Jon Fauer, ASC www.fdtimes.com Nov 2014 Camerimage Edition 65C

FILM AND DIGITAL TIMES

Art, Technique and Technology in Motion Picture Production Worldwide

ARRI: FULL FACTORY TOUR

The Documentary-Style Camera – AMIRA with interchangeable lens mount

35mm Family – ALEXA XT Plus with 4:3 Anamorphic-Friendly Sensor

65mm Rebooted – ALEXA 65 – The New Large Format System from ARRI Rental

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 Chieftains, 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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FDTimes ARRI 2014 Special

ARRI AMIRA

ARRI ALEXA 65

ARRI ALEXA (35mm) Updates, Lenses, Accessories

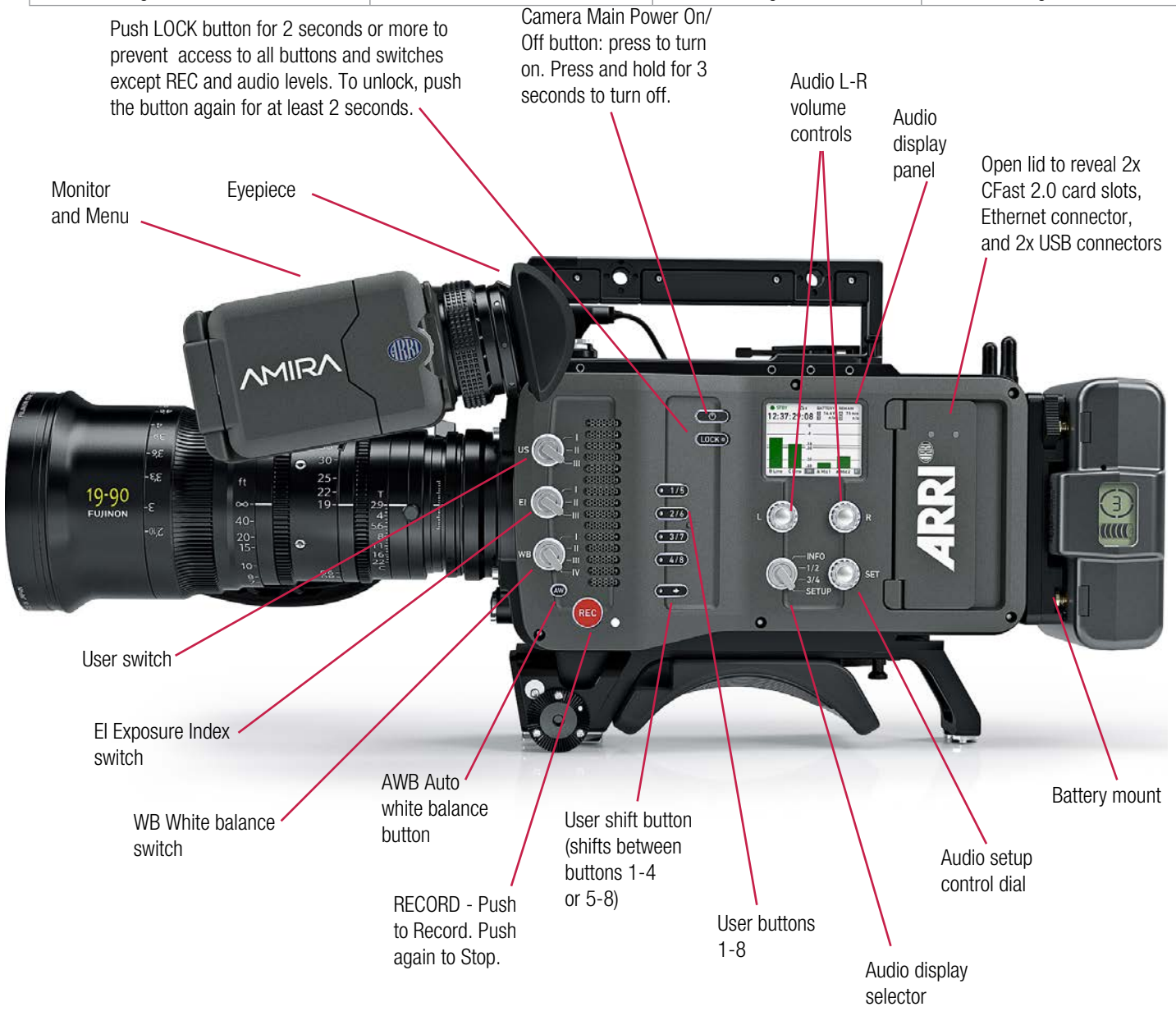
ARRI AMIRA

Buddy Squires, ASC in New York
photo: AbelCine

ARRI AMIRA Jumpstart

Here is a quick, 5-minute guide to the ARRI AMIRA. It was intended to be a quick cram course to read while waiting on line at ARRI's NAB 2014 Booth to try out the new AMIRA and make it seem like I knew which end of the camera to look through. These are not official ARRI instructions. Information came from prototypes, working models, and long-distance dialogs with the designers who generously contributed to this pre-flight checkout. Three AMIRA sisters made their debut: Plain AMIRA, AMIRA Advanced, and AMIRA Premium. Same body, different licenses. Please note that AMIRA will now have the ability to record all ProRes codecs in Ultra High Definition (UHD) 3840 x 2160 directly onto the in-camera CFast 2.0 cards, at up to 60 fps. UHD will be available for purchase at the online ARRI License Shop through an affordable software upgrade (and a sensor calibration for existing AMIRAs).

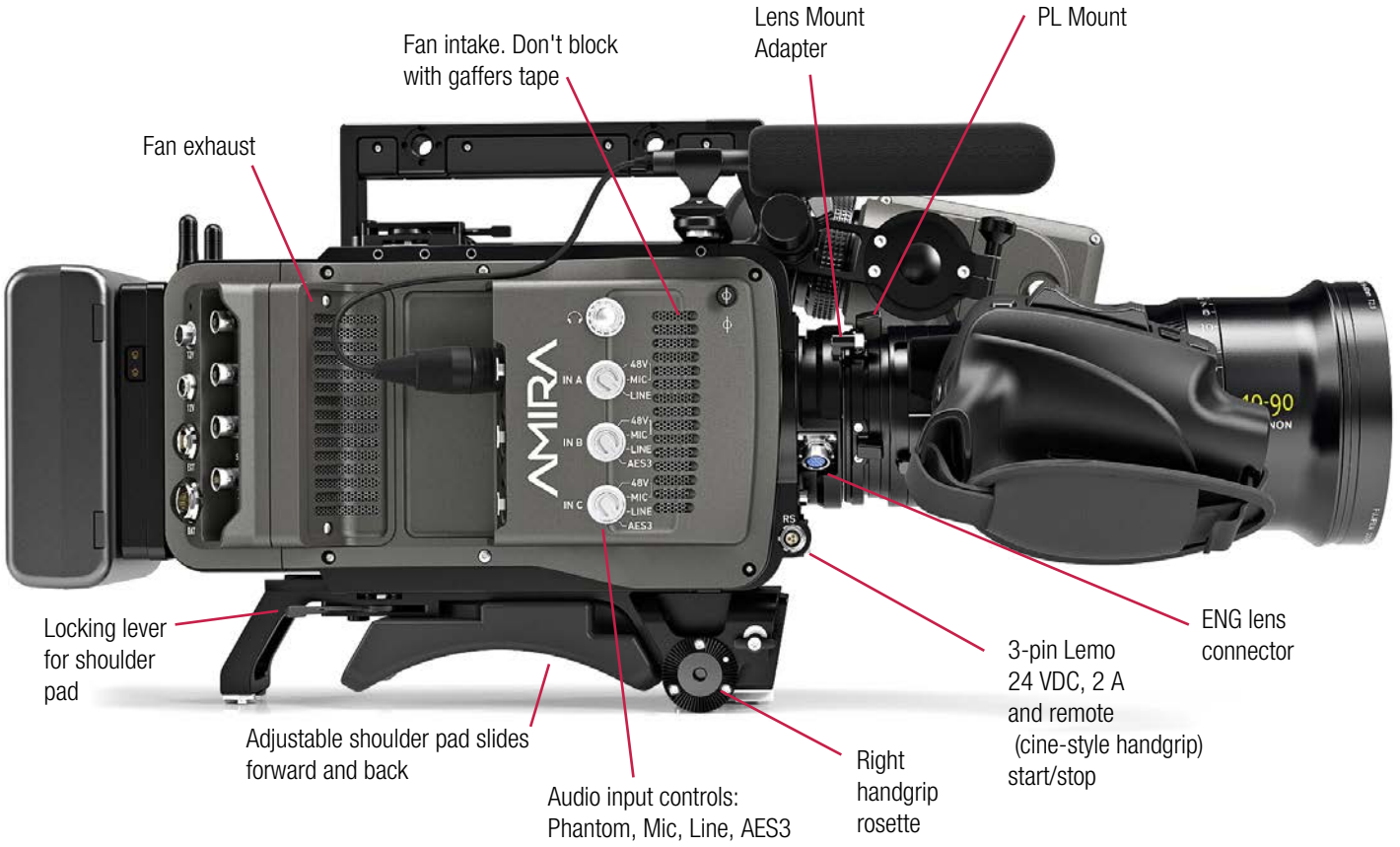
	AMIRA	AMIRA w/ Advanced License	AMIRA w/ Premium License
Recording Formats **(UHD to come in ProRes 422 (LT), 422, 422 (HQ) and 4444 —for all models and all up to 60fps**	HD 1920x1080 (interlaced & progressive)	HD 1920x1080 (interlaced & progressive)	2K 2048x1152, HD 1920x1080 (interlaced & progressive)
Recording Frame Rates	0.75 - 100 fps (progressive)	0.75 - 200 fps (progressive)	0.75 - 200 fps (progressive)
Recording Codecs (w/ embedded audio and metadata)	ProRes 422, 422 (LT)	ProRes 422 (HQ), 422, 422 (LT)	ProRes 4444, 422 (HQ), 422, 422 (LT)
Rec.709 / LogC	Rec.709	Rec.709 & Log C	Rec.709 & Log C



ARRI AMIRA

Specs Common to all AMIRAs

Sensor	35mm format ARRI ALEV III CMOS (28.17x18.13)
Sensor Pixels	3414 x 2198: 2880 x 1620 (HD 16:9), 2868 x 1612 (2K 16x9), for monitoring with surround area: 3168 x 1772 (HD), 3154x1764 (2K)
Recording Pixels	1920x1080 ProRes HD and HD ouputs, 2048 x 1152 ProRes 2K
Lens Mounts	PL mount w/ Hirose connector and LDS, B4 mount w/ Hirose connector, EF mount
Shutter	Electronic shutter, 5.0° to 356.0°
Exposure Index	EI 800 base sensitivity
Exposure Latitude	14+ stops over the entire sensitivity range from EI 160 to EI 3200 (per ARRI Dynamic Range Test Chart)
Internal Motorized ND Filters	ND 0.6, 1.2, 2.1 (-2, -4, -7 stops)
Sound Level	< 20 dB(A)
Weight	~ 4.1 kg/9.2 lbs (camera body with PL Lens mount)
Viewfinder	AMIRA Multi Viewfinder MVF-1 (OLED and LCD)
Video Outputs	2x HD-SDI - 1.5G and 3G: uncompressed HD video with embedded audio and metadata
Audio Outputs	3.5 mm headphone jack, Bluetooth audio
Power Outputs	Hirose 12-pin (for ENG type zoom lenses); 12V: D-tap, Hirose 4-pin, 2-pin Lemo; 24V: 3-pin Lemo RS
BNC Inputs	Genlock, HD-SDI, Timecode (In and Output)
Other Connectors	USB 2.0 (for usersets, Looks, etc.), Ethernet
Recording Media	CFast 2.0 memory cards



ARRI AMIRA

Monitor (800x480) for viewing and menus

Diopter adjustment ring

OLED (1280x720 pixel) viewfinder. "Electronic auto-closure eyepiece": an infra-red sensor turns the OLED display off when you take your eye away from the finder.

WiFi antennna

Bluetooth antenna

Open the media cover to reveal 2x USB slots.

Camera updates are done via USB connec-tions (USB stick - FAT file format)

You may be able charge 5 VDC devices like your iPhone.

MENU jogwheel: push to access MENU. Rotate to navigate. Push the jogwheel to select.

8x select buttons, like on the ALEXA Main Display

Playback button: push to review. Push for at least 2 seconds to exit.

Handgrip rosette

Rear "leg" and ENG style tripod bracket mount

Shoulder pad slides forward-back

VF2

RECORD

Open monitor from here

VF1

Exposure

Peaking

Monitor/GUI

Top handle adjusts forward-back and has ⅜-16 threads

Viewfinder adjustment

Choice of on-board battery mounting brackets

WiFi antennna

Bluetooth antenna

Microphone

ARRI AMIRA


Monitor hinges from here
Filters: Clear, ND.6 (-2 stops), ND1.2 (-4 stops), ND2.1 (-7 stops)
Lightweight support rods slide in here
Fan intake


HD-SDI 1 & 2 out 1920x1080 422 1.5G, 422 3G, and 444 3G single link
Headphone connector
12 VDC, 2 A aux power out 4-pin Hirose
12 VDC, 2 A aux power out 2-pin Lemo
Headphone volume
D-Tap power out
Audio input controls: Phantom, Mic, Line, AES3
XLR audio inputs
EXT in/out
Genlock in, or HD-SDI return image out
Main power in: 10.5 - 34 VDC
Timecode in/out

ARRI AMIRA Factory Tour

I had the pleasure to visit ARRI in Munich and get a tour of the AMIRA manufacturing facility. What follows is a lengthy report: a day in the life of building AMIRAs. Colleagues have asked, "Is it a replacement for ALEXA?" "Is it a baby ALEXA?" and "How soon can I get one?"

I don't think it's either a replacement or a baby. AMIRA is a documentary style camera. It is going to re-open an entire market to ARRI that they once had with the 35-2C for news films, followed by the 16S and 16SR for documentaries, magazine shows, corporate films and news.

A new software upgrade for the ARRI AMIRA camera will allow it to record ProRes UHD files, satisfying the current UHD/4K requirements of some productions and offering future-proof archiving possibilities for all.

To remain fair to all and editorially balanced, I normally try to remain National Geographically neutral. (The National Geographic Manual of Style, when I shot docs for them, insisted that scripts and narration be devoid of adjectives, superlatives and speculation. Just the facts. Avoid opinion. Resist ratings. Nat Geo is not Guide Michelin. But here goes: this is the most interesting documentary camera since the Arriflex 16SR.

AMIRA is very sophisticated. Built-in 3D LUTs will be a big draw. It's very rugged. I was talking to a Dutch cameraman heading to the jungles of South America, and he's only taking an AMIRA. Not even a backup. "No room in my backpack for a back-up," he said. This is the first 35mm sensor digital documentary camera that Buddy Squires, ASC has bought. He's off shooting in some sketchy places with it by now, no doubt.

Buddy Squires, ASC and AMIRA

Another factor in AMIRA's favor is its brand name and reputation for reliability. Good, solid, German engineering: looks good, works well. Carries, shoots, leaves.

ARRI AMIRA began delivery in April 2014. It has the same 35mm sensor as ALEXA, uses CFast 2.0 media cards, and enjoys an ergonomic design for long days and nights on a camera operator's shoulder. Like its 16SR ancestor, AMIRA is ready to roll right out of a camera bag. It can run to 200 fps. Although AMIRA was designed for docs, news, corporate films, TV drama and independent films, it will inevitably be found on all kinds of other productions.

TV productions often do not have the luxury of spending time working on a look in post. AMIRA comes with a number of 3D LUTs that can be applied on set during the shoot. You can build your own 3D LUTs in-camera or with third-party grading systems and then load these LUTs into the camera during prep. You can even modify the LUTs in-camera while filming.

ARRI has again chosen to work with Codex as a workflow partner for AMIRA. Codex developed a CFast 2.0 reader, sold exclusively by ARRI, and also an adaptor for Codex Vault for transferring CFast 2.0 cards.

There are 3 camera configurations to choose from: Basic, Advanced and Premium. You then add a lens mount, battery mount and bottom plate. The camera is then built in Munich to your specifications at a prodigious rate. Any configuration can be upgraded by buying the appropriate license on the ARRI website.

Basic AMIRA includes: HD 1080i and 1080p, 0.75-100 fps, ProRes 422 and 422 LT recording in Rec 709, three looks, adjustable in-camera image controls for knee, gamma and saturation, peaking for focus control, zebra and false color for exposure control. Base price: $39,999.

AMIRA Advanced includes the basic package plus: 100-200 fps, ProRes 422 HQ recording, Log C, unlimited Look functions, import Looks, and ASC CDL in-camera grading. Dynamic auto-tracking white balance, Wi-Fi remote control, Bluetooth audio monitoring and pre-record function will be available with upcoming Software Update Package 1.1.

AMIRA Premium includes the Advanced package plus: 2K (2048 x 1152) and ProRes 4444 recording; importing custom 3D LUTs.

www.arri.com/amira

Stephan Schenk on ARRI, ALEXA, AMIRA, "Avengers" and...

Stephan Schenk, Managing Director ARRI Cine Technik, responsible for the Business Unit Camera Systems ((Sales, Product Management, Workflow and Service)

ALEXA

JON FAUER: IBC 2014 was 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 global box office for 2014 at the end of September, you will find that 6 of the top 10 feature films were shot with ALEXA cameras; of the rest, 2 were animation, and the other 2 were shot on film.

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.

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.

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 are also constantly working 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 like ProRes 3.2K or ARRIRAW Checksum 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.

4K and Consumer Electronics

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.

Lenses

What about the future in lenses? Will there be other formats? What are you pushing next?

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 there's a new kid 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-of 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 T4. 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?"

Rental Houses

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 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.

AMIRA

Was there a specific market you had in mind with the AMIRA?

Cinematographers, who were using ALEXA, have often told us, "We would like to have, for particular shows and applications, something that is a bit more suitable for handheld, with less weight and a bit smaller, but please keep both the image and the build quality." We received a lot of feedback for such a camera from other more TV-oriented markets, where a large sensor look is requested more and more. Before AMIRA, the right camera was not available for these kinds of mostly-single operator or handheld style applications.

We also were looking back at our history, and I am sure you will recall that about until the 1980s ARRI's film cameras were used by many cinematographers for doc-style projects like magazine shows, reality, documentaries, corporate, etc. With AMIRA, we again want to give cinematographers a tool that suits their needs in these applications.

AMIRA reminds me of the Arriflex 16SR or 416 for the digital age. A truly comfortable, ergonomic, handholdable documentary-style camera.

Exactly. You just have to watch out that you don't drop the word "style," because then it becomes a documentary camera only, and as we just discussed, there are many more applications for this camera. Also, documentary is often confused with ENG. AMIRA certainly is not aimed at the pure "news gathering" market, which in my opinion, will remain dominated by 2/3 inch camcorders—because in this application you very often need more depth of field. However, as I said before, our customers find out what they need no matter what manufacturers tell them and what they aim at with a certain camera.

AMIRA is intended to be used for various production types and we already received wonderful feedback from cinematographers like Susan Gibson who was shooting for the BBC National History Unit. AMIRA is the first 35mm digital sensor camera that Buddy Squires, ASC, the famous documentary cinematographer, purchased. Also, NFL Films just decided to use AMIRA for their renowned coverage. There are reality shows using it. When we were at Camerimage, Sean Bobbitt, BSC, the DP of *12 Years a Slave*, who also has a documentary background, tried it, and he said, "For the next feature, I will definitely need AMIRA on the show for handheld work." Certainly AMIRA will be used as a B or C camera on features and TV dramas where ALEXA is the A-camera. Johann Perry used AMIRA for the new Vodafone campaign and loved the 200 fps capability and also the AMIRA Look creator.

With all these different applications in mind, *documentary-style* was the term we came to.

Talking about weight, some say that AMIRA should have been even more lightweight.

We also wanted it to be as light as possible. But weight on one side and reliability and durability on the other side are a trade-off most of the time. When we sat down and debated weight vs durability, we always opted for durability. The same applied for performance. To give you some examples, would our customers want software updates or a new camera whenever a major upgrade could be done? Would they want the 200 fps AMIRA gives them in full image quality or in cropped mode? Would they want the body ARRI-like or in plastic? Would they want the sensor and electronics sealed or can we cool the sensor by blowing the outside air over it?

The answer to all these questions is AMIRA as we offer it today. This is also based on the feedback of DPs we spoke to during the design phase. Our customers want reliable ARRI quality. What should not be forgotten is that it's not only about the weight but also about the balance on the shoulder that is important. If you have a zoom in the front and then need to add a counter weight in the back, you are better off with a camera that is well-balanced in the first place and also has the right weight for a smooth pan.

Having seen AMIRA yourself, what do you think we should do differently or additionally or less?

