now even though it is a small team. We are 10 people, but of course we use the complete ARRI infrastructure here. Our service department, manufacturing and QC department are involved from an early point in time in most of the projects.

We work closely with all other R&D teams at ARRI and we exchange ideas and experiences—sometimes simply during a coffee break in our coffee lounge.

**Yes, I noticed your industrial strength, incredibly high-tech coffee machine. That’s impressive. And I had no idea that you had so much sensor design capability right in house. I was always under the impression that you just farmed it out to some sensor design company, and that was it.**

We do both. We try to do some things on our own, to realize our own ideas, which is not easy, because the design houses are not prepared for that. They have their own building blocks. And they want to have customers go there and say, “Okay, I want to have a sensor of a set size, and set speed, and that latitude.”

And then they tell you, “Okay we can do it,” or not. Then they put together their blocks. And eventually, if you’re lucky, or unlucky, it depends on the success, they invent a new block, or they modify a block, or they talk to another fab about how they could do it.

But what they don’t like is when a guy like Michael shows up and says “Okay, guys, let me tell you how to design the sensor.” It drives them crazy. But it’s really hard to design everything by yourself. You would need millions of Euros for the design tools and very experienced designers. And you just can’t buy a design team. It’s such a special discipline.

**Does the big 65mm sensor have a similar high dynamic range technology as current ALEXA cameras?**

Yes, it looks like an ALEXA camera. It has the same image characteristics.

And then, what we did was to use the complete ALEXA concept. We enhanced the electronics with modern FPGAs, we updated the electronics with the latest components, so there’s nothing old in there. We can use it for another five years. At the same time, we can reuse about 90% of the software. There are about 20 man-years of software design in that camera. You would never be able to fund a project like that or do all that just for a small series of cameras. The image processing chain represents, I would say, another 40 man-years, or so. All in all there is a tremendous amount of ARRI in-house development inside the ALEXA 65.

# ALEXA 65 Specifications

Tommy “the Cork” Corcoran, an advisor to FDR, once said you can pretty much learn everything you needed to know about a place by looking at a map. His office was festooned with maps and globes. Wasn’t a leader of New Deal policy supposed to be looking at the big picture instead of big maps?

“Look at this,” he said, stabbing his finger at the map. “Mountains here, desert there, and a river. What do you think that means for trade and commerce? You’re not going to traverse treacherous mountain ranges. You going to follow the river to a port.”

There are two ways to learn about a new camera. Look at the images it produces. And read the map. We’ll do both.

Overview	
Camera	ALEXA 65 65mm Digital Cinema Camera
Sensor type	ARRI A3X CMOS sensor
Image Aperture	5-perf 65mm (full camera aperture)
Sensor active image area	54.12 x 25.58 mm (diagonal 59.86 mm)
Sensor Resolution	6560 x 3100 (maximum recordable)
Size	
Weight	10.5 kg / 23.2 lb
Size (body without mount, EVF, handle, antenna)	L: 338.7 mm / 13.3” W: 208.3 / 8.2” H: 163 mm / 6.4”
Overall length (body with XPL mount)	L: 387.8 mm / 15.3” Mount adds 49.05 mm / 1.9” to length
Power	24 VDC
Lens Mount	ARRI XPL Mount
Lens Mount Contacts	LDS
Optical Center	105 mm / 4.13” from base
Accessories	Same as ALEXA XT range
Shutter	Electronic, 5° - 358° adjustable in 1/10° increments
Frame Rate	20 - 28 fps (full aperture) (sensor capable of 60 fps upgrade planned for Q1/2015)
ISO Settings	200 - 3200 ISO. Base is 800 ISO.
Dynamic Range	>14 stops
Recording System	* Upgrade planned for Q1/2015
Recording File Format	Uncompressed ARRIRAW
Recorder Crop Modes	5-perf 65mm (full aperture, 1.78 extraction), 8-perf 35mm (24x36mm - future)
Storage (type)	Codex XR capture drive
Storage (capacity)	480 GByte capacity 860 MByte per second data rate
Storage (recording time)	11 minutes @ 24 fps

Once we catch our collective breath after screening ALEXA 65 images, the facts and figures helped explain why they look so good. It’s an interesting map: 54.12 x 25.58 mm image area, 6560 x 3100 resolution, more than 14 stops dynamic range, 200-3200 ISO.

After getting our bearings, we’ll look at some of the thought and background that went into the development of the ALEXA 65 large format digital motion picture camera system.

Connectors	
Viewfinder	ALEXA EVF-1
BNC connector	4 x 3G SDI - MON (1) Out: 2 x 3G SDI - MON (2) Out: 2 x 3G SDI
SD card	For software updates and menu settings (like ALEXA) New high speed mode for fast ARRIRAW frame grabs (planned feature)
Other connectors	Focus / Iris / Zoom motor connections
	5 x RS 24V for accessories
	1 x 12V for accessories
	TC I/O (5-pin Lemo)
	1 x LDD, 2 x LCS, ACC
	BAT (pin 1: GND, pin 2: +24 VDC)
ETHERNET, EXT (multi-pin accessory),	
Other	
Camera IP Address	169.254.XXX.123
Synchronization	Like ALEXA, RET IN and EXT: Sensor sync, processing and HD-SDI outputs for 3D and multi-camera
Monitoring	3 independent color outputs: 1. EVF LogC/709/ARRILook 2. MON (1) OUT LogC/709/ARRILook 3. MON (2) OUT LogC/709/ARRILook All with optional overlays. All options are available during playback. MON OUT tools: Zoom, Overscan, Overlay info, Frame Lines, False Color, Peaking
CDL	CDL server support like ALEXA XT
In-camera playback	Playback via EVF, HD-SDI MON OUT including Audio
Audio	Two channel recording and playback, Analog line inputs, Headphone monitor output
Remote UI	Existing RCU-4, Web-Remote via ethernet, WCU





8 new primes and 1 zoom will be available initially in the new ALEXA 65 XPL mount (64 mm diameter, 60 mm flange focal depth). Image circle is 62 mm.

# ALEXA 65

Antenna for Wireless  
Lens Control, Lens Data  
and Camera Remote  
Control

Focus Tape  
Hook

M6 Rosette

ZOOM: to enlarge image  
for focus check

EXP: for false color

M6 Rosette



Top Handle

Lever to secure EVF





MENU: Access the Main Camera Menu

Jogwheel: rotate to select, push to set

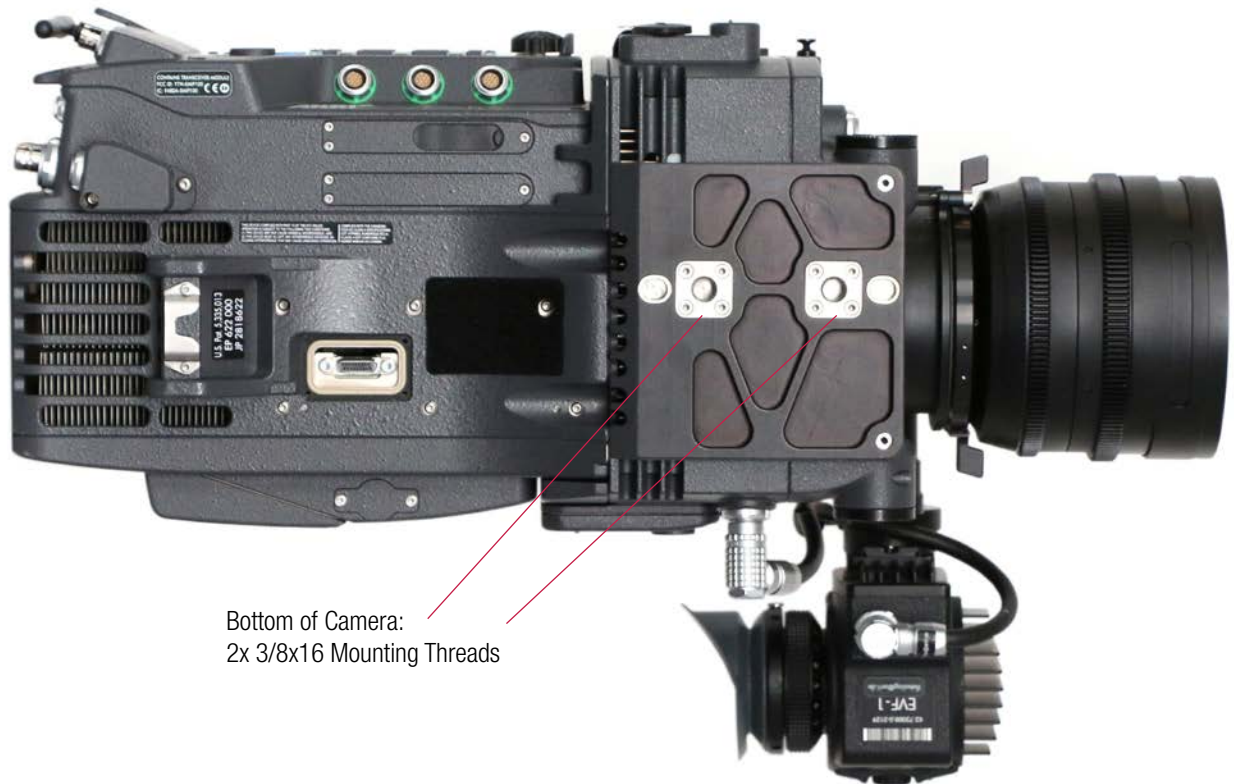
BAT: Power

ON-OFF: Press to turn on. Press and hold for 5 seconds to turn the camera off.

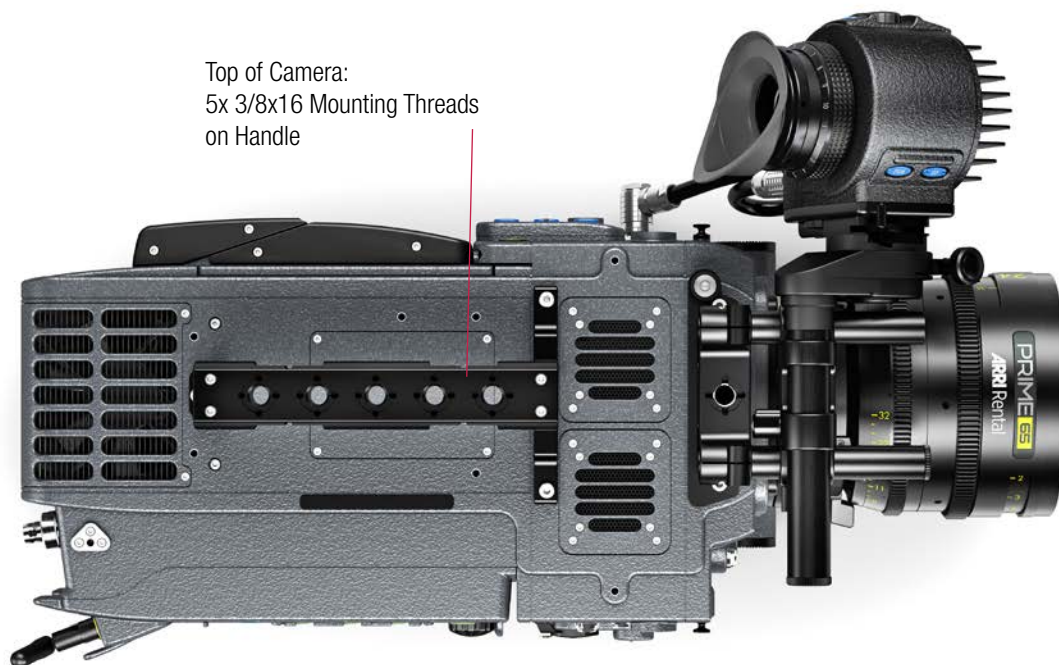
Familiar ALEXA-like user-interface and menu layout



IRIS, ZOOM, FOCUS:  
Connectors to ARRI  
Lens Motors



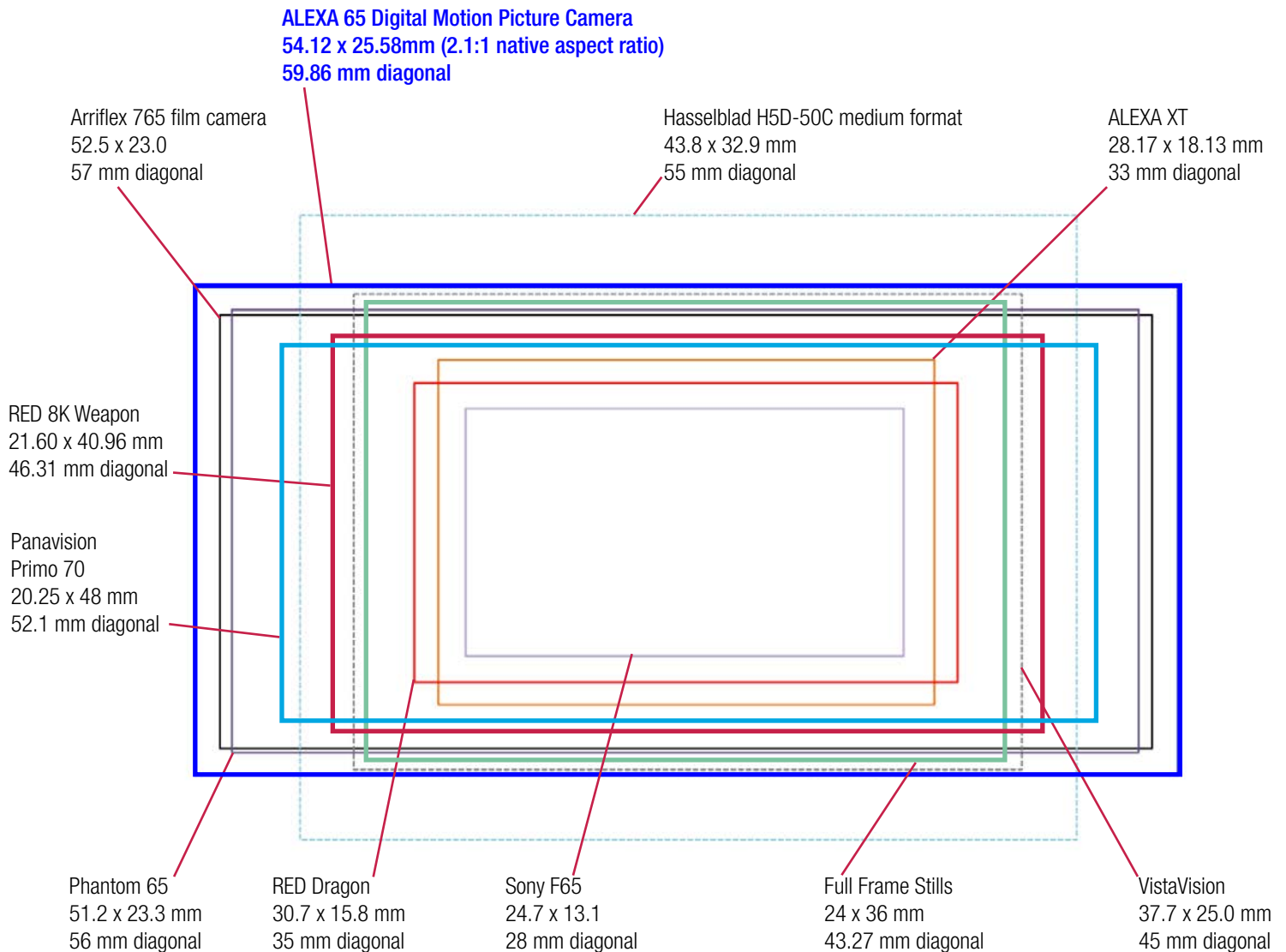
Bottom of Camera:  
2x 3/8x16 Mounting Threads



Top of Camera:  
5x 3/8x16 Mounting Threads  
on Handle



# Sep 2014: ALEXA 65 Sensor Size Comparisons



	Width	Height	Diagonal	Horiz Rez	Vertical Rez	Aspect Ratio
ALEXA 65	54.12	25.58	59.86	6560	3100	2.11:1
Arriflex 765	52.5	23.0	57			2.28:1
Phantom 65	51.2	23.3	56	4096	2440	1.68:1
Hasselblad H5D	43.8	32.9	55	8272	6200	1.33:1
Leica S	45	30	54	7500	5000	1.50:1
VistaVision	37.7	25.0	45			1.50:1
Full Frame Stills	36	24	43.27			1.50:1
RED Dragon	30.7	15.8	35	6144	3160	1.94:1
RED W8K	40.96	21.60	46.31	8,192	4,320	1.89:1
Panavision Primo 70	48	20.25	52.1			
ALEXA XT	28.17	18.13	33	3414	2198	1.54:1
Sony F65	24.7	13.1	28	8192	2160	1.89:1



Here's a camera that Chivo and Chris Haarhoff would have enjoyed on *Birdman*. The new ARRI ALEXA Mini has a carbon fiber body and weighs 5 lb. Its titanium PL mount is connected directly to the sensor assembly for unwavering flange focal depth. It can also accept interchangeable lens mounts of the ARRI Amira for B4 video and EF (Canon) lenses.

The ALEXA Mini can be operated by wireless remote control, as a normal camera with the ARRI MVF-1 multi viewfinder attached, or with an on-board monitor. It has user buttons on the camera body.

ALEXA Mini is compact, quiet and (hurray) has a symmetrical design. You can shoot in almost any orientation: upside-down, portrait mode, straight up, down, etc. There are many mounting points.

A sigh of relief can be heard worldwide today. ALEXA Mini

comes with a 4:3 sensor. It will have an automatic de-squeeze mode for anamorphic lenses.

The camera records 0.75-200 fps, ProRes or uncompressed AR-RIRAW, either in-camera to CFast 2.0 cards or to a specially-designed external Codex recorder. The Codex recorder can handle up to four image streams simultaneously. For example, you might use 4 ALEXA Minis at one time for car rig shots, stunts, or 360° plate shots.

ALEXA Mini images will match all other ALEXA cameras.

ALEXA Mini has a built-in lens motor controller. New active lens motors can be connected directly. iOS or Android tablets can be connected via Wi-Fi to remotely control camera functions such as the motorized internal ND filters. Wow—internal ND in something this small. The ARRI ALEXA Mini is scheduled to ship in May 2015.





Stephan Schenk (above right), Managing Director at ARRI Cine Technik and heads ARRI's Business Unit Camera Systems. Michael Jonas (at left, Product Manager of the ARRI ALEXA Mini.

**JON FAUER:** A lot of new camera announcements were made by ARRI during the last weeks: a new software update road map for Amira, then the ALEXA Mini, and ALEXA SXT.

**STEPHAN SCHENK:** Not to forget ALEXA 65, which has been launched by our colleagues from ARRI Rental. So yes, we have a lot of news for our customers. But the great thing about all that is that none of these announced cameras are making the others obsolete. Based on the tremendous success of our classic ALEXA—which by the way, is still in our line-up and is still being sold in what will soon be its 6th year—we received a lot of feedback on what to improve. We are trying to turn as many of those suggestions into products or product upgrades.

**How has the reaction to Amira been since it started shipping in June last year?**

Amira has been very well received and, as I mentioned, not by replacing ALEXAs. We have reached out to new customers who might have used ALEXA on one occasion or the other, but now have really invested in Amira, because it is exactly the right tool for what they do. Take Jamie Oliver with his cooking show or the NFL. TV shows have embraced Amira for productions like *Das Supertalent*, the German equivalent of *America's Got Talent*, as well as Reality TV shows. The 200 fps capability is making it a popular choice for commercials. I just read in a British magazine that Amira last year was the 4th most rented camera in the UK, quite remarkable considering that we just launched it mid-year. I have to thank all the early adopters here for relying on Amira.

**What's next with Amira?**

We try to get even better—both, in hardware and software—to ensure a long product lifecycle, as with ALEXA. We made a new eyepiece because we received feedback to improve it, and we did.

Then we announced the software update road map for the next 2

updates. With SUP 2.0 Amira supports 4K UHD, and with SUP 3.0 it will have a 50 Mbps codec. So Amira will give customers a huge number of options from low broadcast-style data rates to ALEXA-quality ProRes 444 high data rates. And we, of course, are already thinking about what to add next.

**The ALEXA Mini announcement got a lot of attention. You must have received a lot of feedback and questions. It ranked among the highest number of hits ever on FDTimes online.**

Same with us. Our server was down for 15 minutes. Not that I like that, but the interest in ALEXA Mini was and, more importantly, continues to be phenomenal.

**Are we in a new era of hand-held camera work? *Slumdog Millionaire* a few years ago and now *Birdman* both won best cinematography Oscars with lighter, smaller, hand-held cameras.**

Not so sure. Both Anthony and Chivo use normal form factor cameras on their projects, too.

In *Birdman* Chivo used ALEXA M but also ALEXA XT. Anthony had 9 different camera types on *Rush*, including a classic ALEXA Plus and ALEXA Studio.

I think DPs chose their tools according to their shooting style but even more according to the project needs. And this is exactly why we have so many different cameras. At ARRI we believe in dedicated cameras for dedicated jobs – not in one fits all.

There's a long history at ARRI where our studio cameras were accompanied by our lighter and smaller companion cameras like the 2C, 35-3 and 435 or the ARRICAM LT. Many DPs like to have well balanced cameras in a pick-up and shoot configuration and not only box cameras that need to be complemented by accessories like a Christmas tree.

**What market is the ALEXA Mini aimed at?**

The ALEXA Mini is a companion camera to the ALEXA in the first place. Our customers ideally would like to have the same image quality for their A, B and C cameras. ALEXA Mini gives them exactly this. But equally, Amira is a wonderful shoulder mount camera for handheld work. It has the same sensor and image quality and can also be easily intercut with ALEXA and ALEXA Mini footage.

Secondly, there is a fairly new style of shooting out there, where DPs use gimbals and multicopters for their projects. There is a huge interest in ALEXA Mini among these creatives.

**How did the idea for the ALEXA Mini first begin?**

Actually it started way back with ALEXA M. In the early days of ALEXA, our customers requested a smaller and lighter model for rigs, cars mounts and special applications in addition to their A camera. Also for the 3D rigs, the classic ALEXA was not the ideal choice. Ask Larry McConkey, who bravely had a 3D rig with 2 classic ALEXAs on his Steadicam on *Hugo Cabret*.

That was the reason we built the ALEXA M. James Cameron and Vince Pace approached us because they wanted to have ALEXA image quality in a smaller form factor for their 3D rigs.

About the same time, I first met Anthony Dod Mantle, and asked him whether he would consider the classic ALEXA. He said, "Well, my shooting style is a bit different and I like to have a small



ALEXA 65  
available through ARRI Rental

ALEXA SXT

Amira

ALEXA Mini

form-factor camera.” So I said, “What if we remove the head?” He said, “Certainly that would be an interesting idea.” From that day on, our email subject line was “Marie Antoinette” as the ALEXA M developed. He was one of the first to use it, on *Trance*. Quite a number of significant productions have used ALEXA M: *X-Men Days of Future Past*, *Dawn of the Planet of the Apes*, *T.S. Spivet* and *Divergent* to name just a few more.

But the requests were eliminate the cable, because a fiber connection between the head and the back end is not always ideal. So now we have an answer to this with ALEXA Mini.

**Why couldn't you come up with ALEXA Mini earlier? Was it a physical limitation of shrinking the electronics down to that size?**

Yes, at that moment in time, we could not squeeze everything into a small package, so we had to separate the camera head and the recording unit with a tether. Now we are able to benefit from advances, some of which are also seen in Amira.

What is important to point out is that the entire processing hardware is already inside the camera. There's no need for external computer cards and a computer to get the files processed. It is all in the camera. You record completely processed color images onto internal CFast 2.0 cards or onto the Codex recorder.

**In your travels talking to customers, are most people going to use the Mini with internal data cards or do you think they will use the external Codex recorder?**

I think there will be both. Most people will shoot ProRes to the CFast 2.0 cards and ARRIRAW up to 30 fps can also be done like this. But there are a lot of requests for high speed in ARRIRAW these days, and that is when they certainly will use the Codex recorder. Furthermore, the Codex records multiple cameras. Also, an external Codex is helpful in more dangerous scenarios where you may not want to record data on a camera that might get damaged, but is recorded externally, somewhere safe. Or maybe in a helicopter mount so you can easily swap capture drives.

**You've been pretty busy lately with yet another new camera. Tell us about the ALEXA SXT.**

SXT stands for Super Extended Technology. Again, the list of wishes to improve and complement the ALEXA is very long and our Product Manager Marc Shipman-Mueller and our R&D team in Munich are not getting tired of looking for ways to incorporate them in software updates. But some requests can't be fulfilled with software upgrades based on the same electronic platform; you need a higher performance base. Now with ALEXA 65 we have this platform. However, ALEXA 65 is a 65mm large-format

camera and not the answer to all questions of shooting Super 35.

By using ALEXA SXT, our feature film, TV drama and commercial customers can now benefit from ALEXA 65 electronics and also from some new features that we implemented first on Amira, like 3D LUT-based looks. Therefore they will have a very powerful tool for their projects.

**The 4K discussion continues and ARRI now also announced 4K features. What is your view on this subject?**

All of our new cameras offer an in-camera 4K recording. However, and we have said this over and over again and it remains our message: spatial resolution is just one parameter of an image. If you look at what ALEXA SXT will give you, it is not just 4K Cine and 4K UHD. We always aim to deliver the best overall image quality and also the best overall production costs, i.e. efficient workflows, reliable functionality, fast and easy color grading and VFX work.

**Some production companies insist on native 4K.**

First of all, ALEXA 65 has a 6.5K sensor. If a customer wants high spatial resolution that is an option from ARRI through our ARRI Rental group, as there will be business-to-business deals possible.

Also, with ALEXA SXT, Mini and Amira, our 4K image looks fantastic and we ask all our customers to just compare images. The creatives out there don't shoot test charts, they want to tell a story. Therefore we are not dogmatic about which pixel count to use, but about delivering the best image quality.

We do not claim that we have a new sensor, we openly say that we use our ALEV 3 sensor with a very mild 1.2 up-sample to create 4K UHD or 4K Cine in-camera. The ALEV 3 sensor may have fewer pixels than others but we think that our design of each pixel delivers more information with excellent results. But again, we leave that decision up to the user. Try, compare, and then judge the image quality.

In this year's award season, the vast majority of nominated feature films used ALEXA. This is true not only for cinematography but also for VFX. Four of the five VFX Oscar nominated films were captured with ALEXA, except *Interstellar*, which was shot on Imax. This says something about the quality of our pixel design.

**It's going to be very exciting NAB for ARRI.**

We really have a great camera line-up: ALEXA 65, ALEXA SXT, ALEXA Mini and Amira. And don't forget, we have lighting, lenses and accessories too. In particular, with our anamorphic lens range and the new flare options, there is much to see. We're really looking forward to NAB.



*Michael Jonas is Product Manager of the ARRI ALEXA Mini at ARRI Cinetechnik.*

## **JON FAUER: How did you first become involved in the ALEXA Mini?**

MICHAEL JONAS: Flying remote controlled helicopters used to be my hobby. When I worked at AVID, we built a small multirotor in our spare time. I was quite into the scene and had a lot of contacts. After I joined ARRI, a lot of people called me about being able to fly the ALEXA. But ALEXA cameras were not originally intended for this. A few people tried and built big multicopters, but it was pretty clear that just increasing the size of these rigs was not going to be sufficient for the kind of agility and movement required.

I used to be the project manager for the ALEXA XT recorder module which had just been delivered so I had time to look into the large emerging market of gimbals. At the time, the idea of hand-holding multirotor gimbals kept coming up and Freefly introduced the MoVI. I went to a BBC tech meeting and talked to users. Next, we developed preliminary specs for a camera, including the size and optimal weight. We discussed the concept with our engineers who said they could try to shrink the ALEXA electronics, but there would be a cost factor. We began with an exercise focusing on size and weight and cost. It wasn't unrealistic. We decided to build a prototype and see whether it would work out. And it did. It started as a very small idea and now it's a very, very cool project.

## **How does a guy from Avid, like you, wind up building cameras?**

I've been in the motion picture industry for quite a while. I used to work for Das Werk doing VFX and later for a start-up called NXX/Alienbrain which got acquired by AVID. My focus used to be VFX and postproduction workflows, meta-data and asset management. I live next door to ARRI and I knew a few people. They were interested in hiring someone with a post background to do research on workflow and codecs. It seemed interesting and I joined ARRI. Initially, I worked on defining post production strategy, but a few weeks into the job, ARRI needed a project manager for ALEXA XT and I was thrown in at the deep end.

## **Let's talk about the Mini. What is its intended use?**

It was designed to be a companion to ALEXA in order to cover all the scenarios where our larger cameras were not ideal. The goal was to have another tool in the ARRI toolbox which would have the same image quality but focus on low weight and a compact form factor. As it turns out the camera is really exciting because there are so many different ways you can use it and I look forward to seeing where this camera is going to end up. Underwater is a very exciting application because I'm a diver myself. Getting in touch with all these cinematographers who seek to get special shots is amazing and very rewarding.

## **Let's go into specific details. How do you plug in a lens motor?**

The lens motor plugs directly into the titanium PL mount. There is an L-Bus interface with a Lemo plug on the PL lens mount. You can daisy-chain up to 3 cforce motors from there. Each cforce motor has two connectors. The daisy-chain keeps cabling simple and clean. We are going to release a new cforce model for the ALEXA Mini that is smaller and lighter, but still has very serious

torque. It is called the cforce mini and will work very well with primes and midsized zooms.

## **The PL mount has the same four pin lens contacts?**

It is an Amira style PL mount with LDS contacts. You can use our new titanium mount, and you will also be able to use the LDS steel mount of the Amira. These mounts provide power for the Fujinon Cabrio zoom lenses. Also, you can use Amira's EF mount on the ALEXA Mini, and the B4 mount.

## **Are third party manufacturers making mounts for Canon, Leica, Nikon, and other lenses?**

I know there is a range of mechanical mounts available from P+S Technik, which include Nikon F-mount, Canon FD, Panavision and I believe Leica R.

## **What are you doing for the viewfinder?**

It's basically the same EVF as used on the Amira. The cable is a little different because we have a new, very rugged connector on the camera body. Same EVF, new cable.

## **ALEXA Mini has a 4:3 sensor. Will it handle anamorphic de-squeeze in the viewing?**

Not initially, but in a later software release with a license upgrade it will do 4:3 recording and de-squeeze anamorphic.

## **I guess your PCA group is busy building rigs to shoulder-rest the Mini and mount the Codex recorder on the back?**

We'll offer a complete, modular cage consisting of multiple adapter plates and side arms. There is going to be a minimal, very lightweight adapter plate and a more complex one with 15mm rod support. We will provide a bridge plate adapter so that the camera can be mounted to our traditional cine-style bridge plates like BP-8 and be used with a long lens on a tripod if needed. We will have side arms that offer our standard rosettes for handgrips and extensions. There is going to be a battery plate that mounts on rods and has some special features for balancing. Also there is going to be a shoulder pad.

## **ND filters, LUTs, Monitors, Controls?**

The ALEXA Mini has motorized internal ND filters, very much like the system we have on Amira. ALEXA Mini features our advanced look management known from Amira with 3D LUTs and CDL color controls in the camera. The camera does not need a viewfinder: camera controls can be managed with a four-button interface. We will provide a new version of the Transvideo StarliteHD 5" OLED monitor which integrates with the camera and will provide a touch interface. One thing I often forget to mention, that a lot of people asked about, is that the camera has an audio input. It's a Lemo 5-pin connector in front for stereo line level input.

We are going to build an LCD control panel for the camera as well. It's a standalone LCD system that you can connect to the camera in order to do the setups. The LCD screen and the buttons around it will be very much like our RCUs. It has two connectors. You can daisy-chain it between the camera and the viewfinder so you can put the LCD on the right-hand side for the assistant and use the viewfinder on the left-hand side. This LCD panel will also work on Amira so you can use it on the right-hand side assistant



The ARRI R&D camera team for the ALEXA Mini, in Munich.

panel as well.

## And the antenna in back?

It's for our lens control system. WCU-4 will be a good remote control unit for the ALEXA Mini providing control of lens motors and operational parameters. There's also Wi-Fi built into the camera so you can control it via a smartphone, tablet or laptop wirelessly. It's a web-based system so you don't need an app. You just join the network of the camera and call up a specific web page and you will have full control of the camera. It looks similar to the menu or the display in the viewfinder.

## Where is the recommended place for mounting an on-board battery?

We will provide a battery plate that will go on rods. Most of the gimbal operators will actually use the battery on the right side of the camera. Right now we are using Velcro to attach the battery adapter there but we are looking into something more "ARRI-like". I know that Freefly is working on a way to mount the battery on the side as well. There is going to be a very exciting new battery from PAG UK which provides 90Wh of power and I think around 10A of current in a very small and lightweight form factor.

It is going to be very good with the ALEXA Mini.

## Do we have to worry about blocking the cooling vents?

The cooling vent's intake is on the camera right side. The exhaust is on the back. A nice feature of the camera is that it is symmetrical and you can easily rig it upside down. So if you need the clean side for the battery mount on the other side, just switch the camera around and flip the image.

## How long does it take to boot up the Mini?

The camera boots in about 12 seconds, which is quicker than some of the accessories we have tested.

**Several rental houses who recently purchased anamorphic lenses, and need cameras with 4:3 sensors, are wondering whether to upgrade to an ALEXA SXT or purchase an ALEXA Mini.**

I think they will need both. ALEXA XT and ALEXA SXT still is

the better choice as the main unit camera. The Mini is the companion camera. The advantages of the Mini vanish very quickly with the amount of equipment you add on the camera. If you look at a typical main unit camera, it's usually built up with a video transmitter, motor controller, video monitor, UDM, lens motors, and what not. Next, add a large zoom lens, lens support, rugged baseplate, and you wind up with a large and relatively heavy package. Then, compare the practical day-to-day differences in media, of using internal CFast 2.0 to Codex Capture Drives. CFast 2.0 cards are very small and you need to take care of them, which is okay if you are aware of that. I'm not one to downplay CFast, but you can literally drive a car over a Codex Capture Drive, and not much is going to happen (hopefully).

In a really rugged environment, the ALEXA XT is the gold standard and I think will remain the gold standard because it's actually built so solidly. The Mini has been designed to be small and lightweight. It is rugged, but not to the extent of the ALEXA XT.

If you try to build the Mini up to an A-camera configuration, it isn't a big advantage anymore. It starts to become what people call a Frankencamera. The ALEXA is very streamlined and efficient for what it's designed to do.

Of course, for somebody like Anthony Dod Mantle who likes to shoot handheld in front of his body, the Mini is the better choice for him.

## If I were a rental house buying a Mini body, what else would I need to complete the package?

Along with the ALEXA Mini, you would probably buy the viewfinder, the cage, the mounting option for the viewfinder, battery plates, a shoulder set, and base plate adapter.

If you want to control the camera in handheld mode, then a big advantage is in using our wireless control unit WCU-4 because it can remote-control the camera and you will be able to change all the operational parameters as well as control focus, iris and zoom. You'll probably want to buy three of our new cforce mini motors.

## When you will actually be delivering the first Minis?

If all goes well, then we will start shipping in May.



# April 2015: ALEXA Mini

## Mini Specs

Camera 35mm digital camera with carbon fiber body  
Weight ~ 2.3 kg / 5 lb (camera body with titanium PL lens mount)  
Length: 185 mm / 7.3" (camera body with PL lens mount)  
Width: 125 mm / 4.9"  
Height: 140 mm / 5.5"  
Sensor: 35 mm ARRI Alev III CMOS,  
Formats: 4:3/16:9 switchable active sensor area  
Shutter: Electronic shutter, 5.0° - 356.0°  
Latitude: 14+ stops dynamic range — EI 160 to EI 3200  
(measured with ARRI Dynamic Range Test Chart DRTC-1)  
EI: EI 800 base sensitivity  
Filters: Built-in motorized ND filters 0.6, 1.2, 2.1, and clear.  
Mounts: Titanium PL mount with L-Bus connector and LDS  
EF mount  
PL mount with Hirose connector and LDS  
B4 mount with Hirose connector  
Finder: Multi Viewfinder MVF-1 (OLED) with flip-out LCD screen  
and military-grade connector to camera.  
Onboard Transvideo StarliteHD monitor with touch screen \*  
Media: CFast 2.0 memory cards (internal)

### Photosites (with surround view)

16:9  
HD: 2880x1620 (3168x1772)  
2K: 2868x1612 (3154x1764)  
3.2K: 3200x1800 (3424x1926)  
4K UHD: 3200x1800 (3424x1926)  
4:3  
2K: 2867x2150 (3168x2160) \*

### Recording formats

HD 1920x1080  
2K Cine 16:9 2048x1152  
2K Cine 4:3 2048x1536 \*  
3.2K 3200x1800  
4K UHD 3840x2160  
ARRIRAW 2.8K 16:9 2880x1620 \*  
ARRIRAW 2.8K 4:3 2880x2160 \*

### Recording codecs

ProRes 4444XQ, 4444, 422 (HQ), 422, 422(LT), ARRIRAW \*

### Video outputs

2x HD-SDI out 1.5G and 3G: uncompressed HD video with embedded audio metadata, SDI-6G interface to external CODEX recorder \*

### Also

Built-in remote control via ARRI Electronic Control System and Wi-Fi, support for cforce motors, built-in motorized ND filters, interchangeable lens mounts and ARRI Lens Data System. Manual and auto white balance.