Now I'm in the hot seat. AMIRA is extremely comfortable, ergonomic, stylish. There's little that I find lacking. What about a 4:3 sensor for anamorphic? You're going to hate that idea…

That would make it more expensive and given that the main target markets are for TV, we did not include this feature. The same applies for ARRIRAW.

How much could you save by having a carbon fiber body for the really serious documentarians who are handholding all day?

I would have to ask one of our engineers, but I guess it's maybe about a kilo maximum, depending on how many parts of the camera you make in carbon fiber and also what type of carbon fiber. Certainly, it's an interesting technology, but it's also more expensive.

Is cooling different on AMIRA and ALEXA?

With both ALEXA and AMIRA, the electronics are sealed and the sensor has a Peltier element behind it to maintain constant temperature. We don't cool the sensor by sucking the air over it. ALEXA has pipes that transport the heat to the radiator in the back which cools the sensor and the electronics. With the AMIRA, there are no heat pipes, but a thermal core to cool them, similar to the way the latest Mac Pro is using it.

Looks like you are happy with the feedback on AMIRA?

Indeed, we received a lot of great feedback on AMIRA already. There will always be a certain scene where another camera may be better suited, but that was and is true for ALEXA, too. If you look at sets today, you will find ALEXAs used as A and B camera. But on top there are C300s or even GoPros mounted around a car rig. There are Phantoms for high-speed. Cameras find their applications, and now that AMIRA has been in the field for only a few months, we can already see that cinematographer all around the world are finding many applications for AMIRA and love the outstanding images they get out of it.

Walter Trauninger on Assembling AMIRA

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 constantly delivering new and significant features with each Software Update Packet to take changes in the market into account. Software Update Packet 11, for instance, will include ProRes 3.2K, which allows an easy up-sample to ProRes UHD. 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. An-

other 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 and started a renaissance of 16 mm production, but this did not help 65 mm cameras. 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 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

Above: 11 years earlier at ARRI, different camera, shorter haircut. Walter Trauninger with Arricam LT.

Opposite: Stephan Schenk and Walter Trauninger on the top floor of ARRI, overlooking Munich

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 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.

I've known you for that whole time then. Tell me about AMIRA camera manufacturing techniques.

Since I became responsible for production, we've changed a lot. I think you wrote about some of that in your ALEXA article a couple of years ago.

AMIRA is very similar to the ALEXA with one additional requirement. We assemble each one to order. Normally, ALEXAs are built "anonymously"—in a standard configuration, put in the warehouse and then delivered. But with the AMIRA we have so many different configurations, different mounts. Therefore we have to assemble it to order, when we know which camera is needed in which configuration for a certain date, and we put it together with the accessories. This required an additional assembly line and a slightly different process.

How many AMIRAs are you building per month?

We are now looking at about 250 cameras per month, a mix of ALEXAs and AMIRAs. Because of the way we have structured the production line, we are very flexible regarding how many of each we manufacture.

Did you have to find more space in this building on Türkenstrasse for building the AMIRA?

We have enough space. Also, with the one-piece flow manufacturing technique we are using, it is advantageous to have the individual workstations as close to each other as possible.

Are the manufacturing techniques different?

The AMIRA family requires somewhat less effort in assembly, but the testing process is more intensive because there's more functionality—we have more complex audio in there and other functions that we do not have in ALEXA.

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 would 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 ALEXA has had a successful four year product cycle and is still going strong. That 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, ProRes 4444 XQ, or ARRIRAW Open Gate.

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 Electronic Control Systems (ECS), 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.

Markus Dürr, AMIRA Product Manager

Markus Dürr, AMIRA Product Manager (above), was kind enough to give me an Advanced AMIRA Lesson. Before joining ARRI, Markus worked as Product Manager at Avid Technology, after working as a cinematographer for many years and shooting a lot of documentaries. These were excellent credentials for someone deeply involved in the development of AMIRA.

JON FAUER: One of the most interesting features of the AMIRA is the 3D LUT Look capability. Can you explain it?

MARKUS DÜRR: The 3D LUT-based Look functionality in the AMIRA allows you to access the color processing of the camera in a very sophisticated way. It really goes to the heart of the color processing in the camera. This is great if you want to define or trim the Look of your program in advance or during shooting, as you have more creative control of the final outcome of your production. This way, you may also save some money in post.

With a 3D LUT based AMIRA Look (.AML file), you have a lot of access points to modify how the image looks (color, contrast, brightness, saturation, hue, etc). For the user, that offers several things. First, you can import 3D LUTs from grading tools (like AMIRA Color Tool or DaVinci Resolve) into the AMIRA Premium and use them for your own Log C to Rec.709 conversion.

The other part of the story, which is probably even more exciting, is that you have the whole look functionality where you can go to a grading suite, create your look with the typical ASC CDL parameters, save them as an AMIRA look file, load that in the camera and once loaded in the camera, you can apply that to the Log C file as a meta-data, or you can also bake it into the Rec.709.

On top of that, you can also modify the looks for whatever ASC CDL parameter, you can trim and change them in the camera. You also have other tools available such as Video look parameters like gamma, knee, black gamma, saturation and so on. Or you can do a vector based secondary color correction if you want to reduce a certain color. You can do all that in-camera while you're on set or on location. You don't need a grading station or cart. You can do all that with the little screen in the camera.

AMIRA's 3D LUT look ability offers opportunities that, so far, have not been possible with any other camera. Customer feedback tells us that many users see a lot of opportunity in that functionality.

These Look Files are possible because the AMIRA has more processing power?

Yes. AMIRA has more processing: the color pipeline and LUT conversion is based on a extended processing pipeline.

Since AMIRA is a next-generation camera, coming 5 years after ALEXA was introduced, is the software more sophisticated?

It's not that the ALEXA would fall behind, for that matter, because the ALEXA still offers what we feel is the best image quality you can get in the industry. So, ALEXA by no means has less image quality. AMIRA just has different tools to let you modify the image in-camera. I don't see that as a problem for ALEXA because we see the applications of ALEXA as different from the AMIRA.

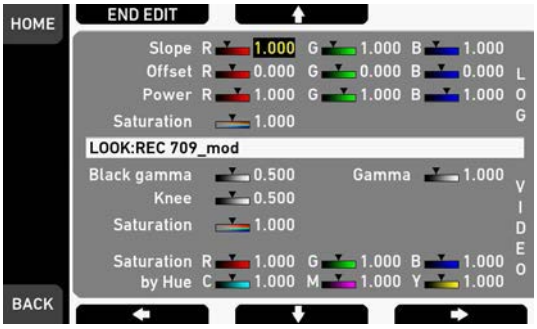
For the AMIRA, you're very often shooting alone or with a small crew. It's very helpful to do these kind of things quickly in-camera: for example, modify and bake the look into Rec.709. With the ALEXA, you're probably working with a bigger crew and under different circumstances.

Are most people going to shoot Rec.709 with AMIRA?

I don't think so, but you certainly can do that. What we envision, as an ideal kind of scenario, is that pretty much everybody would shoot in Log C, with a Rec.709 or other look predefined and applied to the monitor and viewfinder outputs. The look is stored in the recorded metadata, where it can be used in post production. This is a non-destructive decision because you can fully change your mind later about how the footage looks.

So, the editing system can take the Log C and read the 3D LUT metadata of the applied look as it was originally seen in the camera by the camera person, and it can automatically display the footage in Rec.709 in the editing suite, with no action or attention required anywhere for the conversion. It's seamless and simple: in reality, you shoot Log C, but you never see it, and you only view Rec.709 or your individual look. Once you would go into grading, you have the full Log C range available though.

We're going pretty much in that direction, but we are not yet there. We also see that in the documentary style shooting world, if there is not an extreme time or budget pressure, people appreciate shooting in Log C because they like the opportunity to modify the images more than they would for Rec.709. Nevertheless, there are productions that prefer recording directly in Rec.709 out of traditional workflow considerations or to avoid losing control once the project goes to post. With AMIRA, you can easily travel both paths in an equally effective way.

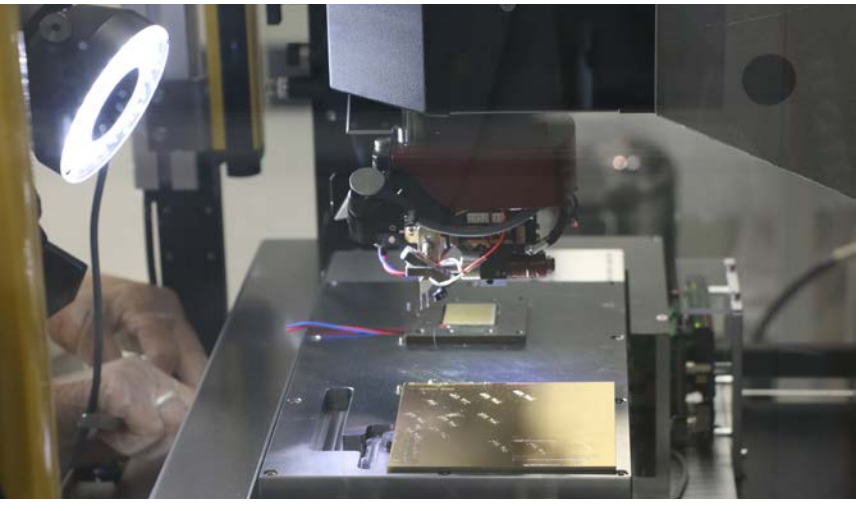


These are your "grading suite in the viewfinder" controls. To create your own AMIRA Look within the camera, duplicate the default Rec.709 or any other Look, and save it with a new name. Next, using a monitor attached to AMIRA's HD-SDI output, adjust the ASC CDL parameters and/or the Video Look parameters. For a more comfortable way of creating or modifying AMIRA Looks, use the free AMIRA Color Tool.

Assembling AMIRA

At 10 am every Wednesday, R&D, Camera Assembly, CQM, Supply Chain, Purchasing, Parts and Service teams meet to discuss progress

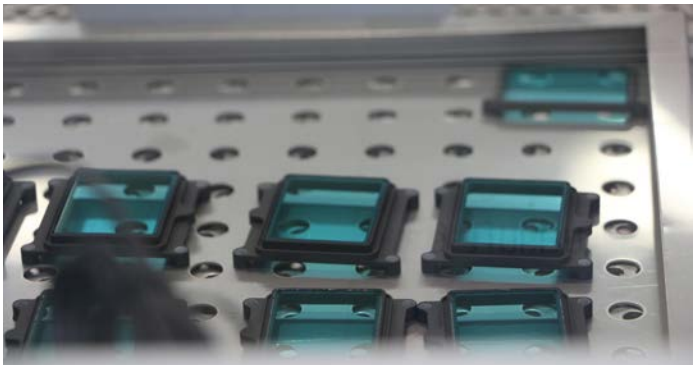
AMIRA Sensor Bonding and Clean-Room



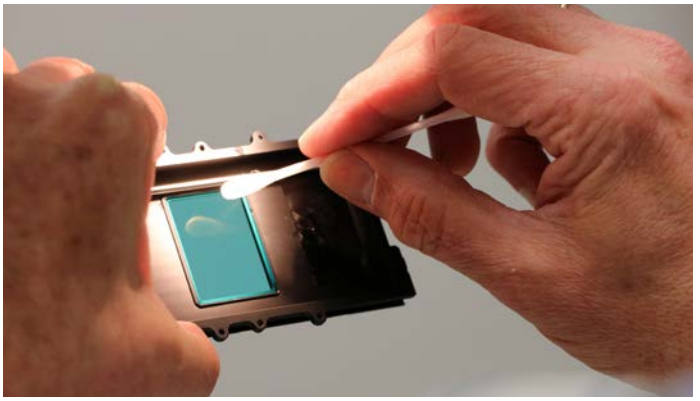
AMIRA Factory Tour (cont'd)

Siegfried Wetscheck, head of Sensor Bonding and Clean Room Assembly, shows how sensors arrive as round wafers in air tight gel packs

The individual sensors are cut from the wafers

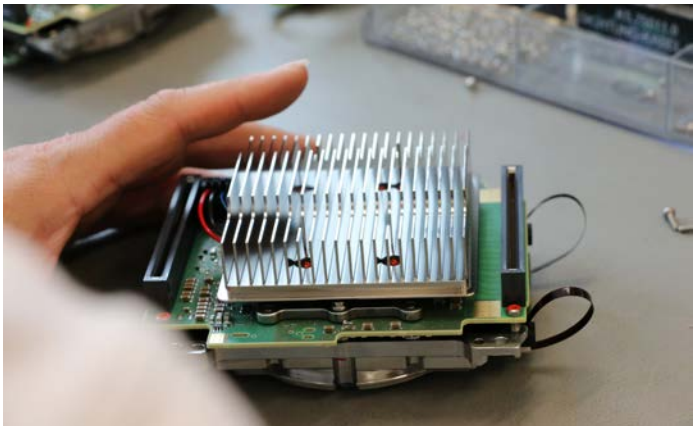


The cover glass is mounted into its carrier

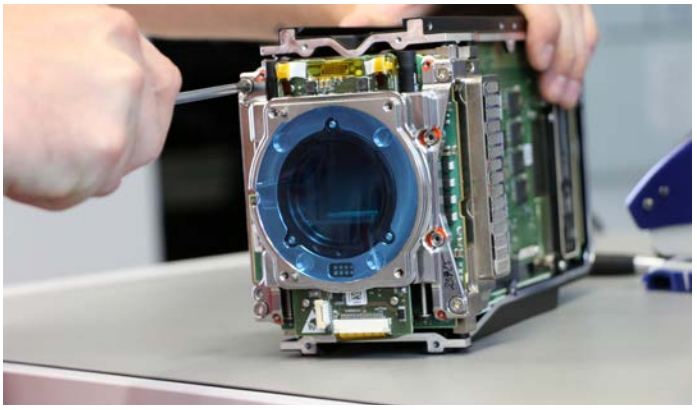


Cover glass is cleaned

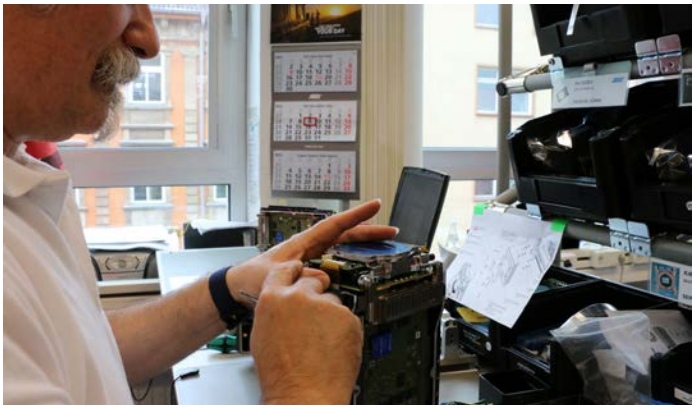
The sensor, covered with plastic, is mounted to electronics board



Heat sink on the rear side of sensor



Mounting sensor assembly to the internal spine and boards



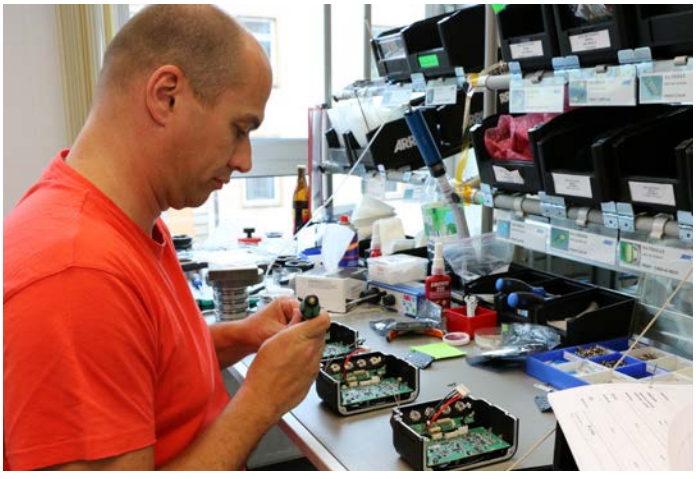
One-piece flow manufacturing: each assembly technician adds something to the camera as it passes all the workstations.

AMIRA Factory Tour (cont'd)

Christian Hartl, head of Camera Assembly

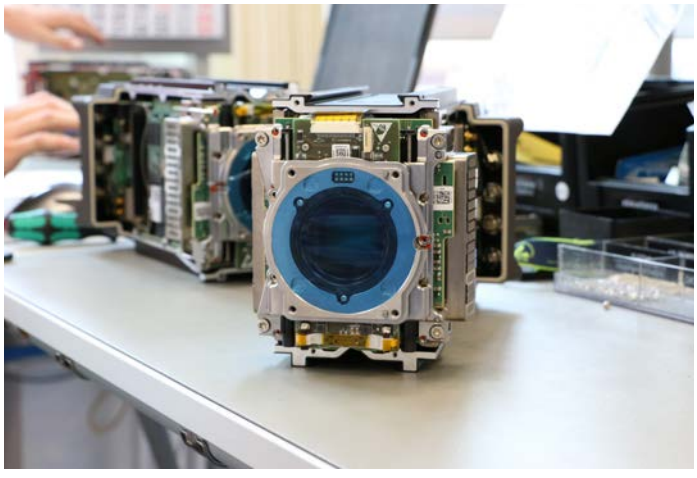
AMIRA is built from over 1000 components in these bins (above). Many of these parts are crafted at ARRI on the latest CNC machines (below).

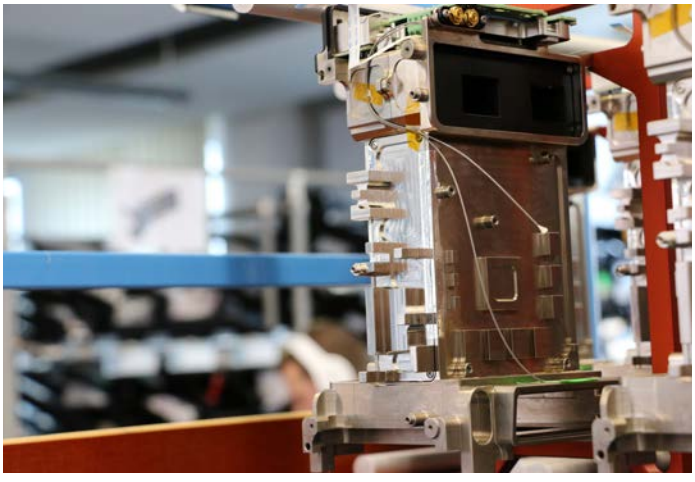
Andreas Weeber (above) member of the assembly team, whom many remember from his stint at ARRI service and ARRI Rental in New York.

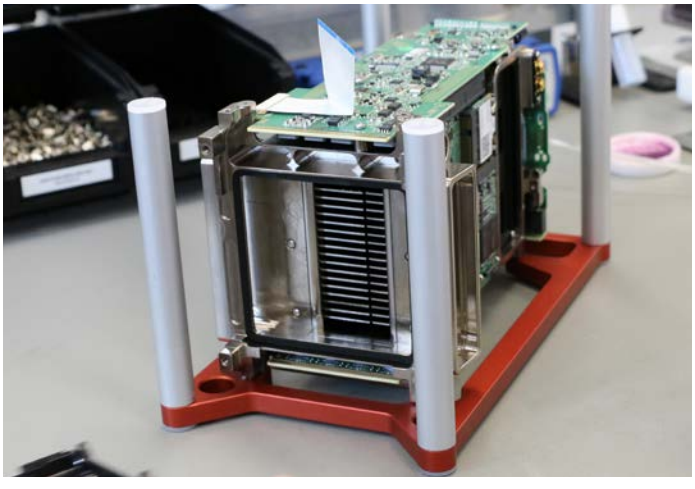


AMIRA Factory Tour (cont'd)

ALEXAs (above) continue to be in high demand and are built in the same facility as AMIRA (below)

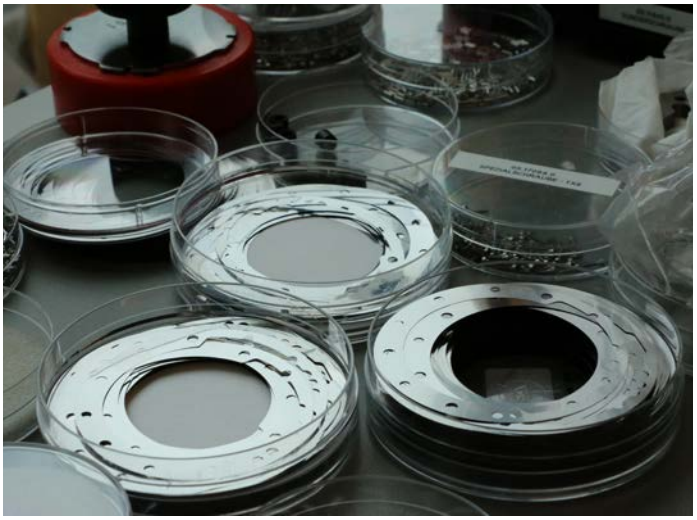






Matters of Life (of AMIRA) and Depth

You can order your AMIRA with the following mounts: PL-LDS, B4 or EF. The PL and B4 mounts have a 12-pin Hirose connector to provide power and data connection (rec start/stop, iris control, user button) to the servo of the lens. For B4 mount lenses, you can use the AMIRA B4 mount, the ARRI B4 to PL adapter or 3rd party adapters with approximately 2.5x magnification.



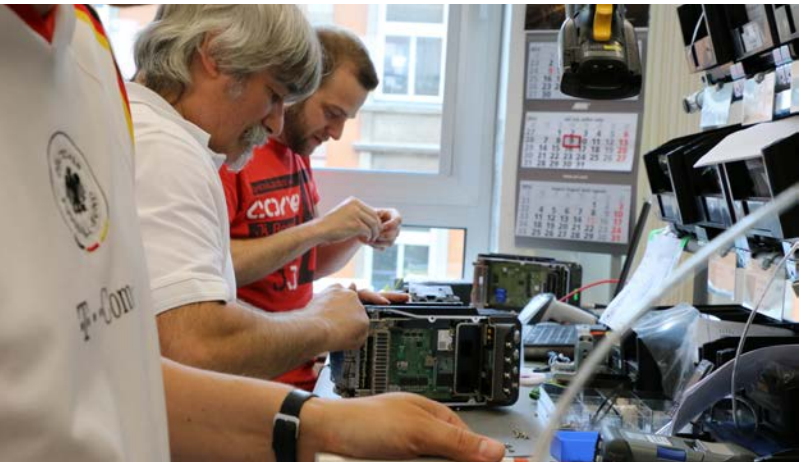
Just like familiar film cameras: reliable stainless steel shims set the flange focal depth of the lens mount

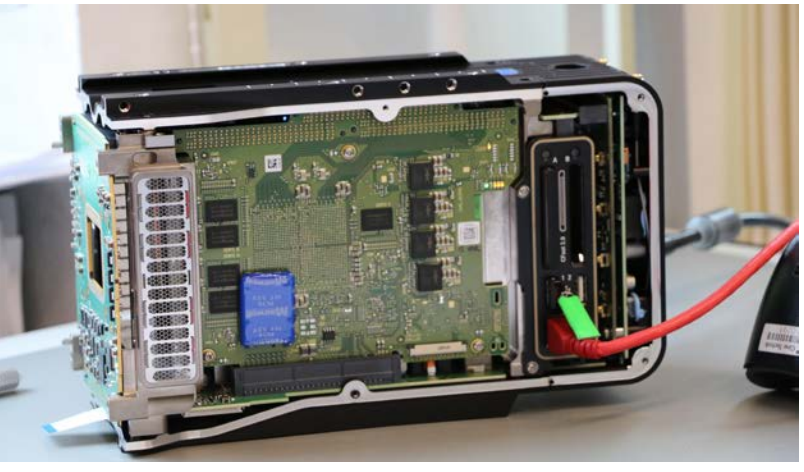
If you're wondering what the factory uses to check flange focal depth of the lens mount, it's a DENZ FDC Flange Depth Controller

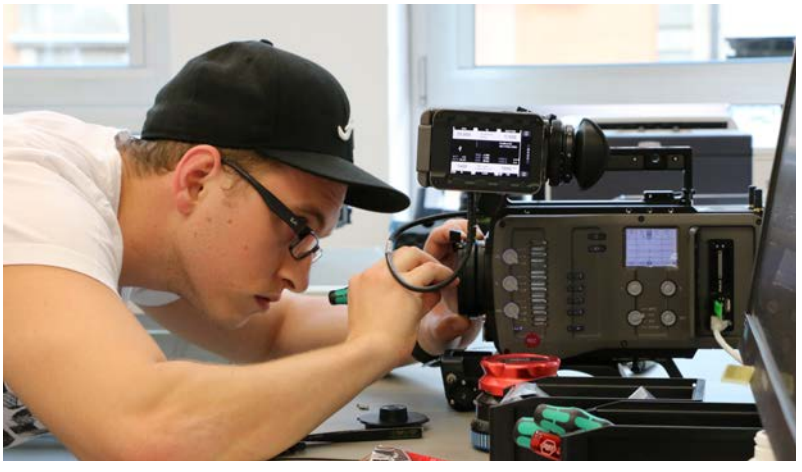
Correct Flange focal depth (52.00 mm) is confirmed when the red bar lines up equally between the green bars on a monitor that is connected to the output of the camera.

The FDC's calibrated hand wheel ring will display "0" when the measurement is correct. It's calibrated in increments of .01 mm and corresponds to the thickness of shims to be added or subtracted.

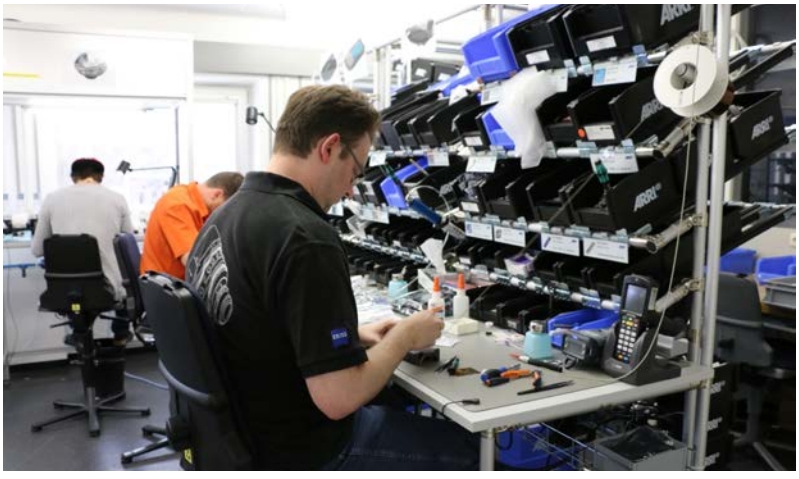
AMIRA Factory Tour (cont'd)





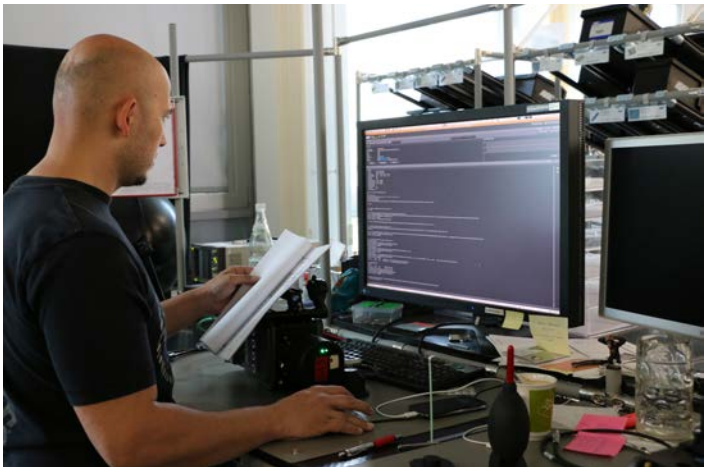


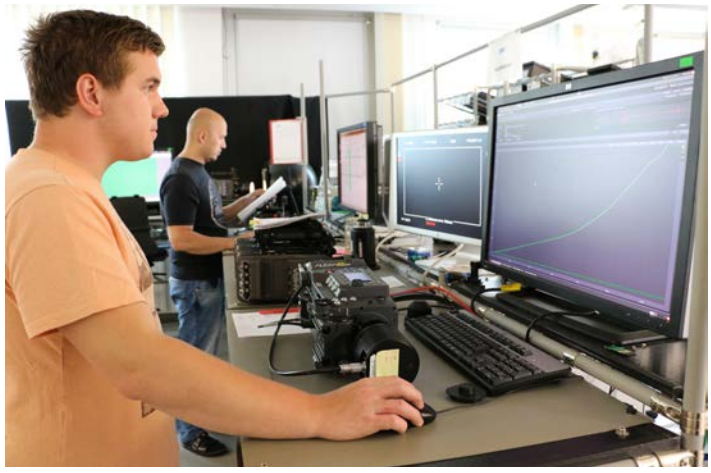
Electronic Viewfinder

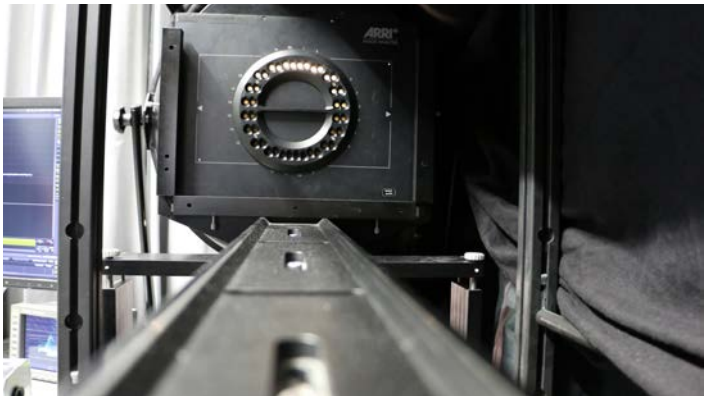


Testing AMIRA

Ensuring proverbial ARRI reliability: Sebastian Lange (middle), head of Central Quality Management and some of his team.
(AMIRA Product Manager Markus Dürr is on the right, hugging his baby.)







AMIRAs Ready to Go

Guido Felber from the assembly team with a cart full of shiny, new AMIRAs on their way to the shipping department.

As Walter Trauninger said, these are not “anonymous cameras”—every camera is built to the customer’s specific configuration.

ProRes UHD 3840 x 2160 for AMIRA

Kevin and David Couliau shooting a promo video with French Olympic boxing champion Brahim Asloum using PhotoCineRent AMIRA. Photo by PhotoCineRent.

Any documentarians dragging their feet on the way to the AMIRA shop will doubtlessly hit the ARRI speed-dial button when they hear this. If their only hesitation, up to now, was caused by the ominous hyphenate "future-proof," that anxiety is now assuaged.

Wildlife cinematographer Sophie Darlington recently wrote, "I think many wildlife production companies will be waiting for a 4K version to satisfy the pixel pickers." Yes, Sophie, this upgrade may be for you and them.

A new software upgrade for ARRI's documentary-style AMIRA camera will allow it to record ProRes UHD files, satisfying current UHD/4K requirements and offering future-proof headache relief.

An increasing number of producers, studios and companies have considered safeguarding the longevity of their programs by ensuring that they will be suitable for UHD transmission, viewing, streaming or downloading. The old mantra of "we'll just do the remake when the next standard rears its head" is no longer credible. (Remember how long it took stations and studios to move from standard 16mm to Super 16mm, long after every new camera in the world was already fitted with a S16 gate?)

For productions that need to generate UHD deliverables, AMIRA will now offer the ability to record all ProRes codecs in Ultra High Definition 3840 x 2160 resolution directly onto the in-camera CFast 2.0 cards, at up to 60 fps. This feature, available for purchase through a software license (and a sensor calibration for existing AMIRA cameras), comes in response to feedback from AMIRA customers, some of whom have been grilled about UHD/4K deliverables by clients. It is made possible by the camera's image quality, processing power and reprogrammable system architecture (FPGA).

Whether a production is pursuing UHD production from lens to living room, from deal to distribution, or simply want to archive in UHD for future-proofability and potential future profit, AMIRA now offers an easy upgrade that requires no additional processes in postproduction.

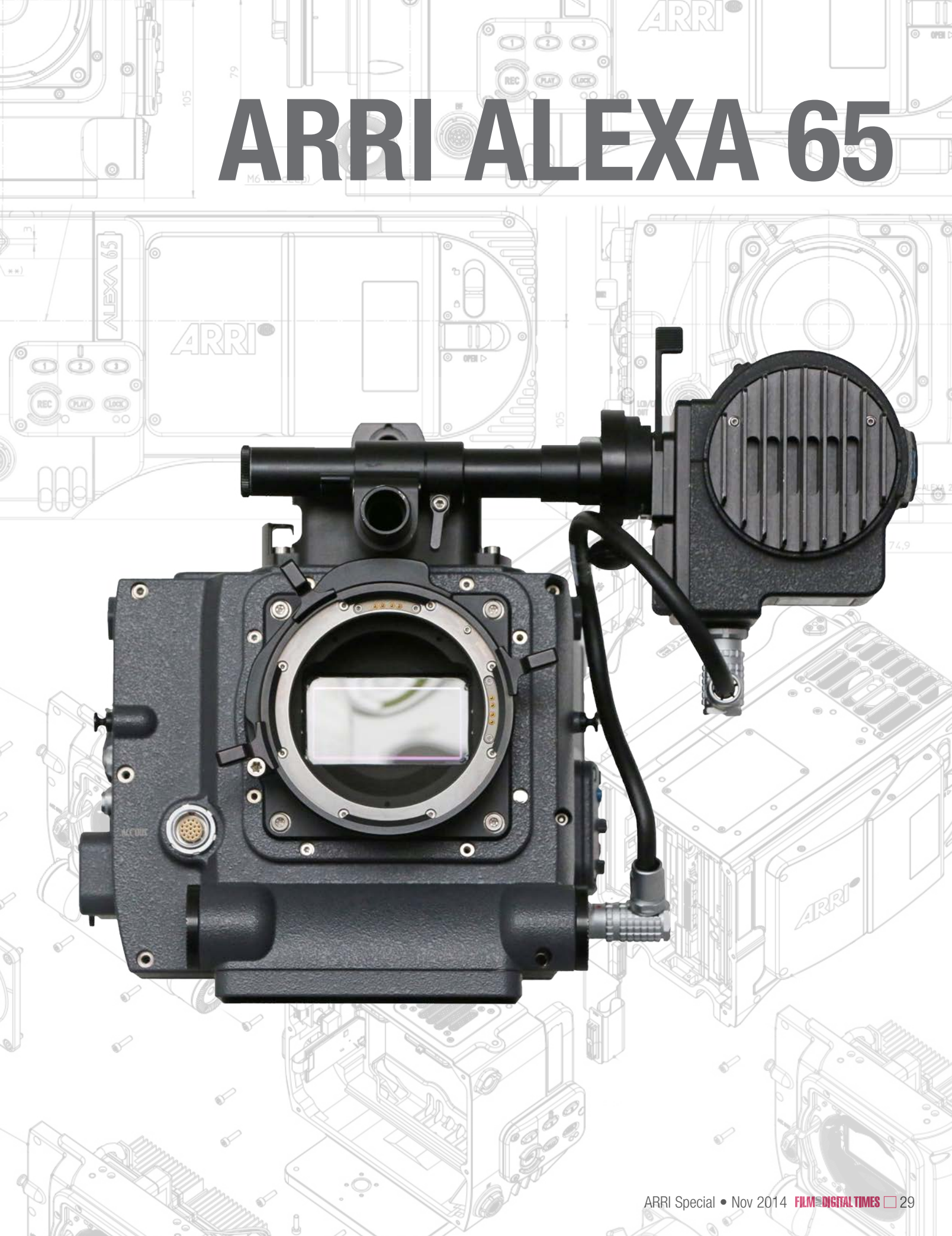
For major feature films, an up-sample to 4K can be carried out after visual effects and other postproduction tasks have been completed at 2K resolution. For certain fast-paced AMIRA productions, however, there may not be the time or resources for such processes in post, which is why 4K or UHD directly in-camera has been requested.

AMIRA's UHD uses the same efficient 1.2x up-sample filter that ALEXA's Open Gate mode employs in the ARRIRAW Converter (ARC) to up-sample the same sensor pixels for 4K distribution. In the AMIRA, this up-sample to UHD happens in- camera, and in real time.

Outputting UHD broadens the distribution options. The 14+ stop dynamic range remains unaltered, as does the colorimetry, contrast, style and look. By making the sensor's high-quality image data compatible with higher spatial resolution formats, the UHD upgrade addresses concerns in certain regions and productions about a 4K future, allowing AMIRA to be used on any project, no matter what deliverables are required.

Markus Dürr, ARRI AMIRA Product Manager, said, "Feedback on AMIRA from all over the world has been overwhelmingly positive, and it is clear that the camera is already a great success, as it is being used on an amazing variety of challenging productions. Already acclaimed for its phenomenal image quality, ease of use and versatility, the new ProRes UHD output will take these benefits even further, adding value for customers in areas like China, where 4K is a major focus of industry attention."

ARRI ALEXA 65



ARRI ALEXA 65

65mm digital cinema camera
ARRI A3X CMOS Sensor
Aperture equivalent to 5-perf 65mm film
6560 x 3102 Resolution
54.12 x 25.58 mm Sensor size (active image area)
Sensor image diagonal: 59.87 mm
ARRI XPL Mount (64 mm diameter)

Photos of ALEXA 65 Prototype by David Zucker

LDS metadata
Same accessories as ALEXA XT cameras
Electronic Shutter 5° - 358°, adjustable in 1/10° increments
0.75 to 27 fps (upgrade to 60 fps planned for early 2015)
EI 160 to EI 3200. Base is EI 800
Dynamic Range greater than 14 stops

65mm Rebooted: ARRI ALEXA 65

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."

Franz Kraus, Managing Director of ARRI

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 delicious and stylish 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 aliasing 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 ARRI Rental 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.

Martin Cayzer and Neil Fanthom

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. 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? How do we remain relevant in the industry and to our customers? What's going to change, and what do we need to do to innovate and provide the latest technology and services—to do something special?"

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 about 8 billion?

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: China's box office was up by 27% last year, which is amazing. China's box office is now the number one international box office. There is huge growth in the BRIC countries (Brazil, Russia, India and China.) Because of that global trend, heavy visual effect blockbusters translate well into international box office. Then, we looked at the IMAX trend. They are certainly, from their results, going from strength-to-strength. Now, with over 860 installed theatre systems globally and 160 IMAX screens in China up from just 9 in 2008.

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.

How do we, as a Rental Group, approach this? This was the key question. We need to be globally integrated, and we'll see later that we have a group of very good individual rental companies around the world with the same ethos, and we are all owned by ARRI. We are integrated, but historically probably not as well connected as people would think we are. And that needs to be addressed. Since we do have five different brands, it can be confusing as people say, "Well, is ARRI CSC in the U.S. the same company as ARRI Media in London? Are we all part of the same group?"

And, this is especially important as cinematographers, crew and the post and visual effects community move around the world. We have to be in the right locations. In fact, this month, we just opened an office in Atlanta, because of the predominance of high-end television drama and feature film production in Atlanta.

What are the five brands that you mentioned?

MARTIN: ARRI Rental in Germany, ARRI/CSC, ARRI Media and ARRI Lighting Rental in the UK, and Illumination Dynamics. Located in 17 offices throughout 7 countries.

From October this year, all our global rental companies - including our lighting and grip rental businesses – will be incorporated under our new brand. Apart from Illumination Dynamics. That's because its rental business is more focused on moving light technology, broadcasting and events. It makes sense that they retain that name, certainly for the immediate future. But, of course it will have an ARRI Rental company brand association as they are still very much part of our group.

When cinematographers turn up somewhere in the world, they need to know that it's an ARRI owned rental company, supported by everything you would expect from ARRI. ARRI brought me on board 2 years ago as the CEO of the ARRI Rental to help bring our global rental companies closer together.

How is ARRI Rental structured?

MARTIN: My first move was to create a Rental Group senior management team consisting of myself, Simon Broad, Thomas Loher, and David Everitt. Rather than have a bricks-and-mortar head office we now have a senior team of existing executives already in our global rental businesses operating as a virtual headquarters.

With Thomas Loher (also Managing Director of our Mainland European rental operations), we have the insight of a great operational manager with a vast knowledge of the industry.

David Everitt (Finance Director of our UK operations) has very strong financial and analytical skills.

Simon Broad (President of our US rental operations) has over 3 decades of successful industry experience and specific experience in marketing.

Together we take an overall view of all parts of the ARRI Rental business around the world. We've brought on Neil as the executive for technical marketing to bring together all our technical people around the world in order to advise and help develop new products. We've got a lens team. We have a workflow team. We have a technical marketing team around the world that meets on a regular basis, chaired by Neil, to talk about technology and how it interacts with our clients, what our clients are looking for, and how we can create that.

You can imagine the depth of skills, knowledge and experience of the people we have within our Rental companies. As we bring them together even closer we become capable of developing exciting new technologies. In particular, I have to mention the vital contribution of Manfred Jahn who is a leader in the development of our lens strategy.

We should also remember Bill Lovell, the ARRI Rental technologist behind this project. Bill tragically died the night before the kick-off meeting in 2013. Bill created the original ARRI Rental specification requirement for the camera, which is largely the same today. He was a driving force with Franz Kraus and the rest of the ARRI team behind the D-20, D-21 and ALEXA development. The ALEXA 65 would have been the pinnacle of endeavour over many years for him. Bill's inspiration and influence on the ALEXA 65 system will remain with us for some time to come.

We have just taken on Dana Ross, who is our very first ARRI Rental representative in Los Angeles. His role absolutely is about relationships with the community, the cinematographers and the post and visual effects people.