\* may not be available at product launch, available as a software upgrade later in 2015.

NAB Booth C4337. [arri.com/alexamini](http://arri.com/alexamini)



Camera Left



Camera Right



Front with PL Mount



Front without Mount



Titanium PL Mount



Rear



Symmetrical: Top (above) and Bottom (below)





ALEXA SXT EV



ALEXA SXT Plus



ALEXA SXT Studio

*Marc Shipman-Mueller is Product Manager for Camera Systems at ARRI, which includes all ALEXA 35mm format digital cameras and accessories (except ALEXA Mini) as well as film cameras.*

**JON FAUER: Tell us how the ALEXA SXT came about.**

MARC SHIPMAN-MUELLER: We saw that there was a market demand for more features in the ALEXA. With the ALEXA 65 electronics we had the horse power. With the 65 image processing chain and the Amira color management and noise reduction we had the code to make that happen. So we decided to create another evolutionary step in the ALEXA line, the ALEXA SXT. The ALEXA XT cameras extended the feature set of the ALEXA Classic cameras, and the ALEXA SXT now extends the feature set of the XT cameras even further.

**You have new boards and new software. What about the sensor?**

We kept that the same. There seems to be some confusion about this, so let me be very clear here: the ALEXA SXT cameras have the same sensor as the previous generations of ALEXA cameras, the 3.4K ALEV 3 sensor, that is the basis for the image quality of all ALEXA cameras.

**Tell us about the features of the ALEXA SXT.**

There are a couple of features we're still looking at and we're not quite sure if they are going to make it to the final product. We try to announce only things we know will work. We try to be a reliable partner, because when people invest their money in our gear, that is a lot of money and serious business. But here is what we have so far: There will be ProRes 4K, better image quality, a totally revamped color management system and three independent HD-SDI outputs.

**How does the ProRes 4K work? You said the sensor is 3.4K?**

Yes, and that sensor has played a vital part in the success story of the ALEXA. What our tests have shown, and what we hear from our customers, is that with this sensor we have superb overall image quality, extremely wide dynamic range, fantastic skin tones, and great sensitivity. With the extra horse power of the ALEXA 65 electronics and the new image processing chain, we can take the image from the sensor and do a minimal up-sample in-camera, either to ProRes 4K UHD or to ProRes 4K Cine.

**I have to ask a difficult question now. Most of us have been trained by ARRI, I think it goes back to the scanner days, that to get the best picture you have to over-sample. If you want a 4K image, you really have to be shooting or scanning in 6K. So now we're being told that this mild up-sampling is perfectly okay. What happened in the meantime?**

That is a fair question. First of all, in those days we were talking

about scanning film, which is a completely different proposition from shooting digitally. There, we have a transformation from an analog medium with grain to a digital medium. Additionally there have been a number of changes in technology and in our understanding of what is important to create a good looking image.

Now, scientifically, if you want the best resolution of a black and white test chart, you should over-sample. However, an image is not just resolution. Some people talk as if all a cinematographer does all day is shoot black and white charts and resolution is the most important image quality parameter. But that is not the case, there is so much more to it. It is silly to look at just one aspect of the image and make all decisions based on that. Parameters like dynamic range, noise, skin tone reproduction and the quality of the debayer are actually much more important than just resolution.

And then the technology has also changed. Debayering has gotten much better, the electronics are much more powerful and we have learned a lot about in-camera image processing and up-sample algorithms. We have a whole color science department that continually pushes the envelope of what is possible, and that is very important. They came up with our in-camera up-sample algorithm which is just fantastic.

So at some point we entertained the idea to do this mild up-sample from 3.2K photosites on the sensor to 3.8K (= 4K UHD) pixels in the file. There were many inside ARRI who were opposed to that. But we have learned that theory will only get you so far and at some point the only way to really know is to shoot a test. The results looked great. That convinced everybody within ARRI that it's possible to do a mild up-sample of 1.2x and still get the beautiful images everyone is used to from ALEXA. Now we have an answer for those who need to record a 4K image, be it in 4K UHD or 4K Cine.

**Can you explain the differences between 4K UHD and 4K Cine? And should it not be 4K DCI instead of 4K Cine?**

With all the different new formats out there, this has gotten a bit overwhelming. To avoid confusion, we are making a clear distinction between the number of photosites on the sensor and the number of pixels in the recorded file. We are also making a distinction between what is recorded in-camera, which we call a recording format and what ultimately comes out of post, which is a distribution format. When you start mixing up all those terms, it can get very messy.

So—for 4K UHD, we are using 3200 x 1800 photosites on the sensor. We then do a mild up-sample with a factor of 1.2x in-camera to the ProRes 4K UHD recording format with 3840 x 2160 pixels. The distribution format is a 3840 x 2160 pixel 4K UHD TV deliv-



# April 2015: Marc Shipman-Mueller on ALEXA SXT

erable. This, by the way, is the same method, the same photosite count, the same up-sample factor and the same resulting pixel count as used in ALEXA Mini and Amira, so here again we have a great sharing of technology.

## Then what is 4K Cine?

4K Cine is a recording format unique to the ALEXA SXT. We use 3414 x 2198 photosites from the sensor—Open Gate—the full sensor area, and with the same 1.2x up-sample we create a 4096 x 2637 pixel ProRes file. From that you can create a 4K DCI distribution format in post. Now, our recording format has some more lines than the distribution format. The DCI container is 4096 x 2160, but we record 4096 x 2637 in-camera, so there is some wiggle room up and down for repositioning or placing VFX markers. That is the difference between our 4K Cine recording format and the 4K DCI distribution format. The recording format has some more lines for some extra flexibility in post. [see Chart 1]

## In the ALEXA SXT, do you have the choice of not up-sampling ProRes to 4K?

Sure. The ALEXA SXT provides a number of ProRes recording formats that cover most of the needs of our customers. You can record ProRes in HD, 2K Cine, 3.2K, 4K UHD or 4K Cine. And you can do that with all the different ProRes flavors, from ProRes 422 to ProRes 4444 XQ.

## Can you shoot ProRes 3.2K and then do the up-sample yourself later in post?

Yes. ProRes 3.2K is a recording format we already have in ALEXA XT cameras with SUP 11. We are seeing some productions that shoot ProRes 3.2K and do a post up-sample to 4K UHD. But we are also seeing some productions shooting ProRes 3.2K when they want an HD or 2K deliverable. The 3.2K gives them extra space around their image for resizing, reframing, rotating or stabilizing. In fact, in our online ARRI Frameline Composer we now have a preset for exactly that purpose, called '1.78:1, 2.8K inside 3.2K'. You can find the Frameline Composer in the TOOLS section of the ALEXA web pages. It is a great tool for making your own framelines.

## Let's talk about the SXT and internal ARRIRAW recording.

The SXT can record ARRIRAW just like the XT camera. We have the 16:9 ARRIRAW up to 120 fps, 4:3 ARRIRAW up to 96 fps and Open Gate ARRIRAW up to 75 fps.

## Is there any in-camera up-sampling planned for ARRIRAW?

No, that gets recorded straight as it is on the sensor. Anyone who shoots ARRIRAW has to do some post anyway, and they usually prefer to use their own up-sample algorithms if they need to up-sample.

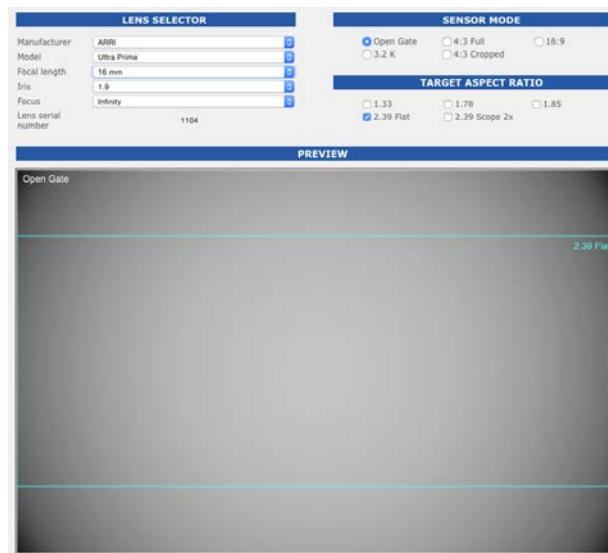
## Open Gate is becoming more and more popular for high-end features. But it has a larger image circle. How can you figure out which lenses will work and which will not?

For that we have a new online tool, the ARRI Lens Illumination Guide. It is also in the TOOLS section of the ALEXA web pages. Every lens is brighter in the center than in the corners: that is called the lens illumination. We wanted an easy way for customers to get a feeling of how lenses performed in Open Gate. You choose a sensor mode and what framelines you want to check out, and then you choose a lens model, focal length, iris and focus

setting, which are all parameters that affect the lens illumination. The resulting image shows you how the illumination falls off towards the corners and if you get vignetting. Some lenses do better and others worse. One of the lenses that does really well is our Ultra Wide Zoom UWZ 9.5 - 18, since it was designed for a large image circle. Most high-end primes wider than 18 mm have an issue shooting Open Gate, so the UWZ really solves the question of how to shoot wide angle with Open Gate.

## Are the Lens Illumination Guide images computer generated?

No, we actually shot all those lenses on an ALEXA with Open Gate in front of an integrating sphere with a grey chart. We have most ARRI lenses in there already, but the guys are still shooting, so we will add more lenses as time goes by. I think the UWZ is next in line. You can see the result right there on the screen or save the image as a JPEG file.



## Nice. Lets get back to the SXT. What did you mean when you said there's better image quality on the ALEXA SXT?

Well, we have completely re-written the image processing chain and changed the architecture, which includes a lot of small image quality improvements. There's a new pixel correction algorithm originally developed for the ALEXA 65. That helps. Then we inherited the noise reduction from the Amira. Personally, I have never been a big fan of noise reduction in-camera, as it can create artifacts that can be difficult or impossible to remove in post. But this noise reduction is very mild, nothing too crazy, and looks really nice and clean. Of course, it is off by default and you can turn it on if you want to. In sum, all that adds up so you get a better picture out of the camera.

## The color management has also changed?

Yes, just like Amira and ALEXA Mini, we have a new look file that includes the ASC CDL (Color Decision List) and a 3D Look-Up Table. Those can be applied individually or together to any of the monitoring outputs or to the recorded ProRes file. We are now changing some of the tools so they will be the same tools for the ALEXA SXT, ALEXA Mini and Amira. In addition we can also output Rec 2020 gamma, which has a very wide color gamut. We know there are some Rec 2020 monitors in the works and when they are here, the ALEXA SXT will be ready for them.

# Marc Shipman-Mueller on ALEXA SXT



## You also mentioned three HD-SDI outputs?

Now that we have this powerful engine in the SXT cameras, we can do three fully-independent HD-SDI outputs. DITs really depend on independent outputs. With the ALEXA SXT, on a typical feature or TV series set, you can send a clean Log C image to the DIT who does a preview grading to show the director what the image will look like. At the same time you can send a clean Rec 709 image to the dolly grip and the monitor right next to the camera, and a Rec 709 image with status information overlays to the camera's on-board monitor. And any of those can also have the ASC CDL and/or 3D LUT applied, or alternatively be in Rec 2020. This is a really powerful in-camera setup that provides a lot of options for the DITs.

## I noticed that you're offering an SXR Module upgrade for owners of existing XT's.

That's correct. We feel it is important to offer an upgrade path in order to protect our customer's investment. Anybody who owns an ALEXA XT, except the XT M, can get the SXR Module upgrade, and we are planning on pricing it in the same vicinity as the XR Module upgrade.

## What is the difference between a new SXT camera and an XT camera with the SXR Module upgrade?

At this point in time they will have the same features. However, there are always new things we're working on. And when we build a brand new SXT camera, we can already put provisions in there to prepare for future features. Doing that for an SXR Module upgrade would be cost prohibitive.

## I read that ALEXA XT cameras since January this year can get the full SXT upgrade for free.

It is our philosophy to make sure that our customers have a functioning business model, so we try to make sure that those who

recently bought a camera are not left in the dust. Anybody who bought an ALEXA XT camera starting January 1, 2015, or who will buy one until we're starting to ship the SXT cameras, will get a full SXT upgrade for free. That's the complete SXT camera, the whole shebang, the full ALEXA SXT with all the upgrade options that will come later. That's a great deal because the SXT is going to be slightly more expensive than the XT.

So if you buy an XT now you can actually earn some money with it and then you get a free SXT for actually less money than what you would pay if you buy an SXT once it comes out. However, this does not include the XT M.

## Now I have to ask some tough questions. Why do you not offer this full SXT upgrade for free for XT cameras before January 2015?

First off, those who had bought a camera a while ago, they've already had the ability to make some money with the camera. Second, we also have to make some money to finance all that development, so we can't extend an offer like that forever into the past. There has got to be a cut-off point that makes financial sense for our customers and for us, it is a precarious balance we are trying to achieve there. And third, we still have the SXR upgrade available to all XT cameras ever sold.

## Why is the XT M excluded from all this?

Well, now that we have the ALEXA Mini, it fulfills most features of the ALEXA XT M, and the effort to create an ALEXA SXT M would bear no relation to the number of customers who would still buy it.

## A last difficult question: the ALEXA ALEV 3 sensor is probably five or six years old by now. Isn't it getting past its prime in terms of Moore's Law, even for image sensor technology?

First, I have strong doubts that Moore's Law is applicable to sensor design. And second, the photosite design of the ALEV 3 is unique and really brilliant. That design gives you the great dynamic range and the highlight handling that the ALEXA has, it gives you the sensitivity, the low-noise floor and the beautiful skin tones. The sensor design, combined with the ever-improving processing chain, has stood the test of time. So far I have not seen any camera that surpasses ALEXA.

Of course, we are working on a new sensor; we are a camera manufacturer. However, we're only going to release it in a product if we can achieve a better overall image quality than in the ALEXA. And that is not an easy task for anyone.

We feel the ALEXA SXT is a great camera with many new options and future-proof images for high end professional productions.

**Chart 1: ALEXA SXT 4K Recording and Distribution Formats**

Sensor Mode	Recording format	Photosites on sensor	Up-sample factor	Pixels in recording format	Distribution format	Pixels in distribution format	ARRI Cameras
16:9	ProRes 4K UHD	3200 x 1800	1.2	3840 x 2160	4K UHD TV	3840 x 2160	ALEXA SXT, ALEXA Mini, Amira
Open Gate	ProRes 4K Cine	3414 x 2198	1.2	4096 x 2637	4K DCI	4096 x 2160	ALEXA SXT





ARRI ALEXA SXT  
with SXR Capture Drive

Like a long-running popular TV series, ARRI announced the latest evolution of the ALEXA sisters: ALEXA SXT (Super Xtended Technology). Same body, same sensor, upgraded hardware and software.

ALEXA SXT cameras offer ProRes 4K recording, improved image quality, color management and 3 fully independent HD-SDI outputs. SXT cameras will record ProRes 4K UHD (3840 x 2160 pixels) and ProRes 4K Cine (4096 x 2637 pixels) with mild in-camera up-sampling. This is similar to what Amira does. The difference is that while Amira does ProRes 4K UHD (3840 x 2160 pixels) — SXT does both 4K UHD and 4K Cine.

ALEXA SXT cameras use the same 3.4K Alev III sensor of previous models. Increased performance comes from electronics developed for ALEXA 65 and Amira. The latest FPGA processors provide improved image quality, with faster processing, advanced pixel correction and optional noise reduction. New electronic boards enable faster and more powerful image processing—which is what makes the mild 1.2x in-camera up-sampling to 4K possible. Like their XT predecessors, ALEXA SXT cameras have Open Gate, 4:3 Anamorphic and Spherical modes, 16:9, and can record ARRIRAW or ProRes.

Look creation in the SXT has roots in the advanced color management system originally developed for Amira. A new type of look file, the ALF-2 (ARRI Look File 2), contains an ASC CDL (Color Decision List) as well as a 3D LUT (Look-Up Table). The new color management engine can easily match the look of current ALEXA cameras, but also offers new, customizable looks. Previewing looks on set is improved, including the option to use the wide color gamut of Rec. 2020 gamma. ALF-2 files and the tools that create them are compatible between ALEXA SXT, ALEXA Mini and Amira.

ALEXA SXT cameras have 3 fully independent HD-SDI outputs. For example, a Log C image can be fed to the director's monitor for a pristine image with live grading, while a clean Rec 709 image can go to video village, and a Rec 709 image with information overlays can be displayed on the camera's on-board monitor.

The first ALEXA SXT cameras are planned for release around mid-2015; the full range will comprise ALEXA SXT EV, SXT Plus and SXT Studio models, replacing current ALEXA XT cameras. (ALEXA Classic EV model will remain in the line-up).

## Codex on ALEXA SXT



SXT  
Media  
Bay

Adapters and  
cards, top to  
bottom:

CFast 2.0  
SxS PRO/PRO+  
XR  
SXR

Codex once again collaborated with ARRI on data and recording for the ALEXA SXT. The companies' engineering teams worked closely together to create a high-performance, integrated recording system as well as on-set, near-set, and after-set data management from camera through post, that is recognized as an industry standard.

ALEXA SXT cameras use a new revised Codex recording engine, similar to the system that is built into the new ALEXA 65. They use the latest SXR Capture Drives, which offer a staggering data rate of 20Gb/s. ALEXA SXT cameras have a new media bay, developed by Codex, that uses adapters for new SXR Capture Drives, existing XR Capture Drives, SxSPRO/PRO+ cards and CFast 2.0 cards.



Codex SXR  
Capture  
Drives



Codex S-Series  
with Codex  
Vault Platform  
and Review



ARRI ALEXA Mini SUP 4.0 enables internal ARRIRAW recording and 4:3 sensor modes for anamorphic production.

## 4:3 ProRes recording modes

After upgrading to SUP4.0, get an ALEXA Mini 4:3 License Key ([alshop.arri.de](http://alshop.arri.de)) that unlocks 3 new ProRes recording modes to access the full 4:3 sensor area and supports two anamorphic modes. All 4:3 modes offer SDI dual 1.5G or 3G outputs.

**ProRes 4:3 2.8K** is the highest 4:3 ProRes resolution. The full 4:3 sensor area (2880 x 2160) is used for anamorphic or spherical formats. It offers frame rates up to 50 fps and the choice of 2x anamorphic de-squeeze for the EVF and SDI monitoring outputs.

**ProRes 2.39:1 2K Anamorphic** captures the 2K 1.2:1 (2560 x 2145) anamorphic image and then desqueezes, scales and records it in camera to a 2.39:1 standard 2K format (2048 x 858). You don't have to crop or scale in post. The in-camera scaling reduces the data rate, so maximum fps is 120.

**ProRes 16:9 HD Anamorphic** also desqueezes and rescales in camera. In this mode, the .88:1 (1920 x 2160) anamorphic image is unsqueezed, scaled and recorded to a 16:9 (1920 x 1080) ratio. This is for cinematographers who like the look of anamorphic lenses but the exhibition format is 16:9 HD—without letterbox. Maximum fps is also 120.

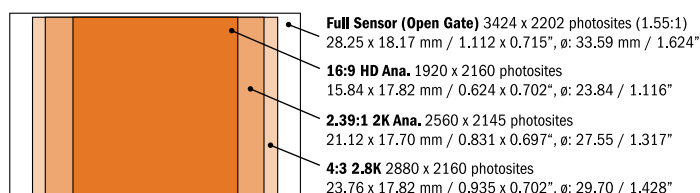
## Internal MXF/ARRIRAW recording

An ALEXA Mini ARRIRAW License Key and SUP 4.0 enables ARRIRAW recording to ALEXA Mini's in-camera CFast 2.0 cards.

**MXF/ARRIRAW 16:9 2.8K** records an area of 2880 x 1620 and supports frame rates up to 48 fps.

Files are wrapped in an MXF container. Like ARRIRAW, the new MXF/ARRIRAW format is uncompressed, unencrypted, and contains audio and metadata. Only the packing is different. ARRIRAW processing tools such as DaVinci Resolve and Baselight have to be updated with a new SDK, which ARRI has provided.

## Anamorphic Modes: ProRes and MXF/ARRIRAW



ARRIRAW Converter supports MXF/ARRIRAW from version 3.4, available at no of charge on the ARRI website.

MXF/ARRIRAW clips do not require specially formatted CFast 2.0 cards, so MXF/ARRIRAW and QuickTime/ProRes clips can be mixed on the same card.

## Internal MXF/ARRIRAW Open Gate recording

Installing both the ALEXA Mini 4:3 and the ARRIRAW License Keys on the camera activates MXF/ARRIRAW Open Gate 3.4K recording modes.

**MXF/ARRIRAW Open Gate 3.4K** (3424 x 2202) maximum recording speed is 30 fps. As with ProRes 4:3 recording modes, an optional 2x anamorphic desqueeze is available for all monitoring paths and dual 1.5G or 3G SDI output is supported.

With MXF/ARRIRAW, 3 additional Open Gate 3.4K recording modes are introduced:

**MXF/ARRIRAW 4:3 2.8K (Open Gate 3.4K)**

**MXF/ARRIRAW 2.39:1 2K Ana. (Open Gate 3.4K)**

**MXF/ARRIRAW 16:9 HD Ana. (Open Gate 3.4K)**

Recording is 3.4K Open Gate at up to 30 fps, but the monitoring paths reflect the corresponding 4:3 ProRes modes. The active image area is noted in the metadata, so postproduction tools can crop the images automatically. ARRIRAW Converter and other tools that support the new ARRIRAW SDK are able to override that information and return to the full Open Gate frame if required.

## Super 16 HD recording

**ProRes S16 HD** mode lets you shoot with Super 16mm lenses onto a 1600 x 900 sensor area that's scaled to HD 1920 x 1080.

## ECS and Lens Data Archive

Electronic Control System (ECS) support in the ALEXA Mini has been extended to include the Lens Data Archive, allowing custom lens files to be created and used.

## Transvideo StarliteHD5-ARRI

The touchscreen interface of the Transvideo StarliteHD5-ARRI monitor now has a more neutral look, new functions including record start/stop, access to the top 3 user buttons, and playback.

## Camera Control Panel CCP-1

The CCP-1 is essentially an MVF-1 viewfinder without the eyepiece. It provides full access to the menu along with a small monitor image. It can also be used in combination with the MVF-1 by daisy-chaining from the second EVF connector of the CCP-1.

## Additional SUP 4.0 Features

- Extended SDI metadata – SDI outputs now embedded with standard ARRI metadata.
- Wi-Fi toggle via user button – to quickly enable and disable the Wi-Fi interface.
- Selectable viewfinder zoom position – adjustable via the LCD panel buttons.
- Longer exposure times – no restrictions on exposure times longer than 1/24 s.





ALEXA SXT Plus

ARRI announced ALEXA SXT cameras before NAB last year. Marc Shipman-Mueller, Product Manager for Camera Systems, flew in from Germany to go over this product update. He said, “ALEXA SXT cameras feature new components that include electronics and image processing from the ALEXA 65, as well as color management and noise reduction from the AMIRA. They share the same qualities as previous ALEXA cameras, but offer far more versatile recording and monitoring options, and improved look management.”

## New ARRI Look Management

ARRI Look Management now includes the ARRI Look File 2 (ALF-2)—containing a 3D LUT, CDL values and a target color space. The new ARRI Color Tool is a free Mac utility that can import and export 3D LUTs in many formats and create ALF-2 files.

Therefore, an ALEXA SXT can replace a LUT box on set and the same look is available for reference throughout post-production. Live on set grading is supported by Pomfort LiveGrade and Codex Live, with more to come. The ALF-2 look file is stored in ARRIRAW and ProRes metadata, so dailies and editing files can be generated automatically with the look applied. The same look files and tools are shared by ALEXA SXT, ALEXA Mini (SUP 4.0) and AMIRA (SUP 4.0).

ALEXA SXT has 4 independent monitoring outputs, each with independent settings of image processing, surround view, status info, peaking, false color and color space. These can satisfy the different requirements while filming. For example, the camera operator can see framelines, surround view and status information in the EVF. The AC may want all that and LDS lens data on a Rec 709 monitor. The DIT can get a clean Log C feed. And the Director can watch a Rec 2020 view with custom look.

ALEXA SXT allows an independent Rec 709 or Rec 2020 setting for each MON OUT connection. And while ALEXA recording has been High Dynamic Range (HDR) since June 2010, the ALEXA SXT is now prepared for HDR monitoring on set.

## Single speed mode

No need to switch from regular to high speed mode. All speeds are directly available from a single menu.

## New media bay and drives

ALEXA SXT cameras have a new media bay side panel that can accommodate four different recording media with their respective adapters: SXR Capture Drives and XR Capture Drives, SxS PRO and SxS PRO+ cards, and CFast 2.0 cards. The new SXR

Capture Drives fit ALEXA SXT, ALEXA SXR and ALEXA 65 cameras. They have a maximum write speed of 20 Gb/s to handle maximum frame rates up to 120 fps with full image quality. 1 TB and 2 TB capacities enable longer recording times.

## New recording formats

ALEXA SXT cameras now have 14 recording formats; 6 are new. For the first time, all sensor modes are available in both ProRes and ARRIRAW. ProRes offers high image quality in compressed files that are smaller, immediately viewable on a Mac and easy to manage in post. ARRIRAW provides uncompressed, higher quality images, with the greatest flexibility for color grading, visual effects and long-term archiving.

## In-camera ProRes recording

16:9 ProRes 4K UHD 3840 is for TV productions.

Open Gate ProRes 4K Cine is designed for 4K DCI cinema and includes extra headroom for VFX markers or repositioning in post.

Open Gate ProRes 3.4K has a lower data rate, combining the economy of ProRes with the resolution advantages of Open Gate, including padding or up-sampling if required.

6:5 ProRes (both 2K Anamorphic and 4K Cine 4096 Anamorphic) provide economical routes for shooting with anamorphic lenses. The camera creates a ready-to-view ProRes image in the 2K or 4K DCI delivery format, with no debayer, cropping, re-scaling or de-squeezing needed in post.

## In-camera ARRIRAW recording

16:9 ARRIRAW 3.2K covers the image circle of most ARRI Super 35 PL mount lenses (31.5 mm diagonal) at speeds to 120 fps. The data load is less than 4K, but there's enough resolution for padding or up-sampling if required.

## Summary of All SXT Recording Formats (SXT SUP 1.0) (new recording formats shown in red)

Sensor Mode	Recording File Type	Recording Resolution
16:9	ProRes	HD
		2K
		3.2K
		4K UHD
	ARRIRAW	2.8K
		3.2K
6:5	ProRes	2K Anamorphic
		4K Cine Anamorphic
	ARRIRAW	2.6K
4:3	ProRes	2.8K
	ARRIRAW	2.8K
Open Gate	ProRes	3.4K
		4K Cine
	ARRIRAW	3.4K



ARRI expects to begin upgrades from ALEXA XT to SXT cameras soon. There will be a bevy of upgrade paths, too numerous to list here. Existing XT owners should check with ARRI. The big deal is that all upgrades will be SXT. There will not be an SXR upgrade (which was mainly a new Capture Drive module).

ALEXA SXT cameras replace ALEXA XT. There will be 3 models: ALEXA SXT EV (Entry Version-EVF), SXT Plus (wireless control-EVF) and SXT Studio (wireless control-optical finder).

ALEXA SXT cameras benefit from electronics and image processing from the ALEXA 65, color management and noise reduction from the Amira, more recording and monitoring options, and improved look management.

ARRI Look Management now includes ARRI Look File 2 (ALF-2) and ALF-2 HDR. A Look File accompanies the image file as meta-data including the target color space (for example, Rec 709, Rec 2020 or P3 DCI) and any 3D LUT or ASC CDL values that were applied to transform the ALEXA's Wide Gamut/ Log C (AWG/ Log C) native values into the display's color space. A Look File travels from pre-production, to production, and through post to help communicate the envisioned look of the shot. So, an ALEXA SXT on set can essentially replace a LUT box and the same look will be available for reference throughout the show.

ALEXA SXT has 4 independent monitoring outputs, each with independent settings for image processing, surround view, status info, peaking, false color and color space. More on this, next page.

SXT cameras accept many recording media: Codex SXR and XR Capture Drives, SxS PRO and SxS PRO+ cards, and CFast 2.0 cards.

There are now 14 recording formats; 6 are new. All sensor modes are available in both ProRes and ARRIRAW. ProRes offers high image quality in compressed files that are smaller, immediately viewable on a Mac and easy to manage in post. ARRIRAW provides uncompressed, higher quality images, with the greatest flexibility for color grading, visual effects and long-term archiving.

In-camera ProRes recording includes 16:9 ProRes 4K UHD 3840 for TV productions, Open Gate ProRes 4K Cine for 4K DCI cinema, and 6:5 ProRes (both 2K Anamorphic and 4K Cine 4096 Anamorphic) for economical anamorphic productions.

In-camera ARRIRAW recording includes 16:9 3.2K which covers the image diagonal of most Super 35 PL mount lenses (31.5 mm) at speeds to 120 fps. ARRIRAW Open Gate 3.4K provides the highest level of resolution, with an image diagonal of 33.5mm. Because not all S35 lenses cover 33.5mm diagonal—ARRI has a helpful online Lens Illumination Guide that shows amount of coverage, shading or vignetting.





# Sep 2016: ALEXA SXT Independent Monitoring Outputs

ALEXA SXT has 4 independent monitoring outputs.

EVF: The camera operator will probably like to see frame lines, surround view and status information in the electronic viewfinder.



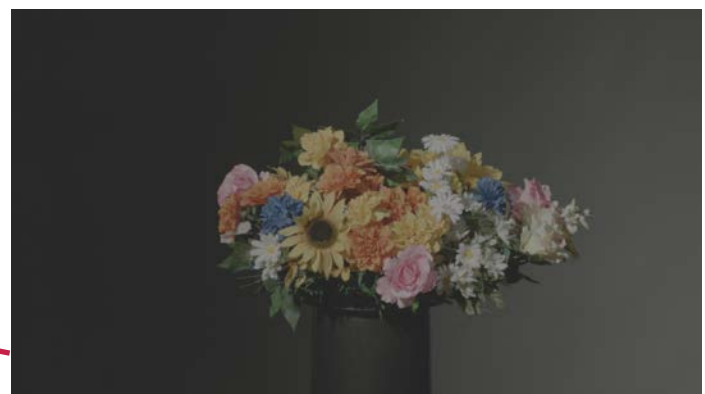
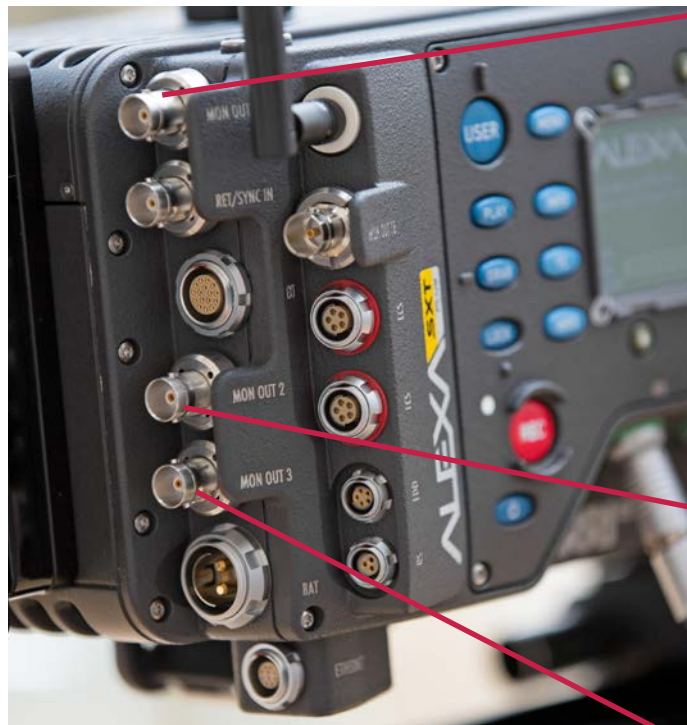
EVF: Camera Operator's EVF display

The three HD-SDI Monitor Outputs at the back of the camera provide Rec.709 or Rec.2020 video.

MON OUT 1: The camera assistant most likely will be viewing the live feed with frame lines, surround view, status information, LDS lens data, and peaking to emphasise focus.



MON OUT 1: Camera Assistant's Monitor



MON OUT 2: DIT's Grading Monitor, toggling between clean LOG C and real-time grading of the scene

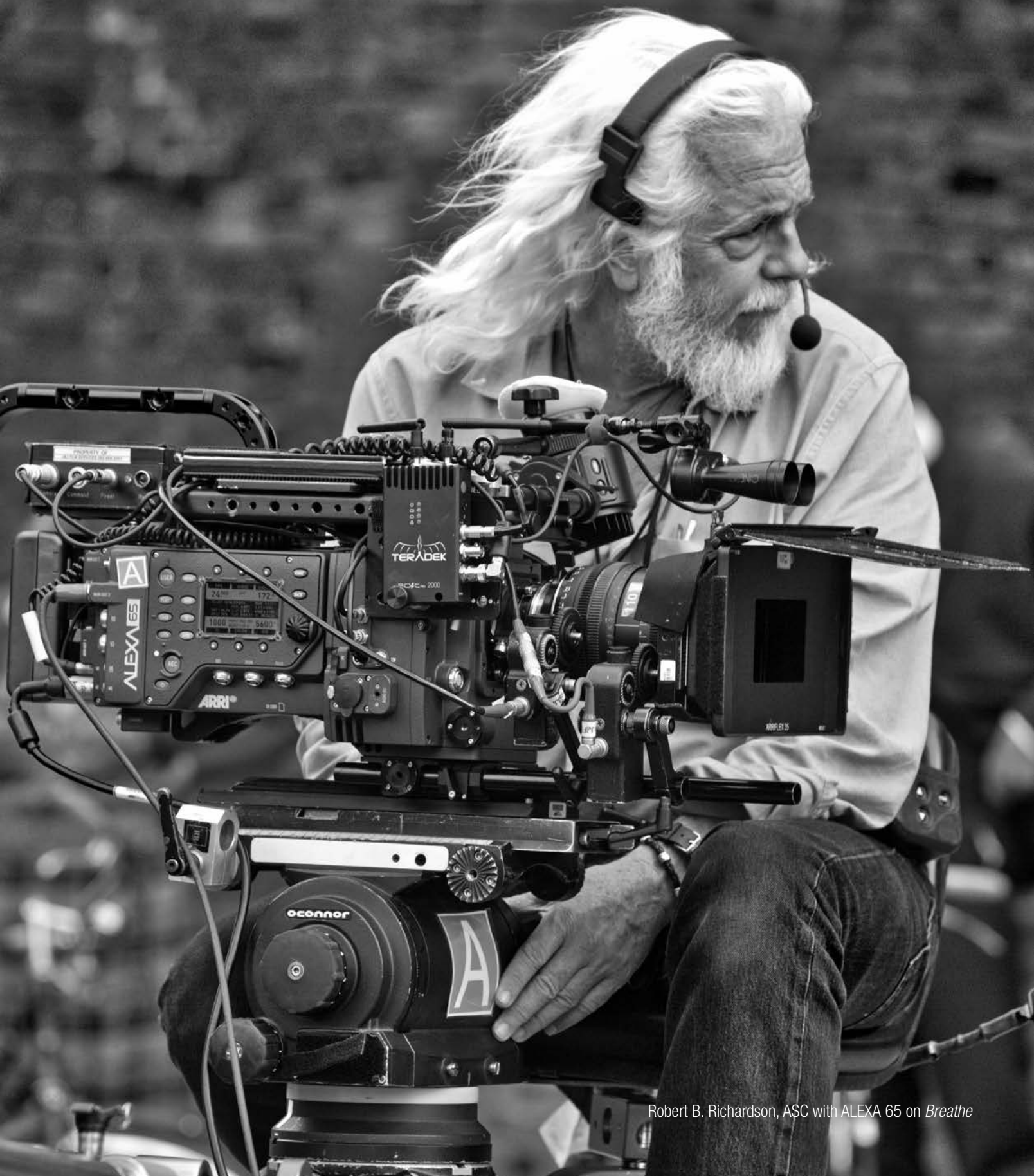
MON OUT 2: A clean Log C image can go to the DIT for preview grading with the Cinematographer. ASC CDL and/or 3D LUTs can be applied. These in-camera options provide many choices for DITs.