Dana was every cinematographer's best friend at Technicolor.

MARTIN: Dana is now our Executive of International Marketing. His role is really to be out there and spread the word about what we're doing, talk to people about what we're up to, listen to them, feed that back and create a really strong relationship in a location where we've never been strong as a rental company. And whether you're a cinematographer who is Mexican, Australian, Kiwi, Brit or of any nationality, you're probably going to pass through Los Angeles at some point and we've never had anyone specifically from our rental group there. We are so lucky to have Dana join us with his knowledge, skills and relationships.

And then, behind the scenes we are putting in common integrated operational systems and processes, so it's more than technology and branding. It's much more about having a common way of doing business in all our group companies, as well. We've now set up a Quality Control Group. Previously in our rental group, each individual company would have had its own way of dealing with camera packaging and set-ups. We have to have a common approach and a common quality control. We have a group that's talking about a much more global approach to technology, and how we set it up. So that's another real positive, as well.

The real goal for David, Simon, Thomas, Neil, Dana and me, and for the whole team, is that we really want ARRI Rental to be an innovator as well as a rental company. With the ALEXA 65 camera, ARRI sales had already decided it was not viable to be developed as a product for sale. The quantities would be too small, and therefore the pricing would be prohibitive. Also, it required a complete system to be developed including lensing and workflow.

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.

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—a rental product that ARRI Rental 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.

Is ALEXA 65 the only exclusive project that you are developing?

NEIL: It was a product which Rental had to hone, because it was originally sitting in R&D when I was still working for ARRI in Munich, and nobody really knew what to do with it. Bill Bennett, ASC, had shot a very fine Audi commercial with the camera, in infrared, which generated a lot of interest and that prompted some internal debate: "Is it a sales product? Is it something that we would rent into the market? Is there a market for it, even?"

That was the first product Rental took under its wing in a very limited quantity to test the water on our ability to promote new technology into niche markets. And it worked out very well, particularly with high-end music videos. For example, recent music videos for Kylie Minogue and John Newman looked wonderful in black-and-white, and of course several commercials have been shot with the camera, in black-and-white as well as infrared. The ALEXA B+W infrared look was adopted very successfully by Audi for a while as a high-impact format for their new car commercials.

Cinematic productions have been a little slower to adopt the camera, but because it does have such a resolute and contrasty look I'm sure that a great feature opportunity will present itself in the near future.

For the ALEXA 65, we touched on the question of our initial launch messaging, 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.

The "big chip" really is the beating heart of the camera. The size, you guessed pretty much as soon as you saw it, so impressive estimation skills on your part, Jon.

Tell me more about the new sensor in the ALEXA 65.

NEIL: 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 ALEXA 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.

We can't talk about everything at this point in time. But the first

upgrade, to the recorder hardware, will be early in Quarter One 2015. Faster frame rates, longer recording times, larger capacity Capture Drives.

What is the capacity now?

NEIL: Half a terabyte capacity—on a standard XR drive we are all familiar with. The new larger capacity Capture Drives we are considering will provide significant extended recording times. But they will also be much quicker than the current XR capture drive, therefore allowing for uncompressed higher frame rate recording. The camera architecture is capable of supporting a sustained recording data rate over 2 Gigabytes (not bits) per second.

2 Gigabytes per second. What is the data rate now?

NEIL: For XR Capture Drives: 860 Megabytes (not bits) per second.

Is the ALEXA XT the same? If so, how do you do that?

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 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 in its launch format.

MARTIN: At 24 fps. As Neil said, it's a base launch format. As with ALEXA, we will be adding extended functionality over the coming months addressing frame rates, recording capacity and formats.

NEIL: As far as recording formats go, keeping it simple is going to be important. To start with, the camera will support 5-perf 65mm and 8-perf 35mm (VistaVision) recording modes. These can be cropped in camera, or cropped in post. There will be a white paper which covers best practices for the camera and workflow. We both feel that it is going to be important to offer productions the choice of format, of data footprint.

We'd like to talk about recording formats in terms that cinematographers can relate to, and which are based on film standards. The ALEXA 65 menu selections will relate to standard film formats, not "Ks of resolution. In any mode, the camera will have plenty of "K", so resolution does not need to be a creative consideration when choosing your lens, or framing your shot.

You mentioned Hasselblad optics. How many lenses will you have in time for launch, and what are the plans?

NEIL: We have in development additional primes and zooms for next year. We'll launch with eight primes over a wide spread of focal lengths, and one zoom. But hot on the heels of that zoom will be another zoom and some more primes. To fill out the range, we have the ZEISS Hasselblad lenses used on the Arriflex 765 film camera, which are actually very good lenses, of course. They will provide a subtly different look.

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 anymore, 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. We have a very good strategy for dailies, which can be processed faster than real-time during ingest of the XR Capture Drive.

MARTIN: For very high-quality dailies.

NEIL: They will be HD ProRes 4444 "source dailies" which can be used either as they come, or further transcoded down to DNxHD 115, DNxHD 36, etc. Again, giving production the choice to decide what format they want to suit their working needs. And then for our pristine uncompressed images, 6.5K at the highest resolution, processing to generate archive masters will take a little bit longer than, say, ALEXA images would.

MARTIN: I think its important to point out that to get enough cameras in quantity and enough lenses, it is obviously going to take a little bit of time. We also aim for greater functionality of the cameras, and in 2015, we will speak to people who have a genuine interest in a business-to-business relationship with the cameras and have conversations with them.

Would it be sold by ARRI?

MARTIN: The intention might be to have a business-to-business rental or lease arrangement with other rental houses.

Just because it's not in the traditional ARRI service network, in terms of servicing, in terms of lenses, and in terms of packaging and workflow, we couldn't sell just the camera body to someone. It would have to be a relationship for the whole system.

And ARRI Rental would also need to hand-hold that, as well, to a large extent, because of technology, and service, and parts, and all that. It's not an easy question to answer, but it will be possible.

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.

I'm impressed. I think you have come up with one of the most interesting products in the history of large format cameras. It's really exciting.

MARTIN: I think we need to congratulate Achim Oehler, who was the project leader for this endeavor.

Achim Oehler

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 mangers 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 do a 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.

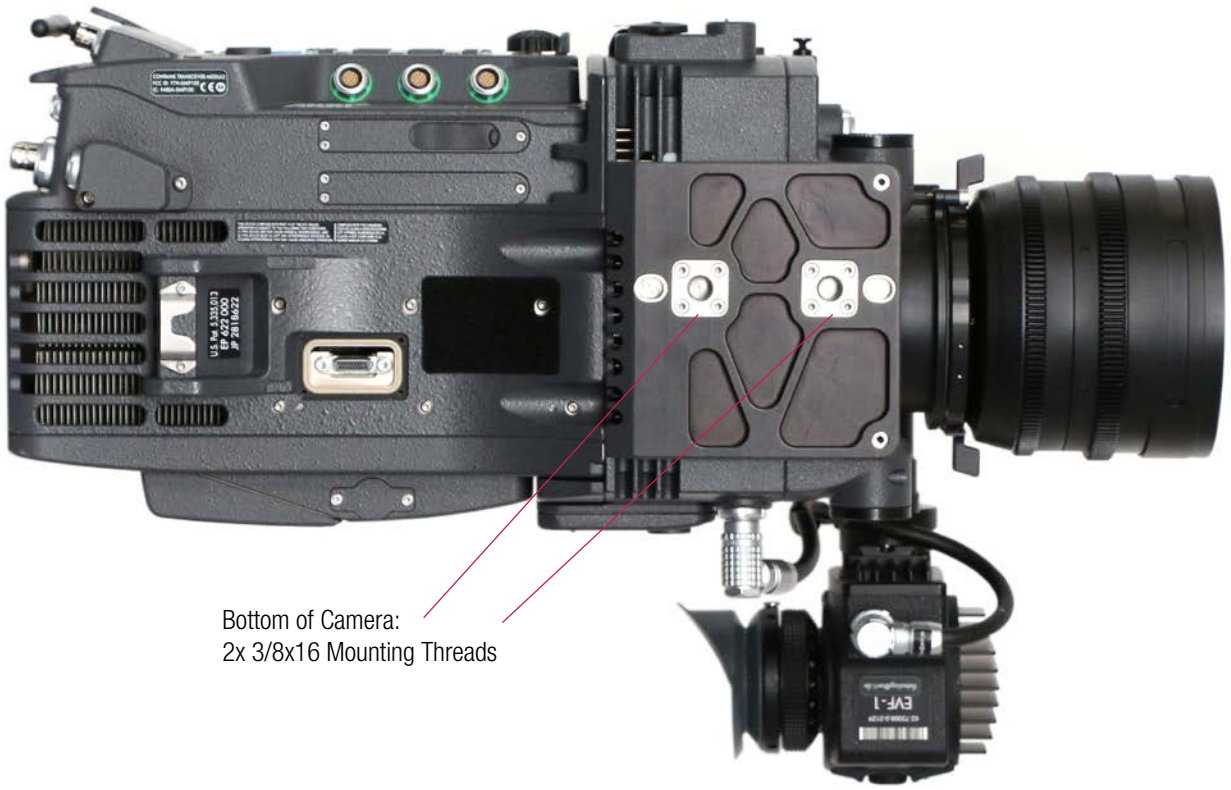
And then, what we did was to use the complete ALEXA concept. We enhanced the electronics with modern FPGAs, we updated the electronics with the latest components, so there's nothing old in there. We can use it for another five years. At the same time, we can reuse about 90% of the software. There are 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.

ARRI ALEXA 65

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.

ARRI ALEXA 65

ARRI ALEXA 65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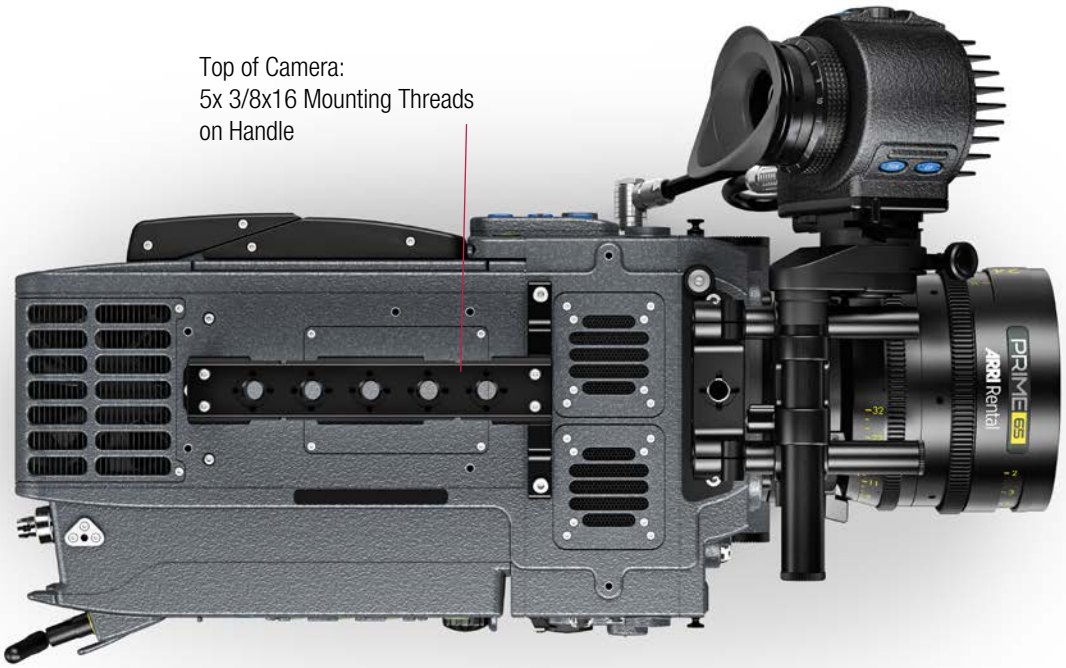
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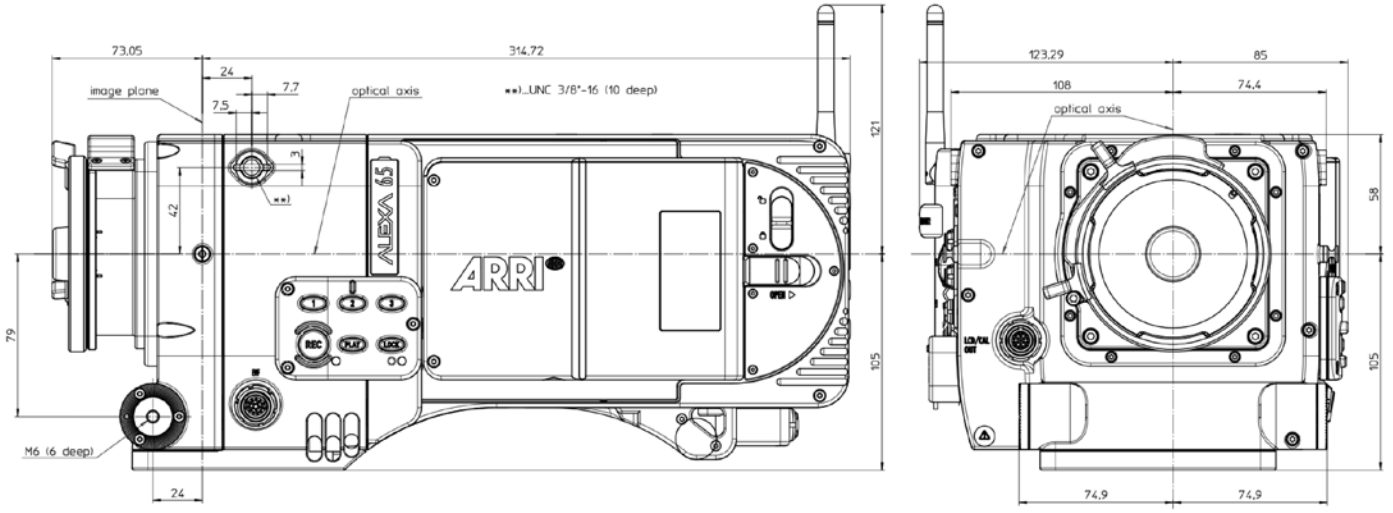
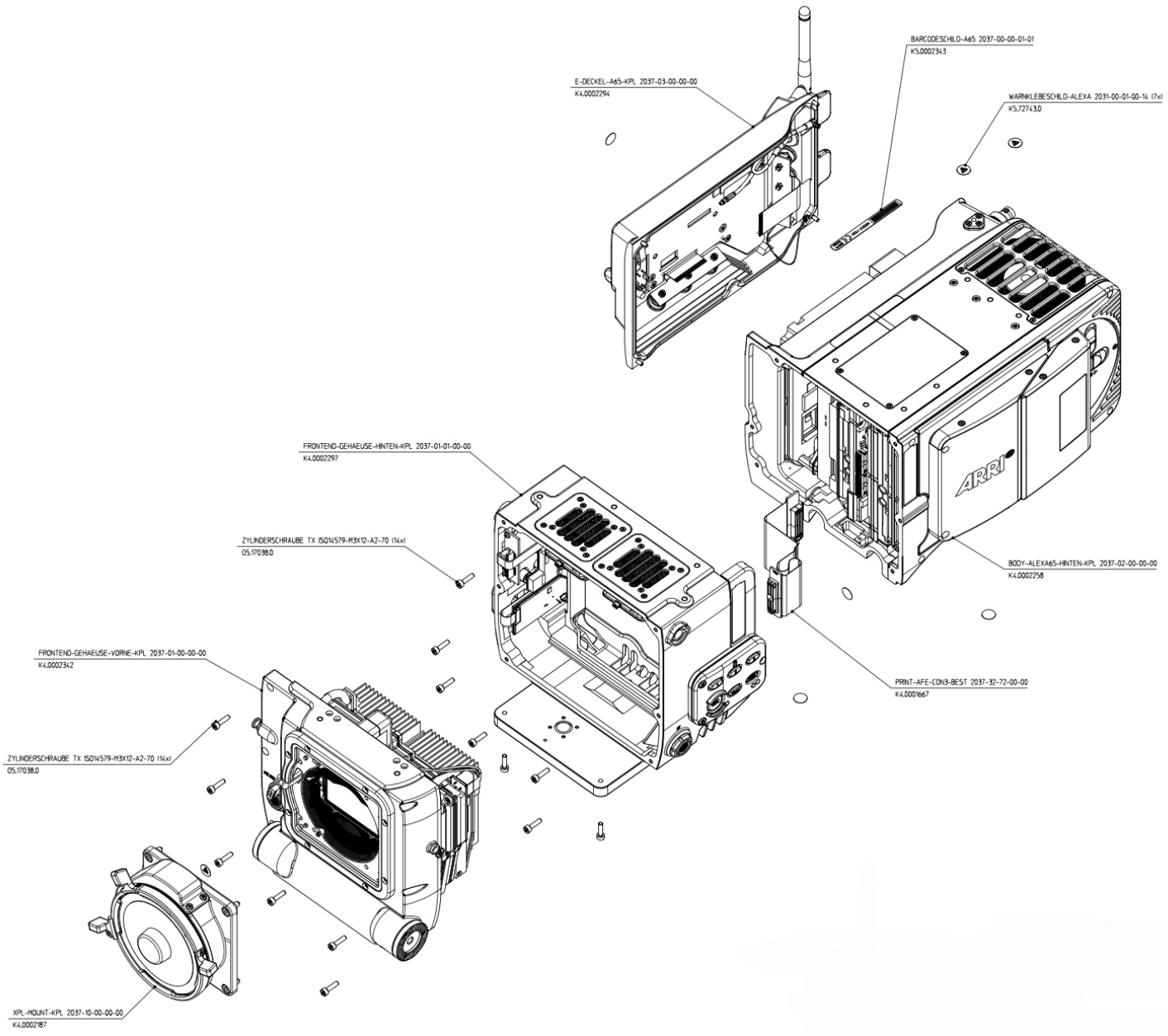
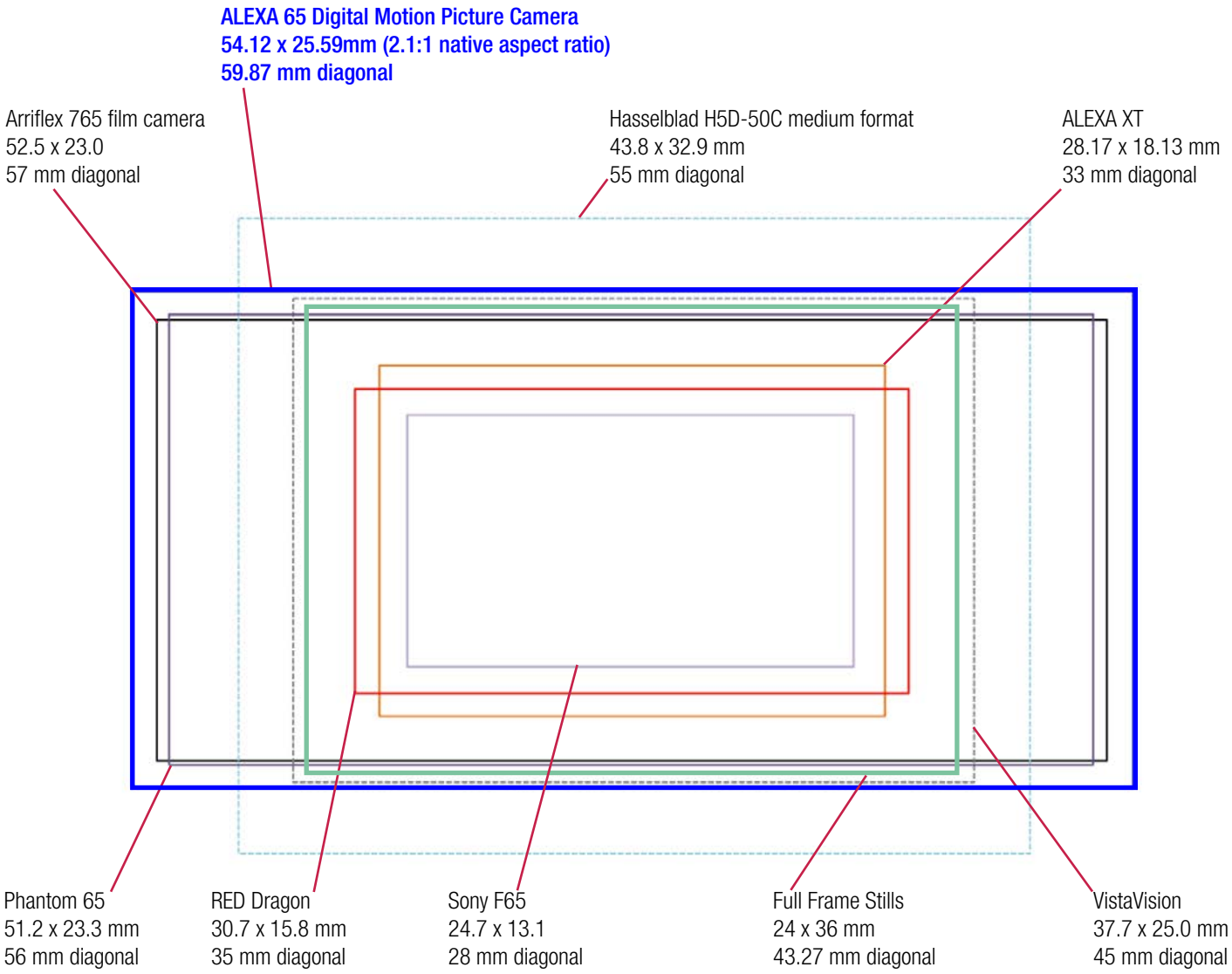
5x 3/8x16 Mounting Threads
on Handle
PRIME 65
ARRI Rental

Exterior Dimensions





Sensor Size Comparisons



	Width	Height	Diagonal	Horiz Rez	Vertical Rez	Aspect Ratio
ALEXA 65	54.12	25.59	59.87	6560	3102	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
ALEXA XT	28.17	18.13	33	3414	2198	1.54:1
Sony F65	24.7	13.1	28	8192	2160	1.89:1

New ALEXA 65 Lenses

The initial rental package includes a set of 8 primes and 1 zoom. The lenses began life as Hasselblad HC lenses made by Fujinon for the Hasselblad H5D. ARRI and IB/E Optics re-designed, re-mounted and re-housed the lenses in the new ALEXA 65 XPL mount (64 mm diameter, 60 mm flange focal depth). The original lenses were completely stripped and basically only the optical elements were used inside the housings. Focus uses a smooth cam mechanism. As Manfred Jahn, ARRI's project leader on the lenses said, "They have to feel as smooth as Master Primes."

65mm format lens	Aperture	Close Focus	Length	Front diameter	Image Circle	Weight
24 mm	T4.8-32	.38 m / 15"	101 mm / 4"	114 mm / 4.5"	62 mm	1.5 kg / 3.8 lb
28 mm	T4-32	0.35 / 14"	101 mm / 4"	114 mm / 4.5"	62 mm	1.5 kg / 3.8 lb
35 mm	T3.5-32	0.5 / 20"	120 mm / 4.7"	114 mm / 4.5"	62 mm	1.8 kg / 4 lb
50 mm	T3.5-32	0.6 / 24"	120 mm / 4.7"	114 mm / 4.5"	62 mm	1.8 kg / 4 lb
8 0mm	T2.8-32	0.7 / 28"	120 mm / 4.7"	114 mm / 4.5"	62 mm	1.8 kg / 4 lb
100 mm	T2.2-32	0.3 / 12"	120 mm / 4.7"	114 mm / 4.5"	62 mm	1.8 kg / 4 lb
150 mm	T3.2-45	1.3 / 4'3"	120 mm / 4.7"	114 mm / 4.5"	62 mm	2.2 kg / 4.9 lb
300 mm	T4.5-45	2.45 / 8'	200 mm / 7.9"	114 mm / 4.5"	62 mm	2.6 kg / 5.7 lb
50-110 mm Zoom	T3.5/4.5-32	0.7 / 28"			62 mm	4 kg / 8.8 lb

- IB/E and ARRI series: totally re-housed Hasselblad/Fujinon HC lenses
- New XPL mount, 64 mm diameter
- Flange focal depth is 60 mm
- Image circle is 62 mm
- Additional primes and zooms are expected

Arriflex 765 Lenses

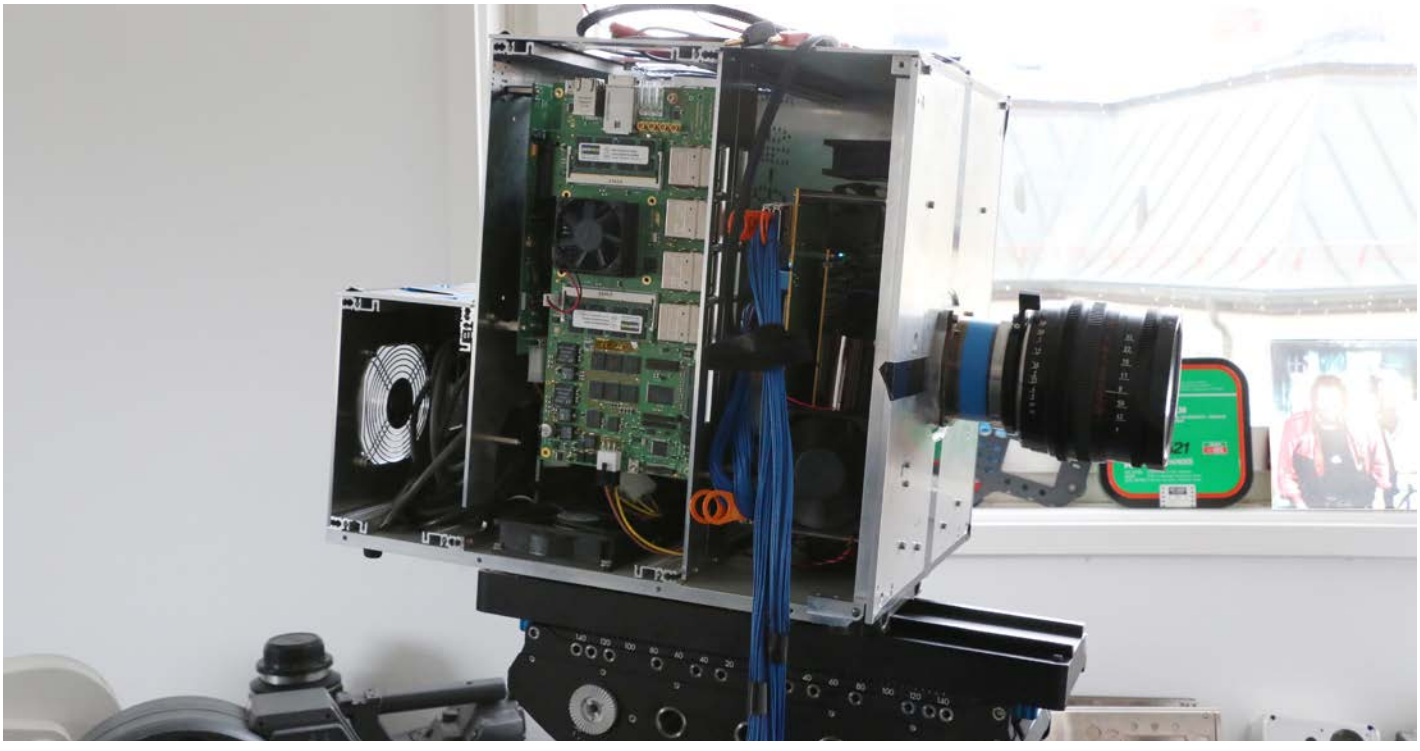
11 updated, vintage Hasselblad/ZEISS/ARRI lenses are available for the ALEXA 65. They were originally re-housed with a Maxi PL mount for the Arriflex 765. These lenses are familiar to Hasselblad users as V-series (or 500 series) lenses and they cover the analog medium format size of 56 x 56 mm (aka 6 x 6 cm or 2 ¼ x 2 ¼"). The image circle is a whopping 79 mm.

Flange focal depth of the original Arriflex 765 camera was 73.5 mm. These lenses can be used on the 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.

65mm format lens	comparable 35mm cine format equivalent
30 mm T3.6	
40 mm T4.2	18 mm
50 mm T3.0	24 mm
60 mm T3.6	28 mm
80 mm T2.8	35 mm
100 mm T3.6	46 mm
110 mm T2.1	50 mm
120 mm T4.2 Macro (1:4.5)	55 mm
150 mm T3.0	70 mm
250 mm T4.2	115 mm
350 mm T4.2	150 mm
Mutar Doubler (2x)	
Cooke Varotal 38-210 mm T6.2 Zoom Lens (close-focus 2 ft)	

ALEXA 65 Development

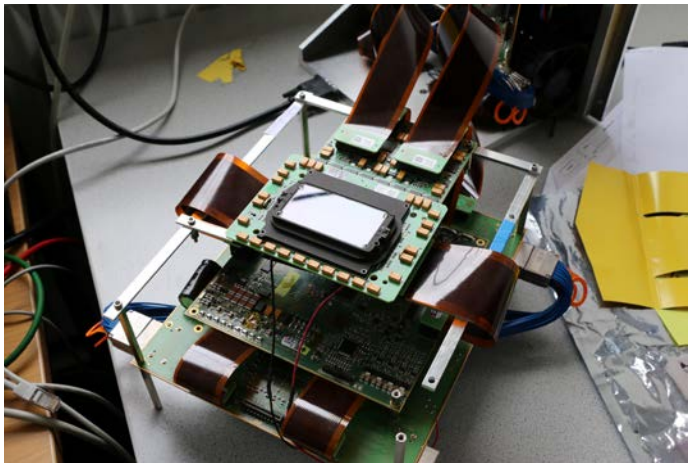
Above: Neil Fanthom, Michael Cieslinski, Martin Cayzer. Below: Pre-prototype camera and lens: proof of concept.



ALEXA 65 Construction

ALEXA 65 sensor—actual size: 54.12 x 25.59 mm (6560 x 3102)

Collector's items: ARRI D-20 T-shirt and Arriflex 535

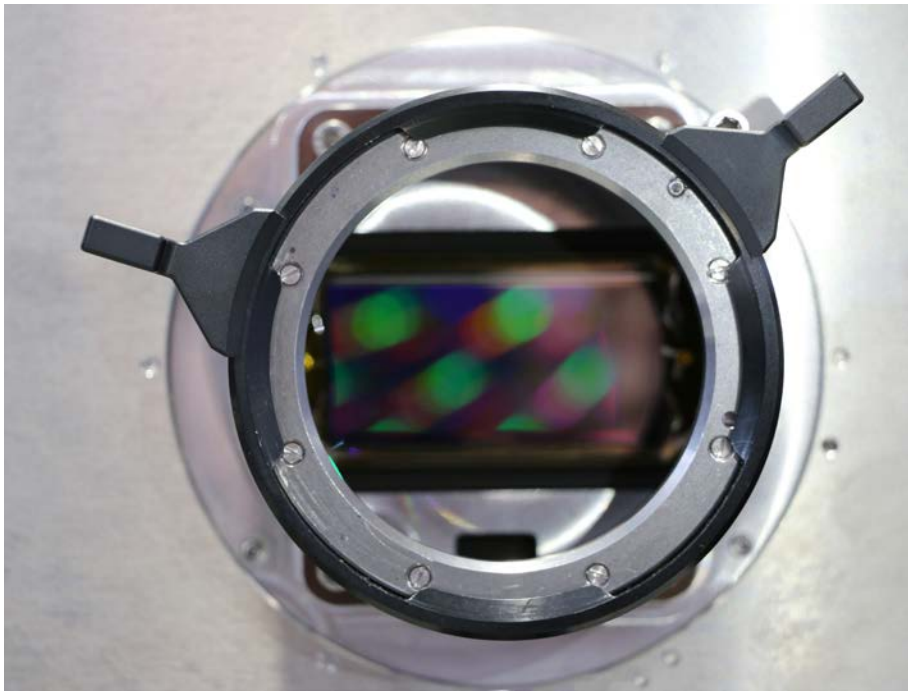


Testing sensor — breadboard phase

Sensor optimization

XPL mount and gate of ALEXA 65

XPL mount and sensor



Klaus Eckerl, IB/E Optics

Klaus Eckerl, Managing Director of IB/E Optics

During that fateful meeting at NAB last April, I asked who was doing the lenses. Neil and Martin wouldn't say, other than to hint that the lenses were based on Hasselblad optics and the modifications were being done in Southern Germany.

"Aha," I said. "Then there's only company I know of who could be doing that: Klaus Eckerl's IB/E Optics."

The Pinteresque pause was enough in the NDA world to suggest I may have been on the right track.

The FDTimes ALEXA 65 scavenger hunt adventure continued in July—to visit the place where the ALEXA 65 lenses are developed. With Neil Fanthom at the wheel of a fast Mercedes, we drove 212 km West from Munich to the Bavarian town of Freyung, about 5 miles from the Czech border.

And there it was: IB/E Optics.

IB/E is an acronym for Ingenieur Büro Eckerl (Eckerl's Office for Engineering), and Klaus Eckerl is the Managing Director. The company occupies a modern 4-story building with the latest CNC and optical machinery, offices, and a James Bond-like screening room in the penthouse. On the day we visited, Klaus was calibrating the ALEXA 65 lenses' focus scales with Manfred Jahn from ARRI Rentals and gentlemen from ARRI Austria.

JON FAUER: Klaus, your company, IB/E Optics, is doing the lenses for the ALEXA 65?

KLAUS ECKERL: The ARRI guys came to us with a very special, very exciting idea: create a set of lenses for the big camera sensor of the new ALEXA 65. It started with a call from Manfred Jahn of ARRI Rentals. They had a choice of several candidates who had lenses for this big format. The well-known contenders in medium format lenses included Leica S, Schneider, Mamiya, Hasselblad, and others. Together, we tested lenses, did MTF tests and comparisons. We liked the Hasselblad lenses. When we looked at the MTF values; they were really great lenses.

It sounds quite simple to just rehouse some existing lenses, but the Hasselblad lenses, of course, are fully auto-focus. If I sound a little bit negative, that's because I hate automatic controls on lenses. I'm a manual guy and autofocus lenses used to be full of plastic materials, have a completely different mechanical setup because motors inside drive the shutter, iris and the focus movement parts. The new Hasselblad lenses are designed as still lenses, but optically they are very good lenses. We dropped all the mechanical parts of the original lenses. Only the optical elements and some of lens barrels were used.

The challenge was to combine the opto-mechanical needs of the cine world with the good optical elements of the Hasselblad optics. We did a feasibility study with Manfred Jahn. We disassembled the lenses and did a CAD redesign of the lens. We also designed and manufactured new linear irises. We developed a focus mechanism with full 300 degree rotation that camera assistants are familiar with. We needed all the focus and iris barrels to be in the same relative position. This turned out to be more for the zooms: with the focus ring in front, then the zoom ring, and then the iris ring. The original iris was driven electronically. One of the biggest challenges was to get our new iris and its mechanical carrier between the complex zoom mechanism.

These all are commonplace things in the cine world, but not in stills. We were fortunate to have already designed special software to calculate and create CAD models on linear irises. We had invested a lot of resources on this years ago, because we understood the complexity of working on new irises: different diameters, different angles, number of blades, and so on.

Another difficult job was to get good ergonomics for the feel of the focus. The main thing Manfred simply told us was that the focus barrel should feel like a Master Prime to a camera assistant. That may seem to be a quite short specification for mechanical issues, but it was quite a challenging one.

You used cams, then?

Yes, and it's very critical. We do it in-house, along with all the other key parts. We have very special software and hardware tools to do it, because we are milling in a special way. You can't do it without this unique tooling and we actually created two hardware systems in case one machine breaks down. On this job we had the good cops and the bad cops. Neil and Martin are the tough cops who need it ready right away and to be perfect! Manfred was the good cop who constantly pushed us to do even better. Seriously, they were all a very good influence on this project.

The point is that it's especially critical to pay attention to the small details, choosing the components, assembling hundreds of parts, checking and doing quality control.

Do these lenses have LDS metadata?

Yes. When we were asked to introduce the LDS electronics, we worked with the ARRI Austria guys in Vienna. We wanted to keep

the standard components of existing ARRI/ZEISS LDS lenses so as not to develop new or different components. This also makes sense for serviceability if you have to replace components. These additional electronics had to fit inside the lens housing.

I'm really convinced the lens is very good, especially when you look at the MTF data. We are really proud of having been a part on the project.

You can't just buy the optical elements?

No. We tried. But we have to buy the entire Hasselblad/Fujinon still lenses and then completely take them apart.

What's the image circle of these lenses?

The image circle of these ALEXA 65/HC lenses is 62 mm.

What is the image diagonal of the sensor in the camera?

60 mm. (Maximum sensor size diagonal is 59.87 mm.) So this fits rather well. Remember, these are not the classic Hasselblad V-series lenses with an image circle of 79 mm, which are much larger.

Hasselblad reduced the format when they went digital?

Yes, and it's a pity, because I also have a collection of the old Hasselblad cameras. Also the flange focal depth was reduced to 61.63 millimeters on the new HD5. It was around 74 with the older format, because they needed to have a bigger mirror. So at least it's shrunk down a bit in this area. But for the new ARRI format, it's perfect. I think it was a good choice to take the new Hasselblad lenses. They offer the most complete line of focal lengths and they go as wide as 24 mm, which is really wide lens for medium format.

Manfred and I spent a lot of time doing very critical optical testing of all the possible lenses that were out there. These are very good, they cover the image circle, they have the right range in terms of focal lengths, they're the right size, and they are available.

Manfred Jahn, Head of ARRI Camera Rental and Project Leader of the ALEXA 65 lenses at IB/E Optics.

IB/E Optics in Freyung

Rooftop deck and screening room

IB/E Optics clean room

Barrels for the ALEXA 65 lenses

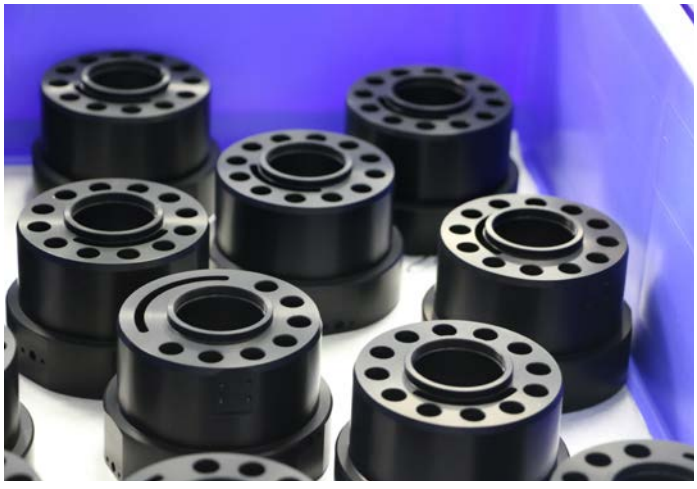
Lenses for ALEXA 65 (cont'd)

Klaus and Little Buddha. This is appropriate, since the first major feature shot with the Arriflex 765 was "Little Buddha." Bernardo Bertolucci was the director; Vittorio Storaro, ASC, AIC was the cinematographer.

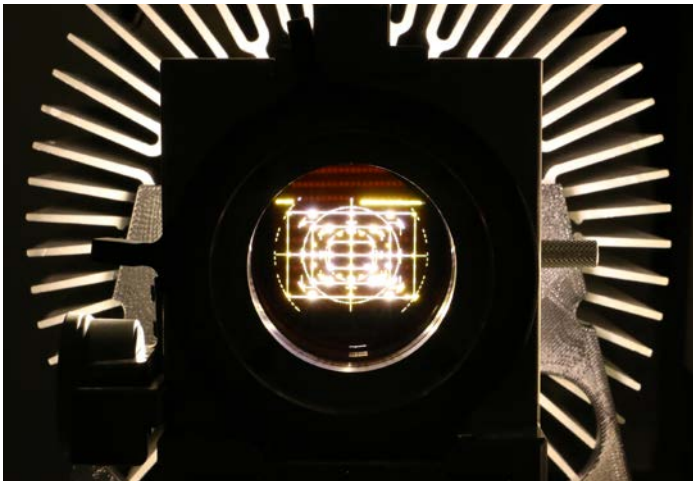
Klaus is almost as passionate about travel to new places as he is about optics, and his office is filled with items from his journeys.

Calibrating focus scale

ALEXA 65 XPL lens mount



Internal mechanical assemblies



Lens projector at IB/E Optics

CNC machining of mechanical assemblies

Aperture scale

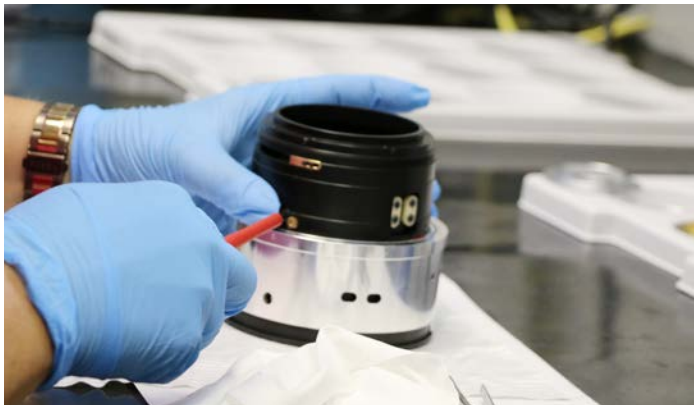
ALEXA 65 Lenses (cont'd)

Klaus, Martin, Neil in IB/E Optics rooftop screening room

Assembling optical elements in the clean room

Mechanical assembly—cleaning

Mechanical assembly



Adjusting the focus cams

Adjusting the focus cams

ALEXA 65 Lens design meeting

Manfred Jahn and Klaus Eckerl

Marc Dando on Codex and ALEXA 65

Marc Dando is the Managing Director of Codex. Prior to founding Codex, Marc began as a design engineer developing automation systems for the manufacture of printed circuit boards. He worked on 3D animation at CubiComp and then Vertigo 3D. From there he went to Softimage and Discreet Logic. Marc and Delwyn Holroyd came up with the idea for Codex in 2003, and Marc joined Codex in 2009. Interview by Sarah Priestnall.