MON OUT 3: The Director can watch a Rec 2020 monitor with frame-lines and the "Show LUT" applied.

ALEXA has been recording High Dynamic Range (HDR) since June 2010, and now the ALEXA SXT is prepared for HDR monitoring on set.



MON OUT 3: Director's monitor with framelines and Show LUT



Robert B. Richardson, ASC with ALEXA 65 on *Breathe*





ARRI Rental launched ALEXA 65 at Cinec in September 2014 and at Camerimage in November 2014.

Within the next 25 months, ALEXA 65 has been used on more 65mm productions than were shot on film in the previous 25 years. That may not account for military films and unaccountable films in the East. "It's a sobering thought when you consider that, during the concept phase of the ALEXA 65 system back in 2014, we assumed that the camera would be used mainly for special sequences and VFX work," said Neil Fanthom, Director of Technology at ARRI Rental.

Now, isn't that archetypal ARRI? When the original ALEXA 35mm digital camera was announced at IBC in September 2009 (7 years ago), it was another golly aw-shucks modesty moment. ALEXA was positioned at the time, in the august words of FDTimes, "for HD television, commercials and a few features. (*note the 'few'*) ARRI feels that uncompromised and uncompressed 4K resolution will remain in the domain of 35mm film for some time to come." (*Ahem, eat words.*) That humble camera for "a few features" went on to become one of the most successful digital cine cameras of all time, capturing 80% of major motion picture production recently.

In the beginning, ALEXA 65 followed a similar path. Robert Elswit, ASC and Pete Romano, ASC used the ALEXA 65 for the underwater sequence on "Mission: Impossible 5," Emmanuel Lubezki, ASC, AMC used it on parts of "The Revenant," and Anthony Dod Mantle ASC, BSC, DFF used it on sequences of "Snowden."

Word got out quickly that the camera was indeed lighter, smaller, flexible, rugged, and actually very well suited for entire feature productions. It even proved to be economical and appealing to producers. The skills of a soothsayer were not required to predict the appeal. After all, a prominent rental house owner once famously said, "Give a cinematographer a larger canvas and they will want to fill it up." This isn't new. A visit to the "Machines of Cinema" exhibit at the Cinémathèque in Paris shows a 65mm camera from 1896, two years after the birth of 35mm, quickly followed by 68mm, 58mm and a Lumière 75mm camera in 1899.

The first production shot entirely with ALEXA 65 was "The Great Wall" in spring 2015. Cinematographer Stuart Dryburgh ASC, NZCS used four ALEXA 65 cameras.

What's the appeal of the 65mm format? Robert Richardson, ASC explained, "I shot two back-to-back films on the ALEXA 65. 'Live by Night' used Panavision lenses and then on 'Breathe' I used ARRI Rental lenses. Why the ALEXA 65? It has, by far, the best image I have found in digital. The speed of the camera is not as advertised. It is vastly higher. I rate it at 2000 rather than 1000. It has gorgeous color. Yes, lenses matter: they are the one element one must be careful with. Neil and ARRI Rental gave me a stunning selection of lenses. Panavision also did. But what matters here is the body. The ALEXA 65 is without doubt the most subtle camera I have worked with in the digital world."

Which brings us to lenses that matter. All the early ALEXA 65 productions were shot with ARRI Prime 65 and Vintage 765 lenses.

Prime 65 lenses began life as Hasselblad HC lenses made by Fujinon for the Hasselblad H5D (image circle 61.9 mm and larger). They have the new ALEXA 65 XPL mount (72 mm diameter, 60 mm flange focal depth). ARRI Rental and IB/E Optics completely stripped the original lenses and only used the optical elements inside. All the mechanical parts, barrel, cams, and rings were custom built. Focus is managed by a smooth cam mechanism. As Manfred Jahn, ARRI Rental's project leader on the lenses said, "They feel as smooth as Master Primes."

In addition to the Prime 65 series, 11 Vintage 765 lenses are available for the ALEXA 65. These are updated Hasselblad/ZEISS/ARRI lenses with a Maxi PL mount, originally built for the Arriflex 765. Familiar to Hasselblad users as V-series (or 500 series) lenses, they cover the analog medium format size of 56 x 56 mm (aka 6 x 6 cm or 2 1/4" x 2 1/4"). The image circle is a whopping 79 mm.

Flange focal depth of the original Arriflex 765 camera with Maxi PL mount was 73.5 mm. The Vintage 765 lenses can be used on an ALEXA 65 with a Maxi PL to XPL adapter, which mechanically extends the ALEXA 65 XPL mount's 60 mm flange depth to the Arriflex 765 flange depth of 73.5 mm.

## Nov 2016: ARRI Camera Manufacturing Update



It's been a year since the last visit to ARRI's camera manufacturing and assembly facility on Türkenstrasse in Munich. A few things have changed.

On the last visit, Managing Director of ARRI Cine Technik Walter Trauninger—famous for fast cars and need of speed—was the proud owner of a powerful new bike. This time, Walter was on a bicycle, riding fast, saying something about the motorcycle having been totalled or in the shop.

Now, ARRI's manufacturing area is running full tilt in several shifts. ALEXA cameras are flying off the shelves. Forty new ALEXA 65 cameras are in the works. ALEXA SXT cameras are being put together at a prodigious pace and shipping. ALEXA Minis are on benches everywhere, along with AMIRAs.

The space occupied for so many years by ARRI's film lab is now being renovated to become a new center for the ever-expanding R&D team.



May 2015: David Bermbach, ALEXA Mini Project Manager; Christian Hartl, Head of Camera Assembly; Walter Trauninger, Managing Director of ARRI Camera Systems, with his new motorbike; Martin Höcht, Head of Procurement; Michael Jonas, ALEXA Mini Product Manager.





# Nov 2016: ARRI Camera Manufacturing



Jörg Pohlman viewing 3D image with an ARRISCOPE medical camera



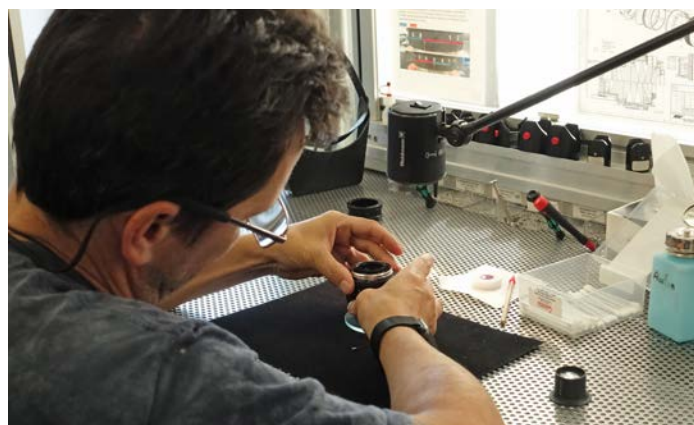
Christian Hartl, Head of Camera Assembly and Andreas Weeber



ARRISCOPE Cameras



ALEXA Minis



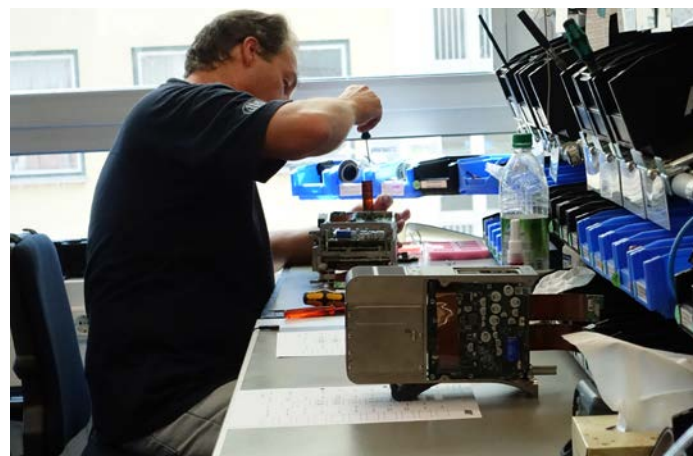
Eyepiece assembly



ALEXA SXT



Cooling fins inside ALEXA SXT



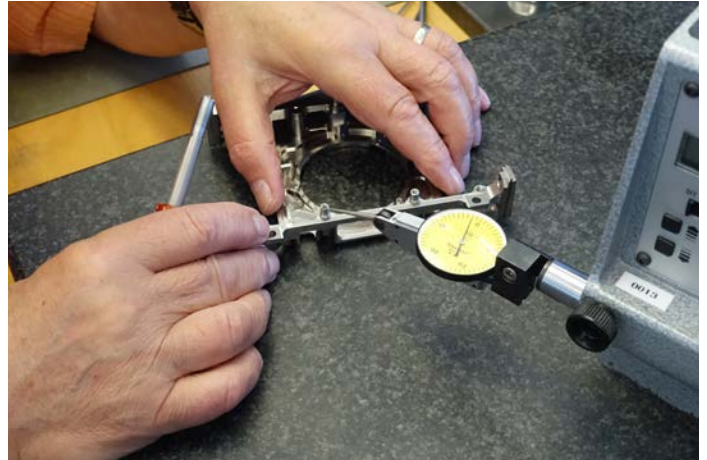
ALEXA SXT



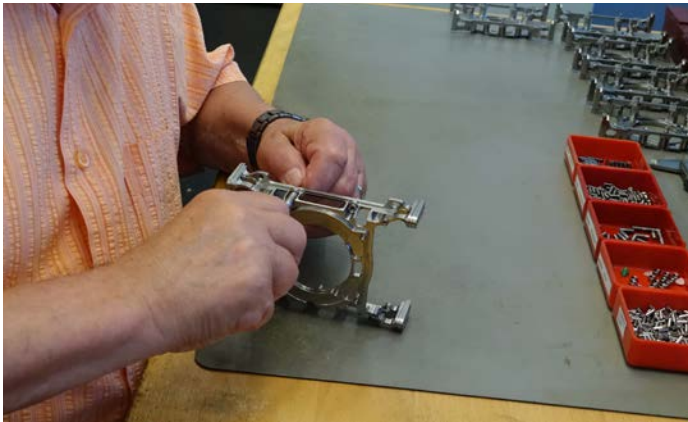
## Nov 2016: Camera Manufacturing



Preparing SXT camera left side media drive doors



Measuring lens mount carrier



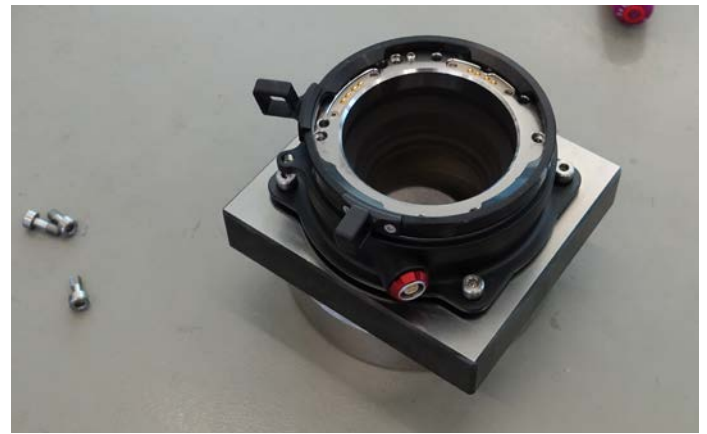
Lens mount carrier



Preparing lens mounts



Fitting mounts to AMIRA cameras



PL mount for AMIRA and MINI cameras with LDS and /i data contacts



Rear connection panel



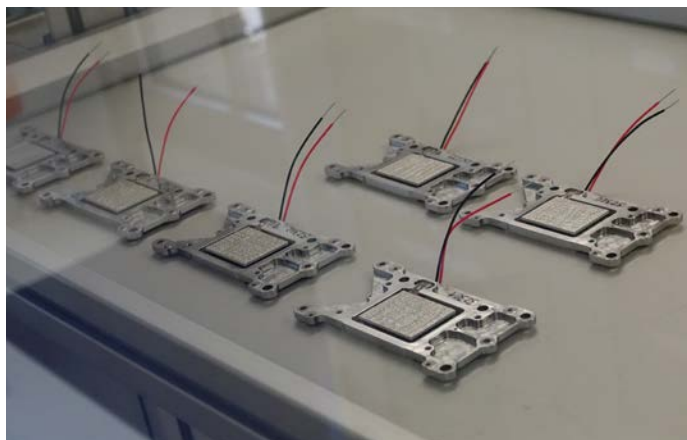
Loading software



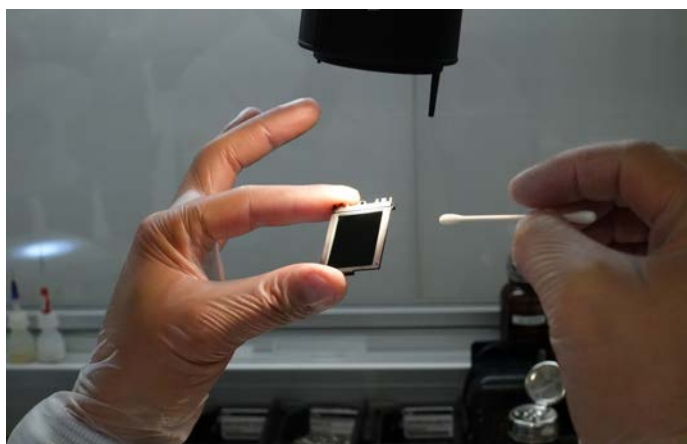
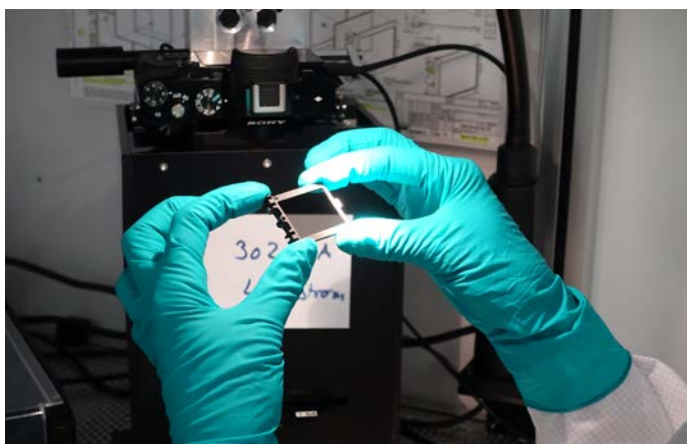
## Nov 2016: Clean Room



ARRI ALEV 3 sensors are prepared



Sensors mounted on carriers



Cleaning individual behind-the-lens ND filters for AMIRA and MINI



Completed ALEXA Mini and AMIRA motorized ND assembly

## April 2017: ARRI ALEXA SXT W



W as in Wireless. ALEXA SXT W is totally wireless. Wireless Video, WiFi and wireless camera/lens control are all built in.

ARRI has integrated a high-quality, low-latency (no delay) HD video transmitter and a WiFi radio into the new ALEXA SXT W model. Having a video transmitter built in makes the camera smaller, lighter and less cluttered than having an external transmitter. Fewer cables is nice because how many times have you rummaged through equipment cases looking for the essential one that you just cannot find? Camera setup can now be quicker, and the AD might even thank you for saving precious production time.

Product Manager Marc Shipman-Mueller explains, “ARRI’s new WVS Wireless Video System transmits uncompressed HD up to 600 m with no delay (< 1ms). The signal includes audio, timecode and Record Start/Stop flags. Up to four ARRI receivers can be used per transmitter.

“The second set of antennas on ALEXA SXT W is for the integrated WiFi radio. It can be used for wireless color management on set, wireless camera remote control using the ALEXA Web Remote, and other interesting apps available now or in development.

“The fifth antenna is dedicated to ARRI’s Electronic Control System (ECS) for WCU-4 wireless lens, focus, iris, zoom and camera control.”

Interference between different radio frequencies has often been a headache, heartburn or worse. The SXT W mitigates that worry.

ALEXA SXT W will replace all previous SXT models. Life gets simpler: there is only one version of SXT W. Existing ALEXA SXT EV and SXT Plus owners can upgrade.

SXT W will be accompanied by software upgrade SXT SUP 2.0, which adds improved HDR monitoring, support for current SxS PRO+ and CFast 2.0 cards, quicker frame grabs, various WCU-4 and lens motor features, and other refinements.







ALEXA Mini Software Upgrade SUP 5 involves an intoxicating inventory of interesting ideas.

By far the most fun and creative feature is the huge library of beautiful, predefined looks for ARRI cameras with advanced look management. ARRI Look Library will be available for all ALEXA Mini and AMIRA coming soon. *See below and next page.*

The team at ARRI must have had a rollicking good time this winter coming up with descriptive names to fit the looks. There are seasons, film emulations, locations (city, suburban), vintage decades from the 20s through the 90s, fashion, beauty, bleach bypass, cross processed, and video. There are 87 looks within each of three scenes: a pretty model, Honda car, and Hollywood and Vine in front of Katsuya Restaurant.

The new ARRI Look Library basically brings pre-visualization and post production grading into the camera itself—with many of the permutations previously enjoyed by variables in motion picture film stocks and labs. Looks can be licensed for a modest fee and are included in ALEXA Mini cameras coming soon.

Additional SUP5 upgrades include:

- 1.3x anamorphic de-squeeze in EVF and SDI outs.
- Camera Access Protocol: control camera and look via Ethernet and WiFi, for example with Pomfort LiveGrade Air.
- WCU-4 controls for playback of camera, user setups.
- Playback and user setup for Starlite HD5-ARRI.
- Jam Sync: camera stays in sync with source up to 8 hours.

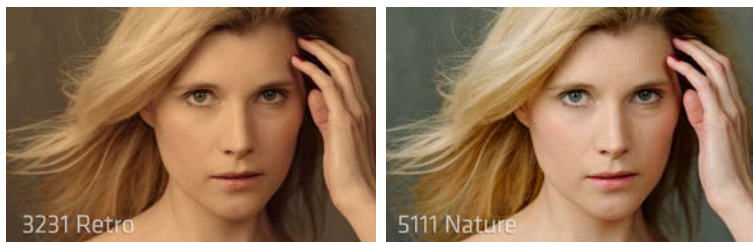
- Timecode clock is kept alive during off-speed scenes.
- Extended support for EF lenses: power for lens OIS stabilization; focus and iris control with ARRI Master Grips.
- Framegrabs while recording or during playback.

It has been only two years since ALEXA Mini was introduced at NAB 2015. Remember, it was originally intended as a B-camera, “a companion camera to the ALEXA.” Of course, DPs bristle when told what a piece of equipment is for or how to use it, and take great pleasure in subsequently using that equipment in ways it was never intended. So...ALEXA Minis have become wildly successful A-cameras of choice on many productions and are the darlings of DPs everywhere.

With this in mind, the clever crew at ARRI PCA have come up with a versatile Studio Set for ALEXA Mini. It enables swift shifts between configurations. The set of accessories adapts to a wide range of uses, on shoulder and tripod set-ups, rigs, stabilizers, on ARRI Trinity or Steadicam.

[arri.com/alexa\\_mini](http://arri.com/alexa_mini)

[arri.com/arrilooklibrary](http://arri.com/arrilooklibrary)





# ARRI Look Library

9210 Day for Night

6120 Cold

3250 Cross

4240 Tinted - Fire

4170 Tinted - Blue sky

3112 Film C

3150 Film process - Bleach bypass

9110 Dream

7121 High Contrast

2120 Fashion

6240 Winter

6210 Spring

5230 Saturated

3211 Vintage

6220 Summer

6230 Autumn

2130 Beauty

2111 Commercial

7130 High Key

6620 Snow

3210 Vintage

1110 Black and White

8120 20s

8130 30s

6410 Sunset

4110 Tinted - Desert

8140 40s

8150 50s

5121 City

3241 Faded

8160 60s

8170 70s

5130 Suburban

9210 Day for Night

8180 80s

8190 90s









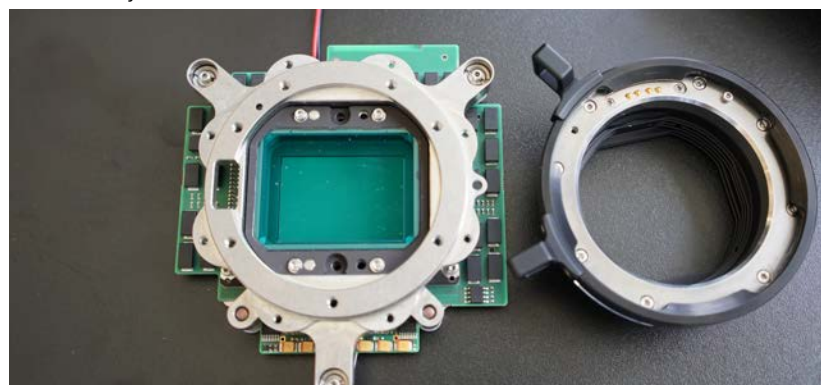
Mark Shipman-Mueller with ALEXA LF sensor



Thorsten Meywald with LPL Mount. Below: ALEXA LF sensor and LPL mount



Franz Kraus and Thorsten Meywald





## February 2018: ALEXA LF



February 2018 Cover, Issue 86

## ARRI ALEXA LF Camera System







Thousands attended ARRI 100th anniversary parties in Munich, Amsterdam, LA, and Asia this past September. But there was one guest who skipped the festivities. ARRI's rumored next big camera stayed home in Munich.

To paraphrase Orson Welles, "We will show no camera before its time." Maybe "it's" has an apostrophe, as in "...it is time." ARRI was adamant about introduction only if delivery was imminent. Now it is.

A new round of events ripple around the world as ARRI rolls out their new, Large Format system: ALEXA LF camera accompanied by astonishingly alluring Large Format ARRI Signature Primes. The premiere is at BSC Expo in London on Feb 2, followed by events in Paris, Beijing and Los Angeles.

ALEXA LF was a closely guarded secret. It didn't even have a name until a few weeks ago. A couple of demo units were on location in November, carefully camouflaged as ALEXA SXT W cameras.

A choice of new lens mounts made the NDA rounds in Hollywood and New York this summer. Surely you don't make a new mount as an exercise for your metal shop apprentices, I thought.

It was not until a visit to ARRI Austria that the whispers became louder at the end of September. There were new lenses on the workbenches with a new LDS-2 system inside. Surely you don't make new lenses with a new mount and data system without a new camera in the works.

Readers of the November FDTimes may have wondered why it arrived in January—hopelessly. Hopefully you enjoyed the factory tours in Vienna and Italy. But weren't the stories of Schnitzel and Sacher Tortes sounding suspicious and the fantasies of a Fiat 500 navigating mountain passes seem diversionary? Yes they were.

In the beginning of December, I was summoned to Munich under stricter vows of silence than a Cistercian to see the secret new

ALEXA LF and its system of Large Format lenses. What followed were two weeks of total immersion in Large Format technique and technology, factory tours, meetings with engineers, executives, designers and fabricators of a big new system.

What follows is an overview of the ALEXA LF Large Format System, with an inside view of how it's made, who makes it, what's inside and behind it, and how to use it.

As we'll hear from the engineers, this was probably the fastest design-to-delivery of any camera ever made by the company on Tuerkenstrasse in Munich. This has also been the fastest turnaround from non disclosure agreement to full disclosure article for a writer on York Avenue in New York.

My thanks to Joerg Pohlman, Franz Kraus, Stephan Schenk, Walter Trauninger, Marc Shipman-Mueller, Thorsten Meywald, Susanne Mayer, Frederic Merten, Thomas Feuchtmann, Henning Rädlein, Achim Oehler, Harald Brendel, Tamara Seybold, Matthias Pesch, Klemens Kehrer, Christoph Beckmerhagen, Andreas Moeller and at least 30 more people who patiently spent hours and days unveiling the mysteries of concept, design, manufacturing and testing.



16 Large Format ARRI Signature Prime Lenses



## ALEXA LF 2-Minute Pitch

- “LF” in the ALEXA LF name was derived from “Large Format” because it’s bigger than 36 x 24 mm Full Frame.
- The Large Format sensor is 36.70 x 25.54 mm, 44.71 Ø
- You can switch sensor modes quickly — no reboot needed.
- 3 Sensor Modes:
  - LF Open Gate full aperture 4448 x 3096, 36.70 x 25.54 mm, up to 90 fps.
  - LF 2.39:1 Full width spherical widescreen 4448 x 1856, 36.70 x 15.31 mm, up to 150 fps.
  - LF 16:9 4K UHD 3840 x 2160, 31.68 x 17.82 mm, up to 90 fps.
- Anamorphic desqueezing : 1.25x, 1.3x, 1.5x, 2x.
- Latest A2X revision of ALEXA ALEV 3 sensor has same 8.25 micron photosite size and familiar look.
- Same user interface as previous ALEXA cameras.
- New LPL (Large Positive Locking) lens mount. The flange focal depth is 44 mm. Inside Diameter is 62 mm.
- There was a mechanical reason for 44 mm FFD. That was the minimum distance to retrofit the new LPL mount onto Super35 ALEXA (except ALEXA Studio because of its spinning mirror), ALEXA Mini and AMIRA cameras.
- The LPL mount is available for ALEXA Classic, XT, SXT, SXT-W.
- LPL Mount for ALEXA Mini also fits AMIRA.
- I expect most rental houses will retrofit their mounts with LPL.
- All PL mount lenses will fit with ARRI’s PL-to-LPL adapter. You can continue to shoot S35 as if you were working with an ALEXA SXT—just crop the S35 image in post.
- Record ARRIRAW and ProRes internally. No external processing required.
- View the playback of ARRIRAW or ProRes on the EVF-1 viewfinder and via 3 independent Monitor OUTs.
- Record uncompressed ARRIRAW Large Format Open Gate 0.75 - 90 fps internally.
- Record uncompressed ARRIRAW Large Format spherical widescreen 2.39:1 0.75 - 150 fps internally.
- Record ProRes LF Open Gate 0.75 - 60 fps internally.
- Exposure Index : 800 EI.
- Exposure Latitude is greater than 14 stops from EI 160 to 3200. Lower noise at higher EI than previous cameras.
- Rule of 1.5x: ALEXA LF sensor is 1.5 times larger than ALEXA SXT. ALEXA 65 sensor is 1.5 times larger than ALEXA LF.
- Resolution follows similar 1.5x math, approximately:
  - ALEXA SXT W maximum resolution: 3424 x 2202
  - ALEXA LF maximum resolution: 4448 x 3096
  - ALEXA 65 maximum resolution: 6560 x 3102
- The 1.5x rule does not apply to ARRI Signature Prime Large Format lenses, which are amazingly smaller than Master Primes and about 2/3rd the weight.
- Built-in wireless video transmitter, WiFi, Wireless lens control.
- 4x Fischer 3-pin RS 24V DC accessory power connectors.
- 1x Fischer 2-pin 12 V DC accessory power connector.
- 2x 6G SDI and 1x 1.5G HD-SDI Monitor Outputs.
- Familiar ALEXA workflow: 16-bit linear internal image processing in full ALEXA Wide Gamut / Log C color space. Target output color spaces: Log C, Rec 709 or Rec 2020.

*In this ALEXA LF Report, “Large Format” and “Full Frame” are used pretty much interchangeably.*





ARRI ALEXA LF Camera  
and initial set of ARRI Signature Primes







## February 2018: ALEXA LF Camera Views



Camera Left (Operator Side)



Front



Camera Right



Rear



Top



Left Rear

# ALEXA LF Camera Views



Left Front



Right Front



Left Rear



Right Rear



Bottom



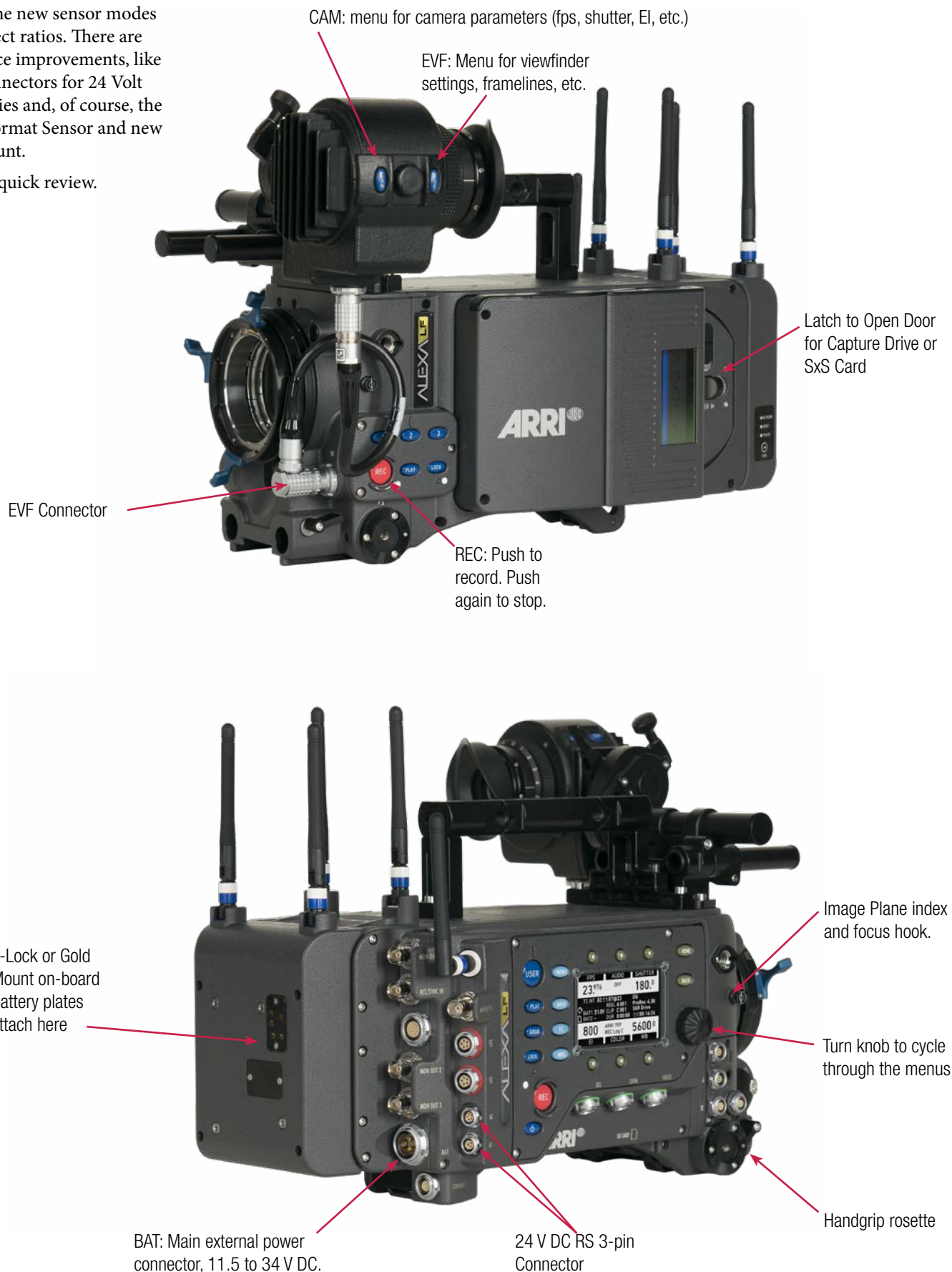
Media Bay



# February 2018: ALEXA LF 3-Minute Guide

It works pretty much like an ALEXA SXT W camera, so there's not much to learn except the new sensor modes and aspect ratios. There are some nice improvements, like 4 RS connectors for 24 Volt accessories and, of course, the Large Format Sensor and new LPL mount.

Here's a quick review.



# ALEXA LF 3-Minute Guide

USER: Displays a screen to access and assign user buttons on camera left (operator's side)

GRAB: Framegrab (during standby, record or playback) and store onto SD card

LOCK controls

REC: Push to record. Push again to stop.

Main Power Switch for Camera

24 V DC RS 3-pin Connector

12 V DC 2-pin Connector

MENU

HOME: up to top menu page

BACK: previous menu page



Handgrip rosette



# February 2018: Comparing ALEXA LF to ALEXA 65

ALEXA LF



Top ALEXA LF



Bottom ALEXA LF

ALEXA 65



Top ALEXA 65

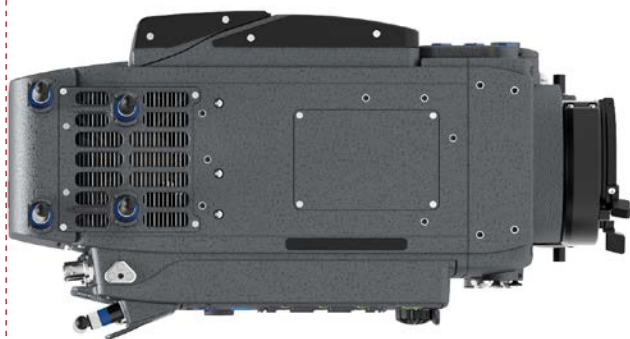


Bottom ALEXA 65



## ALEXA Top View Comparison

### ALEXA SXT W - Super35



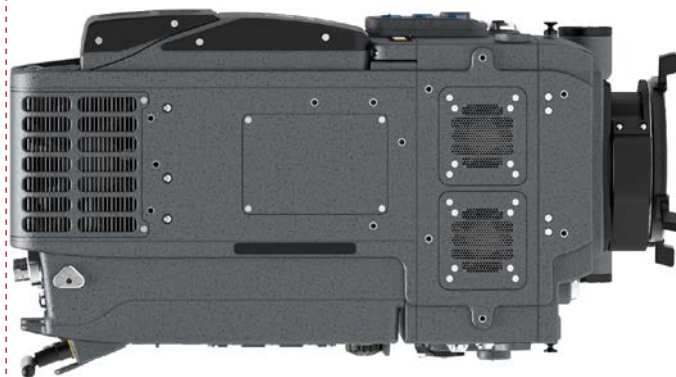
ALEXA SXT W body with PL mount  
length: 351 mm / 13.82"      width: 189 mm / 7.44"  
height: 158 mm / 6.22"      weight 7.4 kg / 16.3 lb

### ALEXA LF - Large Format



ALEXA LF body with LPL mount  
length: 364 mm / 14.33"      width: 201 mm / 7.91"  
height: 158 mm / 6.22"      weight: 7.8 kg / 17.2 lb

### ALEXA 65 - 65mm



ALEXA 65 body with XPL mount  
length: 388 mm / 15.28"      width: 208 mm / 8.20"  
height: 163 mm / 6.42"      weight: 9.3 kg / 20.5 lb

## Sensor Sizes and Mounts Compared



ALEXA SXT sensor: 28.17 x 18.13 mm, Ø 33.50 mm  
3424 x 2202 photosites. PL Mount 52 mm FFD, Ø 54 mm



ALEXA LF sensor: 36.70 x 25.54 mm, Ø 44.71 mm  
4448 x 3096 photosites. LPL Mount 44 mm FFD, Ø 62 mm



ALEXA 65 sensor: 54.12 mm x 25.58 mm, Ø 59.86 mm  
6560 x 3100 photosites. XPL Mount 60 mm FFD, Ø 72 mm





Stephan Schenk, Managing Director of ARRI Cine Technik and, together with Walter Trauninger, General Manager of Business Unit Camera Systems

**JON FAUER:** Please give us some background about developing the new ALEXA LF camera system.

**STEPHAN SCHENK:** There was an obvious gap. Cinematographers can use 65mm format ALEXA 65 camera systems as well as S35 camera systems like ALEXA SXT W, ALEXA Mini and AMIRA. While the ALEXA 65 is great for selected 65mm projects and film sequences, it's not an appealing option for a broader range of productions.

So, we needed to look into something that answered the clearly existing demand for larger format images but with smaller data footprint and slimmer workflow.

**From your point of view, who are the customers for the new ALEXA LF camera? And who will continue to buy ALEXA SXT W, Mini and so on?**

That's an interesting question. We have our preconceived ideas based on feedback we get from the market, as always. But what winds up happening is sometimes different.

**Let me guess. You're expecting ALEXA LF to be for enthusiasts of Large Format cinematography, and a year from now we will be talking about how it caught on at every level of production.**

Clearly, ALEXA LF is meant to be a camera for high-end applications. We have seen the high level of interest in larger format cameras on big budget feature films. And it's fair to say that the ALEXA 65 paved the way there.

But certainly, commercials will also endorse the wish for a larger format look. Feature films and commercials often travel together. And also, some high-end TV series might wish to differentiate their look. Nevertheless, we don't at all think that S35 will disappear.