SARAH PRIESTNALL: When did ARRI ask Codex to become involved with the ALEXA 65?

MARC DANDO: It must be over 2 years ago that I first had discussions with Franz Kraus about how a digital 65mm camera would make the format much more accessible. Things got serious at Camerimage 2012 when I discussed the idea further with Bill Lovell from ARRI Media who was very excited about this camera system. My last conversation with Bill was about the camera. When he found out I was walking through Soho, he found it very amusing that we were discussing our "dirty little secret" as he called the project—this was typical of Bill.

You talk to a lot of cinematographers. What do you think will be their response to this camera?

I think for many it's the digital camera they've been waiting for. I was talking to Bob Richardson, ASC recently. He's shooting with 65mm film on a project right now. He said, "I cannot express how enthusiastic I am about the forthcoming ALEXA 65. I am currently working with 65mm film and if the quality is anywhere near that of film, we will all benefit from the increased information and quality of image." This just about sums up what people will think.

What were the challenges, if any, of being involved with this project?

Fortunately at Codex we've been working with large files since the company started. One of the first cameras we supported was the Dalsa Origin 4K. For the ALEXA 65 camera, the RAW files are 31 MB per frame. The data rate is 733 MB/s. So obviously we needed a robust recording format with solid state drives that were rock-solid in sustaining the required data rates, at frame rates of up to 60 fps. This put us close to the cutting edge of technology but it's a place where we are absolutely comfortable. The recording media we created for the ALEXA XT, the Capture Drive, is robust and available.

How important was it to Codex and ARRI to build on existing tools and formats—Codex Capture Drives, Codex Vault, and the ARRIRAW format?

Really, really important. Our customers and users would expect nothing less from us. The ARRIRAW format has become standard and productions and post houses are comfortable using it. Codex workflows have become standard and so there will be no learning curve as this camera rolls out to productions. As Neil Fanthom from the ARRI Rental Group says, "the uncompressed 65mm imaging format of the ALEXA 65 demands a high performance, cost-effective workflow to ensure that post production processes and budgets are kept under control." Given our history of collaboration plus Codex's widespread adoption, ARRI were confident that Codex could provide this. And we've strived to provide some standardization so that a new camera like the ALEXA 65 doesn't mean re-inventing the wheel.

In the quest for next generation cinema, what's more important: resolution, dynamic range or high frame rates? Or are all required?

These are all tools that cinematographers and directors can use to tell better stories. In a perfect world we would have all of these things and the plan is to provide a continuous development program that allows us to improve as we go. Of course, we also have other things to consider for a next generation camera. The requirements of visual effects are extremely important now and filmmaking is about collaboration. We also have many more delivery platforms to support now, from smart phones to higher resolution displays. Cinema has some fantastic new display technologies coming soon. Dolby Vision, for example, requires cameras like the ALEXA 65 to bring a better experience to the viewer.

What about workflow? How important is it that the camera is backed up by a rock-solid workflow?

It's absolutely critical. At Codex we've focused on providing reliable workflows for digital cameras and this one is no exception. In fact, with the data requirements of this camera, workflow is even more important. DPs understand this. Bob Richardson told me that the Vault Lab 65 is vital for this. We've spent years developing reliable workflows so that filmmakers can be confident that their digital negative is secure. Modern filmmaking requires a solid technology background. When you are capturing multiple terabytes per day you need to plan. Producers need to know that the digital negative is safe. Post support for production is making a massive change from the past. New systems need new ways of doing things with the same guarantees you would expect from a lab in the past.

Handling ALEXA 65 Data

Codex Vault S with 8 TB Removable Transfer Storage

Codex Capture Drive 2TB

Vault S On-Set Cart

ALEXA 65 In-Camera, On-Set and Near-Set Data management is a collaboration of the usual suspects: ARRI and Codex.

Marc Dando, Managing Director of Codex, said, "DPs wanted something different. They wanted to raise the bar for theatrical release and expand the options they have for the look of their project. 65mm is a wonderful format and with the ALEXA 65 system for the first time it becomes affordable." The ALEXA 65 uses a Codex recording engine similar to the ARRI ALEXA XT.

Existing ALEXA 512 GB XR Capture Drives will support recording up to 24 fps for about 10 minutes in full open gate (full aperture) mode. Next-generation 2TB Capture Drives capable of 20Gb/s data rates will be available in the future. These will also allow for recording times of over 40 minutes.

A typical production scenario would be to have a Vault S for the On-Set cart with 8TB solid state transfer drives supporting about 3 hours of footage. This would be used to create safety copies and allow for playback. The Vault XL would be used Near-Set for dailies, editorial deliverables, camera original archive to LTO, look creation, syncing sound, and other post production work. It also supports high-speed networking and file-transfer to allow for integration with other production workflows.

"Anyone familiar with ARRI ALEXA and Codex Vault will be comfortable with the ALEXA 65 workflow," was Marc Dando's summary. We are looking forward to updates to the DCI (Digital Cinema Initiative) specifications that will encompass these now high-end capabilities.

Exploded view of Codex Vault S showing modular and scalable design

Vault XL

ALEXA 65 Workflow with the Codex Vault Lab 65

Vault S
On-Set

Vault XL
Near-Set

ARRI Rental has partnered with Codex to deliver a streamlined system, capable of managing the data requirements of productions using the ALEXA 65 camera. The Codex Lab 65 consists of two pieces: the Codex Vault S and the Codex Vault XL. These two pieces provide an on-set and near-set workflow combination with all the necessary tools for managing data, archiving and generating dailies.

Shown here on a Codex Cart, the Codex Vault S is the familiar Codex Vault, already used on hundreds of productions worldwide. It's a rugged, modular system, designed to go wherever needed and as comfortable on location-based productions as it is in studios. Camera original material can be quickly cloned to Codex 8TB Transfer Drives (RAID-protected) and then drives can be sent to a near-set Codex Vault XL.

Vault XL is a rack-mounted network-attached device, ideal for near-set or a post-production facility. It's shown here in a flight case but could equally well be configured in a rack in a facility. Containing multiple CPU and GPU cores, Vault XL can render out full ALEXA Open Gate 6.5K ARRIRAW files in near real-time. Dailies for offline can be transcoded simultaneously at speeds far greater than real-time. 2K or 4K files can also be generated easily depending on the particular post-production pipeline. The camera original files can be archived to dual LTO tapes with full verification using the industry-standard LTFS format.

With the Codex Review Module, files can be played back on a calibrated display with the correct look applied. A full QC can be carried out efficiently using a sophisticated timeline and intuitive user interface, and detailed QC reports can be generated. The system also includes full color correction, including support for ACES and ASC CDL, as well as non-destructive, primary color grading tools.

Codex Vault Lab 65 Specifications

Codex S for ALEXA 65

Hardware
10” Touch Screen
DC 24V Power Supply

CPU
Intel Core i7-3740QM Processor
4 cores, 8 threads
6M cache
Clock speed 2.7GHz, max turbo frequency 3.7GHz
AVX instruction set extensions

Memory
1600MHz DDR3 RAM

Ingest
4 x Capture Drive XR
1 x Capture Drive 2TB
2 x SxS Card
1 x CFast 2.0 Card
1 x CF Card
1 x 2.5” SSD

Storage
Removable Transfer Drive Bay
8TB Solid-state Transfer Drive Module

Outputs
4 x 3G-SDI
10-bit HD / 2K / 4K

GPU
GPU Engine with 2880 Cores
6GB Texture Memory

Networking
1GbE Interface

Vault Platform Software
GPU Processing
Metadata Editing
Virtual File System
Transcoding Engine Export
Archiving
Data Reporting
Import
Clone
Offload

Vault Review
2K / 4K Player
QC Tools
Color Correction

Codex XL for ALEXA 65

Hardware
10” Touch Screen
AC Powered

CPU
2 x Intel Xeon Processor E5-2690 v3
24 cores, 48 threads
30MB cache
Clock speed 2.6GHz, max turbo frequency 3.5GHz
AVX 2.0 instruction set

Memory
2133MHz DDR4 ECC

Ingest
1 x Capture Drive 2TB
1 x Transfer Drive 8TB

Storage
Removable Transfer Drive Bay
8TB Solid-state Transfer Drive Module

Outputs
4 x 3G-SDI
10-bit HD / 2K / 4K
DisplayPort

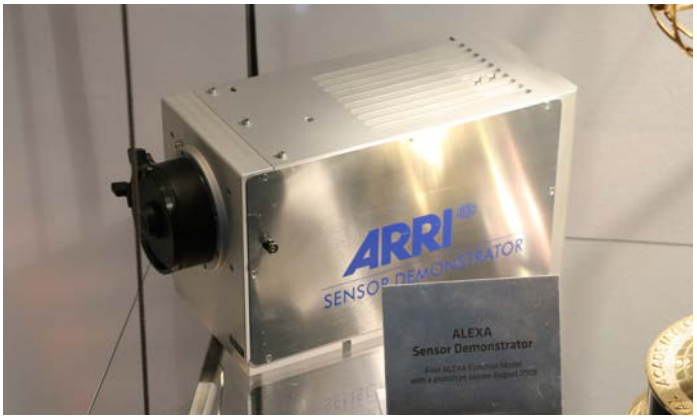
GPU
GPU Engine with 2880 Cores 6GB Texture Memory

Networking
1GbE and 10GbE Interface

Vault Platform Software
GPU Processing
Metadata Editing
Virtual File System
Transcoding Engine Export
Archiving
Data Reporting Import
Clone Offload

Vault Review
2K / 4K Player
QC Tools
Color Correction
LUT Pipeline
Audio Sync

ALEXA, ALEXA 65 and an Early 65mm Project

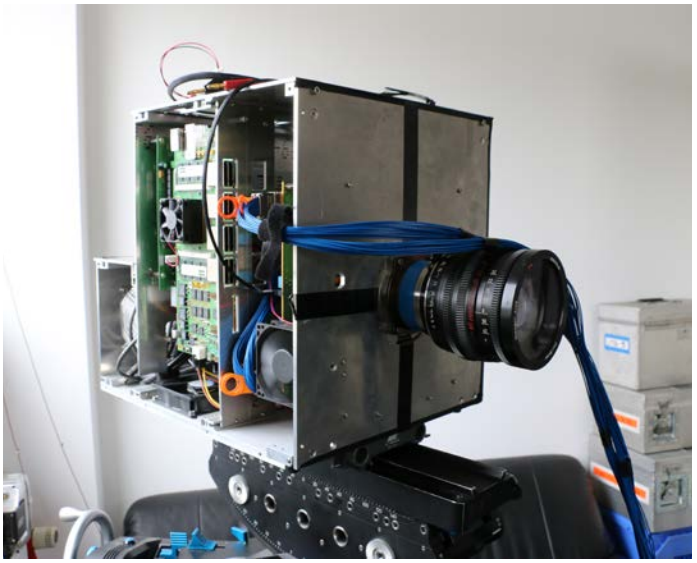


This was the ALEXA prototype, above, used for sensor demonstrations in August 2009. ARRI stopped the FDTimes presses just before IBC with a torrent of announcements. At that time, we wrote,

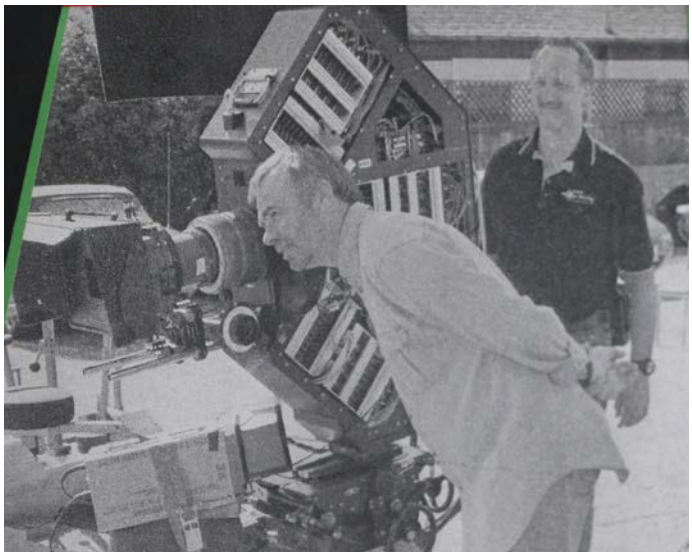
"Stop the presses! Blazing Headlines: Not One but Three New Digital Motion Picture Cameras from ARRI, the company with the Blue Logo. Just when we thought it was safe to consecrate these pages to press, the phone rang amid a torrent, no...a cascade, of pictures, text, and information that not only changes this entire edition but also has the potential for changing the nature of digital production. We had heard cries and whispers about a new camera for a long time. But—bango!—just so!—faster than you can say "Tom Wolfe," three new cameras, code named ALEXA, make their stunning debut at IBC.

The screenplay of the story would imagine down-to-the-wire meetings in which the corporate 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 more enigmatic. I doubt whether ARRI will conduct a competition for cinematographers to name the three new cameras. So, until they get a real name or number (D-31?), perhaps we can call them ALEXA. ALEXA is a good name. It reminds me of Billy Joel's song The Downeaster ALEXA, from his Storm Front album." The rest is history. The camera was named ALEXA.

Now there's a new, bigger ALEXA. The prototype proof of concept ALEXA 65 looked like this in January 2014, below.



The ALEXA 65 prototype camera, above, in ARRI's Skunkworks lab on Türkenstrasse has a photo of the 1990s ARRI-Lockheed Martin Blue Herring 65mm digital camera taped to the side. The real Skunk Works, of course, was Lockheed Martin's Advanced Development Projects facility, responsible for famous aircraft designs that included the U-2, SR-71 Blackbird, F-117 Nighthawk, and F-22 Raptor. The name "Skunk Works" was taken from the moonshine factory in the comic strip "Li'l Abner."



Here's a blow-up of the photo. That's Stargate's Sam Nicholson in front of the Fiat 500-size 3-chip ARRI-Lockheed Martin Blue Herring digital test camera in the 1990s. The prototype camera was a 36 megapixels (12 million per chip). Blue Herring was a Lockheed Martin/ARRI project and ARRI brought in Stargate to produce and shoot the proof of concept film.

Sam said, "The Blue Herring camera only had enough RAM to shoot for 8 seconds, followed by a 14 minute download for each take. That, plus no eyepiece, a very shallow depth of field and its 200 lb+ weight made for a challenging shoot.

"We shot a short film, *As Time Goes By*, with the camera. It was shot with both 35mm film on an ARRI 435 and the 4K Blue Herring camera, and then intercut back and forth in editorial. The digital material was a very difficult 4K finish with lots of post production fixes to get an exact match. But, I think it worked. Franz Kraus, Volker Bahnemann, Bill Russell and Steve Stough were very involved with the production. We definitely proved that 4K RGB digital could match the quality of 35mm film. ARRI decided that some basic modifications (like a manageable size and an eyepiece) would be needed for a practical digital motion picture camera. They came out with the D-20 a few years later.."

The Blue Herring 65mm Project

by Steve Stough, SMPTE Board of Editors

The BLUE HERRING project was born when Lockheed and Loral Aerospace (formerly, Ford Aerospace) merged in 1996, which brought the nation of signal processing engineers into close proximity to the nation of image processing engineers. And, every one of them on both sides of the technology canyon came from the intelligence community, building spy gear for the US and other governments.

But what drove them together was the excitement of doing something with commercial, real-world value. Here were all these engineers in Silicon Valley, surrounded by all the glitz and hype that only fevered venture capitalists can conjure up.

I had both venture-capital envy and film school envy. My father was an amateur film-maker, and one who could afford lots of gear and tens of thousands of feet of film. We had a Moviola and a black-and-white 16 mm film processor at home. An Arriflex camera cost half as much as a Rolls Royce at the time. My dad had to have it. When I was 16 he went into the cinema business, among other things, in Sunnyvale and Santa Clara, California. I came from a solid family of film-wannabe-insiders. I ran a lot of 16mm film through the gate in my youth, as well as spent some time working as a photographer for a local newspaper. I loved the smell of the emulsion.

When Elbert Turner, a Lockheed engineer who worked on the earliest days of CCD research in Palo Alto, California, proposed some sort of investment in commercial imaging technology, he found eager ears in the corner office. Surely, this was a way to satiate our film school envy, and on other peoples' money, at that.

Since we were about to spend corporate money, we needed a name. Someone suggested "Red Herring." I didn't like it. It was a bit obvious and it connoted criminality. I blurted out, "Blue Herring" and that project name became immutable.

Volker Bahnemann impressed on us the need to create a show reel for our future camera. An easy sell there. If you cannot make films, after all, why fiddle around with the technology? They introduced us to Sam Nicholson. The company was Stargate Films.

We also had a meeting or two with Denny Clairmont. A camera owner, who had brought in his Angenieux zoom to put it up for rent, was sitting in an overstuffed faux-leather seat in Denny's outer office, asked me how long I expected the market for real film cameras would survive. With no thought, I said "ten years." That was 1998. Those two words resonated with the Clairmont brothers and with many others as well. We soon had everyone from members of the DGA, ASC, Technicolor, to executives from the major studios wanting to look over our shoulders as we developed the camera technology.

On the technology side, the fundamental problem was that none of the electronics needed to support a 36 megapixel, 24p imager existed. We created our storage system from a jumble of commercial, off-the-shelf disk drives.

When combined with a state-of-the-art 4 Gigabyte random access memory, this gave us a whopping eight seconds of image capture time per shot, requiring a room full of disk drives and over a minute to download each take from memory to the disk drives.

But, why 36 Mpix? It was really just 12 Mpix times three color bands (R-G-B). But, why 12 MPix? It was a number calculated from the resolution of 35 mm black and white film through a near-perfect 50 mm lens operating well above the diffraction limit. That is, a circle of confusion of 6 microns. Nothing more sophisticated than that.

And the sensor itself was the size of a 65 mm frame for another very simple reason: fat pixels were required in order to provide a 12-stop dynamic range with CCD technology.

This work occurred in the technical dark ages before wide availability of gigabit Ethernet and high speed disk drives. The storage and data processing infrastructure simply didn't support a 4K camera system. There was no way to color time a 4K image without making a film print – which is exactly what Stargate Films had to do. And, of course, no 4K digital projectors existed, so the test footage was finished to film.

The camera itself included a few "firsts;" not in a particularly good way. The color-splitting prism system required the construction of the world's-largest (at the time) ophthalmic-quality prism. The glass was formulated and poured in Italy then ground and polished optically flat in Germany. The brass sensor backing plate needed to be ground optically-flat – something apparently never before tried. Our wafer fabrication runs were designed for use with astronomical telescope applications, which required extraordinary contamination controls.

Sam Nicholson and team developed a short film project that could be shot with our 300 pound, 6 kilowatt camera, and do it side-by-side with an ARRI 435, in a practical set no less. And, his poignant story set in World War II was genuinely entertaining while still serving as a rather severe camera test.

Formidable cable wrangling was required. And that was the least of our troubles, which ranged from temperatures approaching 100 degrees while shooting a scene with a live fire in a fireplace, to the prop manager getting in a fight with the smoke machine operator. The shoot consumed four days, but resulted in only about one minute per day of product out of the far end of the post-production pipeline. Down-time between takes accounted for the low efficiency.

Just think about trying to shoot a picture in close-quarters with the equivalent of an 80 mm lens (referenced to a standard 35 mm frame) and no viewfinder. None. Thanks to Denny Clairmont, a digital lipstick camera was gaffer taped to the camera body to provide some means of framing for the camera operator.

But the results were stunning and certainly attracted a lot of attention from the industry. Over time, all that survived of the original engineering were a few design techniques, but nothing of the core technology itself. Ultimately, it was proven that end-to-end image quality and system utility were just as important as the need for high resolution and dynamic range; and all of that technology had to be supported by companies with absolute dedication to the success of the production company's mission, or the economics of digital image capture would never succeed in the market place.

It took another nine years after this test shoot before the ARRI ALEXA was released, and it was not until the ALEXA and similar imaging systems came on the market that a reasonable claim could be made that film had been replaced with digital imaging.

Arriflex 765: 65mm Film

One word may explain why epic 65/70mm films came and went, and why I think the new ALEXA 65 digital format is here to stay. Economics. It's expensive to shoot 65mm film—1000 feet of 65mm negative costs about $1372 today. Only 45 American features were shot in 65mm between 1955 and 2014. That's not a great business model—fewer than 1 per year. (15 in Europe during that time.) Nevertheless, 65/70mm production was always a desire in the dream factory. The digital ALEXA 65 could expedite those dreams in viable and affordable ways previously unimaginable.