**What about anamorphic?**

We see people using anamorphic not only on features but also on commercials and TV series. When I started, people were not even thinking about shooting anamorphic for TV. Now you see it quite often. It's fair to say that cinematographers are always pushing the boundaries, the limits, always looking for new looks and new

ways to tell their stories. And the anamorphic look will remain an important tool in their toolset.

**How would you describe the look of the ALEXA LF Large Format camera system from where you sit?**

It is a new look, a different angle of view, a new perspective, with shallower depth of field. It definitely looks different. But we are launching not only a camera but also a new mount and an entire series of new Large Format lenses, the ARRI Signature Primes. Together with the ALEXA LF, the look is just stunning.

The lenses have a beautiful combination of gorgeous, velvety skin tones, nice bokeh, smooth out of focus areas, and straight lines stay straight. The name "Signature" is appropriate. Our designers put their signature on these lenses. But it is also up to cinematographers to lend their signatures to create the looks that move images from script to screen.

**Suppose you're a cinematographer in pre-production on a high-end feature and I'm the director. We're both talking about large format. How do we make the decision whether to go ALEXA 65 or ALEXA LF?**

Well, there are only 70 ALEXA 65 cameras out there. If I have the chance to get access to one of them, I would shoot a test comparing it to the ALEXA LF. And I would also test the Signature Primes and other Full Frame lenses. No project is the same and different stories need different tools. Also, productions have different budgets. And, if budget and availability allows, it might also be ALEXA 65 and ALEXA LF.

**So, mixing and matching cameras is possible?**

Absolutely. The reason you can match between ARRI cameras is that they share the same color science and the sensors are based on the same architecture. Cinematographers can be confident that their ALEXA, ALEXA Mini, ALEXA 65, and AMIRA cameras will match with the ALEXA LF. Mixing the different cameras depending on the scene is happening more and more.

**I have some business questions. Imagine you're a parsimonious producer. You're trying to spare every expense. How does the DP talk you into using this new Large Format camera system on the next feature?**

It's a matter of production value. Many producers have realized, over the years, the benefits of using our camera systems. Yes, the ALEXA LF may be a bit more expensive in the beginning. Rental rates will be a little bit higher. But it pays for itself with reliability on set and production value in the end. If a camera system breaks down, the amount of time you spend on set to fix it is enormous.

The same thing in post: how long does it take you to get the skin tones right? You can correct a color. But skin tones are not so easy to fix. DPs should be able to convince producers just by showing and comparing the images that demonstrate more production value. However, that doesn't mean now, all of a sudden, everything needs to be larger format. As I said, every story is different and needs different tools.

**OK. Another economics question. Suppose you're the DP and I'm the hardened Hollywood producer on a TV series. You really want to use the new ALEXA LF because of the look. And I, the producer, say something like, "In two words, impossible."**



**I can get a regular ALEXA much cheaper at the rental house.” How do you talk me into going for the LF?**

I would say, “Do you want to do something different this time? Do we work the same way we have been doing things together in the past? Or do we want to create a different look for the series? Do we want to have a more cinematic, more high-end look? Or do we want to stay with what we have—which doesn’t mean it’s bad. But do we want to be different? Do we want to set ourselves a little bit apart from the look of others and create a higher production value?”

**You’ve convinced me. What is the roadmap for rolling out the ALEXA LF system?**

The launch events are in February. Shipping of the ALEXA LF cameras will start by the end of Q1. The ARRI Signature Prime lenses will start shipping in June. We’ll have an initial set of 4. By the end of 2018, the plan is to have 12 lenses. In 2019 the set will be completed with the 12 and 15mm wide angle lenses, the 95 and 280 mm tele lens.

**What about service?**

That’s an important part of our offering and I’m proud of our service organization. We have a global network of ARRI Certified Service Centers. They work on a 24/5 connected network. As you know, things inevitably seem to happen after-hours and in the middle of the night. But there are no after-hours at ARRI because we can follow the path of the sun around the world. So, if Germany or the UK is going to sleep, the Americans wake up and take over. Then the Asians are on call. And so on around the world.

**ALEXA LF introduces a new mount and a next generation lens data system, LDS-2. What are ARRI’s plans to make it available to other companies?**

To achieve the beautiful look of the Signature Prime lenses in combination with a compact and lightweight design we also needed a new mount, the LPL Mount. It is based on the concept of the PL mount, but larger and even improved in its ease of use. We will share the lens mount specifications with other manufacturers.

It would be presumptuous to think that cinematographers will use ARRI cameras only with ARRI Signature Prime lenses. That will never be the case. There are so many choices. So, we have to

make our mount available to others. There is a formal license. But it’s a minor cost intended to maintain consistent specs and quality. The same applies to LDS-2, our lens data system, which we further improved and will continue to develop.

**Luckily, a lot of lens manufacturers can stay with their existing PL mount, because ALEXA LF has a PL-to-LPL adapter.**

Exactly. We do care about the investment of our customers and all the PL lenses out there can be used with the PL-to-LPL adapter on ALEXA LF.

But equally, there will be an LPL mount for the ALEXA Classic, ALEXA Mini and AMIRA so that the Signature Prime lenses can be used on these cameras in combination with ALEXA LF. It’s a complete system.

**If I’m a rental house, does the ALEXA LF system make everything I have obsolete?**

Not at all, it is just the opposite. You have flexibility with this new camera to do what you have been doing. It increases your possibilities in particular because it’s the same sensor, only larger. It is backwards compatible with almost all previous lenses. It has the same pixels as the S35 ALEXA, the Mini, the AMIRA and even the 65. ALEXA 65 and ALEXA Mini are currently used together on many projects, so we see ALEXA LF also as a complimentary tool when shooting in 65mm or S35.

**And I assume most ALEXA accessories will fit?**

Yes, it really is a complete camera system and existing accessories will fit from the start.

1. The entire PCA range can be used. So, a rental house doesn’t need to buy a whole lot of accessories—because they already have them from the ALEXA ranges.
2. The entire ECS Electronic Control System, the Wireless Control Units and so on will work from day one with the camera.
3. ALEXA LF will also fit nicely on our Camera Stabilizer Systems like the Trinity Rig.

The entire ARRI camera ecosystem works hand in hand with the ALEXA LF and the Signature Prime lenses. Therefore, it is a new camera system that stays within the infrastructure of our product groups but also is compatible to other manufacturers’ products.



ALEXA LF on location in Thailand, mounted on a Trinity Rig, working with ARRI Wireless Control Unit. Story later in this issue.





Marc Shipman-Mueller (above, center, with ALEXA LF) is a Product Manager for Camera Systems at ARRI, with Susanne Mayer (Marketing) and Frederic Merten (Product Management).

**JON FAUER: Marc, what is your process of defining a new camera and what is the difference between a product manager and a project manager?**

MARC SHIPMAN-MUELLER: All through the year, we have meetings with management to determine our strategy, our road map. As Product Manager, I talk to cinematographers, rental houses, camera assistants, DITs, VFX Supervisors and other crew members. What are they doing? What can we do to make their jobs easier? How does it affect post production? Additionally, I keep an eye open for market and technology trends and keep in close contact with our Research and Development team regarding what is technologically possible.

With all that information in the back of my head, I then have to look into my crystal ball and define a new product that I think, 2 years from now and for the next 5 years after that, will be a useful tool and therefore a success. That's actually pretty scary, if you think about it. Luckily, we have built up our product management team, and we all work closely together and openly discuss our ideas and that really helps. Then I present the specifications to management, we make further changes, and when we have the rough outline of what we want I hand it over to Research and Development and say, "We should build this."

All along, we ask various other departments at ARRI for feedback, like the Digital Workflow Solution group and the Service team, to include what they have learned. Then we have lots of meetings with everyone in R&D, led by the Project Manager, during which we work out the fine details of the specifications. The Project Manager then supervises the logistics of actually developing the camera.

**You've been Product Manager on many cameras, including ALEXA, ARRICAM, 235. What do you do while it's being developed?**

I'm still here. There are always additional questions. What did I mean? Why do we do this? Often, there are various compromises. Should it be 7 millimeters higher or 14 millimeters longer? What's more important? I remember on the Arriflex 235 project, Michael Haubmann gave us a choice, "We can buy this chip to allow that function. But it's bigger. Or we buy another chip that's 2mm smaller, but then we don't have this function. What's more important?" Because of the research I have done earlier on how camera crews work, we can then make informed decisions. There are thousands of these choices—big and small—along the way. And each one of these little decisions shapes the camera to go a little more in the right direction, to be the right tool for the job.

When the time comes for the release, we look at what we have accomplished and what is the best way to communicate the camera's features to the market. Our Digital Workflow Solutions team starts working on arranging for test shoots and show reel material. I work closely with the marketing department on the presentations, the website, the press releases. That's very exciting and the rewarding culmination of a lot of work.

**Introducing a new camera system seems very much like the opening night of a movie for all of you.**

Yes. I will have butterflies in my stomach up to opening day in London on February 2. The first week after the announcement is also tense. Although I've introduced many new cameras, the nervousness always lingers for the next week. What do our customers think? Is our camera satisfactory? I know everything is fine if someone calls and says, "I've got this shoot and I need the new camera yesterday." The orders we get at the beginning are like the first weekend box-office.

**I think your phone will be ringing non-stop. When were the first inklings of this camera? What was the first spark?**

You know, there's this guy Jon Fauer who has written a lot about the looming of Large Format in a magazine called *Film and Digital Times* [laughs].

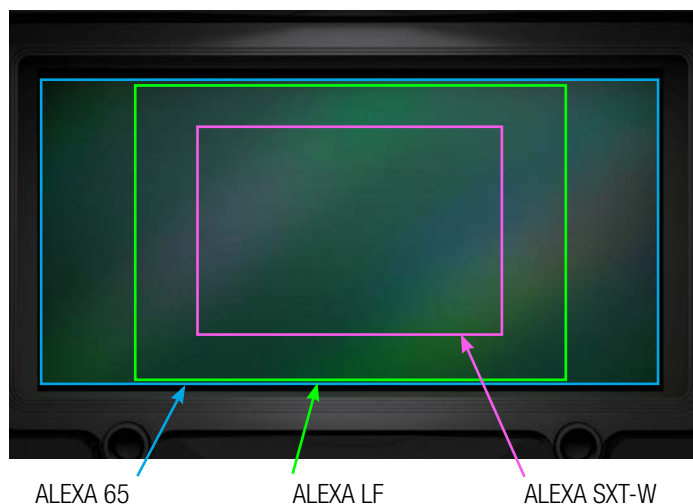
We also had an inkling that Large Format would be compelling. It was actually when work began on the ALEXA 65 sensor that the idea came up. Instead of making a sensor three times as large as Super35 for the ALEXA 65, what if we made it twice as large? Turns out, that is just a little bit bigger than Full Frame. From that concept came the next question: What kind of camera could we build around this sensor?

We looked at all the options and decided that it would be important to come to market really quickly, so the new camera and the new lenses could come out together, as a complete system. And that is one of the reasons the ALEXA LF is based on the existing ALEXA SXT W. The ALEXA SXT W is a processing power house, definitely able to support a large format sensor and the higher data rates involved.

**When you developed SXT W, did you know about the LF?**

We knew we could go in that direction because the SXT W is a derivative of the ALEXA 65. They share the same electronics. The electronics for the ALEXA 65 were designed in a way that they would also fit in a regular ALEXA.

What makes the 65 a little bigger is the extra cooling you need for the front end, for the sensor. But the innards, all the electronic



boards, have the ALEXA shape. And the ALEXA LF is only a little larger than the SXT W. So, the SXT W has the same, very powerful, electronics as the ALEXA 65. This allows us to do 3D LUTs, HDR monitoring, four fully independent monitoring outputs and all those other processor-intensive tasks.

**In terms of a timeline, when did you either get the green light, or give the green light, to do this camera?**

We started in 2016. It was one of the fastest developments we've ever done. It was approved and immediately went into full development.

**All kidding aside about FDTimes, what is it that appeals to you about the large format aesthetic?**

Working for a German engineering company, my natural instinct is to analyze the Large Format aesthetic, break it down into parameters and quantify it technically. I've tried that, but in the end, I don't think it's a useful exercise because it is the images that count. Our customers and cinematographers are in the business of making moving pictures. Pictures either move us or they don't. That is what is important.

I looked at the ALEXA LF images and I can see they are better. They're more pleasing. And other people like them better as well, including the cinematographers we've shown them to. I do have some observations. They're not yet complete. But here they are.

First, to get the same angle of view as in the Super35 format, you have to use longer focal length lenses (more telephoto). Given the same T-stop, that results in a shallower depth of field, providing greater visual separation between foreground and background. Which gives you a more cinematic look.

Second, using longer focal lengths results in a different and more natural perspective. It specifically makes faces look more pleasing, which is very important. It's no accident that portraits are often shot at 85 to 135mm.

**Except Roger Deakins...**

But for most mortals, you will be using these longer focal lengths that feel more natural to the way we see. And third, you have the benefit of less noise with a larger sensor. The noise per pixel is exactly the same. But because you have more pixels on the same

display, the noise actually appears smaller than the noise would be from a Super35 camera.

**Dr. Tamara Seybold and Harald Brendel in your Image Science Department showed me examples today and the explanation was what you just said: because of the larger sensor, the blow-up is less given the same display screen size.**

So, I think you get a better picture with greater separation between foreground and background, a more natural perspective and less noise. Of course, all these things play together along with many other parameters, including the critical choice of what lenses you use. But, really, I don't think we have to be all German about this. It simply looks better and everyone can see it.

**Is it exactly the same sensor as the other ALEXAs?**

The individual photo sites are exactly the same size, 8.25 microns. ALEXA LF uses the same sensor technology and the same color science as we have in the ALEXA, ALEXA 65, ALEXA Mini and AMIRA. Nevertheless, there has been an evolution. The original sensors were in the ALEXA. The next revision went into the AMIRA and the Minis. They were essentially the same but had a higher clock rate. That's why the Mini and the AMIRA can do 200 fps. That AMIRA/Mini revision was also the basis for the 65 sensor. And then the engineers said they could improve the 65 sensor even further. So, they made a new revision and that is what we have in the ALEXA LF.

**When you say a new revision, is that hardware or software?**

It's both. It is a different way of routing the signal through the sensor. It is a slightly different timing. We're improving each time. And, as anybody who manufactures a large sensor knows, it's also a question of yield. With the latest revision for the LF, these changes help us to get a better yield.

**Simulating a week of running shots with the camera mounted on a car that is continuously driving over cobblestones in the Arctic and the Amazon.**

**Is the ALEXA LF as tough in the field as regular ALEXAs?**

Our quality control department tests the living daylight out of our cameras. They run environmental tests at temperatures below minus 20 degrees Celsius to make sure the camera works at minus 20. Then it gets heated to plus 45. Next, they put each camera on a shaking machine. With electronics, anything that fails usually fails in the first week.

We're trying to simulate a week of running shots with the camera mounted on a car that is continuously driving over cobblestone in the Arctic and the Amazon. We do this with prototypes during development, and then manufacturing does the same thing with every camera that gets delivered.

**Last question—you're a DP in love with the new ARRI Signature Prime lenses. How do you describe them in combination with the new camera?**

ALEXA LF and ARRI Signature Prime lenses provide a painterly, organic, gentle, smooth and cinematic image. It's a new, complete camera system with a very different and very exciting look.





Klemens Kehrer, Head of R&D in Vienna and Project Manager for the ALEXA LF in Munich.

**JON FAUER: You worked on many other ARRI cameras before becoming Project Manager of the ALEXA LF?**

**KLEMENS KEHRER:** I was Project Manager on the Arriflex 235 and 416. And before that I participated on every camera project since the 765—when we still did the design drawings on paper.

**I also asked Marc Shipman-Mueller this question. What is the difference between a Product Manager and a Project Manager?**

Marc is the Product Manager. He decides what to build. As the Project Manager, I get it built. We should also mention the head of manufacturing and R&D. He gets the funding, makes sure that we get the resources, is responsible for assembly and gets it out the door. That's Walter Trauninger, who is also a Managing Director of the ARRI Business Unit Camera Systems.

**Take us through your work in developing the ALEXA LF.**

When I started, it was already cleared, and it had to get to market as quickly as possible. You could almost say that the first and most important thing we decided was what not to do. Anything that might slow things down was ruled out. The next step was to decide what was necessary, what was possible. That meant building on the platform of the ALEXA SXT W. We verified the things we wanted to change. Every new ALEXA has needed more power than the last one. Also, image processing increases with the size of the sensor. We had to improve the thermal management. The ALEXA, as you know, has a cooling system with heat pipes that go out to the back, where you have the radiator. We now have an additional cooling for the SXR Capture Drive because the data rate is so high. We used simulation software to optimize the thermal management system, which is one of the major issues of every camera.

Next, we checked that the sensor could do what it should. Then, the whole team worked on CAD drawings to develop PCB boards for the new sensor and the new sensor control board. We built prototypes as fast as we could. Next came prototype manufacturing, assembly and testing everything thoroughly to make sure the camera system was reliable. The deadline to build a camera in a little over a year was rather ambitious.

**Although you used parts from the ALEXA SXT W, there appear to be some major refinements.**

Exactly. We had to make the body longer and wider by about 12mm because of the heat the camera produces, to make room for the heat pipe for the capture drive and for the larger fan to get

enough air through the chimney in the rear. The main processing boards have been equipped with bigger FPGAs (Field Programmable Gate Arrays (the main processing units) because we now have twice the amount of data to process. The geometry of the sensor in relation to the lens mount can be adjusted from the outside of the camera, from the front, without having to open it up. That is quite an improvement for manufacturing.

**Take us through the design process of the lens mount.**

We had a very long discussions about several concepts. One was a radical change, but its reliability could not be predicted. The other, ultimately accepted, was a more traditional, but fool-proof, PL-style breech lock. We built both prototypes in parallel and then checked with a number of key customers what they thought about both versions. The designs were done at ARRI Austria in our R&D facility, supervised by Josef Handler, head of mechanical design and development.

**Was the 44mm flange focal depth determined by the camera or the lens design?**

It came from both sides. The new mount had to fit onto existing ALEXAs (except Studio). So, you couldn't go too far into the camera body. And it still had to accept all existing PL mount lenses with the PL-to-LPL adapter. Making the adapter was also a challenge because the distance from 44 to 52 mm is not much. We had to include LDS-2 contacts and LDS-1 backward compatibility. Normally an adapter would have the electronics built in. And you go through the same contacts. But as there was so little space, we were not able to fit any electronics into the adapter. Therefore, we had to have secondary contacts in the mount so the signal goes back into the camera where the electronics are.

**When you showed me the designs, why were there many variations of the front view?**

We worked hard to build light baffles. The reason was, when we put some third party lenses on the camera, we saw a lot of stray light bouncing around inside. This caused reflections, loss of contrast and milky shadows. We have a very clever guy here who did a lot of simulations and he came up with excellent ways to reduce stray light. It was a little challenging to get a sensor twice the size into a body that has exactly the same front dimensions as on the previous ALEXAs.

Speaking of the front end, there's another thing that readers of FDTimes might like. It's not the big buying decision, but it is an example of how we really listen to users. This is the first ALEXA where you can replace the RS connectors without having to remove the front housing and the delicate sensor assembly. As we all know, connectors eventually can break and a simple way to exchange them is a helpful thing.

**The R&D facilities are in Munich and Vienna, the cameras are built in Munich. You must spend a lot of time commuting?**

I travel back and forth all the time. It's not a problem. I keep a toothbrush in my backpack, always ready to go [laugh]. I even have my choice of offices here in Munich. I look at the list of who is out or on vacation, and that is the desk I occupy for the day. It's always interesting and I get to meet a lot of people in different departments. Actually, I don't sit at the desk for very long. When I'm here in Munich, I'm busy running around all day.



Dr. Achim Oehler is Project Manager Digital Cine Cameras at ARRI. He has been a force behind ARRI's evolution into the digital age and every ALEXA camera, from ARRISCAN to ALEXA 65 and now ALEXA LF.

**JON FAUER: The ALEXA LF has the latest revision of the ARRI ALEV sensor technology. What is different?**

ACHIM OEHLER: From the previous revision, the A3X, which is the ALEXA 65 sensor, we learned that it's not at all easy to design a large sensor. A large sensor inherently has long lines with certain properties – like slower signal propagation – that you have to respect. So, you have to implement certain circuits to speed it up. We improved this for some stages of the sensor. And we fixed many little details to further minimize cross talk, smear, fixed pattern and all those other evils of an image sensor. And it turned out that the resulting ALEXA LF sensor is quite nice.

**Which means less noise for this revision of the ALEV sensors?**

Noise is dominated by the pixel and the readout path in the end. For both, the noise-relevant structures are unchanged. So, the noise is more or less the same. But it's important not to add additional noise like fixed pattern noise or other types of non-random noise, and not to be artifact-limited.

**What is fixed pattern noise? Like a screen door effect?**

Something like that. You see fixed pattern noise when you move the camera and fine structures appear in fixed positions. It could be eliminated by calibration, but you don't have infinite amounts of bits per pixel for calibrating the sensor. You have to distribute your calibration resources, so that the image looks good in all cases. But there's always a residual. And that's normally called fixed pattern.

Another problem can be line noise. It's a horizontal noise pattern that can be generated on chip or by electromagnetic interference.

If these noise sources are eliminated, there is only the pixel and the readout path dominating the noise. So, when you're designing a sensor, you try to minimize the above mentioned noise sources and to achieve the best noise performance for the pixel and the readout path.

**How were you able to manage RAW data recording and post-processing internally in this camera?**

The ALEXA LF can do uncompressed ARRIRAW recording up to 90 fps for Open Gate and up to 150 fps in 2.39:1 widescreen sensor mode. Full color reconstruction with ProRes recording is possible up to 60 fps Open Gate and up to 90 fps widescreen. This makes a big difference for a large format camera. Because the internal bandwidth is so much higher than in the ALEXA SXT, we had to control it thermally, and this is why there's a bigger fan now. The bigger fan allowed us to add a separate heat sink under the side cover where the Codex Capture Drive is located. This is quite valuable because you can keep the camera in equilibrium at all speeds, even when you're recording at 90 fps Open Gate continuously.

**How were you able to complete ALEXA LF so rapidly?**

It was really quick. We were able to build on our existing technology, especially on the ALEXA 65 technology. So, that's the story of the latest episode in the story of our ALEV sensor design, which was first conceived for the original ALEXA as a sophisticated, cinematic high dynamic range sensor, and continues to the latest ALEXA LF.

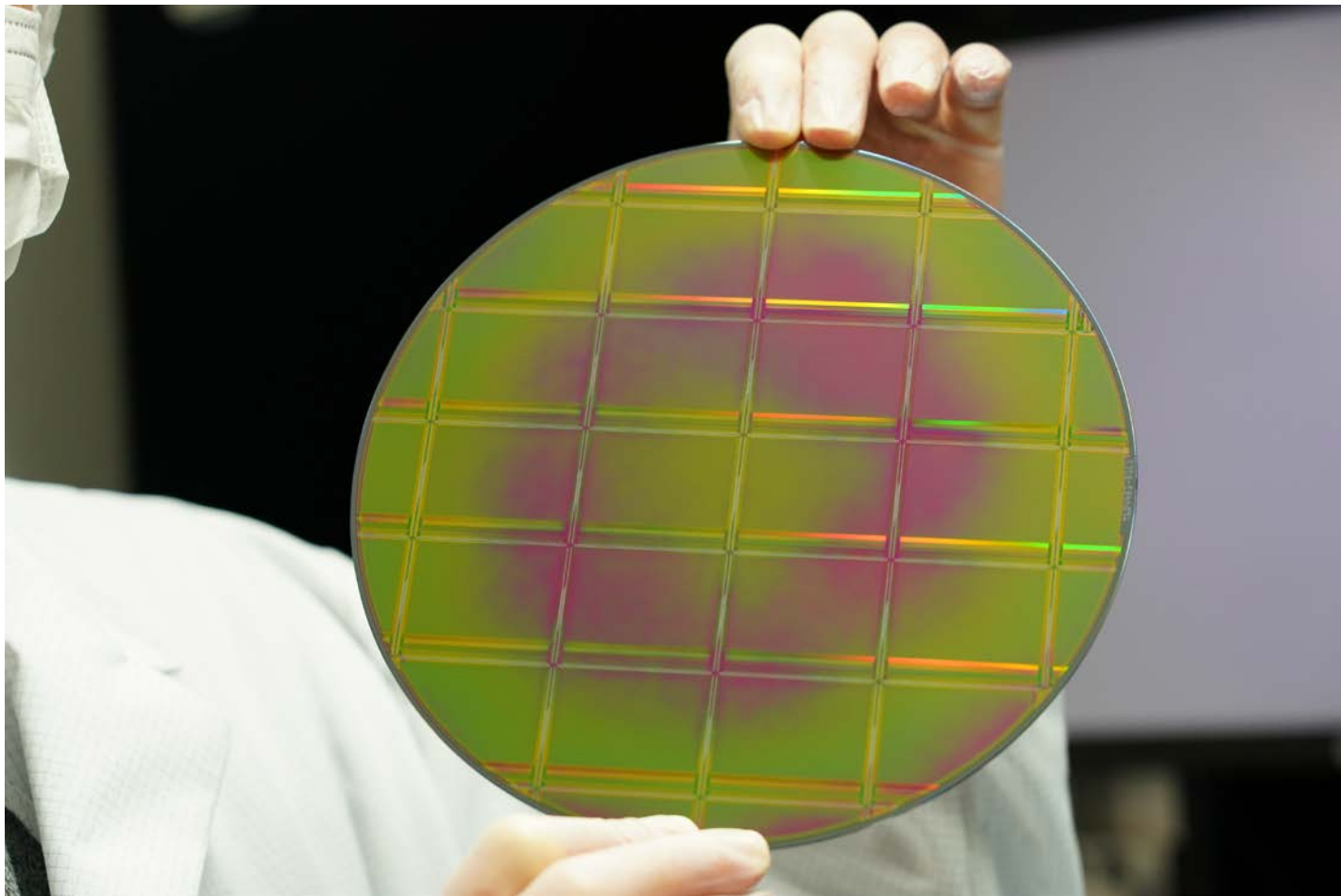


Above: The ARRI ALEXA LF sensor team.

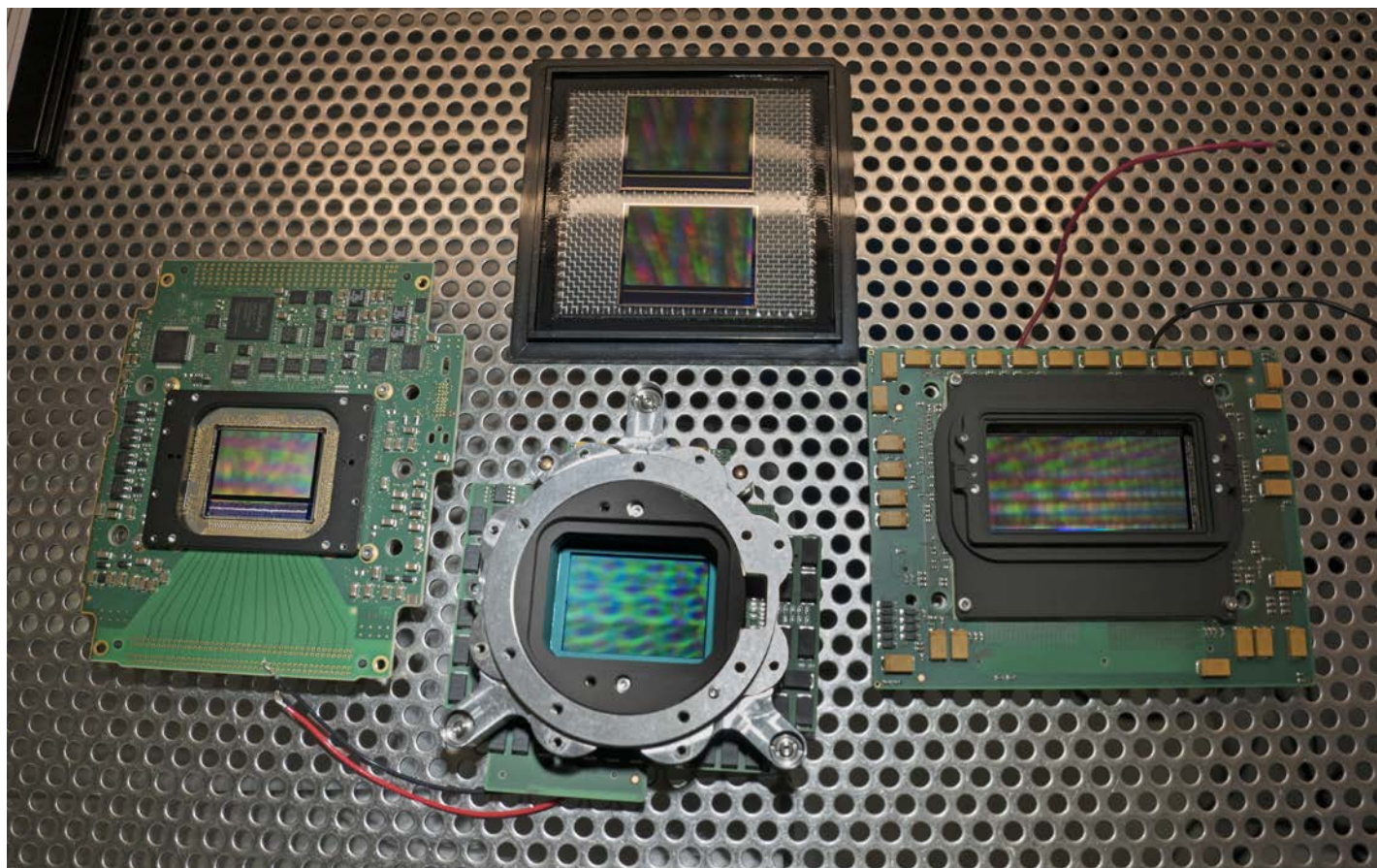
Right: Achim Oehler and the magically levitating ALEXA LF.







Above: it begins with a wafer. Below, various stages of sensor assemblies and size comparisons. Left: ALEXA. Center: ALEXA LF. Right: ALEXA 65

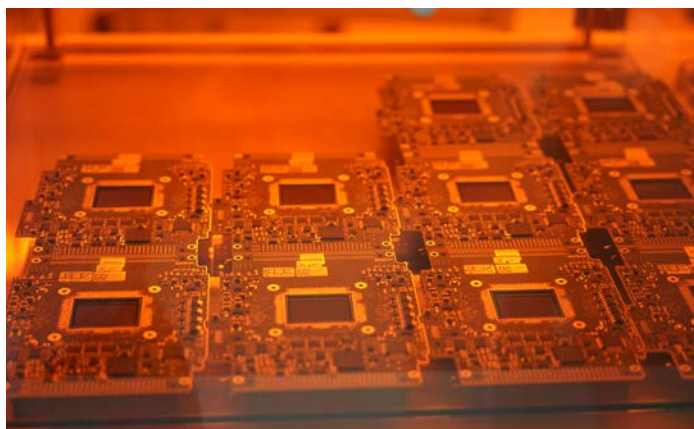




# ALEXA LF Sensor



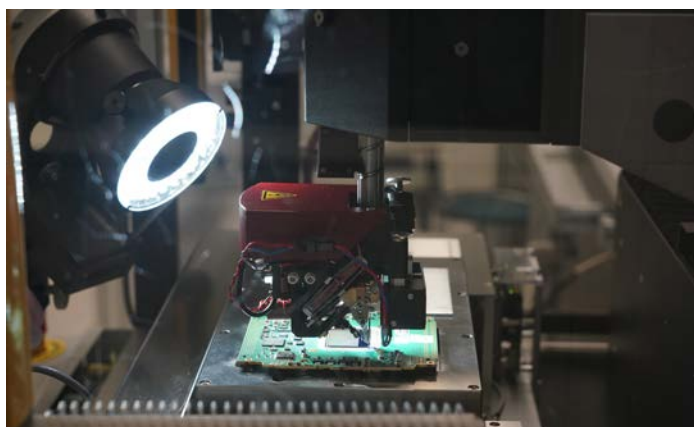
Camera sensor assembly clean room at ARRI



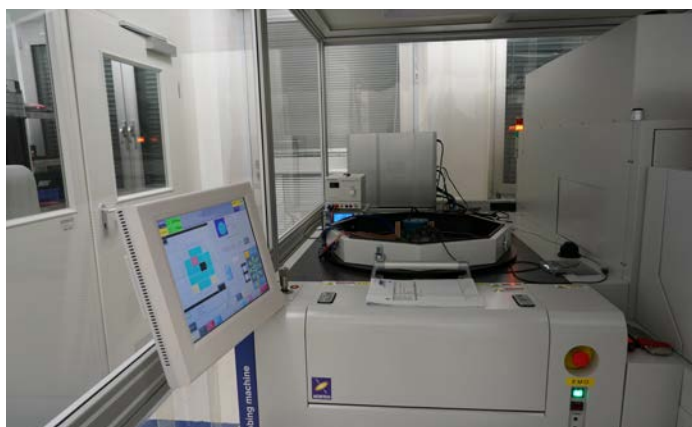
Sensor assemblies



Inspection



Wire bonding



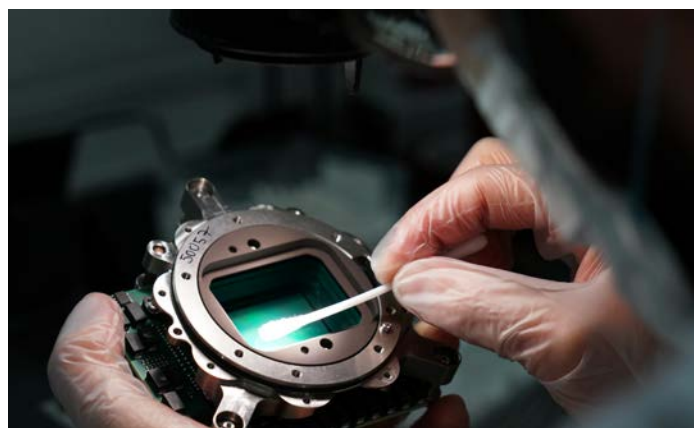
Wafer testing



Wafer testing



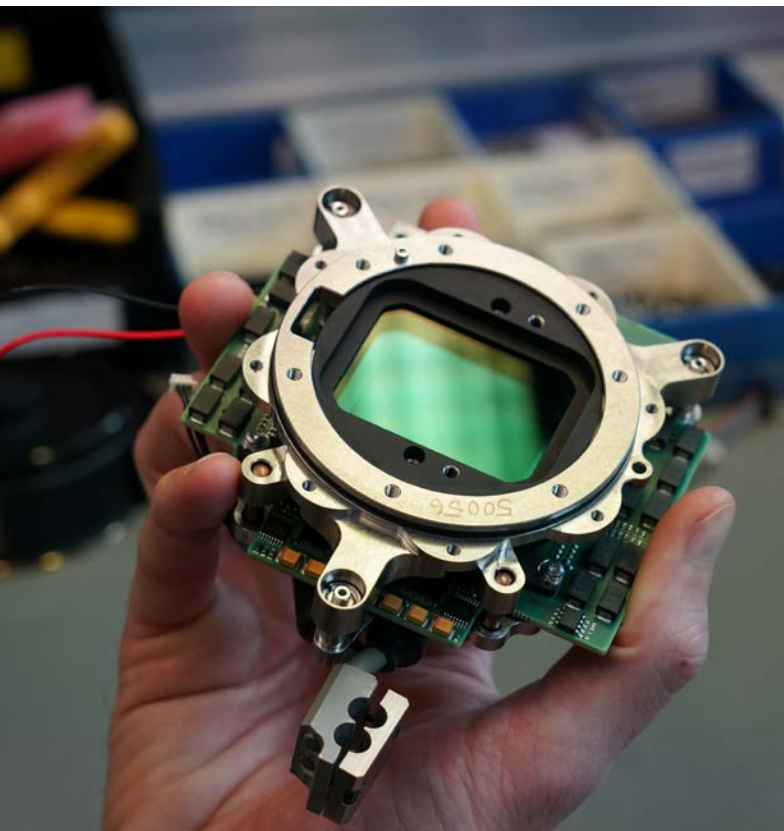
Cleaning cover glass



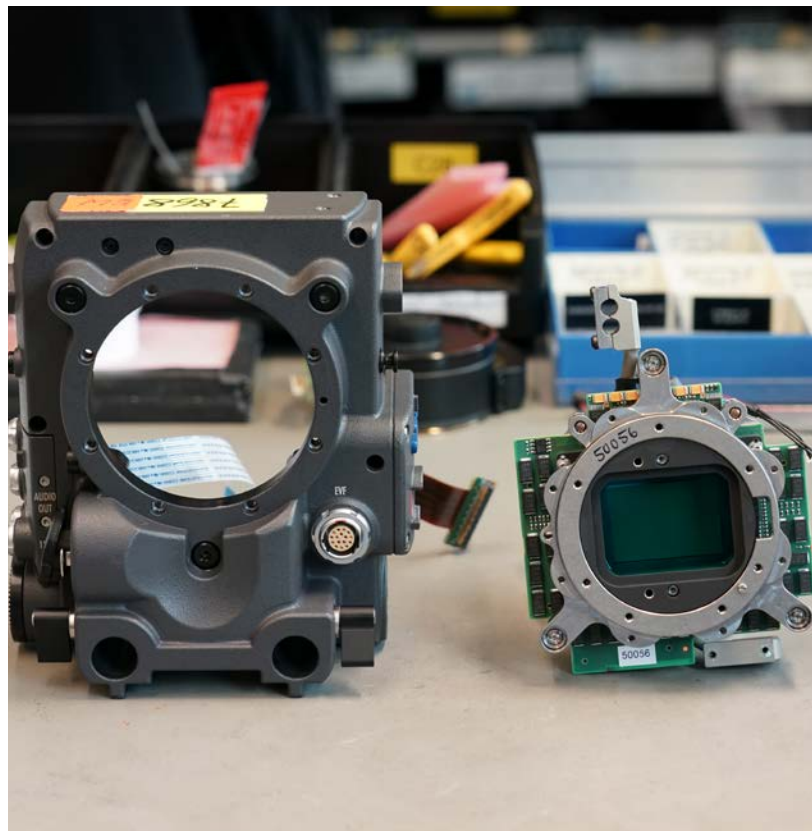


## February 2018: Building an ALEXA LF

Let's build an ALEXA LF. This is a simplified view of a very complex process, sort of an ALEXA Assembly for Bluffers Guide. Do not attempt.