The first 70mm film was probably Birt Acres' 1896 short *The Henley Regatta,* and over the next century, there were many attempts to impress large audiences in big theaters. Todd-AO was introduced in 1955 with *Oklahoma*. Mike Todd's memorable definition was "Cinerama out of one hole." MGM Camera 65, designed by Panavision, arrived in 1956 and in 1959 Panavision released Super Panavision 70.

In 1985, ARRI began work on the Arriflex 765 motion picture camera. They completed 10 cameras by 1988. Otto Blashek was head of the design team. In an interview with Alexander Felsenberg (in70mm.com), Blaschek said, "Our market research and discussions started in 1983, and it was our US subsidiary, Arriflex Corporation who contributed to this to a great extent."

Volker Bahnemann, former President of the US subsidiary, and current board member of ARRI AG, said, "The 765 camera came out of the ongoing desire in the industry to revive the big-screen blockbuster and David Lean type of large format, epic picture.

"Panavision and ARRI were both interested in doing something. Because there was not sufficient capacity in Munich, the Arriflex 765 camera project got off the ground when I assured funding through an outside group of investors to set up a new R&D facility. Otto Blaschek, ARRI's chief engineer, was charged with the project and set up the new facility in Vienna. That is how ARRI Austria was started. The Arriflex 765 was their first project.

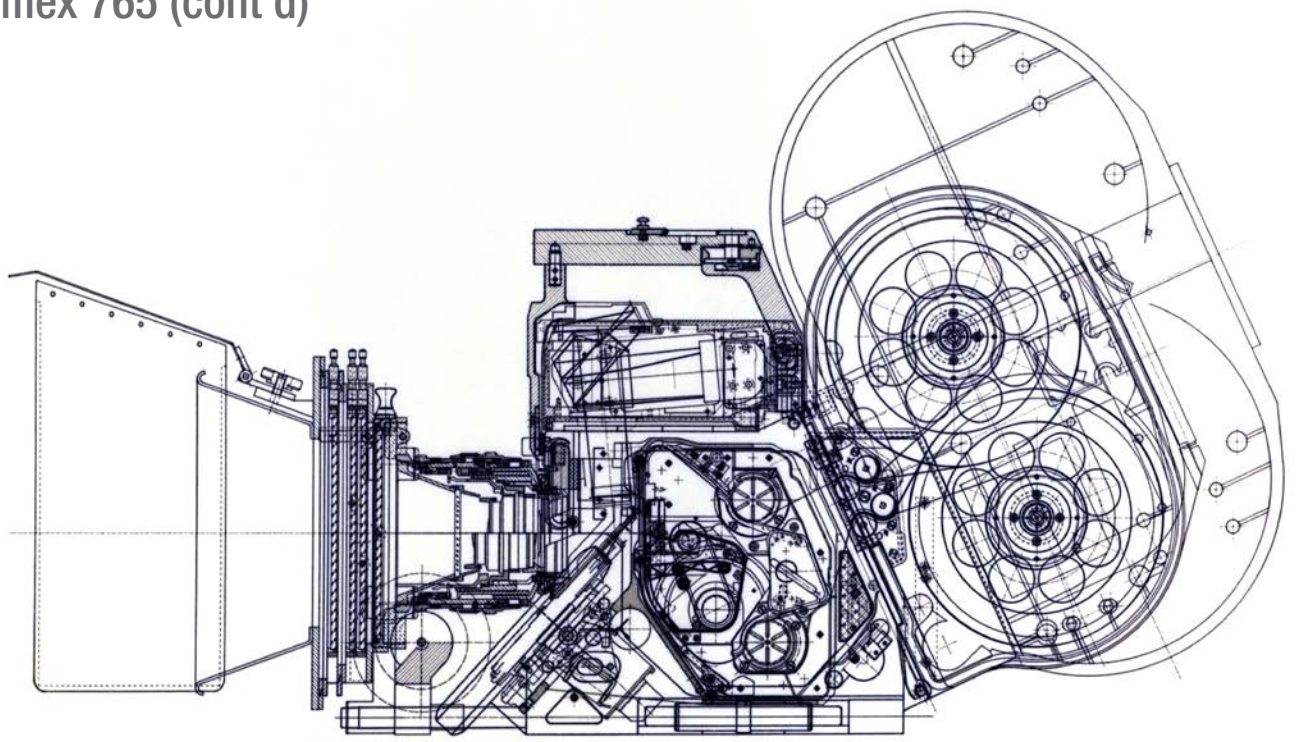
"ARRI realized that a new 65mm camera also required a secure post chain in place. They supported a group led by Richard Edlund of Boss Film and others, including MGM, the last operating 65mm lab. They financed the building of the COSHARP (Continuous Optical, Slit, High-Speed, Anamorphic Reduction Printer), which was a high speed, high resolution optical film printer. Proposed by Richard, it promised to assure a cost effective dailies process."

Richard Edlund said, "At the heart of the 765 was a revolutionary new movement design which ran with sealed bearings, didn't require lubrication, and could safely run at high speeds in reverse. The COSHARP produced 35mm anamorphic prints with key numbers. It was tested against the Technicolor step printer and was shown to be far superior, and could run at well over 100 fpm. When Eastman Kodak came out with a new intermediate stock (5244) and Dolby invented a six-track sound system for 35mm prints—these improvements brought the death-knell to 65mm feature production."

The Arriflex 765 made future camera developments possible. It could go to 100 fps, forward and reverse. It had a huge spinning mirror shutter that couldn't be linked mechanically as had been done in the past. Because of the large mass of the mirror, movement and the 65mm film itself, they couldn't use traditional toothed belts. This was the first camera with electronic syncing of independent motors for each of the major functions and became the basis of the Arriflex 435 and other cameras to follow. The movement was a multi-link design, from which the 435 benefitted as well. Construction of the Arriflex 765 began in 1985, and three years later, 1988, the cameras were ready.

Otto Blaschek said, "Before starting the new design, it was important to have a close look at [other] 65mm cameras already in existence and on the market. I was able to learn about the problems of (these) earlier models.

"In most cases, the earlier camera models were not completely suitable for sync sound recording. Sometimes, their noise-level was as high as approximately 50 dBA at a frame rate of 25 fps. It



goes without saying that this eliminated simultaneous sync sound shooting. In many cases, these cameras were also extremely heavy and bulky, so filming was not so simple and involved great efforts.

"Another problem [with these other pre-765 cameras] was winding-up of the wider and thus heavier film stock. There were frequent break-downs. Generally speaking, operational dependability was not guaranteed to such an extent as we are used to with today's professional 35 mm cine cameras. These were some of the reasons why there were no more 'big films' shot in the 65 mm format during the past years. Technology was simply not perfected enough. This is where we saw our prospects."

The Arriflex 765 was designed with what was described as "the user ergonomics of 35mm motion picture cameras" of the time. Never mind that a contemporary Arriflex 35BL-4s was 32 lb without lens or film. The Arriflex 765 had a standard 5-perf 65mm gate, with dual 3-claw pulldown (on each side of the film), and dual single-pin registration. This stabilized the film to less than .1% of picture height at reasonable sound levels.

The projected image had an aspect ratio of 2.2:1,with a film negative area about 3 times larger than a 35mm anamorphic frame and 2.5 times larger than a Super35 frame.

Arriflex 765 Specs

- Format: 65mm - 5 perf Frame: 1:2.2
- Mirror Shutter: 180° - 5° in 15° increments; 172.8°, 144°
- Lens Mount: Maxi PL — 64 mm diameter
- Flange focal depth: 73.5 mm
- Aperture: 52.50 x 23.00 mm (1.91" x 0.87")
- Groundglass /Projection Area: 48.40 x 22.00 mm (1.91" x 0.87")
- Viewfinder: 4x / 8x Noise level: < 25 dbA
- Video assist: 80/20, 50/59, 100% video on request
- Frame rates: 2 - 100 fps forward and reverse
- Run-up time: 0-24 fps in 1 second
- Magazines: 500' (150 m) and 1000' (300 m) displacement
- Movement: dual 3-tooth pull down claw, dual single pin registration
- Motors: 2 crystal controlled DC motors (movement and shutter, electronically synchronized), 2 DC-motors in the magazine)
- Power:24 V DC
- Dimensions (L-W-H) with 500' (150 m) magazine, without lens: 22.4" x 14.6" x 15.7" (570 x 370 x 400 mm)
- Dimensions (L-W-H) with 1000' (300 m) magazine, without lens: 24.8" x 14.6" x 20.9: (630 x 370 x 530 mm)
- Weight of camera with loaded 500' (150 m) magazine, without lens: about 70 lb (32 kg)

At left: two 765 cameras on location in Bhaktapur, Nepal for *Little Buddha*

ALEXA 65 Prototype Camera and Lens Views

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.

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 25.59 mm image area, 6560 x 3102 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.

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 25.59 mm (diagonal 59.87 mm)
Sensor Resolution	6560 x 3102 (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 - 27 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

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

ALEXA (35mm) Updates Lenses Accessories

ARRI ALEXA SUP 9.0

ALEXA Classic 16:9 sensor

ALEXA XT 4:3 sensor

ALEXA XT Plus 4:3 sensor

ALEXA XT Studio 4:3 sensor

ALEXA Fiber Remote 16:9 sensor

ALEXA XT M 4:3 sensor

ALEXA's longevity (and return of investment) can be attributed to the steady stream of reliable Software Updates (SUPs). SUP 9.0 was delivered in 2013 with more media, more metadata, improved ProRes recording, ARRIRAW Open Gate, Lens Metadata support, Pre-Recording and more.

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 at the time, 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 lets you 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 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 re-calculate 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.

Henning Rädlein and Marc Shipman-Mueller on SUP 9.0

Marc Shipman-Mueller (left) is ARRI Product Manager of Camera Systems. Henning Rädlein (right) is Head of ARRI Digital Workflow Solutions. 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?

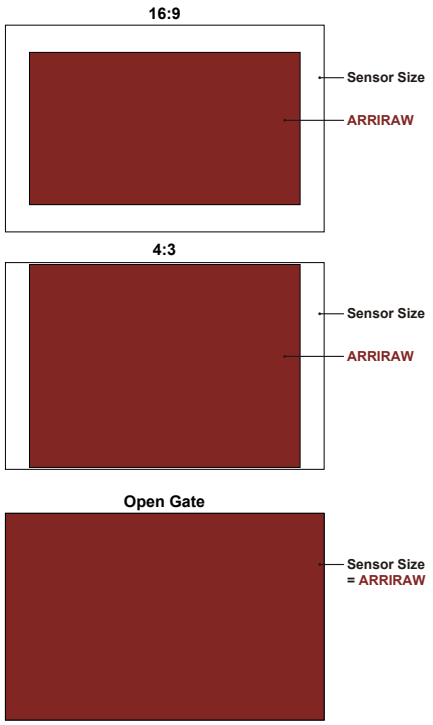
Marc: Let's begin with support for ProRes. With SUP 9.0 we can now record, with the XT camera, ProRes 4444 (pronounced ProRes four by four) up to 120 fps. Previously ProRes 4444 only went to 60 frames a second. With SUP 9.0 on the XT cameras, it's up to 120 frames a second as long as you record to XR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

Another update is that we now have DNxHD on all cameras, Classic Alexa as well as ALEXA XT, 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 ProRes 4444 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 2.0 cards. Right now the advantage of CFast 2.0 cards on ALEXA is recording ProRes 4444 at 120 fps, whereas on the SxS Pro 64 GB card you



ALEXA 16:9, 4:3, and Open Gate Compared

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.

ARRIRAW Open Gate will be used for some shows as the sole format, and other shows will continue to shoot in 16:9 or 4:3 and shoot only certain scenes in Open Gate. 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 have 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—longer lenses are OK. Our 9.5-18 mm Ultra Wide Angle Zoom covers fully. With other zoom lenses, it's all over the 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

ALEXA XT Studio

this new format. The ARRIRAW Converter (ARC) 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 upscale to 4K or UHD.

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, its 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: We have frame lines for most of the common formats that are built in. The one thing you can't do in Open Gate is set user frame lines. Those are custom lines you can set in the other recording formats. 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 pre-recording 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 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 (the owls, not the cinematographers) and then all of a sudden take off. 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 most protected, 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 opens the QuickTime wrapper, starts recording footage into it, and every second it closes the wrapper. Then it opens it again, ads 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 ARRIRAW contains 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 are processing 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 now happening.

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

Henning: Codex Data Logger One is aiming at 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 cameras, 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 with it 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 interesting 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.

[Because they use 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, where those settings are stored in the CDL, travel to dailies, and then to the final grading.

And there's a second version, which I've seen on some of the high-end feature films. The DP can 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 possible only if you're using a Vault?

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. (Note: it has been recently renamed Capture Drive Dock.)

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. Everybody uses that hardware, everybody. There's different software being used, but everybody has 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 that.

Henning: Yes, we are good. R&D hates us. *[Devious smile.]*

Marc: When they find bugs, it goes back to the programmers. When Henning's people think it's okay then it goes to Central Quality Management (CQM) 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. It's boring. It's hard work. But it is necessary.

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 4444. 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 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 certified 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.

A lot of people are using Resolve for ARRIRAW finishing, but of course, 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 that many 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 have those ready now.

Henning: Our online Tech Talks are little stories of the week—short tutorial films, where Marc and Hendrik and others explain products. Hendrik is our product manager for Electronic Control Systems (ECS).

We also have posted 50 short videos explaining the ARRIRAW converter. We discussed writing a manual, but we decided to do these videos instead. You can go right to one of these short 2½ minute videos: tiny.cc/arriraw-tutorial

We can guide people directly with 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."

I collect 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.

ARRI ALEXA SUP 10.0.1

ARRI released Software Update Packet (SUP) 9.1 in March of 2014 for DNxHD at 96 fps (XR Capture Drives) and 90 fps (CFast 2.0 cards).

This was followed by SUP 9.2, which fixes a serious bug in XR Capture Drive firmware. If you have not done so, you should place your drives in an ALEXA with SUP 9.2 or later and format them for ARRIRAW. If the camera suggests to update the firmware, do so. If not, they already have the latest firmware.

SUP 10.0, released in Fall 2014, was pulled because of a distorted image bug. It was quickly replaced by SUP 10.0.1 at the end of October 2014.

Of course, updating to a later SUP includes all previous enhancements of earlier versions. So, for example, if you update to 10.0.1, it will also include the bug fixes and improvements introduced in SUP 9.2. ARRI SUPs are online: www.arri.com/downloads

Attach Viewfinder during update

SUP 10.0.1 includes updated viewfinder software, so the viewfinder should be attached during the installation.

Highlights of SUP 10.0.1

- Apple ProRes 4444 XQ. 500 Mbit/s
- Support for SONY 64GB and 128GB SxS PRO+ memory cards.
- 180° Image Rotation: good for Steadicam upside down and ARRI Ultra Wide Zoom UWZ 9.5 – 18.
- Open Gate support for ALEXA XT M
- Lens Squeeze Factor metadata field. The new metadata field allows manual entry of a lens squeeze factor (1.3x, 2x) so post software can automatically de-squeeze anamorphic images.
- REC OUT = Clean MON OUT
- ARRIRAW 4:3 Cropped: To achieve 96 fps when shooting ARRIRAW 4:3 with anamorphic lenses, the new ARRIRAW 4:3 Cropped mode reduces the width of the recorded image to 1.2:1, which is the native anamorphic aspect ratio.
- Fast regular/high speed switching can now be done in about 20 seconds.
- Dimmable status information
- Monochrome status icons
- Colored camera index letter with monochrome frame lines
- Independent Peaking setting for playback. Peaking on the MON OUT and EVF during playback can be set independently from peaking during recording. The factory default is Peaking during playback = off'.
- Master Anamorphics Lens Data Archive (LDA) Lens Tables.

180º Image Rotation

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 180º (upside down).

When enabled, the image is rotated 180º 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.

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. SUP 10 provides an independent clean Log C output for REC OUT.

Quick Change between Regular and High Speed

Switching from regular speed (0.75 to 60 fps) to high speed (60 to 120 fps) has been sped up from 40 to 20 seconds. This is a welcome thing 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.

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.

ProRes 4444 XQ

ALEXA cameras now support Apple ProRes 4444 XQ, the highest-quality version of ProRes to date,.

Marc Shipman-Mueller explained, "ProRes 4444 XQ has a higher target data rate (500 Mb/s) than ProRes 4444 (330 Mb/s)."

Henning Rädlein 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.

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 color with a lower data rate than uncompressed 4:4:4 HD.

ALEXA SUP 10.0.1 (cont'd)

ProRes Review (cont'd)

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 10.0.1 (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

SUP 11 Preview: ProRes 3.2K for UHD

ARRI ALEXA cameras will soon be able to record 3.2K ProRes for seamless up-sampling to UHD/4K in post.

ProRes 3.2K for ALEXA cameras will be available in a software update 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).

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 based on 3168 x 1720 photo sites on the sensor
- ALEXA ProRes 3.2K records 3168 x 1720 color pixels
- AMIRA ProRes UHD is based on 3200 x 1800 photo sites on the sensor
- AMIRA ProRes UHD records 3820 x 2160 color pixels
- ARRIRAW Open Gate records 3414 x 2198 Bayer pixels
- ProRes 3.2K for ALEXA XR and XT cameras will be available in ProRes 422, 422 HQ, 4444 and 4444 XQ

Maximum Frame Rates for ALEXA XT, ALEXA XT M and ALEXA XT Plus (with SUP 10.0.1)

Recording Format				Maximum Frame Rate in fps [1]				
				Internal Recording				External Recorder
Sensor Mode	Recording File Type	Recording Resolution [7]	Recording File Setting [2]	SxS PRO 32 GB [3]	SxS PRO 64 GB SxS PRO+ 64 GB SxS PRO+ 128 GB [3]	CFast 2.0 60 GB CFast 2.0 120 GB [4]	XR Capture Drive 512 GB	Codex Onboard S Plus
16:9	ProRes	HD	422	60	120	120	120	-
			422 HQ	60	120	120	120	-
			4444	40	60	120	120	-
			4444 XQ	25	48	75	75	-
		2K	422	60	60	60	60	-
			422 HQ	50	60	60	60	-
			4444	30	60	60	60	-
			4444 XQ	-	40	60	60	-
	DNxHD [5]	HD	145	60	120	120	120	-
			220x	60	120	120	120	-
			444	30	60	90	96	-
	REC OUT HD-SDI Video	HD	422 1.5G SL	-	-	-	-	30
			422 1.5G DL	-	-	-	-	60
			422 3G SL [6]	-	-	-	-	60
			444 1.5G DL	-	-	-	-	30
			444 3G SL [6]	-	-	-	-	30
			444 3G DL	-	-	-	-	60
	ARRIRAW	2.8K		-	-	-	120	-
4:3	ProRes	2K	422	48	48	48	48	-
			422 HQ	40	48	48	48	-
			4444	30	48	48	48	-
			4444 XQ	-	30	48	48	-
	ARRIRAW	2.8K	Full	-	-	-	90	-
		2.6K	Cropped	-	-	-	96	-
Open Gate	ARRIRAW	3.4K		-	-	-	75	-

Maximum Frame Rates for ALEXA Classic Cameras with XR Module Upgrade (SUP 10.0.1)

Recording Format				Maximum Frame Rate in fps [1]				
				Internal Recording				External Recorder
Sensor Mode	Recording File Type	Recording Resolution [8]	Recording File Setting [2]	SxS PRO 32 GB [3]	SxS PRO 64 GB SxS PRO+ 64 GB SxS PRO+ 128 GB [3]	CFast 2.0 60 GB CFast 2.0 120 GB [4]	XR Capture Drive 512 GB	Codex Onboard S Plus
16:9	ProRes	HD	422	60	120	120	120	-
			422 HQ	60	120	120	120	-
			4444	40	60	120	120	-
			4444 XQ	25	48	75	75	-
		2K	422	60	60	60	60	-
			422 HQ	50	60	60	60	-
			4444	30	60	60	60	-
			4444 XQ	-	40	60	60	-
	DNxHD [5]	HD	145	60	120	120	120	-
			220x	60	120	120	120	-
			444	30	60	90	96	-
	REC OUT HD-SDI Video	HD	422 1.5G SL	-	-	-	-	30
			422 1.5G DL	-	-	-	-	60
			422 3G SL [6]	-	-	-	-	60
			444 1.5G DL	-	-	-	-	30
			444 3G SL [6]	-	-	-	-	30
			444 3G DL	-	-	-	-	60
	ARRIRAW	2.8K		-	-	-	120	-
4:3 [7]	ProRes 2K	2K	422	48	48	48	48	-
			422 HQ	40	48	48	48	-
			4444	30	48	48	48	-
			4444 XQ	-	30	48	48	-
	ARRIRAW	2.8K	Full	-	-	-	90	-
		2.6K	Cropped	-	-	-	96	-

Charts courtesy of ARRI

ARRIRAW Converter & Meta Extract

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 and ARRI Rental Partners)
- Up-sample 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.