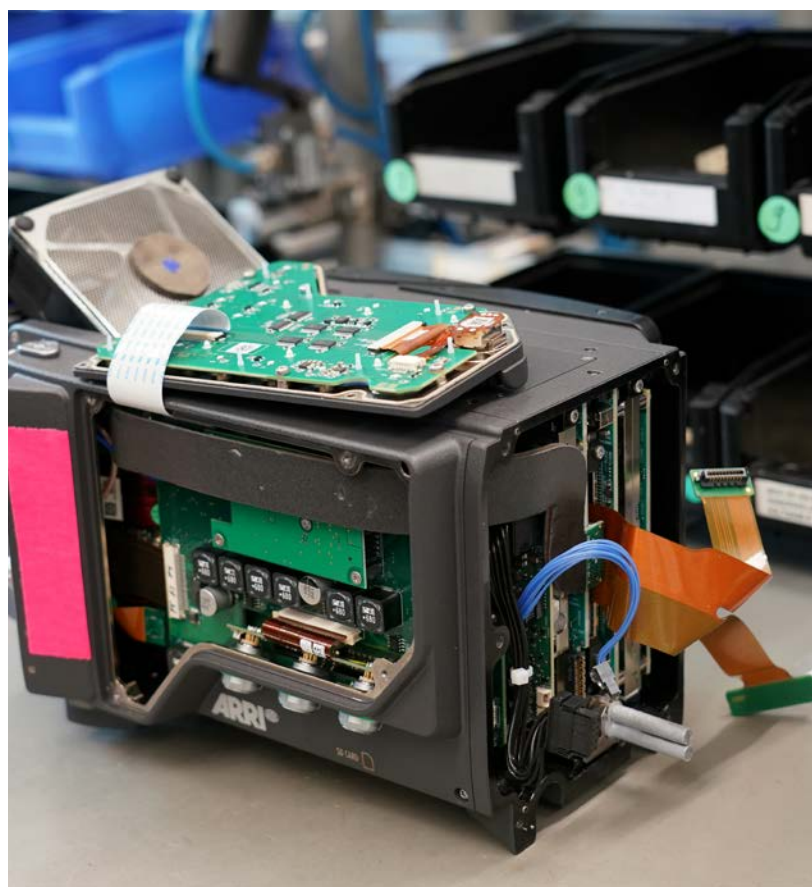
Take one ALEV 3 2X sensor assembly module.



Prepare ALEXA LF front housing.



Sensor assemblies installed. Attach LPL mount to camera body on left.



Printed Circuit Boards and fan go inside the rear camera body housing.



## Building an ALEXA LF



The cooling fan goes in.



Fan cover is attached.



Wireless video module goes on the back.



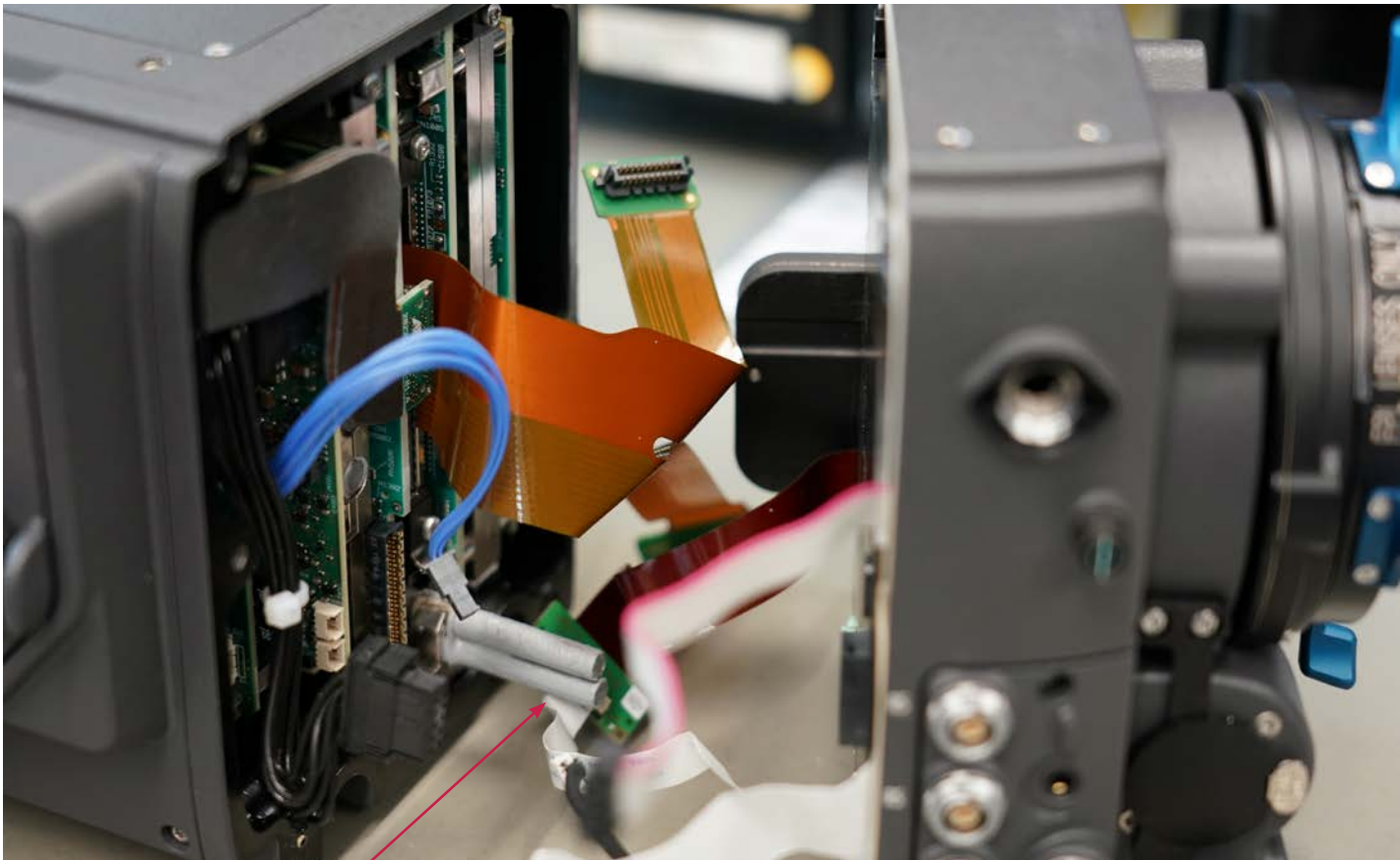
Prepare rear assembly.



Yasmin Bulut and Oliver Luft prepare to join front and rear sections.



## February 2018: Building an ALEXA LF



Tubes called Heat Pipes keep the sensor cool by drawing heat away. Connect cables.



Testing, testing. Simulate a week of continuously driving over cobblestones in the Arctic and the Amazon.



Andreas Weeber tests all models of ALEXA. Nice to see they read FDTime, above right.



# Programming and Testing and Color Science



David Zucker with eclectic collection of cameras.

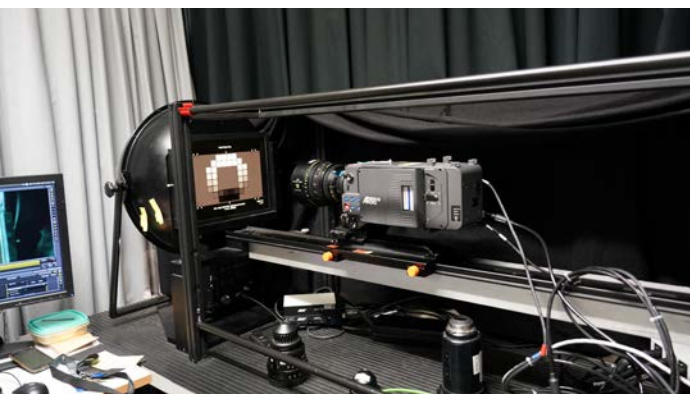
Below, L-R: ALEXA 65, ALEXA LF, ALEXA.



Dr. Tamara Seybold and Harald Brendel.



Michael Grädler.





## February 2018: New LPL Mount

This is the new LPL mount. It attaches to the ALEXA LF camera with 7 screws. The LPL mount has 3 blue ears. The flange focal depth is 44 mm. The inside diameter is 62 mm.

Everything else works pretty much like a PL mount. Rotate the breech clockwise to lock ("Clock to Lock"). Rotate counter-clockwise to unlock.

LDS-2 metadata contacts are at the familiar 12 o'clock position for lens metadata. LDS-2 is backwards compatible with LDS-1 and /i Technology.

By the way, ARRI plans to license the LPL mount and the LDS-2 to third party lens and camera manufacturers at a nominal fee.

### Why did ARRI need a new mount for Large Format?

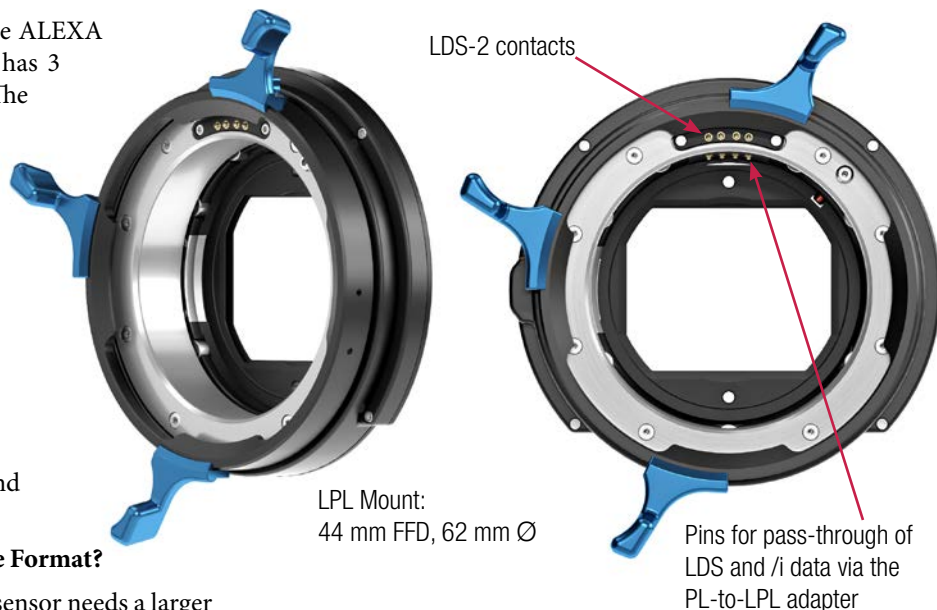
Marc Shipman-Mueller explained, "A larger sensor needs a larger lens mount for optimal lens design. The traditional PL mount compromises full frame lens design—because the PL mount diameter of 54 mm was based on a Super35 image area. The LPL mount has various advantages. It allows lens designers to build full frame lenses that are smaller and lighter with a faster T stop. It also allows a telecentric lens design."

### Why does the new LPL mount have a shorter flange depth (44mm) and wider diameter (62mm) than PL?

Thorsten Meywald replied, "You can make your camera a little bit shorter if you have a reduced flange focal depth (also called flange focal distance or back focus). In the past, this distance was necessary to make room for the spinning mirror shutter. That was the

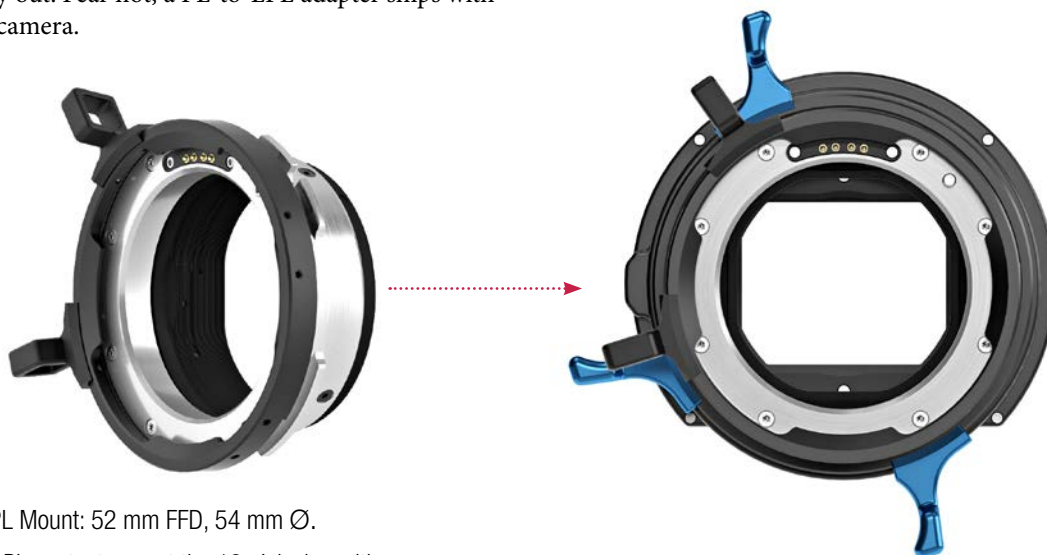
reason for the 52mm flange depth of the PL mount. We don't need that room any longer on our digital cameras. The optical viewfinder is a thing of the past. Also, a shorter back focus distance on the camera enables the use of adapters for a lot of other lenses in the market: M, EF, F, and so on.

This is really a big benefit for cinematographers. Never before have so many lens choices been available: modern lenses, vintage lenses, converted lenses—not only cine, but also from still photography but even from the industrial world. There are so many choices for creativity."



## PL-to-LPL Adapter

"But what about my vast inventory of PL lenses?" I hear a rental house manager cry out. Fear not, a PL-to-LPL adapter ships with every ALEXA LF camera.



PL-to-LPL Adapter. PL Mount: 52 mm FFD, 54 mm Ø.

- LDS-1 and LDS-2 PL contacts are at the 12 o'clock position.
- What happens if you're using an /i lens? Aren't the contacts supposed to be at the 3 o'clock position? Yes. In that case, just rotate the PL-to-LPL adapter 90 degrees clockwise and lock in place.

With the PL-to-LPL adapter in place, it's easy to see which mount is which. The PL mount has 2 traditional black ears. The LPL mount has 3 blue ears.

# LPL and PL Lenses on ALEXA LF

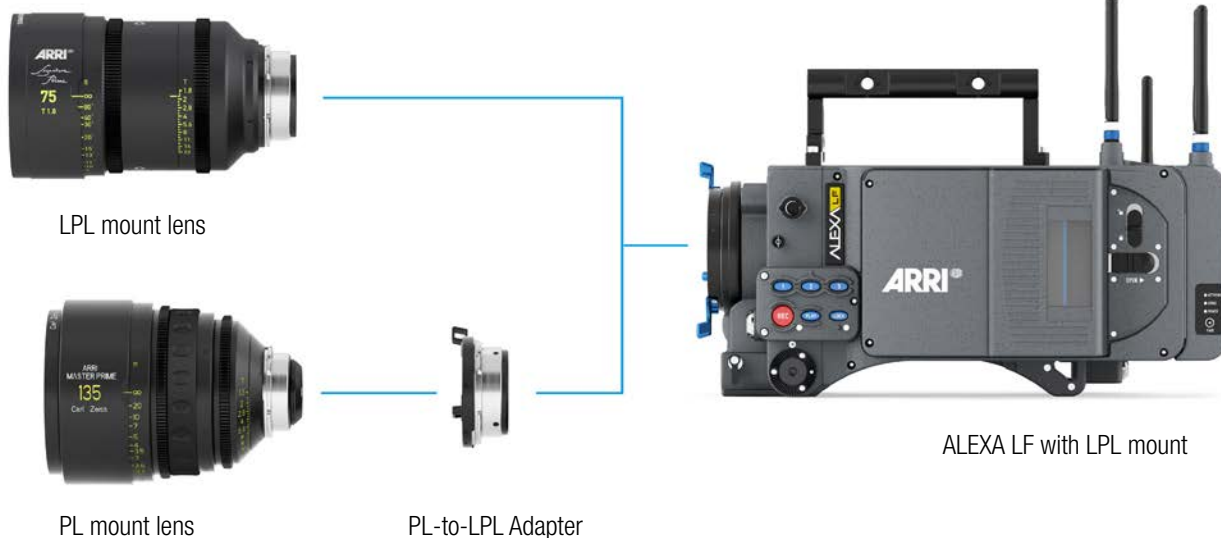
LPL and PL will work together in harmony.

ALEXA LF accepts: LPL lenses and PL lenses with the adapter.

If you're mixing LPL and PL on the same show, you might want to buy extra adapters for each PL lens. History repeats itself. That's what most people did when ARRI switched from bayonet mount to PL mount in 1983.

DPs liked the PL mount so much better and there was a brisk business in bayonet to PL adapters. I suspect the same thing will happen again and the LPL mount will become beloved and ubiquitous. It really is very good.

At this point you may wonder, if the world is going LPL, what happens to all my PL mount cameras?



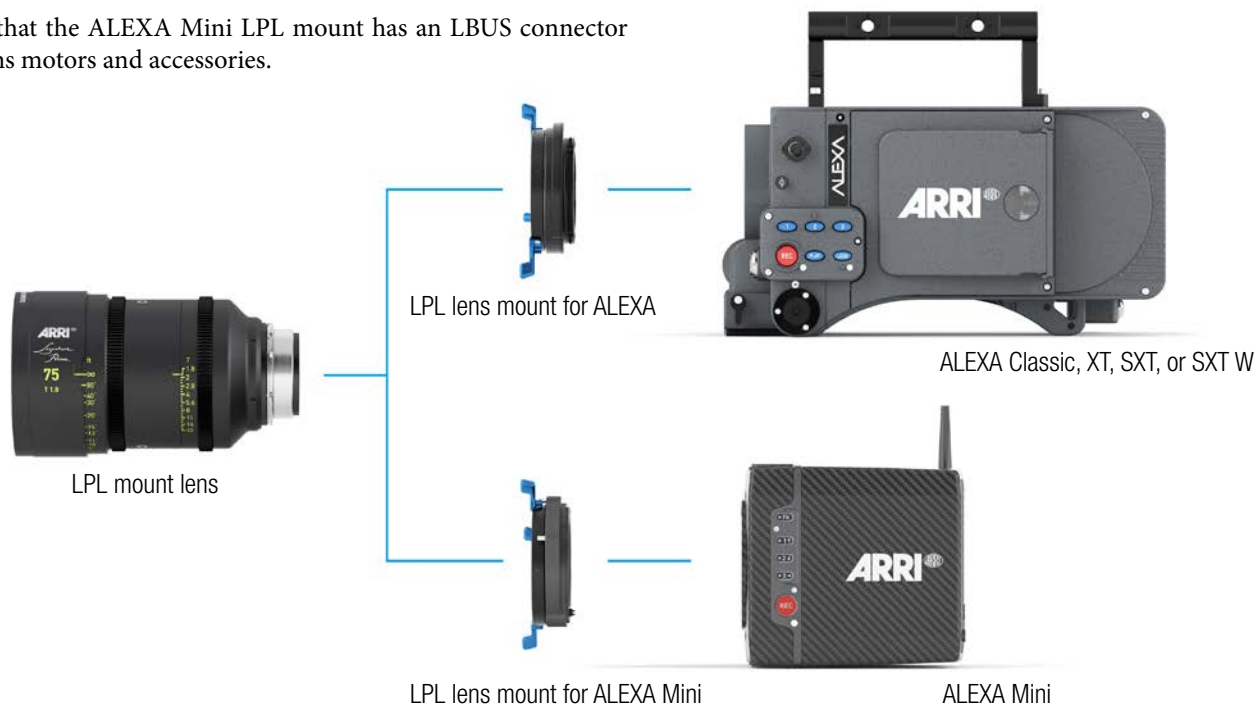
## LPL Lenses on ALEXA Classic, XT, SXT, and SXT W, Mini

Conveniently, the same LPL mount that fits on the ALEXA LF also fits on the ALEXA Classic, XT, SXT, and SXT W. (It will not work on the ALEXA Studio because of its mirror shutter).

However, the LBUS connector is not active when this mount is attached to an AMIRA.

There's also an LPL mount for ALEXA Mini. It fits on the AMIRA as well.

Note that the ALEXA Mini LPL mount has an LBUS connector for lens motors and accessories.



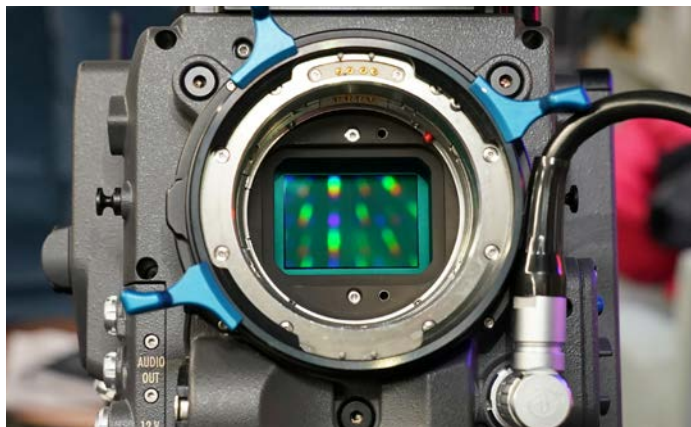




PL-to-LPL adapter accepts any PL mount lens on ALEXA LF. The PL mount has 2 traditional black ears. The LPL mount has 3 blue ears.



# ALEXA LF Sensor Modes



Remember the 5 C's of Cinematography from film school? ("Composition, Camera Angle, Continuity, Close-Up and Cut.") Haskell Wexler ASC famously recalled only 3 C's, and they were not part of the curriculum: "Cars, Chicks and Cameras."

This "C" chapter is about "Composition." In the digital age, composition is influenced by several things. Among them are aspect ratio, framelines, and cropping. We'll get to those in a minute. Most important is sensor mode.

Sensor Mode is how much of the entire sensor you want the camera to read out. Think of it as the hard matte previously installed in film camera gates. For those of us who were wondering why it took so long for Full Frame (Large Format) cameras to come out, Sensor Mode was a major thing. The larger the sensor, the more area the electronic circuits have to digest. And that is why there has been a compromise of maximum frame rate and resolution and image height. Put another way, the taller the image height, the slower (lower) your maximum frames per second rate will be.

And that is why ALEXA LF has 3 Sensor Modes. They are accessed from the camera menu and there's no need to reboot or do a factory reset when switching sensor modes.

The first Sensor Mode is **LF Open Gate**.

This provides the maximum sensor area, 36.7 by 25.54 mm, and the maximum resolution, 4448 x 3096 photo sites. You need full frame lenses. There is no surround view. Maximum frame rate is 90 fps recording ARRIRAW and 40 fps in ProRes 4444 XQ.

Higher frame rates are possible in ARRIRAW since ProRes requires extra processing steps of de-bayering and compression.

The second sensor mode is **LF 16:9**.

This is the smallest sensor area that meets 4K UHD deliverable standards. Full frame lenses cover the active image area. However, some Super 35 lenses, especially longer focal lengths, will also fill the image circle. More on that later.

Surround view is available to see errant C-Stands and drooping microphones. It is indicated by the dotted yellow line at left.

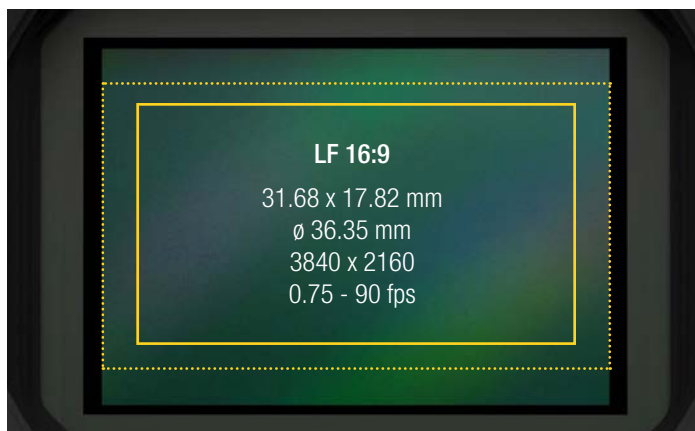
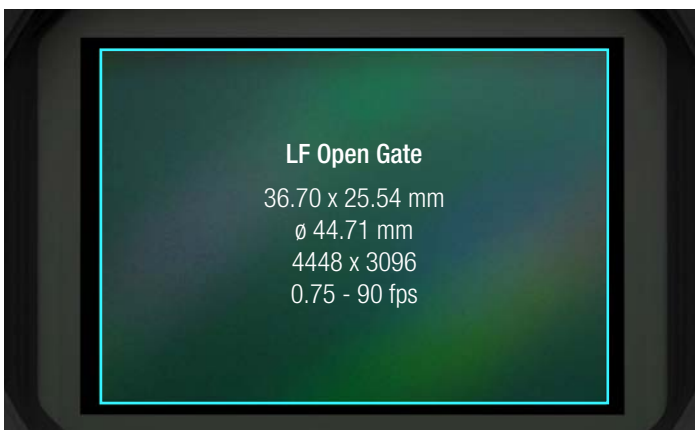
The maximum frame rate is 90 fps in ARRIRAW and 60 fps in ProRes 4444 XQ.

The third sensor mode is **LF 2.39:1**.

This is for spherical widescreen (non-anamorphic 2.39:1) using spherical Large Format and Full Frame lenses.

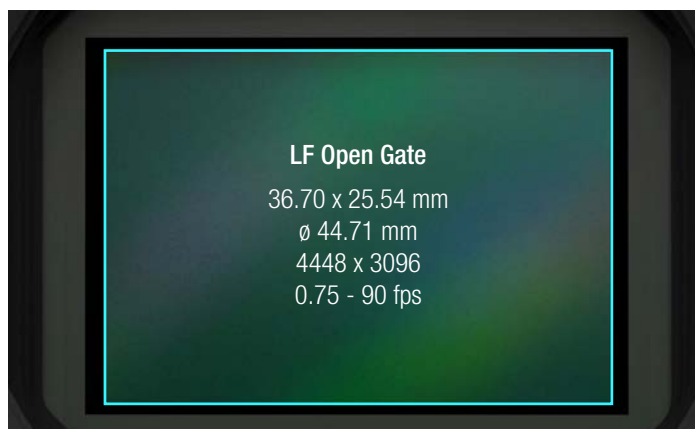
There is no surround view. The image height is a "mere" 15.31. This enables a maximum frame rate of 150 fps in ARRIRAW and 60 fps in ProRes 4444 XQ.

I imagine that some cinematographers may ask for surround view safe area top and bottom and would be willing to sacrifice high frame rates for some scenes or perhaps the entire show. Presumably this could be a future SUP software update.





# February 2018: ALEXA LF Frame Rates and Resolution



## LF Open Gate

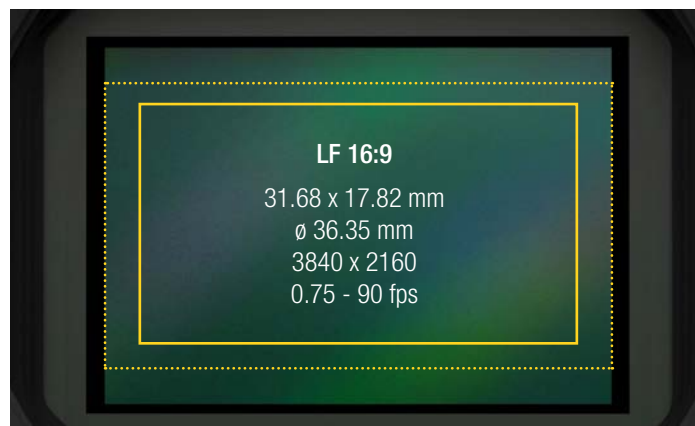
### Maximum fps with SXR Capture Drive

ARRIRAW	90 fps
ProRes 422	60 fps
ProRes 422 HQ	60 fps
ProRes 4444	60 fps
ProRes 4444 XQ	40 fps

### Maximum fps with SxS PRO+ cards

ARRIRAW	—
ProRes	—

Record ARRIRAW and ProRes at Native Resolution of LF Open Gate  
Sensor Mode: 4.5K



## LF 16:9

### Maximum fps with SXR Capture Drive

ARRIRAW	90 fps
ProRes 422	60 fps
ProRes 422 HQ	60 fps
ProRes 4444	60 fps
ProRes 4444 XQ	60 fps

### Maximum fps with SxS PRO+ cards

ARRIRAW	—
ProRes 422	60 fps
ProRes 422 HQ	60 fps
ProRes 4444	40 fps
ProRes 4444 XQ	30 fps

Record ARRIRAW and ProRes at Native Resolution of LF 16:9  
Sensor Mode: 4K UHD. *Also possible to down-sample and record the image to ProRes 16:9 2K or ProRes 16:9 HD.*



## LF 2.39:1

### Maximum fps with SXR Capture Drive

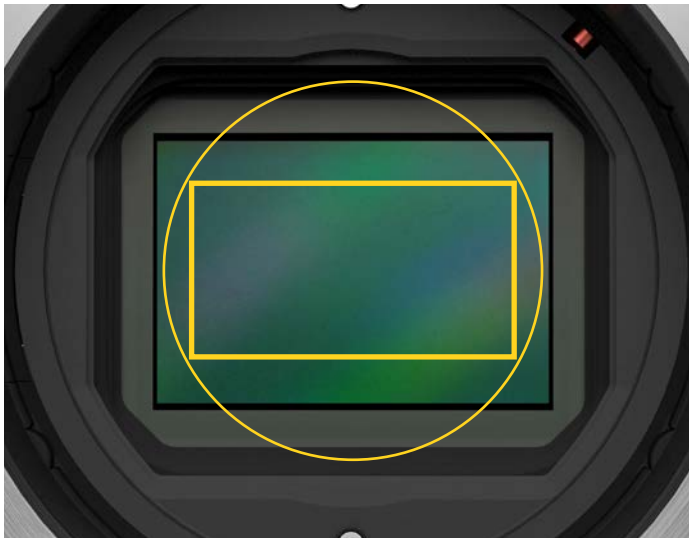
ARRIRAW	150 fps
ProRes 422	100 fps
ProRes 422 HQ	100 fps
ProRes 4444	100 fps
ProRes 4444 XQ	60 fps

### Maximum fps with SxS PRO+ cards

ARRIRAW	—
ProRes 422	90 fps
ProRes 422 HQ	60 fps
ProRes 4444	40 fps
ProRes 4444 XQ	30 fps

Record ARRIRAW and ProRes at Native Resolution of LF 2.39:1  
Sensor Mode: 4.5K

## LF 16:9 4K UHD Sensor Mode, Image Circle and Illumination Circle



ALEXA LF 16:9 sensor mode 3840 x 2160 (4K UHD)  
36.35 mm image circle, 31.68 x 17.82 mm image area



ALEXA LF Open Gate 4480 x 3096: 44.71 mm image circle  
36.70 x 25.54 mm image area

I grilled Marc Shipman-Mueller with the same question asked of Stephan Schenk. “Pretend I’m a tough producer obsessing about the cost of 12 extra C-stands, and you’re the DP who wants to shoot with an ALEXA LF. How do you convince me to part with a few dollars more?”

Marc replied, “It should be easy to convince most producers of feature films. Just look at the success of the ALEXA 65. But what about a TV series? With the ALEXA LF, you get ALEXA image quality in 4K HDR. That makes the DP and the producer happy. Most TV series now are being shot in ProRes with SxS PRO cards, and the ALEXA LF can also do that. Same workflow. What about the lenses? Well, we have a sensor mode in the ALEXA LF called “LF 16:9.” That is 3840 x 2160, so still UHD 4K. And it turns out, Master Primes longer than 35mm will cover this LF 16:9 sensor mode. You can use MPs for most shots and rent just one or two Large Format lens for the wide-angle shots. By the way, an MP 35mm with the LF 16:9 sensor mode has the same angle of view as an MP 26mm for Super35 2.8K.”

The image circle of ALEXA LF in 16:9 4K sensor mode is 36.35 mm. Most S35 lenses have image circles originally specified at 29 to 31 mm. See the ARRI Lens Illumination Guide. The longer focal lengths of some additional S35 lenses will cover ALEXA LF 36.35 mm: for example Ultra Primes longer than 20mm. Some zooms as well.

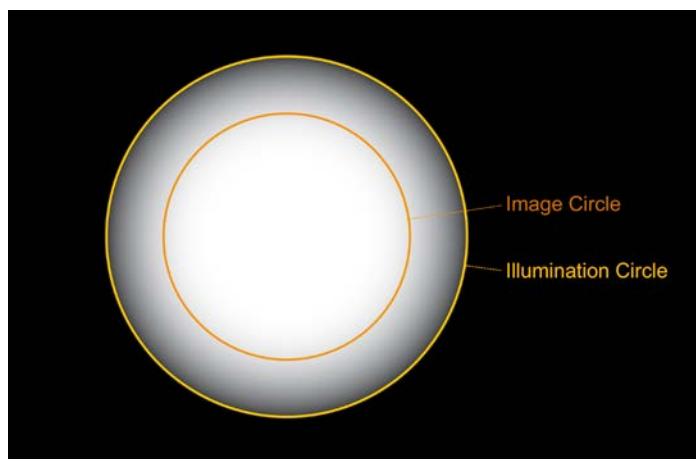
We will have a new vocabulary. There are two circles. There’s the image circle. It’s the area of coverage that optical engineers and manufacturers affirm specified performance of the lens to the edges of frame. And then there’s the illumination circle—where there’s an image, but the optical engineers don’t “guarantee” the quality. We might call it “character.”

Marc continued, “Both circles of most ARRI lenses are very large. This has to do with film—remember that? We wanted to make sure that if a customer shot Super35, but had forgotten to switch the lens mount from N35 to S35, they would still get an image. That is a very obscure piece of historical film-technology trivia by now, but because of that, our lenses have a bigger image circle and a bigger illumination circle than most other Super35 lenses.

And that makes them great for this LF 16:9 sensor mode. Just to be clear, MPs don’t cover the full LF sensor in Open Gate. But, from 35 mm on, they do cover this LF 16:9 sensor mode, which is 4K, and therefore ready for TV shows with a 4K mandate.

**To review: The longer focal lengths of Ultra Primes, Master Primes and some other S35 lenses can cover the larger ALEXA LF 16:9 UHD 4K sensor mode image circle of 36.35 mm.**

Once upon a time, Image Circle was supposed to be a precise measurement. However, one manufacturer’s circle might not be same as the next. And besides, what DP ever accepted specifications as gospel? What if you liked slight shading or softening at the edges? Are image circles the vestiges of an analog age, when film gates were metal and unyielding unless you attacked them with a Dremel Multi Tool?



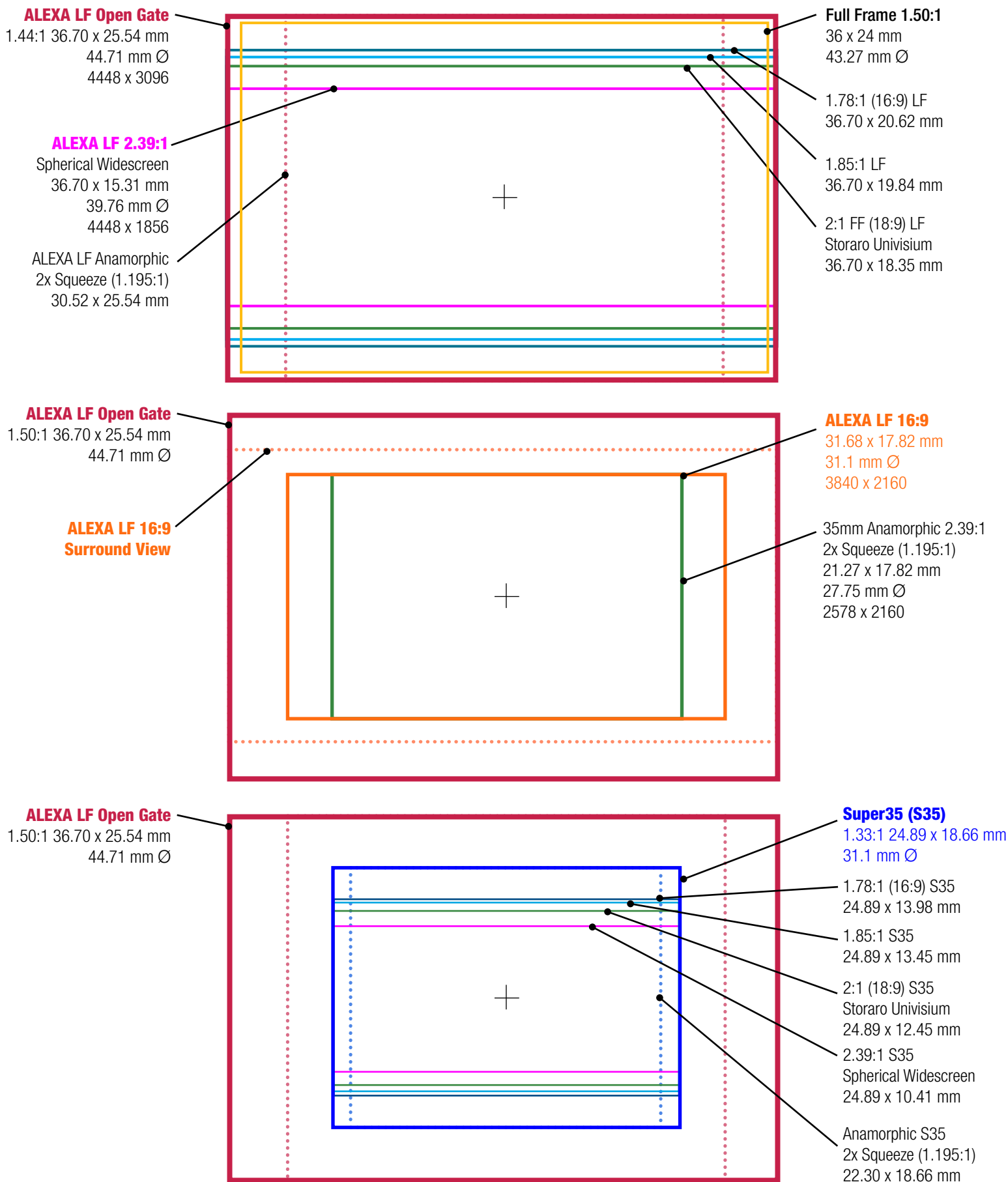
Perhaps our new vocabulary will rename Image Circles as the diagonal of the camera’s image coverage. And Illumination Circles will define the more artistic areas that a lens might fill.

Despite the panoply of PL lenses out there, ALEXA LF is inviting the use of Large Format lenses that amply cover its full 44.71 mm image circle. This frontier is so new and exciting, I don’t even yet know what the Illumination Circles of Signature Primes are. Uh—oh—could some of them cover Medium Format Still images?



# February 2018: ALEXA LF Framelines

The Large Format Sensor makes a multitude of compositions, aspect ratios and framelines possible





Cinematographer Matias Boucard and Trinity Stabilizer operator Junior Luciano on location in Bangkok, Thailand with ALEXA LF and ARRI Signature Primes



# February 2018: The ALEXA LF System



ARRI Signature Prime Lenses



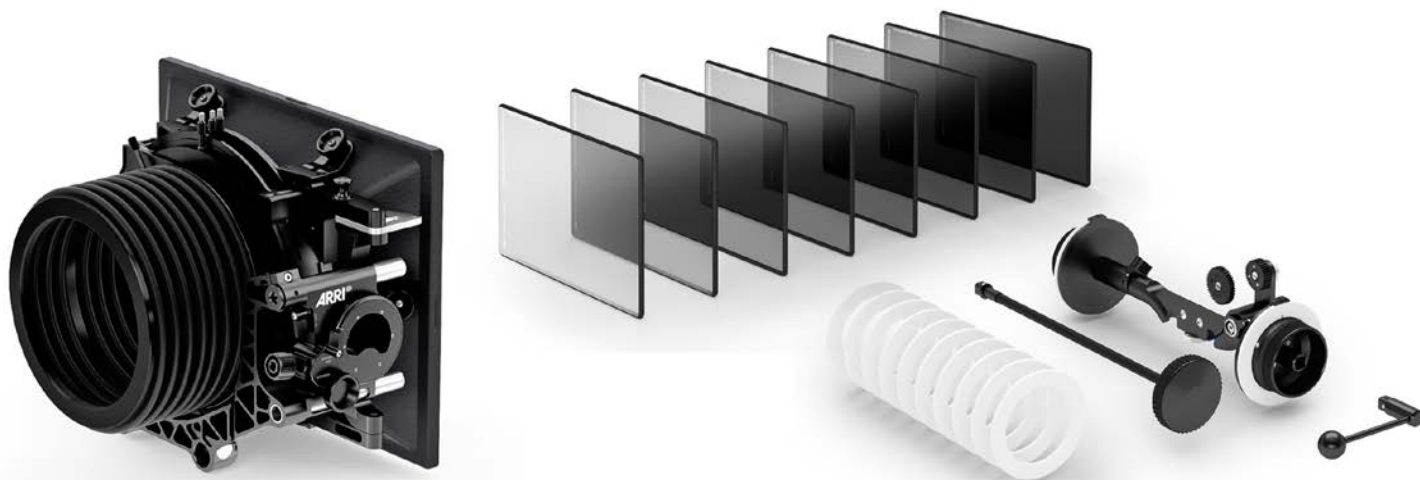
ARRI Cine Lenses



CLM-3, CLM-5, cforce mini  
and cforce plus lens motors



WCU-4 Wireless Control Unit



ARRI PCA Professional Camera Accessories

# The ALEXA LF System



ARRI ALEXA LF with Signature Prime, Viewfinder, Viewfinder Bracket



ALEXA Accessories



ARRI Camera Stabilizer Systems



Transvideo Starlite ARRI-WVS with wireless video receiver



ARRI DMS-1 Duo set for two-camera setups: 2 Transvideo Stargate monitors and 2 WVR-1 Receivers.



ARRI Workflow



## February 2018: ARRI ALEXA LF Camera Views



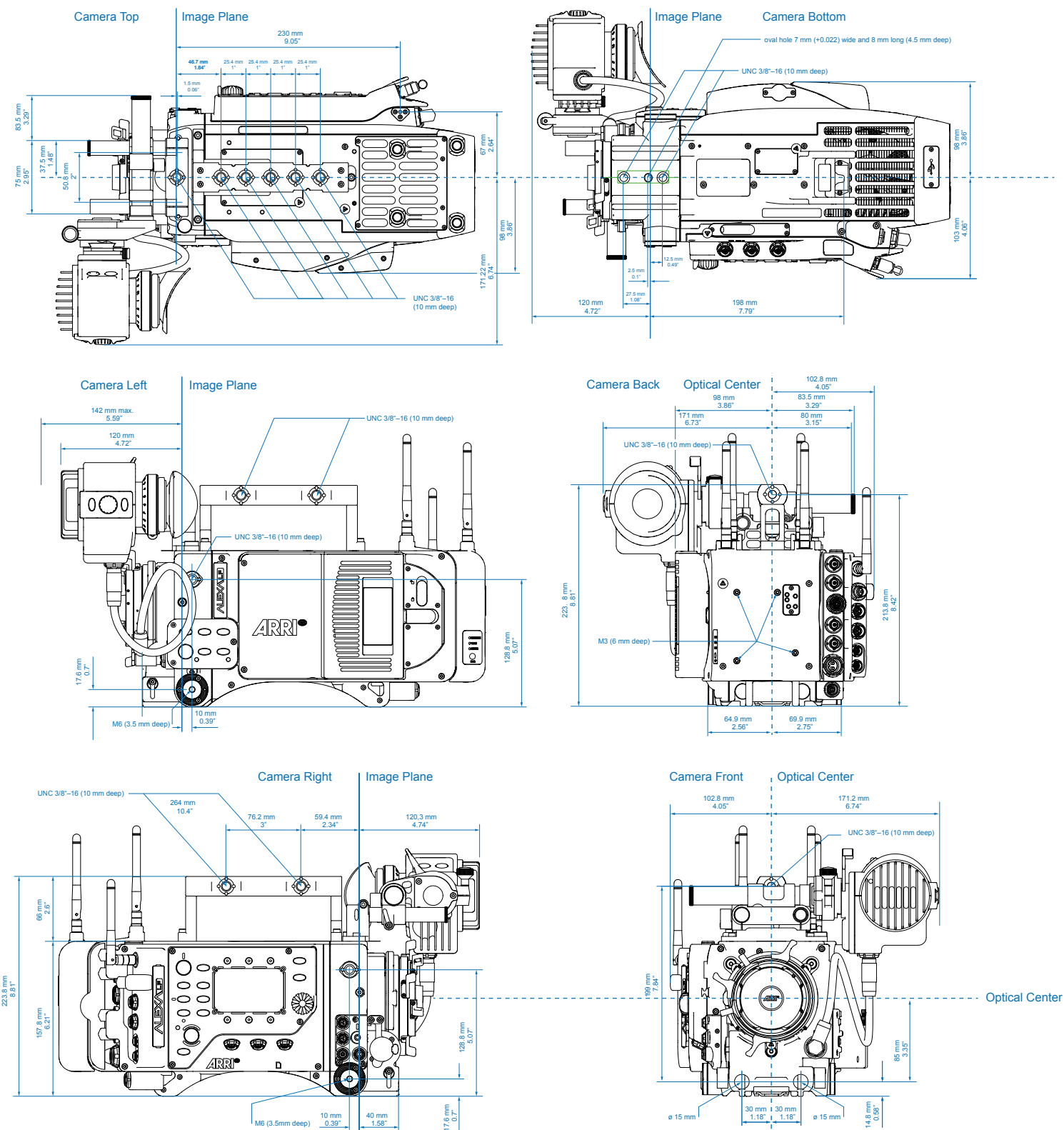
# ALEXA LF Dimensions

## ALEXA LF



CAMERA DIMENSIONS – Version 2018-01

Technical Data are subject to change without notice.



### ALEXA LF

	Length	Width	Height	Weight
Body + LPL mount	351 mm - 14.33"	201 mm - 7.91"	158 mm - 6.22"	7.8 kg - 17.2 lb
Body + LPL mount Electronic Viewfinder EVF-1, EVF-1 cable KC-150-S, Viewfinder Mounting Bracket (VMB-3)	414 mm - 16.3"	251 mm - 9.88"	224 mm - 8.82"	9.4 kg - 20.7 lb



## February 2018: ALEXA LF Credits



Above, from left to right *standing*: Stephan Schenk, Walter Trauning, Henning Rädlein, Matthias Pesch; *sitting*: Harald Brendel, Dr. Achim Oehler, Susanne Mayer, Thorsten Meywald, Klemens Kehrer, Marc Shipman-Mueller, Frederic Merten, Dr. Tamara Seybold, Christoph Beckmerhagen.



Achim Oehler and Marc Shipman Mueller



Thorsten Meywald

# ALEXA LF Specifications

Camera Type	Large Format (LF) film-style digital camera with LF Open Gate, LF 16:9 and LF 2.39:1 switchable active sensor area EVF electronic viewfinder Built-in radios for the ARRI Wireless Remote System, ARRI Wireless Video System and WiFi, Built-in LF FSND filter holder, Lens Data System LDS-1, LDS-2, /i Integrated shoulder arch and receptacles for 15 mm lightweight rods Capable of High Dynamic Range and Wide Color Gamut recording and monitoring.
Sensor	Large Format (36.70 x 25.54 mm) ALEV III CMOS sensor with Bayer pattern color filter array
Sensor Modes	Sensor Mode LF Open Gate (36.70 x 25.54 mm, Ø 44.71 mm) 4448 x 3096 used for LF Open Gate ARRIRAW 4.5K 4448 x 3096 used for LF Open Gate ProRes 4.5K
	Sensor Mode LF 16:9 (31.68 x 17.82 mm, Ø 36.35 mm) 3840 x 2160 used for LF 16:9 ARRIRAW UHD 3840 x 2160 used for LF 16:9 ProRes UHD 3840 x 2160 down sampled to 2048 x 1152 for LF 16:9 ProRes 2K 3840 x 2160 down sampled to 1920 x 1080 for LF 16:9 ProRes HD
	Sensor Mode LF 2.39:1 (36.70 x 15.31 mm, Ø 39.76 mm) 4448 x 1856 used for LF 2.39:1 ARRIRAW 4.5K 4448 x 1856 used for LF 2.39:1 ProRes 4.5K
Operating Modes	LF Open Gate, LF 16:9 or LF 2.39:1 sensor modes. Switching takes approx. 20 seconds. All sensor modes available in ARRIRAW and ProRes.
Frame Rates	ARRIRAW LF Open Gate 0.75 - 90 fps LF 16:9 0.75 - 90 fps LF 2.39:1 0.75 - 150 fps
	ProRes LF Open Gate 0.75 – up to 60 fps LF 16:9 0.75 – 60 fps LF 2.39:1 0.75 – up to 100 fps
	All speeds adjustable to 1/1000 fps increments. Some limitations based on recording media or recording format.
Shutter	Electronic rolling shutter, 5.0° - 358.0° up to 60 fps; 5.0° to 356° above 60 fps. Shutter angle adjustable to 1/10 degree increments.
Cover Glass Filters	Permanent cover glass filters in front of the sensor: Optical low pass (OLPF), UV, IR.
Filters	Includes a built-in Internal Filter Module (LF IFM) filter holder that accepts one of eight (ND 0.3 to ND 2.4) Large Format Full Spectrum Neutral Density (LF FSND) filters that are swapped manually. They are not held in with magnetics like SXT, but spring loaded.
Exposure Latitude	14+ stops for all sensitivity settings from EI 160 to EI 3200, as measured with the ARRI Dynamic Range Test Chart (DRTC).
Exposure Index	EI 800
White Balance	Presets for 3200 (tungsten), 4300 (fluorescent), 5600 (daylight) and 7000 (daylight cool). Automatic calculation or manual white balance for 2000 to 11000 Kelvin, adjustable in 100 K steps.
Color Correction	While white balance changes the red/blue hue of the image, color correction changes green/magenta. Adjustable range from -12 to +12 CC. (1 CC corresponds to 035 Kodak CC values or 1/8 Rosco values.)
Sound Level	≤ 20 db(A) while recording LF Open Gate ProRes 4.5 K 4444 @ 30 fps and ≤ +30° Celsius (≤ +86° Fahrenheit) measured 1 m / 3 feet in front of the lens.



# ALEXA LF Specifications

Power In	<p>3 possible inputs: BAT connector Optional Battery Adapter Back (V-Mount or Gold Mount), Optional Battery Adapter Top</p> <p>All inputs accept 11.5 - 34 V DC.</p> <p>Approx. 116 W power draw for camera and EVF-1 in typical use recording ProRes at 24 fps to an SxS PRO+ 256 GB card at room temperature, without accessories. Initial power draw during power up is higher.</p>
Power Out for Accessories	<p>12 V connector: limited to 12 V, up to 2.2 A.</p> <p>RS, EXT and ETHERNET: input below 24 V is regulated up to 24 V; above 24 V: input voltage = output voltage.</p> <p>RS and EXT connectors combined are limited to 2.2 A.</p> <p>ETHERNET is limited to 1.2 A.</p> <p>Maximum power draw is also limited by the power source.</p>
Weight	<p>ALEXA LF body with LPL mount: 7.8 kg / 17.2 lb</p> <p>ALEXA LF body with LPL mount, electronic viewfinder, viewfinder cable, viewfinder mounting bracket and handle: 9.4 kg / 20.7 lb</p>
Dimensions	ALEXA LF body with LPL mount: Length: 364 mm / 14.33", width: 201 mm / 7.91", height: 158 mm / 6.22"
Hostile Environments	-20° C to +45° C (-4° F to +113° F) @ 70% humidity max, non-condensing. Splash and dust-proof with sealed electronics. System cooling through radiator / single fan.
Lens Mount	LPL mount. 62 mm Ø stainless steel. Supports LDS-1, LDS-2 and /i. 44.00 mm nominal flange focal depth without LF FSND filters. Compatibility with PL Lenses using supplied ARRI PL-to-LPL Adapter.
Other Lens Mount Options	The easily-exchangeable lens mount (7 screws) allows other non-LPL mount lenses to be used.
Viewfinder (EVF-1)	Low latency ( $\leq 1$ frame delay) electronic color viewfinder with 1280 x 784 F-LCOS micro display (image: 1280 x 720, status bars: 1280 x 32 above and 1280 x 32 below image) and ARRI LED illumination, temperature controlled. Image can be flipped to use viewfinder on camera left or right side. Viewfinder Mounting Bracket allows movement of viewfinder forward/backwards, left/right, up/down, 360 degree rotation and placement on camera left or right. EVF-1 controls: viewfinder and basic camera settings, ZOOM button, EXP button (false color exposure check) and jog wheel.
Assistive Displays	<p>For EVF-1 and MON OUT: preset and custom frame lines, user rectangles, surround view, 180° image rotation, camera status, false color exposure check, peaking focus check, compare stored image with live image, RETURN IN video and anamorphic de-squeeze (1.25x, 1.3x, 1.5x, 2.0x).</p> <p>For MON OUT, additionally: Reel &amp; clip number.</p>
Controls	<p>Camera right: Main user interface with a 3" transfective 400 x 240 pixel LCD color screen, illuminated buttons, button lock and jog wheel.</p> <p>Camera left (Operator side): Illuminated buttons and button lock.</p> <p>Camera acts as a web server, displaying the ALEXA Web Remote on web browsers of computers connected to ETHERNET connector or via WiFi.</p> <p>Optional accessory Remote Control Unit RCU-4 for cabled remote control via camera ETHERNET connector. Optional accessory Wireless Compact Unit WCU-4 for wireless remote control.</p>
Recording Codecs	Uncompressed and unencrypted ARRIRAW (.ari) or compressed and unencrypted QuickTime/ProRes recording. All formats include embedded audio, timecode and metadata.
Supported Media	<p>For ProRes recording: SxS PRO+ 256 GB (SBP-256D, SBP-256E), requires SxS Adapter 2</p> <p>For ARRIRAW and ProRes recording: SXR Capture Drives 1 TB (CDX-37019), requires SXR Adapter SXR Capture Drives 2 TB (CDX-37021), requires SXR Adapter</p>
Playback	<p>Playback of ARRIRAW or ProRes recorded material visible on EVF-1 and MON OUT.</p> <p>Playback audio available over headphone jack and embedded in the MON OUT signal.</p>

# ALEXA LF Specifications

SD Card	To import and store ARRI Look Files, camera set up files, frame line files and user pixel masks, and custom lens tables for the Lens Data Archive (LDA). Stores frame grabs in ARRIRAW (.ari, 12-bit), TIFF (.tif, 16-bit), DPX (.dpx, 10-bit) or JPEG (.jpg, 8-bit) format. Stores log files. Also used for installing Software Update Packets (SUPs).		
Monitor Outputs	MON OUT 1a, MON OUT 1b and MON OUT 2 supply uncompressed 6G UHD-SDI (3840 x 2160, 16:9) or 1.5G HD-SDI video (1920 x 1080, 16:9) all at 4:2:2 YCbCr; “legal” range video at 23.976, 24, 25, 29.97, or 30 fps. MON OUT 1b is a clone of MON OUT 1a. MON OUT 3 supplies uncompressed 1.5 G HD-SDI video (1920 x 1080, 16:9), 4:2:2 YCbCr; “legal range” HD video at 23.976, 24, 25, 29.97, or 30 fps. All MON OUT supply embedded audio, time code, metadata and recording flag. The integrated wireless video transmitter transmits a clone of MON OUT 3. The wireless signal can be received by the optional Wireless Video Receiver WVR-1.		
Image Processing	16-bit linear internal image processing in full ALEXA Wide Gamut/Log C color space. Target output color spaces: Log C, Rec 709 or Rec 2020. An ARRI Look File (ALF-2) containing the name of the target color space, CDL values and a 3D LUT can be applied to ProRes or MON OUT images and will be saved in metadata. ARRI Look Files for HDR monitoring with PQ or HLG tonal curves are available. Optional horizontal image mirroring.		
Audio	1x XLR 5-pin AUDIO IN for 2 channel, line level, balanced audio. 24-bit / 48 kHz A/D conversion. Uncompressed PCM audio recording to ARRIRAW, ProRes and embedded in all HD-SDI outputs. Only available with same project/sensor speed at 23.976, 24, 25, 29.97 and 30 fps. Max of 2.5 dBm output from AUDIO OUT headphone connector.		
Connectors	1x media slot (SxS PRO+ or SXR Capture Drives) 3x BNC monitor out 6G UHD-SDI  1x BNC monitor out 1.5G HD-SDI 1x XLR 5-pin analog audio in 1x BNC return video in 1.5G HD-SDI 1x LEMO 16-pin external accessory 1x Fischer 2-pin 24 V power in 4x Fischer 3-pin 24 V remote start / stop & accessory power out 1x LEMO 2-pin 12 V accessory power out 1x LEMO 5-pin timecode in/out 1x TRS 3.5 mm headphone mini stereo jack 1x custom LEMO 16-pin electronic viewfinder 1x custom LEMO 10-pin Ethernet with 24 V power 2x Fischer 5-pin Lens Control System 1x Fischer 12-pin for CLM-2, CLM-3, CLM-4 or later 1x Fischer 12-pin for CLM-2, CLM-3, CLM-4 or later 1x Fischer 12-pin for CLM-2, CLM-3, CLM-4 or later	lens motor lens motor lens motor	MON OUT 1a MON OUT 1b MON OUT 2 MON OUT 3 AUDIO IN RET IN EXT BAT RS 12 V TC AUDIO OUT EVF ETHERNET LCS IRIS FOCUS ZOOM
SUPs	Camera software updates via free-of-charge Software Update Packets		
Software Tools (apps)	ARRIRAW Converter (ARC), ARRI Color Tool (ACT), ARRI Meta Extract.		
Software Tools (online)	ALEXA Camera Simulator, ARRI Lens Illumination Guide, ARRI Frame Line Composer (AFC),LUT Generator, ARRI Formats and Data Rate Calculator		
Note: Technical data based on ALEXA LF Software Update Packet SUP 2.0. SUP 2.0? Yes, the first software for the ALEXA LF is called SUP 2.0. All data subject to change without notice.			





ARRI ALEXA LF gets SUP 3.0 software and hardware update.

## Hardware

This latest software update, LF SUP 3.0, requires a new ACDA4 circuit board inside the camera. New ALEXA LF cameras will have the new board and SUP 3.0 installed. Existing cameras can be updated with the new hardware and software by ARRI Service Centers, free of charge. That is why LF SUP 3.0 is not shown in the downloads section of the ARRI website.

## EVF-2

The big, bright news is the new ALEXA LF Electronic Viewfinder EVF-2. It replaces EVF-1, which has been discontinued.

EVF-2 is sharper, cleaner, brighter, better. It has HD resolution. You can check focus much more clearly. The optics are based on the beloved eyepiece of the ARRICAM, providing a cleaner image, free of distortion. It has a wider exit pupil (wider aperture, brighter image) and gives the operator a more comfortable view of the image.

EVF-2 uses the latest color science for more accurate color rendition and a better match to on-set monitors. Color is stable at all brightness levels over the entire range of operating temperatures from -20°C to +45°C (-4° F to +113° F).

If you're mixing EVF-1 and EVF-2 finders on the same set, an EVF-1 gamma setting helps matching.

The EVF-2 requires ALEXA LF Software Update Packet LF SUP 3.0. ALEXA LF cameras from now on will come with the EVF-2. ALEXA LF cameras with LF SUP 3.0 are compatible with EVF-1 and EVF-2. If you want to upgrade from EVF-1 to EVF-2, you can trade up to EVF-2 at half price.



## LF SUP 3.0 Software

- Support for Electronic Viewfinder EVF-2
- Support for SxS PRO+ 256 GB cards
- Support for battery adapters Bebob BAB-HG & BAB-HV
- Magnification for EVF-1/2 and MON OUT
- Six Zoom positions for EVF-1/2 and MON OUT
- Simplified global anamorphic de-squeeze
- Monitor identification

## Magnification

As with the ALEXA 65, the Magnification feature enlarges the image on each of the 4 monitor outputs (EVF and MON OUT 1, 2 and 3). This helps when frameline/sensor mode combinations result in a smaller image on the viewfinder or MON OUT. For example, you may be windowing a Super35 frame within the Large Format sensor area—and want to see the entire image fill the screen of your monitors. It is possible to set Magnification from 100% to 200%.

## Zoom

The existing Zoom function lets you momentarily zoom in to quickly check focus. The update provide 6 user-settable target areas. They can be accessed with new ZOOM user buttons. So, this lets you zoom into 6 zones within the frame, e.g.: center, top center, top left, top right, bottom left, bottom right.

## Anamorphic De-squeeze

Setting the anamorphic de-squeeze ratio has been simplified. It is now possible to globally set one de-squeeze ratio in the Project Settings. This de-squeeze ratio can be activated or deactivated individually on each of the four monitor outputs (EVF, MON OUT 1, 2, 3). This de-squeeze ratio will be recorded in the camera metadata. It can automatically de-squeeze the image in the ARRIRAW Converter and other postproduction tools.

De-squeeze ratios are currently 1.25x (Ultra Panavision 70), 1.3x (Hawk65), 1.5x (Technovision Classic) and 2.0x (Scorpio). Additional squeezes will surely follow.

## Image Processing

The ARRI Noise Reduction (ANR) algorithm has been improved and results in lower black levels than before.

# ARRI ALEXA LF Update 3.0, cont'd



## Monitor identification

You can now quickly identify which MON OUT a given monitor is connected to. This simplifies cable wrangling on set. The MON status icon that belongs to the connected monitor is as bright as the rest of the status info, while the icons of the other paths are dimmed. (In the example above, MON 2 is connected).

## Additional Update Notes

While updating the camera, ARRI Service will also install the latest version of the ARRI Wireless Video System (WVS) software, which improves the reliability and signal strength of the integrated wireless video transmitter. The stand-alone Wireless Video Transmitter WVT-1 and Wireless Video Receiver WVR-1 are not affected by this, and their latest software (4.3.23) remains compatible with the new WVS software. However, since the new WVS software also contains a bug fix that makes the ARRI WVS compatible with more monitors, ARRI also recommend updating those units to the new WVS software.

As part of the ALEXA LF 3.0 SW & HW Upgrade, a number of hardware patches will be installed to improve sensor cooling, wireless video range and general system stability. The upgrade also includes shimming of FSND filter frames.

ALEXA LF 3.0 SW & HW Upgrade provides a lot of useful new features and performance improvements. It is a pre-requisite for using the EVF-2 and SxS PRO+ cards.

Questions? Email ARRI Service at [service@arri.de](mailto:service@arri.de)

## ALEXA LF Recording Formats, Maximum Frame Rates, and Maximum Recording Capacity

Recording Format				Max fps (media duration in hr:min at max fps/at 24 fps)		
Sensor Mode	Recording File Type	Recording Resolution	Recording File Setting	SxS PRO+ 256 GB (SBP-256D, SBP-256E)	SXR Capture Drive 1 TB	SXR Capture Drive 2 TB
LF Open Gate	ProRes	4.5K	422	-	60 (00:28/01:11)	60 (00:57/02:22)
			422 HQ	-	60 (00:18/00:47)	60 (00:37/01:34)
			4444	-	60 (00:12/00:31)	60 (00:24/01:02)
			4444 XQ	-	40 (00:12/00:20)	40 (00:24/00:40)
	ARRIRAW	4.5K		-	90 (00:08/00:32)	90 (00:17/01:04)
LF 16:9	ProRes	HD	422	60 (01:45/04:23)	60 (03:12/08:02)	60 (06:25/16:04)
			422 HQ	60 (01:10/02:55)	60 (02:08/05:21)	60 (04:16/10:42)
			4444	60 (00:46/01:56)	60 (01:25/03:33)	60 (02:50/07:07)
			4444 XQ	60 (00:31/01:17)	60 (00:56/02:22)	60 (01:53/04:44)
		2K	422	60 (01:32/03:50)	60 (02:48/07:01)	60 (05:37/14:03)
			422 HQ	60 (01:01/02:33)	60 (01:52/04:40)	60 (03:44/09:21)
			4444	60 (00:40/01:42)	60 (01:14/03:06)	60 (02:29/06:13)
			4444 XQ	60 (00:27/01:07)	60 (00:49/02:04)	60 (01:39/04:08)
		UHD	422	60 (00:26/01:05)	60 (00:47/01:59)	60 (01:35/03:59)
			422 HQ	60 (00:17/00:43)	60 (00:31/01:19)	60 (01:03/02:28)
			4444	40 (00:17/00:28)	60 (00:20/00:52)	60 (00:41/01:44)
			4444 XQ	30 (00:15/00:18)	60 (00:13/00:34)	60 (00:27/01:09)
	ARRIRAW	UHD		-	90 (00:14/00:53)	90 (00:28/01:47)
LF 2.39:1	ProRes	4.5K	422	90 (00:17/01:05)	100 (00:28/01:59)	100 (00:57/03:59)
			422 HQ	60 (00:17/00:43)	100 (00:19/01:19)	100 (00:38/02:38)
			4444	40 (00:17/00:28)	100 (00:12/00:52)	100 (00:25/01:45)
			4444 XQ	30 (00:15/00:18)	60 (00:13/00:34)	60 (00:27/01:09)
	ARRIRAW	4.5K		-	150 (00:08/00:53)	150 (00:17/01:47)

Recording Media not Supported:

XR Capture Drives 512 GB (CDX-3730), all SxS PRO and SxS PRO+ cards except SxS PRO+ 256 GB (SBP-256D, SBP-256E) and all CFast 2.0 cards



# Feb 2019: ALEXA LF Update SUP 4.0.

ARRI released SUP 4.0 at the end of November 2018—a suite of helpful new updates for ALEXA LF cameras.

My favorites are additional anamorphic desqueeze ratios and LBUS support.



## Anamorphic Desqueeze

MENU>PROJECT		
Project frame rate	23.9	1.00
Camera index		1.25
Camera index color		1.30
Next reel count		1.50
		1.65
Lens squeeze factor		1.80
Production info		2.00

ALEXA LF gets new anamorphic desqueeze ratios: 1.8x for Cooke Anamorphic/i Full Frame Plus lenses and 1.65x for Panavision Ultra Vista Full Frame Anamorphic lenses. That brings the choice of squeezes to: 1x (normal, no squeeze), 1.25x, 1.3x, 1.5x, 1.65x, 1.8x and 2x. I imagine anamorphic lens makers will conjure up even more desqueeze ratios in the future.

## LBUS Support

LBUS Support means you can use the new ARRI Operator Control Unit OCU-1, as well as Master Grips and much more on ALEXA LF. LBUS Support opens the world of lots of accessories for the ALEXA LF. LBUS is the high-speed data protocol used in cameras and accessories. It's a similar system to the electronics found in many automobiles.

When you connect a Lens Control System LCS-LBUS cable (Cable K2.0007318) to one of the two LCS connectors on the ALEXA LF, most of ARRI LBUS accessories will now work. LBUS devices can daisy chain together.

Note: cforce mini lens motors, cforce plus lens motors and cforce mini RF lens motors are now compatible. (Required: cforce mini RF SUP 1.1. The cforce mini RF motor must be set to "client mode." Then it works like a cforce mini motor without the RF, which is already built into the ALEXA LF.

## Master Grips & Operator Control Unit OCU-1

Requires Master Grip/OCU-1 SUP 1.1.2 or later. For override function, requires Master Grip/OCU-1 SUP 2.0.

Ensure that your OCU-1 has the required Master Grip/OCU-1 SUP 2.0 and that your Wireless Control Unit has WCU-4 SUP 3.2.

## LCUBE CUB-1

With the CUB-1, you can connect an ARRI Ultrasonic Distance Measuring device (UDM) to the LBUS connector. While a different cable can also connect the UDM directly to the ALEXA LF EXT connector, the CUB-1 option might come in handy if the EXT connector is in use for something else (e.g. for sensor sync).

## LCUBE CUB-2

The CUB-2 allows an ARRI LBUS device, for example Master Grips or Operator Control Unit OCU-1, to control the internal motors in ENG lenses, as well as a cmotion pan-bar zoom, cmotion steady zoom, or cmotion cfinder III.

When using cforce motors with ALEXA LF, separate power must be provided to the cforce lens motors from the other side of the daisy chain, for instance from an LBUS to D-tap cable (K2.0006758) connected to an on-board battery. This is because the output from the ALEXA LF LCS connectors do not provide sufficient power to the cforce motors.

## Additional SUP 4.0 updates

- EXT Sync: sensor sync—for example to sync 2 ALEXA LF cameras for 3D work.
- Magnify: Each of the three sensor modes now has separate magnify values for EVF and MON OUT 1, 2 and 3. For example, you can zoom in on the image to check focus, without changing the director's monitor.
- Project Frame Rate: changing the menu item "Project frame rate" will set the project frame rate, the sensor frame rate, and the frame rates of the three MON OUT SDI outputs to the same value.
- Improved dynamic defect pixel correction.

## ALEXA LF LBUS Accessories





## April 2019: ALEXA Mini LF Launched



Special thanks to Marc Shipman-Mueller, Product Manager (above right, with Michael Jonas levitating Mini LF at left) for the countless hours, late night calls, and all his valuable help on this report. Our work together goes back to the Arriflex 535 Book and every camera system that followed. Those were the days when camera reports took a year to write. Now, it's a matter of weeks. Like Hamilton in the musical, "Write day and night like you're running out of time." And great thanks to Johannes Polta for some of the best product renders in the business.





Here's the new little camera from ARRI that shoots big pictures. It's ARRI's latest addition to their large-format camera system. This is what many cinematographers were asking for: Large Format, lighter, smaller, modular.

It's pretty much always followed this way. Arriflex cameras were not just cameras, they have long been part of a system.

As Stephan Schenk explained, there usually was a studio style "A" camera accompanied by a hand-holdable, lighter, smaller "B" camera.

When the Arriflex 35BL came out, its lighter, smaller, faster MOS companion was the 35-3. The Arriflex 535 system was rounded out with the 435. Along with ARRICAM came my favorite hand-held camera, the shoulder-resting Arriflex 235 whose magazines looked like a school of playful dolphins.

This sets the stage for the camera that comes in the days ahead of NAB, in April 2019. Its design is equally joyful. ARRI ALEXA Mini LF is quintessentially an ALEXA LF stuffed into the body of a Super35 ALEXA Mini. It uses the same size ALEV III (A2X) CMOS sensor (36.70 x 25.54 mm). To picture the engineering involved, imagine unloading the entire contents of your 22-foot long camera truck and squeezing almost everything inside a BMW X3.

The new ALEXA Mini LF is not a "B" camera. It's an entire-alphabet camera. Just as the Super35 ALEXA Mini captured the imaginations of users on all kinds of productions, the new Large Format Mini LF is equally versatile.

Which brings us back to the concept of ARRI's camera system. Camera capabilities can be defined by shooting style.

You might want an all-in-one high-speed ALEXA LF camera, most likely in a studio, that does almost everything without having to add accessories. Or you may need a modular Mini LF, either by design or because it's the only camera body the production can afford. You might choose your camera for flexible, fast-paced production. You may want the camera mounted on a gimbal for one scene, handheld the next, and then in full studio regalia with a spaghetti of cables and accessories surrounding it. In the best of all worlds, you'll have one or more of each Large Format Camera.

### Big Picture, Little Camera

ALEXA Mini LF is the newest member of ARRI's Big Picture camera system: ALEXA LF, ALEXA Mini LF, Signature Primes, LPL Lens Mount, LDS-2 lens metadata, and PL-to-LPL Adapter.