ARRI/ZEISS Master Anamorphics

The ARRI/ZEISS Master Anamorphic family made its debut at IBC Amsterdam in September 2012 with a 50 mm T1.9.

The MA 35 mm T1.9 and 75 mm T1.9 were unveiled at NAB 2013, followed by the 100 mm T1.9 at IBC 2013, then the 40 mm T1.9 and 60 mm T1.9 at ZEISS Cine Lens Day in November 2013.

The family was complete when the MA 135 mm T1.9 was presented at NAB 2014. (Lens sets are rarely "complete." DPs, like Oliver Twist, always ask for more.)

ARRI/ZEISS Master Anamorphic lenses have an innovative optical design, with almost no breathing and minimal distortion.

Anamorphic "mumps" (faces looking wider in close-ups) is automatically compensated by careful positioning of the cylindrical lens elements. There are 4 to 8 cylindrical elements in each lens.

The optical design reduces chromatic aberrations and shading (darkening) at the corners of the image. Master Anamorphic lenses produce a smooth anamorphic bokeh, free of artifacts.

The 15-blade iris helps create a bokeh that is elliptical (oval) and consistently illuminated. See the framegrabs (opposite page).

The lenses are compact, light, and have a fast aperture of T1.9 at all focal lengths. They are typically "ZEISS" with reliable and durable mechanical construction. Improved protection against dust and spray means less downtime and fewer repairs.

The ARRI/ZEISS Master Anamorphic lenses herald the return to an era of anamorphic big-screen productions at a new, previously unseen, level of quality.

ARRI/ZEISS Master Anamorphic lenses were developed by ARRI and ZEISS, manufactured by ZEISS, and exclusively distributed by ARRI.

Oval bokehs can be anticipated if the iris looks elliptical when viewed through the front of the lens.

Newest member of the Master Anamorphic family: 135 mm T1.9

ARRI/ZEISS Master Anamorphic Framegrabs

Sheng Lu
"I See"
(China)
MA 50 mm

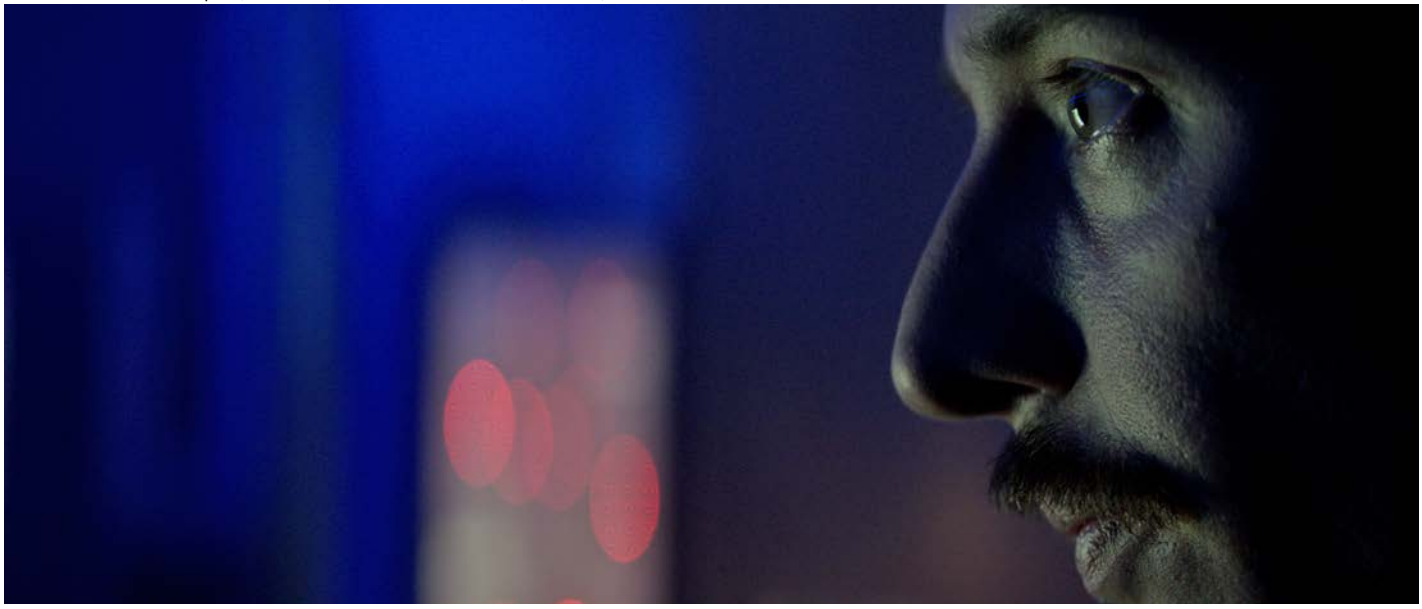
Stijn van der Veken, SBC
"In Flanders Fields"
(Belgium)
MA 35 mm

Michel Abramowicz, AFC
"A trip to remember"
(France)
MA 50 mm

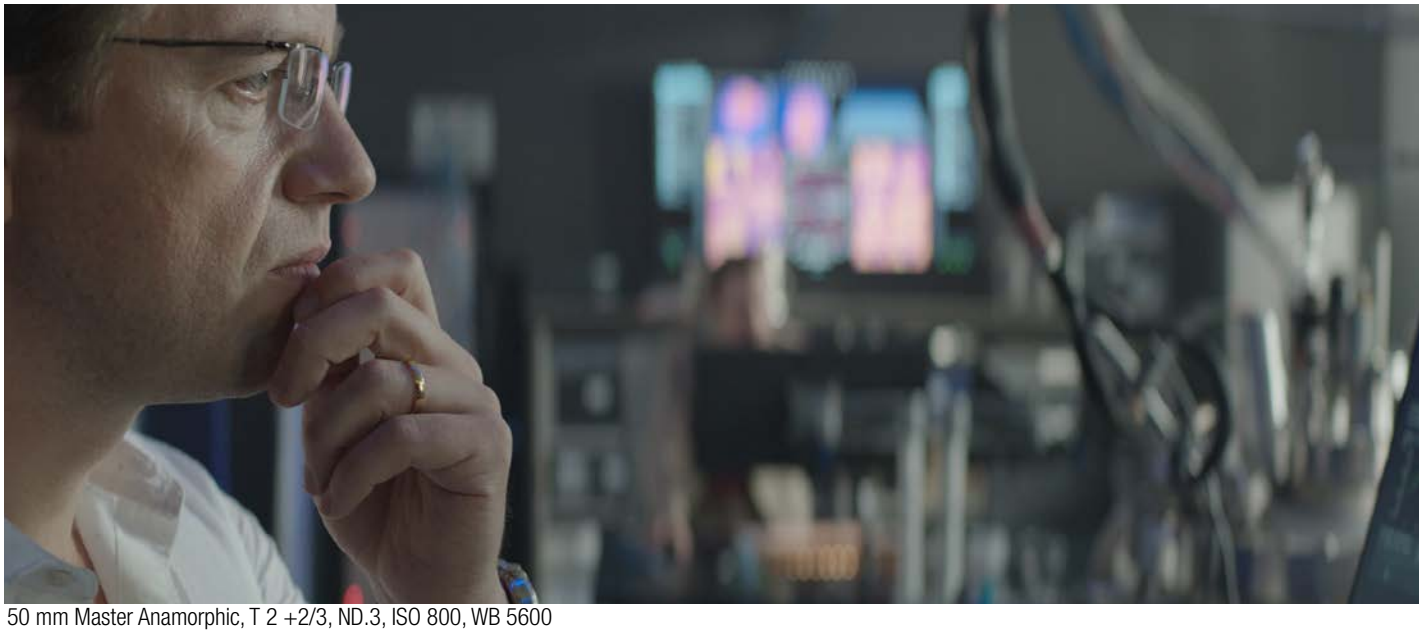
Michel Abramowicz, AFC
"A trip to remember"
(France)
MA 50 mm at close focus

ARRI/ZEISS Master Anamorphics

60 mm Master Anamorphic, T 2 +2/3, 1/2 Tiffen Black Satin, ISO 800, WB 4300



60 mm Master Anamorphic, T2 +2/3,1/2 Black Satin, ISO 800, WB 5600



50 mm Master Anamorphic, T 2 +2/3, ND.3, ISO 800, WB 5600

Stijn Van der Veken with Master Anamorphics

The year is 2040. Professor Viktor (Koen De Graeve) discovers a way to send emails back in time. Using the Casimir effect (quantum field theory in which the space between micro-objects can attract each other) he tries to fight for his beloved Lena. But the past isn't easy to manipulate and every small intervention can have far-reaching consequences to the present—something that Viktor soon discovers. The *Sum of Histories* is a love story with a touch of sci-fi. Cinematographer Stijn Van der Veken, ASC, SBC explained his creative choices.

"The story happens 35% in the present and 65% in the future (2040). The Director wanted a light, romantic, "vintage" feel for the present ,which brought me to use old Cooke S2 lenses because of their warm, slightly soft and imperfect performance. We have a set rehoused by True Lens Services in England.

"For the future scenes we went for a set of ARRI/ZEISS Master Anamorphic lenses. They have a fabulous bokeh, a unique look—smoother than Master Prime lenses, and still an amazing and powerful image all the way open to T1.9. We have a set of six MA lenses, from 35 to 100 mm.

"A lot of people consider anamorphics mainly for artifacts. For me, shooting a movie is an artistic opportunity to use lenses in all conditions. We did a night shoot in a park, under difficult conditions, available night light, no practicals. I call it lighting with milligrams. Many lenses cannot handle these extreme, low light, contrasty conditions. However, like Master Primes, the Master Anamorphics maintained quality all the way to T1.9. As I said before, Master Anamorphics are smoother, a little gentler on faces than Master Primes. On MCU or CU shots, I'll soften them a little with Tiffen ½ Black Satin diffusion—which Kees van Oostrum, ASC recommended to me.

Alles Voor Lena (The Sum of Histories)
Production company: Caviar Belgium
Producer: Frank Van Passel
Director: Lukas Bossuyt
DP: Stijn Van der Veken, ASC, SBC

Technical info:
ARRI ALEXA XT – ARRIRAW
ARRI / ZEISS Master Anamorphic lenses
Cooke S2 spherical lenses rehoused by True Lens Services (TLS) UK
Codex Action Cam on Codex RAW
Lucky Camera Brussels - rental company

"I am a big fan of anamorphic, especially because of the way the focus falls off—which is the narrative aspect of the lenses. Their best performance for me in terms of storytelling for the main characters is situated between 3 and 6 feet, depending on the lens.

"A lot of people try to create their look in grading, but I rather set my look on the set. I don't like to put looks in grading—for me, that seems too artificial. I achieve the look with lenses and lighting."

Stijn is shooting ARRIRAW on ARRI ALEXA. They have one LUT: the same one is used on set, for viewing and editing. This LUT then becomes the starting point for grading. It's a custom LUT derived from the ARRI Low Con LUT with the same saturation, and as Stijn calls it, "a bit more bite."

ARRI/ZEISS Master Anamorphics

The Magnificent Seven (1960) was a 35mm anamorphic film directed by John Sturges. A remake of Akira Kurosawa's *The Seven Samurai*, it starred Yul Brynner, Eli Wallach, Steve McQueen, Charles Bronson, James Coburn, and a young John A. Alonzo, before he became a cinematographer (John A. Alonzo, ASC).

There are seven magnificent new ARRI/ZEISS Master Anamorphic prime lenses for 35mm format digital and film cameras.

They are compact, lightweight, and high speed (T1.9). They exhibit minimal distortion: straight lines remain straight, even at close focus. The iris consists of 15 blades, so bokehs are smooth and anamorphically oval. Focus barrels can be ordered in feet or meters.

ARRRI/ZEISS Master Anamorphic Prime Lenses

Focal Length	**35 mm**	**40 mm**	**50 mm**	**60 mm**	**75 mm**	**100 mm**	**135 mm**
Aperture	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22
Lens Mount (1)	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS
Close Focus (fr. image plane)	0.75 m / 2'6"	0.70 m / 2'4"	0.75 m / 2'6"	0.90 m / 3'	0.90 m / 3'	0.95 m / 3'1''	1.20 m / 3'11''
Length (from lens flange)	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	210 mm / 8.1''	237 mm / 9.3''
Length (from image plane)	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	262 mm / 10.2''	289 mm / 11.4''
Front Diameter	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"
Widest Barrel Diameter	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"
Weight	2.6 kg / 5.7 lb	2.7 kg / 6 lb	2.6 kg / 5.7 lb	2.7 kg / 6 lb	2.6 kg / 5.7 lb	3.1 kg / 6.8 lb	3.7 kg / 8.2 lb
Image circle	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm
Entrance Pupil (mm) (2)	178.7	176.9	171.5	152.2	136.7	145.9	129.3
Entrance Pupil (inches) (2)	7.040	6.929	6.75	5.984	5.380	5.709	5.091
Angle of view H - V Super 35 'Scope format (3)	65.47° - 29.91°	58.72° - 26.31°	48.46° - 21.18°	41.11° - 17.71°	33.40° - 14.21°	25.36° - 10.68°	18.92° - 7.92°

(1) PL Mount is 54 mm diameter, stainless steel, with Lens Data System (LDS) contacts.

(2) The distance from the entrance pupil relative to the film/sensor plane at infinity focus.

(3) Horizontal (H) and vertical (V) angles of view for a Super 35 Cinemascope format camera aperture (22.5 mm x 18.7 mm / 0.8858" x 0.7362").

ARRI Ultra Wide Zoom UWZ 9.5-18 T2.9

ARRI introduced a new Ultra Wide 9.5-18 mm T 2.9 zoom lens at IBC 2013 and production models were shown at IBC 2014. It covers angles previously considered the domain of primes. If you want a rectilinear wide-angle zoom lens where straight lines stay straight, horizontally and vertically, even at close focus, this is for you. Distortion is less than 1% at 9.5 mm and less than 0.1% at 18 mm.

- Image circle larger than 33.7 mm
- Very low image distortion, even at 9.5 mm
- Almost no breathing (image size changes when focusing)
- Uniform field illumination even at close focus
- Very high resolution and contrast all the way to image corners
- Entrance pupil position stays constant over entire zoom range
- Patented optical design
- LDS for lens metadata
- Exchangeable metal rings for mattebox donuts
- Metal rings to protect front element
- Matches ARRI/Fujinon and ARRI/Zeiss lenses
- Available in ARRI PL LDS or Canon EF mount

Distortion is less than 1% even at 9.5 at close focus. (That is even less distortion than the ARRI/ZEISS Ultra Prime 8R.) The 33.7 mm image circle makes the 9.5-18 mm zoom lens a good candidate for ALEXA 3.4K Open Gate.

Dimensions

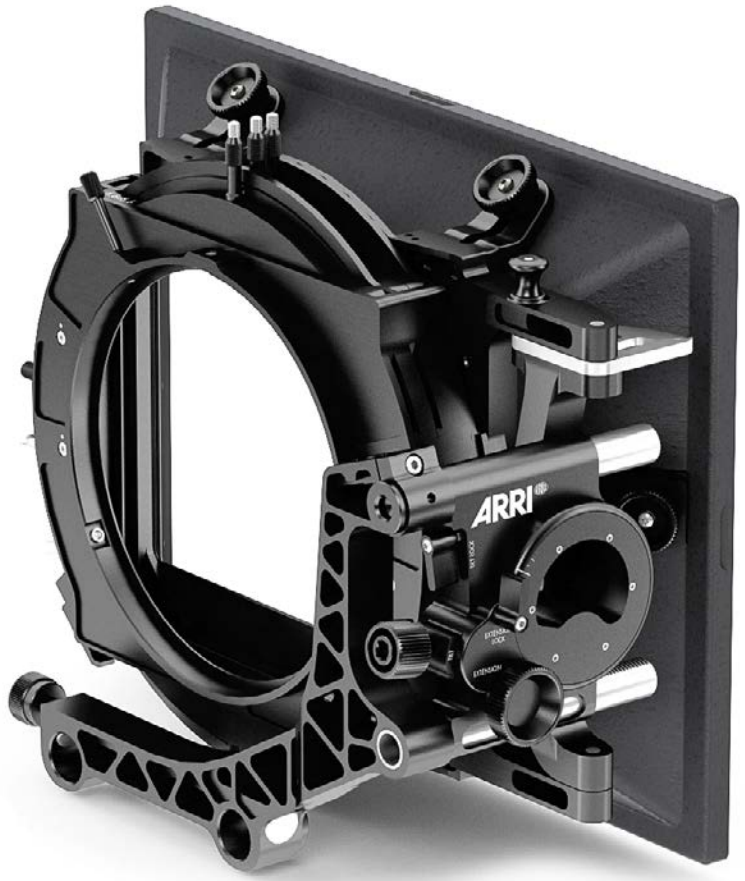
- Weight: 4.5 kg / 9.9 lb
- Front diameter: 156 mm / 6.142 in
- Average barrel diameter: 112 mm / 4.409 in
- Length from PL mount to front: 335.5 mm / 13.209 in

156 mm front ring for filters and matteboxes like ARRI LMB-6 (6.6 x 6.6)

134 mm sun shade when filters not needed but front element protection needed

These illustration are renderings by Johannes Polta.

Studio Mattebox SMB-1



This is a studio mattebox for filters up to 6.6" x 6.6" and works well with wide-angle primes and zooms. The SMB-1 Tilt has a built-in tilt module, which helps minimize those night exterior car headlight reflections and double images. A flexible shaft is available to adjust the tilt angle.

Filter stages can be stacked together as single or dual filter stage modules. Filters rotate in each stage. The 2-filter stage accepts one geared filter frame. All filter stages have tray catchers to prevent your expensive blue streak filter from dropping to the pavement.

The mattebox has a 2:1 ratio sunshade for working in anamorphic or spherical widescreen formats. Accessories include mattes, adjustable top, bottom and side flags, and an accessory mount for a French flag, Obie light, Monitor, Cine Tape, etc.

On an ALEXA, the SMB-1 covers a Master Prime 12 mm with a 2-filter stage; the Ultra Prime 10 mm with a 1-filter stage, and the new ARRI UWZ 9.5-18 mm Ultra Wide Zoom with a 1-filter stage.

ARRI Wireless Controls

Universal Motor Controller UMC-4

ARRI's new Universal Motor Controller UMC-4 is a 3-axis lens motor controller with:

- 3-axis remote control of focus, iris and zoom on any camera
- LDS Lens Data Archive for accurate lens data with any lens
- Long-range wireless
- Timecode interface for lens data synchronization
- Focus-tracking with ultrasonic measurement devices
- Serial connector and Ethernet connector
- Large display
- SD card slot for lens data storage and file upload

Single Motor Controller SMC-1

The Single Motor Controller SMC-1 is a compact 1-axis motor controller designed for weight and size-critical setups such as Steadicam or camera drones. It drives a single CLM motor and works well with the SXU-1 single-axis hand unit.

ENG Motor Controller EMC-1

The ENG Motor Controller EMC-1 works with ENG-style lenses like the Fujinon Cabrio, Canon and Angenieux Zooms. The EMC-1 controls the focus, iris, and zoom servo motors of these ENG lenses and provides lens data for display on the WCU-4 hand unit.

ARRI Accessories

Quick Release Plate QRP-1

The QRP-1 provides quick-release connection of ARRI AMIRAs and most broadcast cameras to a tripod.

Lightweight Rods

ARRI now makes lightweight, thin-walled, stainless steel lens support rods that are less than half the weight of classic rods. The 15 mm diameter lightweight rods are 140, 240 and 340 mm long. The 19 mm diameter rods are 240 and 340 mm long.

ARRI LDE-1

Lens Data Encoder LDE-1

ARRI's new Lens Data Encoder LDE-1 provides metadata for lenses that don't have LDS metadata built in. The position of the lens ring to which it is attached is encoded. This can be useful not only with lenses lacking LDS, but also when using a manual follow focus unit or non-ARRI wireless lens control system.

The LDE-1 plugs into an ALEXA Plus or Studio (or a UMC-4).

WCU-4 Sofware Update Package 2.0

Software Update Packet (SUP) 2.0 for the WCU-4 simplifies lens programming. The WCU-4 hand unit now offers a lens programming interface on its large LCD screen, so a lens scale can be programmed wirelessly in less than a minute, with no additional equipment besides the WCU-4, UMC-4 or ALEXA Plus Module and lens motors. The resulting lens file is stored on an SD card, which can be taken out and reused elsewhere.

Additional features of WCU-4 SUP 2.0 include support for the ENG Motor Controller EMC-1 and focus tracking with the UMC-4, as well as minor bug fixes and improvements in response to customer feedback. The software update is free of charge and will be available beginning November 2014.

Kees Van Oostrum, ASC
Photo: James Bryan Toten

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by

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