Incidentally, "Big Picture" is not a random, cute name. Denny



ALEXA Mini LF



On ARRI's demo film *Café Mila*, Second Unit DP Heiko Knauer with ALEXA Mini LF and ARRI Signature Prime 75mm. First unit cinematography: Tom Faehrman BVK. Photos: Michael Trammer.

Clairmont hated when we said “Super35” because there were so many variations. “Just call it ‘Big TV,’” Denny admonished. So, with a salute to Denny, “Big Picture. Little Camera.”

The Mini LF shares its photosite design and color science with the ALEXA LF, and for that matter, ALEXA 65 and Super 35 ALEXAs. Other well-known and enviable attributes include extremely high dynamic range, natural skin tones, easy color correction, high sensitivity and clean images for VFX. The camera is ergonomic, rugged and reliable. It is easy to operate. Menus are intuitive. Data wrangling and management in post is fast and efficient.

## What's new on ALEXA Mini LF?

ALEXA Mini LF's carbon fiber body plus LPL lens mount weighs a mere 2.6 Kg. How convenient—that's the same size and weight (about 5.7 lb) as the ubiquitous Maß (1-liter beer mug) at Oktoberfest.

The main way to tell the cameras apart is that ALEXA Mini LF has a bulge on the camera left side. This is where the recording media goes. And yes, it records ARRIRAW internally. We'll get to that.

Other new things about the ALEXA Mini LF:

- New, small, tough, affordable Codex Compact Drive 1TB media
- Motorized Large-Format FSND filter slider (Clear, ND 0.6, ND 1.2, ND 1.8)
- 3 extra connectors: 12V 2-pin, 24V RS 3-pin and SYNC IN
- New Multi Viewfinder MVF-2 with large 4" flip-out monitor

that displays the image or menu

- Viewfinder works on camera left and right side
- New VF cable using easier, flexible CoaXPress (up to 10m/33ft)
- Viewfinder has a built-in eyepiece lens heater for de-fogging
- Camera works with 12V and 24V batteries (11V to 34V)
- Power draw at 24 fps with viewfinder is similar to ALEXA Mini, which is about 65 W.
- 3 more user buttons on the camera left side (6 total).
- New 6-pin AUDIO connector (2 Ch LINE IN + 12V)
- Recessed TC connector
- Easier access to recording media and Viewfinder connector
- 2 built-in microphones
- One LOCK button each for camera and viewfinder
- Additional external WiFi antenna
- ARRIRAW license included

## Large Format sensor

This entire edition of FDTimes is pretty much a paean to Large Format, packed as these pages are with new Large Format products. So we probably don't need to rhapsodize further about the distinguishable aesthetic virtues, although it's difficult to resist. More natural perspective. Backgrounds appear closer but shallower depth of field separates them more than S35. Higher resolution and less noise. Higher sensitivity, higher contrast, smoother images.

For more information: [arri.com/alexaminilf](http://arri.com/alexaminilf)





*Stephan Schenk is Managing Director of ARRI Cine Technik and General Manager of the Camera Systems Business Unit.*

### **JON FAUER: How did the concept of ALEXA Mini LF begin?**

STEPHAN SCHENK: ARRI launched the ALEXA 65 in September 2014 and the ALEXA Mini in April 2015. Both developed very successfully over the following years. When we were looking into a Full Format camera, we had 2 options: an ALEXA Mini type camera or an ALEXA 65/SXT type camera. Our engineers looked into the possibilities and we went for the ALEXA LF because we wanted a camera with high-speed capabilities. This was based on customer feedback, especially in commercial productions, who wanted 120 fps and more in full image quality.

Of course, it was already clear even before the launch of ALEXA LF that we would also need a Mini style version. Since February 2018, I have said that our engineers were on it—and they were, successfully, as we know today. And that was a customer demand from day one of the ALEXA LF launch.

### **What was your mandate in development of the ALEXA Mini LF? In other words, what did you suggest to the designers, product and project managers?**

We wanted a camera with the same form factor of the ALEXA Mini. It should record the same types of uncompressed, unencrypted ARRIRAW formats as the ALEXA LF. It should record in-camera, without an additional external unit. But, it was clear from the early evaluations that this would mean a lower maximum frame rate than with ALEXA LF.

The mandate for our teams always has been to not only develop and produce the best camera we can, but also to ensure that it integrates seamlessly into the entire ARRI camera system and that

it also works with other products in the industry. The ALEXA Mini LF really is a great addition to the new ARRI large-format camera system that we launched last year.

**What will be your marketing and sales strategy? In 2015, we discussed the intended market for ALEXA Mini. Most people said it would be a “B” camera. I remember daring to say it would be an “A” camera as well.**

I think the days of a clear “A,” “B,” and “C” camera philosophy are over. The ALEXA Mini can be the companion camera for ALEXA 65 or SXT. For some, it is the main camera—the one and only camera they have on their production. And for others, it is a handheld, drone or gimbal camera. It really depends on the type of production, the budget or the shooting style of the Cinematographer.

### **Have shooting styles changed the way cameras are conceived?**

The shooting style has changed. We see many more sequences shot handheld these days. This makes smaller cameras more attractive and is one reason for the huge success of the ALEXA Mini. Also, there are new tools like drones and gimbals or the ARRI TRINITY that enable Directors and DPs to tell their stories in different ways. These developments have also led us to come out with a number of accessories made specifically for the ALEXA Mini. Almost all of those now fit on the ALEXA Mini LF.

**A tougher question, please. I’m sure you’ve grappled with not wanting to release this camera too soon. But competition and customer demand maybe demanded it. (What do they say—damned if you do and damned if you don’t). So, how do you avoid negative publicity and criticism from rental houses? Another company comes to mind: they were pilloried**



ALEXA LF

ALEXA Mini LF

LPL to PL Adapter

Signature Primes

for bringing out a new S35 camera less than one year after launching a 2/3" camera. The ALEXA Mini LF comes a year after ALEXA LF.

We have been very honest and clear about this from day one. Ever since the launch events of ALEXA LF last year, we always got the question, "When is an ALEXA Mini LF coming?" We always replied that we were working on it, but didn't know whether we could even achieve it. And, if we could do it, what would be its capabilities and when would it be ready? As Marc and Michael will tell you, it was quite an engineering challenge to stuff a larger sensor and so many components into something so small.

It turned out that it was possible. Now that we have a number of working Mini LF prototypes, we are going public.

But, there is also a fundamental difference to your disappointed rental house comparison. To me, the ALEXA Mini LF supports the ALEXA LF instead of superseding or replacing it. It is, in fact, similar to ARRI's concept of having the Arriflex 35-3 complement the 35BL. The 435 complements the 535. The Arriflex 235 complements the ARRICAM. We have built many camera systems that consisted of a studio version and a lighter, smaller companion.

**Manohla Dargis wrote in the NYTimes, "The industry is often and sometimes laughably called liberal, but its entrenched economic conservatism is often matched by its aesthetic traditionalism." Perhaps this is why Full Format/LF has taken longer to take off than expected?**

We made a big leap last year, probably the biggest step since the introduction of the PL-mount about 40 years ago. With the introduction of the ARRI LF camera system, we not only launched a new camera but also a new format, a new set of primes lenses and a new lens mount.

What makes me very confident that it will become more and more popular is the fact that all the cinematographers I have spoken with, who used ALEXA LF, love it and went on to shoot their next project with it again. Just as an example, Greig Fraser captured *The Mandalorian* Star Wars TV Series with ALEXA LF and is now shooting *Dune* with it. Also, many DPs who captured their projects with ALEXA LF went on to subsequently purchase the camera. I think the reason is that there truly is such a thing as the Large Format look. The LF images are stunning and there is a visible difference.

**I hope you have a big enough assembly line to build Large Format cameras, because I see a growing demand for this format.**

We have. But I would like to keep both feet on the ground. The acceptance of Large Format takes time. We need every DP, Director and Producer to try it, to have experience with the format. We also need more lens choices. But it is coming. Many companies are currently working on new LPL lenses. Also, our range of Signature Primes has significantly increased. We already have over 10 focal lengths by now and it will be 16 by the end of the year.

**So, what is next and what about Super35?**

At first, the ALEXA Mini LF will have the same recording formats as the ALEXA LF. However, we know that customers also want Super 35 recording formats cropped from the LF frame. We take that seriously and will look into adding such Super 35 recording formats with a future Software Update Package.

I would like to add that we at ARRI still believe in Super 35. Not everybody will shoot Full Frame/Large Format. A large number of productions, in particular in TV, will remain with Super 35 for the foreseeable future, for a variety of reasons. And I say this very openly here: we are also working on a dedicated Super 35 4K camera (not LF) that is planned to be introduced in the first half of 2020. So, the choices for cinematographers will increase again. But for now, I am really looking forward to seeing how and where the creative community will use our LF camera system — with its new member, the ALEXA Mini LF.







*Michael Jonas (left) and Marc Shipman-Mueller (right), both Product Managers for Camera Systems, with ALEXA Mini LF (center).*

**JON FAUER: How and when did this new ALEXA Mini LF project begin?**

MICHAEL JONAS (MJ): It originally started based on improvements we had planned for the ALEXA Mini. We had been looking, for some time, at how to implement all the user feedback regarding the Mini and then we figured that it might also be possible to include the LF sensor.

**What was the mandate and where did it come from?**

MJ: The ALEXA Mini is a huge success and basing the ALEXA Mini LF on the same concept was the logical choice.

MARC SHIPMAN-MUELLER (MSM): When we conceived the ARRI large-format camera system, we wanted to have a fully featured high speed camera first and follow up with a more lightweight model. The ALEXA LF was faster to market because we could base it on existing technology, as it is very similar to the ALEXA 65. The Mini LF took longer since we had to work out how to fit that large sensor into such a tiny body, and we did not know if that was possible at all.

**The concept, the theme, the main idea?**

MSM: It's basically a large-format sensor in a Mini body, with lots of improvements to the camera based on the comments we have

received on the Mini.

MJ: Given that we want to achieve uncompromised image quality, the questions were: How much processing power can you stick into such a small camera, and how can it be adequately cooled? What would be the right media? And what are the maximum frame rates?

**How did the team manage to squeeze everything into such a small body? What gave way?**

MJ: The engineers used magic [laugh]. Fitting the sensor and the internal, motorized large-format FSND filter stage into the tiny Mini body was indeed a big challenge. We also optimized the cooling by using the space that the CFast 2.0 card slot used in the Mini for a larger internal cooling vent. This, in addition to the new media, provided us with greater options. Given how packed the ALEXA Mini already was, it is amazing that we managed to fit all this into the same package. Huge compliments to our engineering team!

**How did you reduce power consumption and deal with cooling?**

MJ: We had to find a good balance between features, performance and size. We did not want to compromise our core values of mechanical excellence, ruggedness and image quality. It clearly helped to stick to the existing Mini concept as we have thousands of cameras out there. That gave us a good idea of where the issues were and what areas we could focus on for improvements. The defining goal was to address usability issues. We hope that our users will appreciate the new card location, the new viewfinder connection and the additional power outputs—which were the main points of criticism on ALEXA Mini.

MSM: The power consumption of the ALEXA Mini LF is just a little bit more than the original Mini, so you can use regular 12V on-board batteries. What gave way was the number of features in comparison to the ALEXA LF. The Mini LF does not reach the 150 fps of the ALEXA LF, for example, and it does not have the three independent SDI outputs.

**What were the challenges on this project?**

MJ: Fitting everything into the body and keeping the basic form factor. Ensuring that all the accessories of the original Mini would fit. We achieved that except for two brackets. For rental companies and ACs, it will be an easy transition from rigging an ALEXA Mini to rigging an ALEXA Mini LF.

MSM: It was also a Herculean task in terms of the software that had to be written and ported, and our software developers did unsung heroic deeds to get it all done in time.

**What are the main differences (besides sensor size) between this camera and ALEXA Mini?**

MJ: There are many. Improved cooling with larger fans to keep the camera quiet.

MSM: Updated electronics with more power options. We have an extra 24V and 12V power output.

MJ: New media. And the media goes into a media bay on the camera-left side for easier access.

MSM: An additional WiFi antenna for better WiFi range.

MJ: We have three more user buttons on the camera-left side.

# Michael Jonas and Marc Shipman-Mueller

MSM: The camera has two built-in microphones for a scratch track.

MJ: A number of connectors have been moved so you can access them more easily—for example, the VF connector and the TC connector.

MSM: And there is a new SYNC IN connector for black burst and tri-level sync.

MJ: We have a new viewfinder connector (VF), which will be the new standard for ARRI cameras going forward. It is based on the CoaXPress standard.

MSM: Increased VF cable length. The cable is less complex and more cost-effective.

MJ: New, brighter viewfinder (same image as EVF-2) and improved flip-out display.

**I think the native flange focal depth is 24mm. Therefore, can you attach a Leica M mount?**

MJ: Yes, the Leica M-Mount for ALEXA Mini will fit.

**Would you like to mention some of the people on your team?**

MSM: Victor Gómez-Hernández, the project leader, has shown great calm in the face of a tough schedule.

David Bermbach, the project lead of the original ALEXA Mini and now responsible for product development, has brought years of experience building cameras and always brings a chipper attitude to the project.

MJ: Lars Hartmann ensured R&D knew exactly what to build.

MSM: We are also thankful to David Zucker, who deals with the ALEXA 65, for all his input and feedback.

MJ: This would not have been possible without all the brilliant engineers in R&D at ARRI, who are a very enthusiastic and creative bunch of people.

**I think Mini LF and ALEXA LF will happily coexist side by side. Your thoughts? Which camera do you use when?**

MJ: Picking a camera depends on shooting style, workflow, budget and ultimately personal taste.

MSM: Some productions will want to be small and lean with the Mini LF, others prefer to have the fully-featured and larger ALEXA LF with 150 fps and multiple independent SDI outputs. Since they have the same sensor, they complement each other nicely for all kind of scenarios, which makes them a very flexible combination on set.

MJ: With all the hype of cameras getting smaller: some people actually like the weight and form-factor of the original ALEXA.

MSM: The Mini LF will extend the reach of the LF system to smaller productions and lighter grip packages.

MJ: The Mini LF enables the same exciting setups and applications as the ALEXA Mini on drones, gimbals and stabilized heads.

MSM: Essentially, the combination of ALEXA Mini LF, Signature Primes, TRINITY and SRH-3 will raise the bar for moving shots and enable new ways of story-telling with superb image quality. The LF system overall provides the tools for a new visual language.

**ALEXA has had an 8-year or more life. What do you expect it**

**to be for this one?**

MSM: ALEXA cameras have already sold well for over 8 years, and I think they will be rented for much longer than that.

MJ: We hope we will get the same with the Mini LF, as it is really a universal tool and the image quality speaks for itself.

**As with most ARRI cameras, it is really part of a system.**

MSM: I think it is important to see this not just as a single new product, but to understand our system approach.

MJ: We are the only manufacturer to provide an almost complete set of tools: cameras, image science, camera accessories, lenses, lens control, lights, matteboxes, filters, TRINITY, SRH-3, you name it.

MSM: Each item is the best we can do in each category, and we make sure they all work well together. So, as a crew member, you will notice that ARRI stuff is very compatible with third party stuff, but when you use an ARRI component with another ARRI component, there is an extra level of precision and fit, there is much less stress and you get extra capabilities.

**Wrap-up?**

MSM: The ALEXA Mini LF is the newest part of the ARRI large-format camera system, which now consists of ARRI Signature Prime lenses, LPL lens mount, ALEXA LF and ALEXA Mini LF cameras, PL-to-LPL Adapter and Lens Data System LDS-2. Feedback from the many, many productions that have already shot with the ALEXA LF shows that there is a special large-format look that is very much sought after by cinematographers.

MJ: And the ARRI large-format camera system provides it with exceptional image quality.

MSM: Every cinematographer who has shot with the LF wants to continue shooting with the ARRI LF system on their next projects, which is high praise.

MJ: I believe the ALEXA Mini LF will be a big hit and push large format even further into the mainstream.



LPL Mount and LPL to PL Adapter



# April 2019: ALEXA Mini LF vs ALEXA Mini

## ALEXA Mini LF

- LPL Mount
- 36.70 x 25.54 mm sensor
- (Large Format)
- Wider left side for media
- 2 antennas
- Large-format FSND filter slider

LEMO 4-pin LBUS connector on lens mount for daisy-chainable lens motors



## ALEXA Mini

- PL Mount
- 28.25 x 18.17 mm sensor
- (Super35)
- S35-format FSND filter slider

LEMO 4-pin LBUS connector on lens mount for daisy-chainable lens motors



In ALEXA Mini LF, Codex Compact Drive recording media is on the camera left side.



In ALEXA Mini, data is recorded to a CFast 2.0 Card that goes into the right rear.



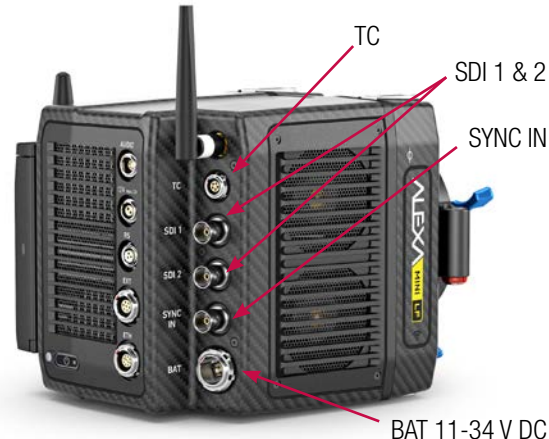
ALEXA Mini LF  
LPL Mount  
44mm FFD  
62mm I.D.



ALEXA Mini  
PL Mount  
52mm FFD  
54mm I.D.



## ALEXA Mini LF



# ALEXA Mini LF





# April 2019: ALEXA Mini LF Configurations



The bare essentials. Camera left. 6 User buttons. REC button. VF connector



Camera right side.



Fully rigged studio and handheld mode



Mounted in a TRINITY Rig

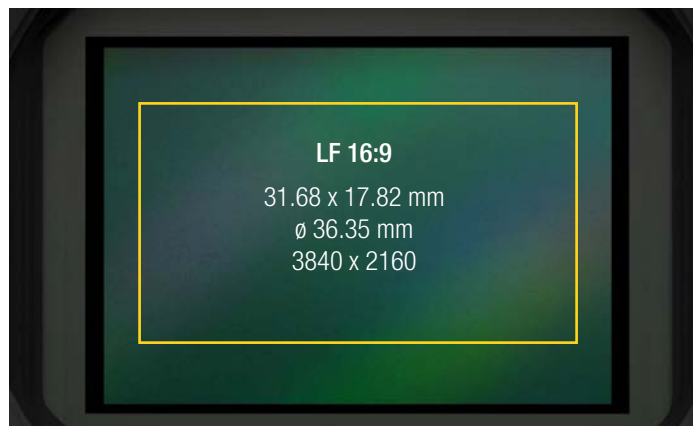
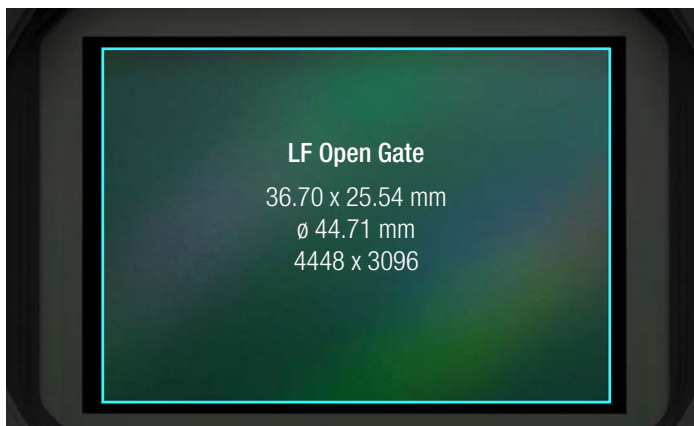


Mini LF turned 90° on side for vertical portrait mode with Vertical Top Plate.



Gimbal Mode, shown with a MoVi

# ALEXA Mini LF Sensor Modes



Just like big sister ALEXA LF, Mini LF has the same 3 Sensor Modes, which is how much of the entire sensor you want the camera to read out. It's similar to a hard matte installed in film camera gates. Remember: the taller the image height, the slower (lower) your maximum frames per second rate will be.

LF Open Gate provides the maximum sensor area, 36.7 by 25.54 mm, and the maximum resolution, 4448 x 3096 photosites.

LF 16:9 meets 4K UHD deliverable standards and it offers surround view. This is also an excellent choice if you want to almost "window" Super35 format lenses and crop the remaining picture area in post.

LF 2.39:1 is for spherical widescreen (non-anamorphic).

## ALEXA Mini LF Media



Codex Compact Drive 1TB Media Bay

Codex Compact Drive 1TB



ALEXA Mini LF records internal MXF/Apple ProRes and uncompressed MXF/ARRIRAW. What's this? The camera now uses one wrapper, MXF, for all recorded files. This is where the industry is going; in fact, Apple is supporting MXF in Mac OS X now. Moving forward, Codex media will be more affordable and workflow should be simpler and faster. The new Codex Compact Drives are smaller and very reliable.

Compact Drive Reader (USB-C) for Mac OS or Windows, works without a driver or license. Approx. 8 Gb/s download speed.



The Compact Drive Adapter (above, with Compact Drive inserted) fits into the SXR Capture Drive Dock.





Victor Gómez-Hernández, at left, is Project Manager of the ALEXA Mini LF.

Florian Lohse, at right, is Project Manager of the new MVF-2 Viewfinder (design plans below and discussed on the next page).

### Victor Gómez-Hernández

#### What were the challenges in manufacturing ALEXA Mini LF?

**VICTOR GÓMEZ-HERNÁNDEZ:** In addition to what Marc and Michael mentioned (LF sensor, motorized FSND filter stage and additional power outputs), we had to retain the form factor of the original ALEXA Mini. It was important to keep the mounting points the same so that our customers could reuse most of the existing Mini accessories.

The cooling of all components (LF sensor, processor, new recording media) in such a small form factor was really challenging. We did a lot of thermal simulations and optimization of the cooling system. This was tricky, as the Mini is already a pretty good camera in that respect. The Mini LF has a larger cooling channel internally and its fan can go faster, so we have more cooling air volume.

The question of where to place the new recording media gave us a lot of headaches. The Mini is a very tightly integrated camera, there really are no empty spaces inside. Ultimately, the best place was the camera left side, similar to the way it is on an ALEXA. The media can be removed easily, even when the Mini LF is mounted on a drone, gimbal, Steadicam, crane, etc.

#### How many different departments were involved at ARRI?

It was a great combined effort of many teams: mechanical, electronic, optical, software, image software, image science, embedded firmware, sensor, user experience, requirement engineering, testing, quality management, series production, programmable systems, controlling and purchasing.

I am deeply thankful to work in a great environment and with an amazing team, making all this possible. It is difficult to highlight anyone special, as everyone in the teams worked very hard. A deep thank you for sure goes to my manager David Bermbach who has always supported me in all kind of situations.

#### Describe a day in the life of a camera project manager.

You think that you have planned all the details for anything that could happen in the project but every day you have to face new challenges and try to address them as soon as possible. In the end, we can all be very proud of the developed product and the teams.

#### How long have you been at ARRI and where were you before?

I started working on this project at ARRI in September 2017. So, you could say that I started just in time. Before that, I worked at BMW and in project management at Turbina, a company in the renewable energy sector.

#### How did you go from cars and energy to building cameras?

For me, it is extremely important to work in an innovative environment with challenging technologies. This is exactly what you can find at ARRI in camera development. I enjoy driving and managing projects.



# Florian Lohse, Project Manager for MVF-2 Viewfinder



Flip-Out Monitor

Eyepiece with HD OLED display



VF cable with CoaXPRESS connectors

## Florian Lohse

### Describe the new MVF-2 Viewfinder.

FLORIAN LOHSE: The “M” stands for “Multi” Viewfinder because it has a regular viewfinder display with an eyepiece and also a flip-out monitor. The flip-out monitor can display the image or the camera control menu. It can remain closed and flat against the left side, or you can flip it out to see the image. Alternately, you can flip it fully around and rest it against the viewfinder, with the menu or image now visible to the assistant. Compared to the MVF-1, the MVF-2 has a larger flip-out monitor and a new control button concept. The eyepiece also can be removed now and it has a built-in eyepiece heater.

### New monitor, new OLED

The flip-out monitor display is larger than the one on the MVF-1. The new display you see through the eyepiece has a native HD OLED display with higher resolution and higher contrast than previous viewfinders. This allows for much better judging of focus, dynamic range and color in the viewfinder. The display is precise, temperature-controlled, individually calibrated. Therefore, it is a great reference for evaluating the image. It has, by the way, the same HD OLED that’s in the ALEXA LF EVF-2 viewfinder. So, when using ALEXA LF and ALEXA Mini LF on the same scene, both camera operators will see the same image in the viewfinder.

### New cable

The new viewfinder cable (called the “VF cable”) is more flexible than the previous model. It has industrial CoaXPRESS connectors that are easier to plug in and out. Since it is coaxial, it does not have a key, so it plugs in no matter how you have rotated the connector. Also, we will be able to support longer cables up to 10 meters.

### Eyepiece heater

The viewfinder has an integrated heater that reduces eyepiece lens fogging in cold and damp conditions. When turned on, the internal heating elements will control the temperature of the eyepiece’s front glass and heat it up if needed. While we will not get as much power through the VF cable as we get through the cable of an external eyepiece heater, it is much more efficient because the heating elements are directly on the glass. I think this will be great for most situations where you are dealing with fogging in the eyepiece. However, if you are shooting in the arctic, you may

still want to also bring an external eyepiece heater, like the ALEXA heated eyepiece HE-7.

### ARRICAM style eyepiece

The eyepiece has the same optical design as on the ARRICAM. At one point, we did a comparison test with all eyepieces we could get our hands on: ALEXA, AMIRA, 235, 435, ARRICAM, and more. We looked through all of them at a number of moving and still images, and we found that the ARRICAM was by far the best. It has very low optical distortion and very minimal chromatic aberrations, which results in a very clear image. It also has a very wide exit pupil, which allows the operator to move their head back and forth a bit more than with other eyepieces before losing the image.

### MVF-2 works on both sides of the camera

The MVF-2 was designed to improve the synergy between camera operator and camera assistant. There are two control dials with identical functions. One is located on the backside of the viewfinder, to be used when the display is folded against the viewfinder’s side. In this position, the display can be used by the assistant without getting too close to the operator’s face. The second control dial is placed on the backside of the monitor display and is intended for a single operator hand-holding the camera.

### The design and manufacturing process

Viewfinders are the direct visual interface to the camera operator. We were eager to hear their comments. The manufacturing of the MVF-2 did not change from previous viewfinders: all suppliers are based in Europe and the assembly is done at our headquarters in Munich. This is a huge advantage for bringing quality to mass production, as we have daily conversations between developers, assembly and service.

### Slide-In Card

The Slide-In Card is a small new feature based on direct client suggestions and field observations. We realized that many assistants and operators tend to use the free surface on MVF-1 for placing Post-it Notes with camera settings, actors’ names, [lunch delivery orders] and other production specific-information. So, we added a slide-in-area hidden behind the foldable monitor to be used for that purpose.





Jeanfre Fachon is Product Manager of ARRI Camera Accessories

**Please describe your new accessories for the new camera.**

Speeding things up on set today is a major concern. Productions often use the same camera shoulder-mounted, handheld, on fluid heads, gear heads, remote heads and various stabilizers. ARRI's new accessory range for ALEXA Mini LF allows quick reconfigurations between set-ups, saving precious time in the process.

**How are they different from current accessories for the Super35 format ALEXA Mini?**

We have optimized and updated our range of support accessories for ALEXA Mini and designed new accessories, such as the Mini Side Bracket MSB-3 and RAB-1 Clamp 2, that adapt to the updated ergonomics of the ALEXA Mini LF. We are emphasizing sturdy, quickly reconfigurable cine set-ups, while keeping available the wide-ranging catalog of support accessories we had for the ALEXA Mini from day one.

**How do you go about designing these? Input from DPs and ACs? Your own experience?**

We are very fortunate to be in contact with amazing camera people from all over the world. We are close to the rental houses and also to many gifted cinematographers, camera assistants, documentary filmmakers—seasoned and emerging. They share a common drive to move things forward. Their input is invaluable.

**Please share with us your opinion about the difference between ALEXA Mini modular style and the SUV style of unibody, all-in-one ALEXA (Classic to SXT W)? For example, in this edition of FDTimes, we have an interview with Ben Richardson in which he says, "By the time you outfit a Mini with all its accessories,**

## Mini LF System & AKS Exploded View



AKS=All Kinds of Stuff

## Mini LF Accessories

it's about the size of an SXT” But then he goes on to explain that a majority of the show was done on gimbals and sliders.

That is an interesting point. The ALEXA, with its larger body, offers a similar scale to traditional film cameras and happily supports many of the required camera accessories. Many disciplines from camera assistants transferred nicely from the analog world to the ALEXA. The ALEXA Mini body can be taken into very tight places, which is a fantastic asset for many filming conditions. However, achieving classic cine-style rigging requires a different approach. Often, support accessories are used as an exoskeleton to support the required devices that improve crew efficiency. Our range of camera accessories has grown and evolved continuously since the launch of the ALEXA Mini in order to address new ideas and challenges, such as when the ARRI Trinity came into the picture.

### Do you offer choices of styles?

Definitely. We cannot impose a particular set-up to our users as the scope of applications is constantly broadening. Our experience with the ALEXA Mini ranges from Hollywood blockbusters to documentaries about free-climbing. We currently offer well over a hundred diverse support accessories for ALEXA Mini, most of which will happily outfit the ALEXA Mini LF. All are developed, tested and manufactured in our facilities, here in Munich.



#### Mini Side Bracket MSB-3

While the MSB-1 and MSB-2 still fit on the ALEXA Mini LF right side, the MSB-3 offers extended mounting options for the left side of the camera. Though it is designed around the updated ergonomics of ALEXA Mini LF, the MSB-3 is also compatible with ALEXA Mini.



#### Clamp 2 for RAB-1

In addition to updated mechanics and a new safety release, Clamp 2 moves battery adapters a small distance to the left in order to make room for the second row of ALEXA Mini LF connectors. Clamp 2 also works well on ALEXA Mini.



#### Vertical Top Plate for ALEXA Mini LF

This new top plate is part of the vertical adapter set for ALEXA Mini LF, which allows 9:16 “portrait” filming—a growing demand in the fields of commercials and visual effects. Configurations can be built to allow quick changes between classic landscape and portrait image capture.

## ARRI WVR-1s Small Video Receiver



The new WVR-1s from ARRI is a smaller, lighter Wireless Video Receiver. It is the most recent addition to ARRI's WVS family of integrated (in-camera) and standalone transmitters, receivers, monitors and associated accessories. The small WVR-1s coordinates nicely when working with an ALEXA Mini LF—whether attached to the focus puller's WCU-4 and monitor, to the focus puller's big monitor on a C-stand or to the back of the director's handheld monitor.

The WVR-1s body is rugged, milled aluminum. The antennas are protected within a ribbed top cover (shown below). It pairs with ARRI's WVS transmitter. Please note, you must pair ARRI with ARRI. You cannot pair ARRI with Teradek or Teradek with Transvideo. Range is rated up to 150 meters/500 feet.

If you work with wireless video products from ARRI, Teradek, Transvideo and a few other companies, chances are that Amimon proprietary chips and circuits are inside. It's somewhat like computers having the label 'Intel Inside.' And then, in November 2018, Amimon Inc. was acquired by The Vitex Group and integrated into their Creative Solutions division.

In a joint statement recently, ARRI, Vitex Creative Solutions and Teradek confirm their continued commitment to the ARRI WVS product line, which is now being expanded with this latest addition, the ARRI WVR-1s.



ARRI WVR-1s Connectors:  
Power IN (10.5-34 V DC) 2-pin Lemo  
Power OUT (12 V DC, max 2.0A) 2-pin Lemo  
3G-SDI OUT BNC



# April 2019: ALEXA Mini LF Specs

Sensor	Large Format ARRI ALEV III (A2X) CMOS sensor with Bayer pattern color filter array
Sensor Size	36.70 x 25.54 mm / 1.444 x 1.005" Ø 44.71 mm / 1.760"
Photosite Pitch	8.25 µm
Sensor Fr. Rates	0.75 - 90 fps
Exposure Latitude	14+ stops over entire sensitivity range from EI 160 to EI 3200 as measured with the ARRI Dynamic Range Test Chart
Exposure Index	Adjustable EI 160-3200 in 1/3 stops; EI 800 base sensitivity
Shutter	Electronic shutter, 5.0° - 356° or 1s - 1/8000s
Recording Formats	MXF/ARRIRAW MXF/Apple ProRes 4444 XQ MXF/Apple ProRes 4444 MXF/Apple ProRes 422 HQ
Recording Media	Codex Compact Drives
Viewfinder	Multi Viewfinder MVF-2 with 4" flip-out LCD monitor, OLED viewfinder display with 1920 x 1080 resolution; diopter adjustable from -5 to +5
Color Output	Rec 709, Rec 2020, Log C, Custom Look (ARRI ALF-2)
Look Control	Import of custom 3D LUT, ASC CDL parameters (slope, offset, power, saturation)
White Balance	Manual and auto white balance, adjustable from 2,000K to 11,000K in 10K steps Color correction adjustable range from -16 to +16 CC 1 CC = 035 Kodak CC values or 1/8 Rosco values
Filters	Built-in motorized ND filters 0.6, 1.2, 1.8 Fixed optical low pass, UV, IR filter
Image Outputs	1x proprietary signal output for MVF-2 viewfinder 2x SDI Out: 1,5G (SMPTE ST292-1), 3G (SMPTE ST425-1, ST425-3), 6G (SMPTE ST2081-10) uncompressed video with embedded audio and metadata
De-Squeeze	1.25x, 1.30x, 1.50x, 1.65x, 1.80x, 2x Anamorphic
Focus & Aids	False Color, Zebra, Zoom, Aperture and Color Peaking
Audio Input	1x LEMO 6-pin balanced stereo line in with 12V power output, (Line input max. level +24dBu correlating to 0dBFS)"
Audio Output	SDI (embedded), 3.5mm stereo headphone jack (on MVF-2)
Audio Recording	2 channel linear PCM, 24 bit 48 kHz
Remote Control Options	Web-based remote control from phones, tablets and laptops via WiFi & Ethernet, Access Protocol via Ethernet & WiFi GPIO interface for integration with custom control interfaces WCU-4 hand-unit with control over lens motors and operational parameters via built-in white radio
Connectors	1x LEMO 5-pin LTC Timecode In/Out, 1x BNC Sync In, 1x LEMO 10-pin Ethernet for remote control and service, 1x LEMO 7-pin EXT multi purpose accessory interface with RS pin and 24V power output; 1x LEMO 4-pin LBUS (on lens mount) for lens motors, daisy chainable; 1x USB 2.0 (user setups, look files etc)
Wireless Interface	Built-in WiFi module (IEEE 802.11b/g) Built-in White Radio: ARRI lens and camera remote control
Lens Mounts	LPL mount with LBUS connector PL to LPL adapter Leica M mount from LEITZ, same as for ALEXA Mini
FFD	Flange Focal Depth: LPL mount 44 mm; PL mount 52 mm
Native Depth	24mm depth in air from intermediate mount flange to the image plane

Power Input	11-34 V DC — 1x LEMO 8-pin
Power Draw	Not yet confirmed. Slightly more than the Mini which is around 65W at 24 fps with viewfinder
Power Outputs	1x Fischer 3-pin 24V RS; 1x LEMO 2-pin 12V; 1x LEMO 7-pin EXT 24V
Size (HxWxL)	140 x 143 x 188 mm / 5.5 x 5.6 x 7.4" (body w/ LPL mount)
Weight	2.6 kg / 5.7 lb (camera body with LPL lens mount)
Operating Temperature	-20° C to +45° C / -4° F to +113° F @ 95% relative humidity max; splash and dust proof with sealed electronics
Storage Temp.	-30° C to +70° C / -22° F to +158° F
Sound Level	< 20 dB(A) at 24fps

## Recording Frame Rates (as of printing on March 22, 2019)

LF Open Gate ProRes 4.5K: 0.75 - 40 fps  
 LF Open Gate ARRIRAW 4.5K: 0.75 - 40 fps  
 LF 16:9 ProRes HD: 0.75 - 90 fps  
 LF 16:9 ProRes 2K: 0.75 - 90 fps  
 LF 16:9 ProRes UHD: 0.75 - 60 fps  
 LF 16:9 ARRIRAW UHD: 0.75 - 60 fps  
 LF 2.39:1 ProRes 4.5K: 0.75 - 60 fps  
 LF 2.39:1 ARRIRAW 4.5K: 0.75 - 60 fps

## Sensor Active Image Area Photosites

LF Open Gate ProRes 4.5K: 4448 x 3096  
 LF Open Gate ARRIRAW 4.5K: 4448 x 3096  
 LF 16:9 ProRes HD: 3840 x 2160  
 LF 16:9 ProRes 2K: 3840 x 2160  
 LF 16:9 ProRes UHD: 3840 x 2160  
 LF 16:9 ARRIRAW UHD: 3840 x 2160  
 LF 2.39:1 ProRes 4.5K: 4448 x 1856  
 LF 2.39:1 ARRIRAW 4.5K: 4448 x 1856

## Sensor Active Image Area Dimensions

LF Open Gate ProRes 4.5K: 36.70 x 25.54 mm / 1.445 x 1.006"  
 LF Open Gate ARRIRAW 4.5K: 36.70 x 25.54 mm / 1.445 x 1.006"  
 LF 16:9 ProRes HD: 31.68 x 17.82 mm / 1.247 x 0.702"  
 LF 16:9 ProRes 2K: 31.68 x 17.82 mm / 1.247 x 0.702"  
 LF 16:9 ProRes UHD: 31.68 x 17.82 mm / 1.247 x 0.702"  
 LF 16:9 ARRIRAW UHD: 31.68 x 17.82 mm / 1.247 x 0.702"  
 LF 2.39:1 ProRes 4.5K: 36.70 x 15.31 mm / 1.445 x 0.603"  
 LF 2.39:1 ARRIRAW 4.5K: 36.70 x 15.31 mm / 1.445 x 0.603"

## Recording File Container Size

LF Open Gate ProRes 4.5K: 4480 x 3096  
 LF Open Gate ARRIRAW 4.5K: 4448 x 3096  
 LF 16:9 ProRes HD: 1920 x 1080  
 LF 16:9 ProRes 2K: 2048 x 1152  
 LF 16:9 ProRes UHD: 3840 x 2160  
 LF 16:9 ARRIRAW UHD: 3840 x 2160  
 LF 2.39:1 ProRes 4.5K: 4480 x 1856  
 LF 2.39:1 ARRIRAW 4.5K: 4448 x 1856

## Recording File Image Content

LF Open Gate ProRes 4.5K: 4448 x 3096  
 LF Open Gate ARRIRAW 4.5K: 4448 x 3096  
 LF 16:9 ProRes HD: 1920 x 1080  
 LF 16:9 ProRes 2K: 2048 x 1152  
 LF 16:9 ProRes UHD: 3840 x 2160  
 LF 16:9 ARRIRAW UHD: 3840 x 2160  
 LF 2.39:1 ProRes 4.5K: 4448 x 1856  
 LF 2.39:1 ARRIRAW 4.5K: 4448 x 1856

Specifications may change. For more information, visit:  
[www.arri.com/alexaminif](http://www.arri.com/alexaminif)

# ARRI ALEXA Mini LF



Above: the ARRI ALEXA Mini LF Development team at Tuerkenstrasse in Munich.

## Recording Formats, Sensor Modes, Resolution, Maximum FPS, Sensor Photosites, Recorded Pixels

Codec	ALEXA LF LF SUP 4.0			ALEXA Mini LF Mini LF SUP 6.0		Sensor Photosites		Recorded File Pixels	
	Sensor Mode	Recording Resolution	Max. fps <sup>1</sup>	Recording Resolution	Max. fps <sup>2, 3</sup>	h	v	h	v
Apple ProRes	LF Open Gate	4.5K	60	LF Open Gate 4.5K	40	4448	3096	4448	3096
	LF 16:9	UHD	60	LF 16:9 UHD	60	3840	2160	3840	2160
	LF 16:9	2K	60	LF 16:9 2K	90	3840	2160	2048	1152
	LF 16:9	HD	60	LF 16:9 HD	90	3840	2160	1920	1080
	LF 2.39:1	4.5K	100	LF 2.39:1 4.5K	60	4448	1856	4448	1856
ARRI RAW	LF Open Gate	4.5K	90	LF Open Gate 4.5K	40	4448	3096	4448	3096
	LF 16:9	UHD	90	LF 16:9 UHD	60	3840	2160	3840	2160
	LF 2.39:1	4.5K	150	LF 2.39:1 4.5K	60	4448	1856	4448	1856

(1) Max fps is valid for all Apple ProRes flavors except LF Open Gate ProRes 4444 XQ (40 fps) and LF 2.39:1 ProRes 4444 XQ (60 fps).

(2) For ALEXA Mini LF, all Apple ProRes flavors have the same maximum frame rate.

(3) These are preliminary frame rates, specifications can change before shipping.





36.70 x 25.54 mm  
(Large Format)  
sensor with  
FSND filter slider

LPL Mount  
44mm FFD  
62mm I.D.

LEMO 4-pin  
LBUS  
connector on  
lens mount for  
daisy-chainable  
lens motors



12V 2A 2-pin LEMO

24V RS 3-pin  
Fischer

POWER  
ON/OFF



ARRI ALEXA Mini LF is shipping now. Guenter Noesner and Michael Best kindly hand-delivered one to FDTimes the other day for the first FDT hands-on and fashion shoot. Only a confirmed camera geek like me could call it a fashion shoot. It was really a day of product shots on a white milkglass sweep.

The report of the Mini LF in April 2019 (FDTimes Issue 93-94) mostly showed renderings of the camera. And, although Johannes Polta is one of the best in the business at creating fabulous renders, there's nothing like getting ones eager hands on the real camera itself.

The ALEXA Mini LF is thoughtfully designed and meticulously built. Usually the measure of a camera's goodness is to count how many petty peeves you wrote down to send to the engineers. The fewer the better. This time, the page was blank.

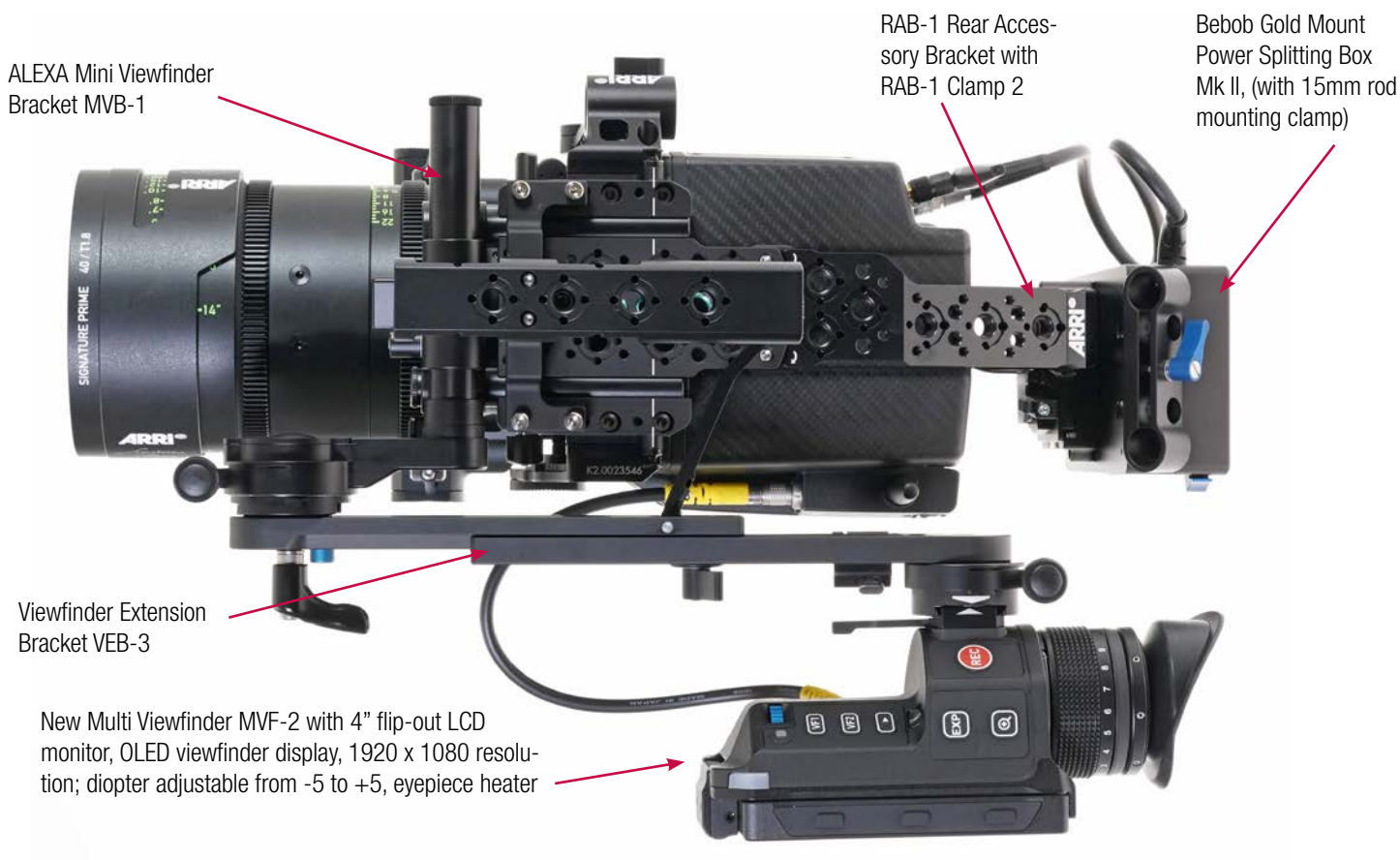
Setting up Mini LF from bare carbon fiber camera body to fully fitted handheld mode and then to complete studio configuration takes mere minutes. It's intuitive, logical, fun and brings out the erector set or Meccano mechanic of your youth. This is not a "minor assembly required" affair. It is not fussy. The beauty of the system is how you can add or remove elegantly crafted modules that enhance the experience of each shooting scenario. You customize your camera in ways that would bring tears of joy to the King of the Kustomizers, the California custom car character in Tom Wolfe's *Kandy-Kolored Tangerine-Flake Streamline Baby*. This concept drives directly to the core of what cinematographers crave, which is to have cameras and lenses that feel "bespoke," tailored and unique to a personal style and technique.

So let's take a quick tour of some of the Mini LF configurations. A more complete guide will follow in the months ahead after another visit to the ARRI factory in Munich.

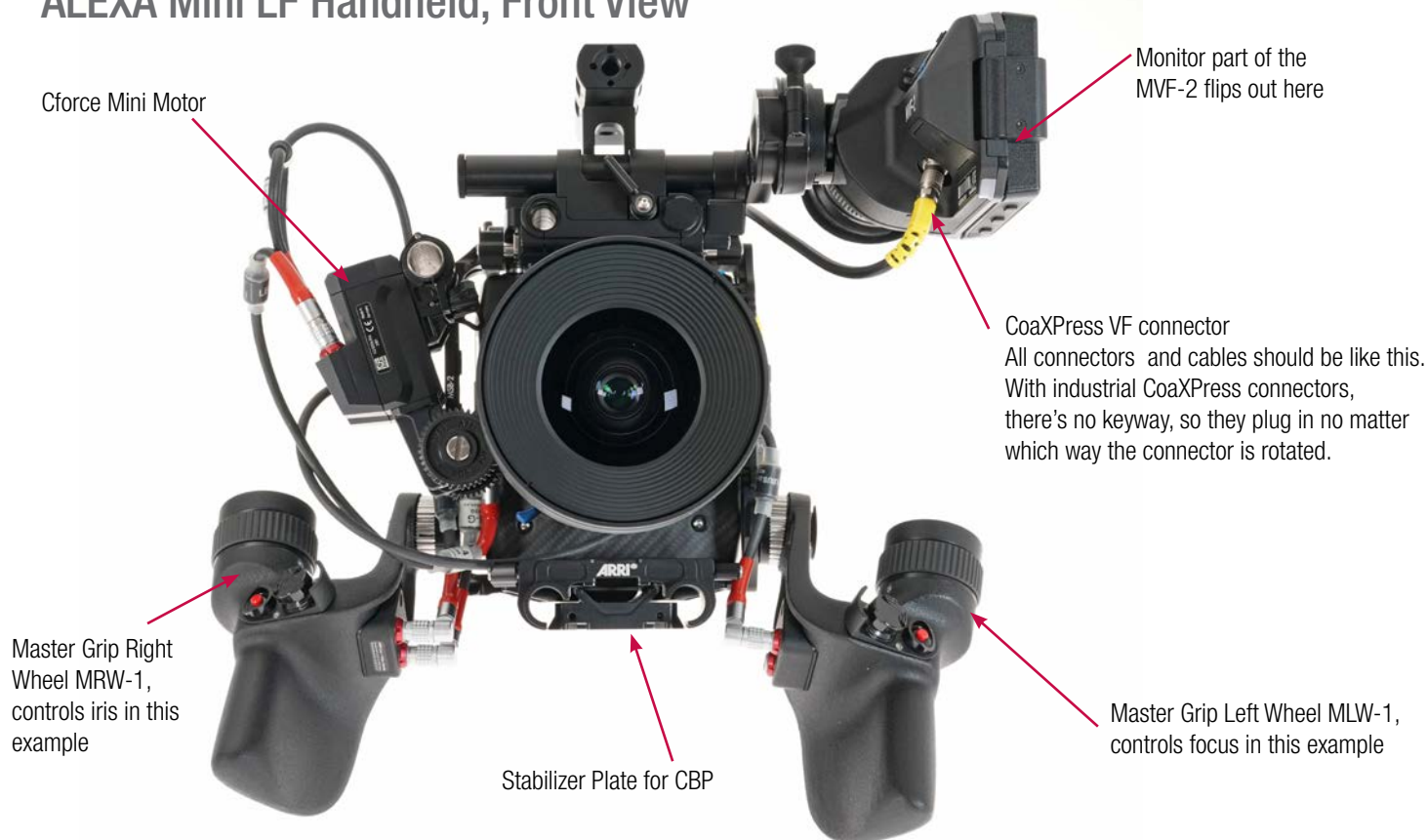
## ALEXA Mini LF Favorite Features

- Carbon fiber body and LPL lens mount weigh a mere 2.6 kg.
- New, small, affordable Codex Compact Drive 1TB media.
- Large Format ARRI ALEV III (A2X) CMOS sensor.
- Sensor size: 36.70 x 25.54 mm
- Adjustable EI 160-3200 in 1/3 stops; EI 800 base sensitivity
- LPL lens mount with LBUS connector; 44mm FFD.
- Recording media drive bay is on the camera left side.
- Motorized Large-Format FSND filter slider (Clear, ND 0.6, ND 1.2, ND 1.8)
- New connectors: 12V 2-pin; 24V RS 3-pin; SYNC IN
- New MVF-2 Viewfinder with large 4" flip-out monitor displays the image or menu.
- New VF cable using easier, flexible CoaXPress (up to 10m/33ft).
- Viewfinder has a built-in eyepiece lens heater/defogger.
- Camera works with 12V and 24V batteries (11V to 34V)
- Power draw at 24 fps with viewfinder is similar to ALEXA Mini, which is about 65 W.
- 6 buttons on the camera left side.
- New 6-pin AUDIO connector (2 Ch LINE IN + 12V).
- Recessed Timecode connector.
- 2 built-in microphones.
- One LOCK button each for camera and viewfinder.
- Additional external WiFi antenna.
- ARRIRAW license included.

## ALEXA Mini LF Studio Mode, Top View



## ALEXA Mini LF Handheld, Front View



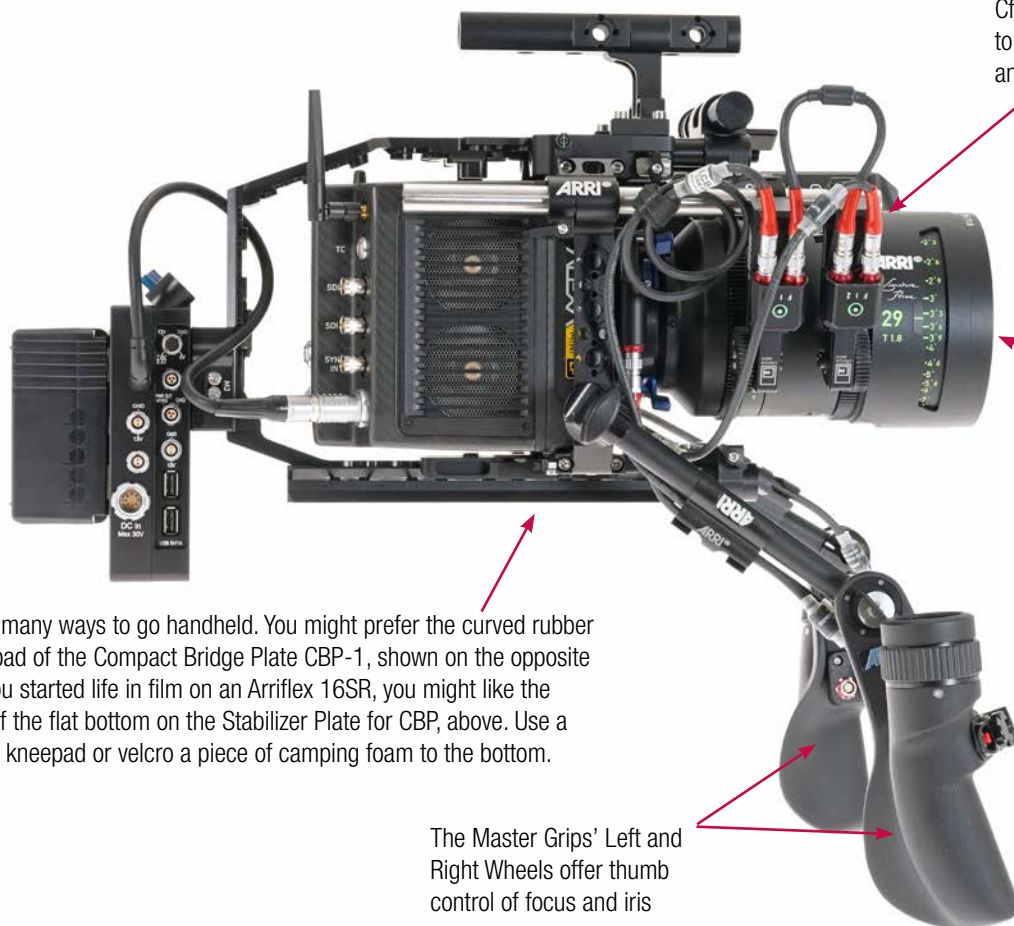


## April 2019: ALEXA Mini LF Studio Setup



This Compact Bridge Plate CBP-1 is lighter than a sliding studio bridge plate. It has a rubber shoulder pad. A quick-release lever lets you open the side and mount the camera onto the balance plate without having to slide it from the back.

# ALEXA Mini LF Handheld Setup

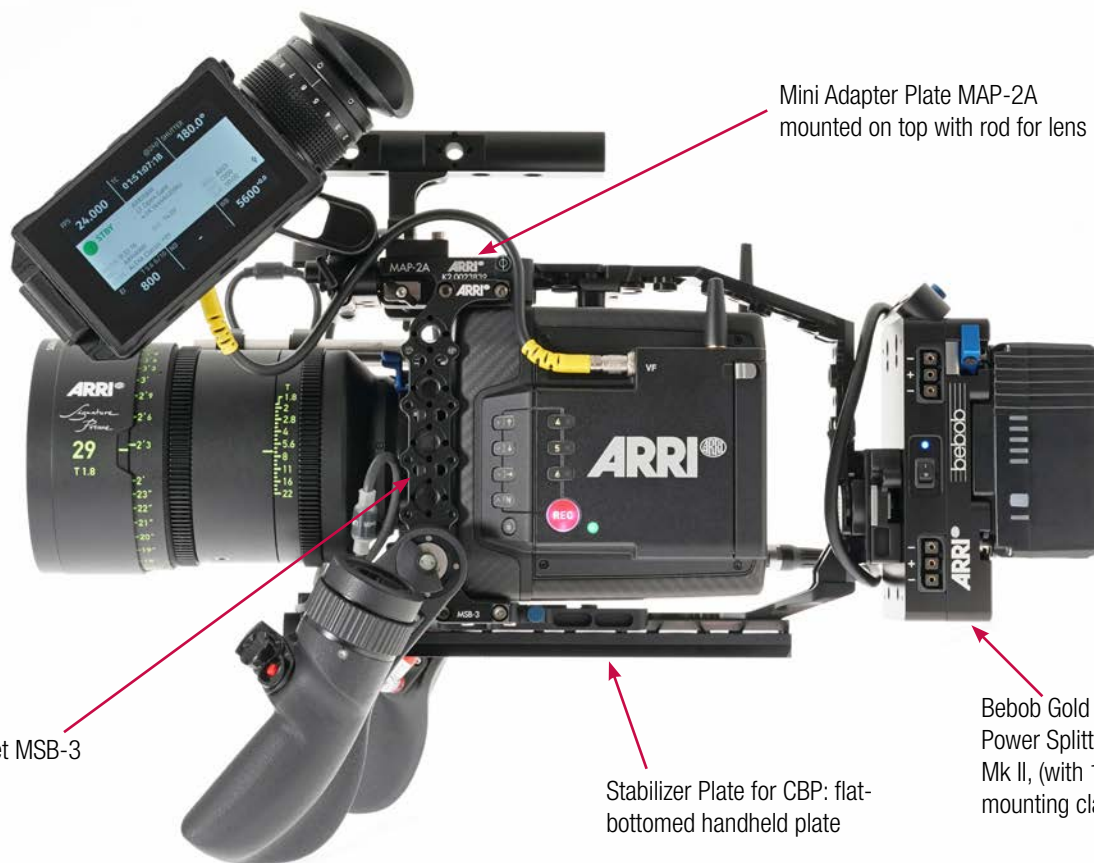


Cforce Mini Motors are attached to top rod of MAP-2A and are daisy-chained together

ARRI Signature Prime lenses are lightweight and balance beautifully on the ALEXA Mini LF in handheld mode.

There are many ways to go handheld. You might prefer the curved rubber shoulder pad of the Compact Bridge Plate CBP-1, shown on the opposite page. If you started life in film on an Arriflex 16SR, you might like the freedom of the flat bottom on the Stabilizer Plate for CBP, above. Use a basketball kneepad or velcro a piece of camping foam to the bottom.

The Master Grips' Left and Right Wheels offer thumb control of focus and iris



Mini Adapter Plate MAP-2A mounted on top with rod for lens motors

Mini Side Bracket MSB-3

Stabilizer Plate for CBP: flat-bottomed handheld plate

Bebob Gold Mount Power Splitting Box Mk II, (with 15mm rod mounting clamp on top)





Codex Compact Drive Dock



Codex Compact Drive

Codex and ARRI introduce their new Thunderbolt 3 Compact Drive Dock. It can read ARRI ALEXA Mini LF Compact Drive Media up to 20 Gb/sec. That is 2.5x faster than the currently-shipping Compact Drive USB-C Reader (up to 8 Gb/sec, opposite page).

The Codex Compact Drive Dock lets you offload ARRI ALEXA Mini LF data much faster than ever before. Combined with Codex Device Manager and HDE (High Density Encoding), downloads are easy and reliable.

The Codex Compact Drive Dock (Thunderbolt 3) is scheduled to ship in May of this year. ARRI part # K2.0034320.

## Key Features

Runs on Mac and Windows.

Works with Codex Device Manager and HDE on macOS.

Powered by external AC adapter.

Up to 20 Gb/s connection speed.

## Technical Specifications

Interface:	Thunderbolt 3
Operating System:	macOS 10.14.4 / Windows 10
Connection Speed:	Up to 20 Gb/s
Power:	12V / 2.5A using supplied AC adapter
Dimensions:	132 x 124 x 37 mm
Weight:	500 g

## Q & A by Codex

### Is a driver or license required for the Compact Drive Dock?

No, there is no driver or license required for the Compact Drive Dock. It can be used as a “plug and play” device.

### Can I use the Compact Drive and Dock with Device Manager and HDE (High Density Encoding)?

Yes, the Compact Drive and Dock can be used with Codex Device Manager and HDE on macOS.

Note that the Device Manager and HDE is not available on Windows.

### What are your recommendations as to connections?

We recommend connecting the dock directly to a Thunderbolt 3 port that is not shared. The Compact Drive Dock will then provide a read speed of 20 Gb/sec.

If connected on older hardware with Thunderbolt 2 ports, using a supported adapter and sharing with other Thunderbolt devices on the same system, the connection speed may be reduced.

### What is the correct way to connect the Compact Drive Dock?

When using a Mac, connect the Compact Drive Dock to the Mac with the provided Thunderbolt 3 cable before booting up the Mac. If the Mac is already booted, connect the Thunderbolt 3 cable to the Compact Drive Dock first and then to the Mac.

### What about USB-C cables?

Although USB-C cables may look like Thunderbolt cables, they are not. Make sure the Thunderbolt cable is properly labeled and rated as Thunderbolt 3. Cables can vary depending on the manufacturer. If you experience reliability issues then try another cable, or a cable from another supplier.

### Which cables are suitable with the Compact Drive Dock?

0.5m to 2m (20" to 6 ft) Thunderbolt 3 cables (passive type).

### Can I use the Compact Drive Dock with the Codex SXR Capture Drive Dock?

Yes, you can daisy-chain the Compact Drive Dock to the open Thunderbolt 3 port on the Capture Drive Dock.

### Can I use the Compact Drive Dock with a Thunderbolt 2 to Thunderbolt 3 adapter?

Yes, however Thunderbolt 2 to Thunderbolt 3 adapters may limit throughput speed. Ideally the dock should be connected directly to a Thunderbolt 3 port.

## Codex Compact Drive Reader



Codex Compact Drive Reader

The Codex Compact Drive Reader is currently shipping with the ARRI ALEXA Mini LF. Although it is only capable of 8 Gb/sec, it is low cost and easy to connect and use.

Nevertheless, an advantage of the Compact Drive Reader is that it does not require a power supply. Just connect it to a laptop or computer's USB-C port and start managing your data. This is especially helpful when racing around on location.

The cost-effective Codex Compact Drive Reader can also be purchased separately and several of them should be in every DIT's permanent collection.

Codex Compact Drive Reader (USB-C) part # K2.0024134.

### Key Features

Runs on Mac, Windows, and Linux. USB-C powered.  
Works with Codex Device Manager and HDE on macOS.  
Up to 8 Gb/s connection speed when using USB-C (3A).

### Technical Specifications

Interface/Power:	USB-C
Operating System:	macOS 10.14.4 / Windows 10 / Centos 7
Dimensions:	122.5 x 71.5 x 24.5 mm
Weight:	160g
Connection Speed:	8 G b/s using USB-C (3A)

## Codex Compact Drive Adapter



Codex Compact Drive Adapter

Codex has also designed an adapter to mount an ALEXA Mini LF Compact Drive into an existing SXR Capture Drive Dock (that normally accepts 1TB or 2TB SXR Capture Drives as used in ALEXA LF and ALEXA SXT). Using this adapter, the Compact Drive can be read at the full bandwidth capabilities of the Thunderbolt 2 or Thunderbolt 3 Capture Drive SXR Dock.

ARRI # K2.0024131 Codex Compact Drive Adapter

### Codex SXR Capture Drive Dock

To support ARRI SXT and ALEXA LF cameras that use SXR Capture Drives, the Codex SXR Capture Drive Dock is still available for sale from ARRI or for rental from leading camera rental houses worldwide. Its dual ports allow for daisy-chaining a CODEX Compact Drive Dock and offloading both an SXR Capture Drive and a Compact Drive at the same time at the full 20Gb/sec bandwidth.

Codex SXR Capture Drive Dock (Thunderbolt 3)  
ARRI part # K2.0019728.

ARRI ALEXA Mini LF  
Codex Compact Drive Media Bay





## April 2020: ARRI EF Mount with LBUS for ALEXA Mini and Mini LF.



New ARRI EF Mount (LBUS)

More than 130 million EF lenses are out in the world from Canon, along with countless others from SIGMA, Tokina, Tamron, ZEISS, Fujinon, Samyang and others.

Wouldn't you want to try some of these on your ARRI ALEXA Mini or ALEXA Mini LF camera?

Now you can, with the new ARRI EF Mount (LBUS) for large-format and Super 35 cameras. Yes, there was an earlier ARRI EF Mount, but it did not have an LBUS electronic connector and it vignetted certain Full Frame lenses.

The new ARRI EF Mount (LBUS) has:

- a wider light baffle that doesn't vignette,
- an extra LBUS connector that frees up the EXT connector on the camera,
- focal length and iris lens metadata that are sent to the camera.

Marc Shipman-Mueller, ARRI Product Manager Camera Systems, explains, "The use of Canon EF mount lenses on motion picture cameras has been a popular way to make a wider range of more affordable high-quality optics available to budget-conscious productions. It also allows filmmakers to use interesting EF mount lenses.

"Since the EF mount was originally designed to cover full-frame 35 mm stills, the lenses are equally useful for large-format and Super 35 cinematography."

Some of the special EF mounted lenses that Marc mentions are vintage, modern and glass of unusual distinction. They include wide zooms, macros, tilt-shifts, fast long lenses and products with built-in optical image stabilization (IS or OS).

It can be a lot cheaper to use these lenses as-is with their native EF mounts than subject them to a lens conversion.



Earlier ARRI EF Mount for ARRI AMIRA (no LBUS connector)

A partial list of interesting Canon EF lenses might include:

- EF 100mm f/2.8L Macro IS (Image Stabilized)
- EF 180mm f/3.5L Macro
- EF 8-15mm f/4L Fisheye
- EF 11-24mm f/4L
- EF 16-35mm f/2.8L III
- EF 85mm f/1.4L IS (Image Stabilized)
- EF 70-200mm f/2.8L IS II (Image Stabilized)
- EF 28-300mm f/3.5-5.6L IS (Image Stabilized)
- EF 100-400mm f/4.5-5.6L IS II
- EF 200mm f/2L IS
- EF 300mm f/2.8L IS II
- EF 400mm f/2.8L IS III
- EF 600mm f/4L IS III
- EF 800mm f/5.6L IS
- TS-E 17mm f/4L Tilt-Shift
- TS-E 45mm f/2.8 Tilt Shift
- TS-E 50mm f/2.8L MACRO Tilt-Shift
- TS-E 90mm f/2.8L MACRO Tilt-Shift
- TS-E 135mm f/4L MACRO Tilt-Shift

A few of the more than 40 SIGMA lenses in EF Mount:

- 14-24mm F2.8 DG HSM | Art
- 24-70mm F2.8 DG OS HSM | Art, Optical Stabilizer
- 105mm F2.8 EX DG OS HSM Macro
- 200-500mm F2.8 APO EX DG
- 150-600mm F5-6.3 DG OS HSM | S

Marc continues, "In order to extend the benefits of using EF mount lenses for large-format productions, ARRI has redesigned the existing EF Lens Mount. The new one has a wider light baffle, allowing it to cover the large-format sensor of the ALEXA Mini LF, as well as the Super 35 sensor of the ALEXA Mini. In addition, an extra LBUS connector frees up the EXT connector on the camera. The previous ARRI EF Lens Mount will remain available for the ARRI AMIRA camera, which does not support LBUS.

# ARRI EF Mount with LBUS for ALEXA Mini and Mini LF

## Remote control of EF mount lenses

Marc Shipman-Mueller explains, “As with the old EF Mount (no LBUS), the new EF Mount (LBUS) allows internal motors of EF mount lenses (focus, iris and zoom) to be controlled by the ARRI WCU-4 or SXU-1 wireless hand units, Operator Control Unit OCU-1 and Master Grips.

“Focus pulling will work best with the OCU-1 or Master Grips since their control rings, like most EF mount lens focus rings, do not have fixed end stops. This is also why only focal length and iris metadata (not focus) are available from those lenses; the lens simply does not know its absolute focus setting.

“Also new is the ability to use an external cforce motor without an external radio receiver. With the old EF lens mount, camera assistants had to use the AMC-1 (Active Motor Controller), UMC-4 (Universal Motor Controller) or cforce mini RF motor. Now the LBUS cable of the cforce motor plugs directly into the LBUS connector of the EF Mount (LBUS) and the camera’s radio is used to communicate with the WCU-4 or SXU-1. The advantage of ditch-

ing the external receiver is a smaller and simpler set up.

“In addition, lens metadata now goes into the camera, where it can be displayed via SDI outputs and in the viewfinder as well as recorded into the image file.

“To use the cforce mini RF motor, which is the fastest and most responsive motor, switch the motor to “client” mode and connect it with an LBUS cable to the EF Mount (LBUS).

“Note that when the focus of the EF mount lens is switched to AF (Auto Focus) and a cforce motor is connected, the EF lens’s internal focus motor has priority. To give priority to the cforce motor, switch the EF lens to MF (Manual Focus).”

All these remote control options work with ALEXA Mini LF as well as with ALEXA Mini.

The EF Mount (LBUS) joins the list of lens mounts for ALEXA Mini LF and Mini from ARRI and third parties: LPL, PV, PV70, PL-to-LP adapter, Leica M and XLP52. The EF Mount (LBUS) is available in April 2020.

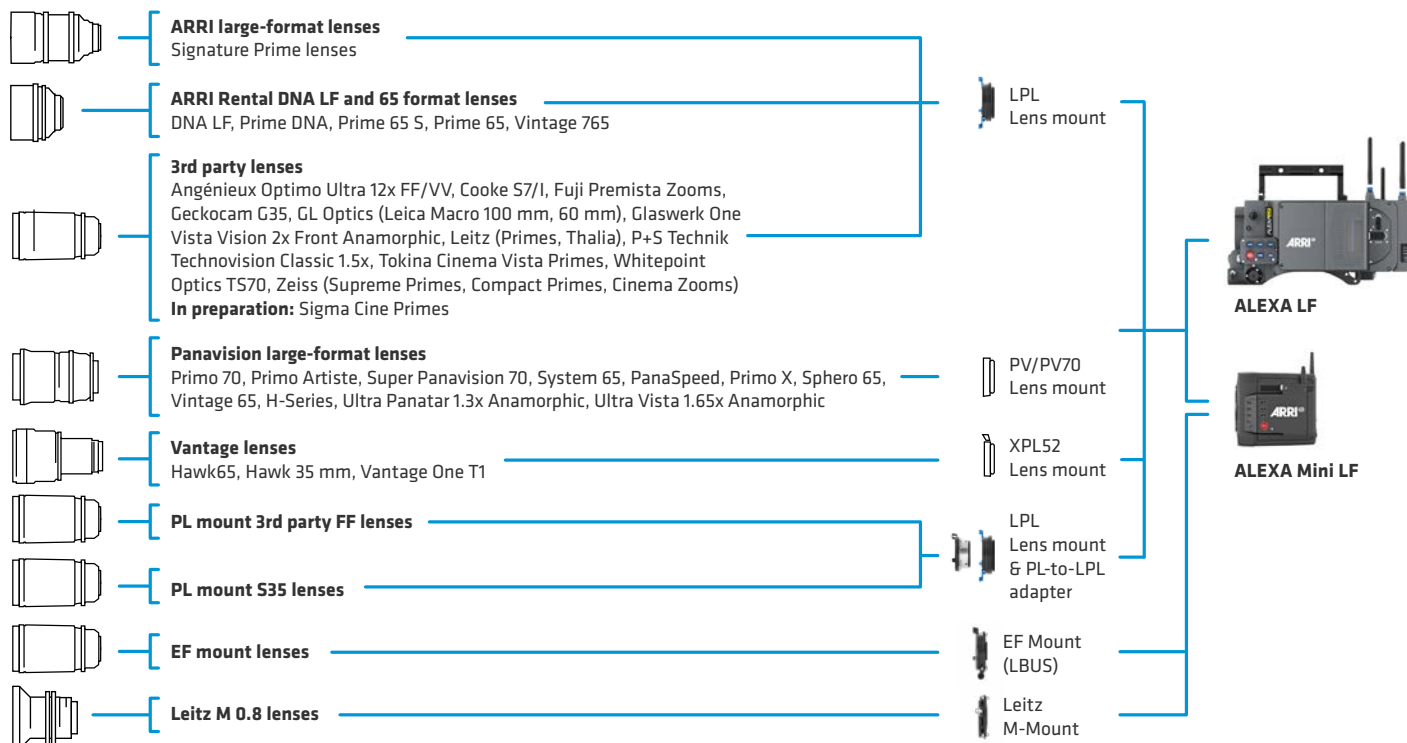
## Lenses and Mounts for Large Format ARRI ALEXA LF and Mini LF



ALEXA Mini LF with LPL lens mount



ALEXA Mini LF with lens mount removed





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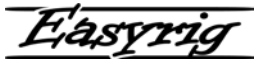
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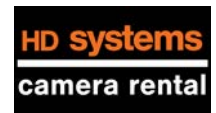
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