Jon Fauer, ASC www.fdtimes.com Jan 2015

FILM AND DIGITAL TIMES

AJA CION Factory Tour

The Road to Grass Valley, CA

Above, left: Grass Valley, California. Below: The Holbrooke Hotel in Grass Valley.
Above right: *Lola Montez* by Joseph Karl Stieler. Painted for Ludwig I of Bavaria in 1847. Schönheitengalerie (Gallery of Beauties), Nymphenburg Palace, Munich.

"The pork I bought in town last night is the stinkinest salt junk ever brought around the Horn. We fry it for breakfast and supper, boil it with our beans and sop our bread in the grease. Lord knows we pay enough for it."

That's what Alfred T. Jackson wrote in his "Diary of a Forty-Niner" on May 18, 1850.

The food in Grass Valley, California is much better today. Sushi in the RAW and nearby New Moon Cafe are as good as it gets. Gold was discovered in Grass Valley in August 1849, eight months after the Rush began at Sutter's Mill in Coloma, 40 miles Southeast.

There's only one direct flight a day from New York to Sacramento, landing late at night, followed by an hour drive north through the mountains to Grass Valley. The fate of the Donner Party hangs heavy, a mere 50 miles Northeast near Truckee in 1846-47.

Up early the next morning, a stroll along the quaint covered sidewalks passes by the home of Lola Montez. LOLA MONTEZ! Courtesan, mistress of King Ludwig I of Bavaria, Countess of Landsfeld, what was she doing here? I didn't remember Grass Valley appearing in Max Ophuls' 1955 film starring Martine Carol, Peter Ustinov and Oskar Werner. I do remember, however, forever, the glorious continuous camera moves of cinematographer Christian Matras, who also shot *Grand Illusion, La Ronde,* and *The Earrings of Madame de...*

Apparently Marie Dolores Eliza Rosanna Gilbert (aka Lola Montez), born in Ireland, fled the German Revolution of 1848, and moved to 248 Mill Street in Grass Valley in 1853. She left in 1855 for Australia. Sierra Nevada Conservancy and National Geographic write, "When Montez arrived at the gold mining camps, she provided a little culture to their standard fare of entertainment. In addition to her immensely popular performances, Montez was skilled at gathering wealthy investors together to support the lagging quartz gold industry and the Empire Mine during its lean years. As a result of her efforts, the mining industry in the Grass Valley area continued to prosper for 100 years."

But the location here is less Max Ophuls and more "McCabe and Mrs. Miller," Robert Altman's anti-Western ode to mud, rain, mining, Julie Christie, Warren Beatty, cinematography by Vilmos Zsigmond, ASC, haunting score by Leonard Cohen:

> But now another stranger seems
> to want you to ignore his dreams
> as though they were the burden of some other.
> Oh you've seen that man before
> his golden arm dispatching cards
> but now it's rusted from the elbows to the finger.
> And he wants to trade the game he plays for shelter.

Grass Valley today isn't muddy, nor was it rainy. Saloons have been replaced by spas, prospectors by mountain bikers, hikers and daytrippers. The town is festooned with rusted mine carts, waterwheels, stamp mills, and relics of the Gold Rush. The Holbrooke Hotel on West Main Street is the oldest hotel in continuous operation since 1852, with a balcony above beckoning for a location scout. But stay at the charming Courtyard Suites.

Empire Mine is now a state park. Below, Empire Cottage, home of mine owner William Bourn, Jr. 1897.

Grass Valley's wealth came from its Empire and North Star Mines, two of the richest in California. Many early settlers came from Cornwall, where there was a long tradition of deep mining. There's still a Cornish pasty shop serving meat and vegetables baked in a pastry.

Mining declined after World War II, but was quickly replaced by high tech companies. Grass Valley became an early Silicon Valley of the Sierra Nevadas. Charles Litton, whose Litton Industries built vacuum tubes for electronics, moved his machinery division to Grass Valley in 1954. Litton's friend Dr. Donald Hare moved here in 1959 and founded a "small" research and development company called Grass Valley Group.

An engineer named John Abt worked for Grass Valley Group. In 1993 he founded AJA, named after the initials of his son. Today, more 200 people worldwide work for AJA, building video capture cards, digital recording devices, video routers, frame synchronizers and scalers, digital converters and, now, a professional 4K camera.

In addition to its extensive line of mini converters that can transform almost any signal to any other standard, AJA expanded into the desktop video market in 2000 with the KONA video capture and playback cards for Mac and Windows PCs. The company's next products included Io Thunderbolt desktop video products and the Ki Pro family of portable and rack-mountable file-based recorders.

And then came CION, the topic of this report.

Nick Rashby, President of AJA

Sushi in the RAW, aptly named in nearby Nevada City, where a great number of inhabitants deal with RAW data at the local high-tech companies.

We were in training for a visit to Tokyo's legendary Sukiyabashi Jiro after InterBEE in November. Nick Rashby, below, perfecting on the FDTimes restaurant lighting kit: iPhone 6 LED bounced in a 12x12 (inch) white napkin for glorious, soft single source.

Try the sashimi with black truffles.

Also notable, New Moon Cafe's roasted organic beet salad and Five Dot Ranch Ribeye.

The Road to AJA CION

I'm sitting with Nick Rashby and Jon Thorn in a conference room at AJA. Jon has thoughtfully lined up a museum-worthy collection of the company's seminal products. It's a veritable AJA timeline of products.

Jon Thorn has arranged the evolutionary journey of AJA CION, like the Time-Life illustration stages of "The Road to Homo Sapiens — man's long march from apelike ancestors."

AJA was founded by John Abt in 1993. I don't dare call that era a primordial swamp, because it was the fertile ground from which emerged all kinds of amazing AJA products.

We begin by looking at the thing on the left, the Io HD.

And that's where our story begins, at AJA in 2007. In the beginning, there was the Io HD.

Io HD

Ki Pro

Mini Box Camera Head with Ki Pro

First Clay Model

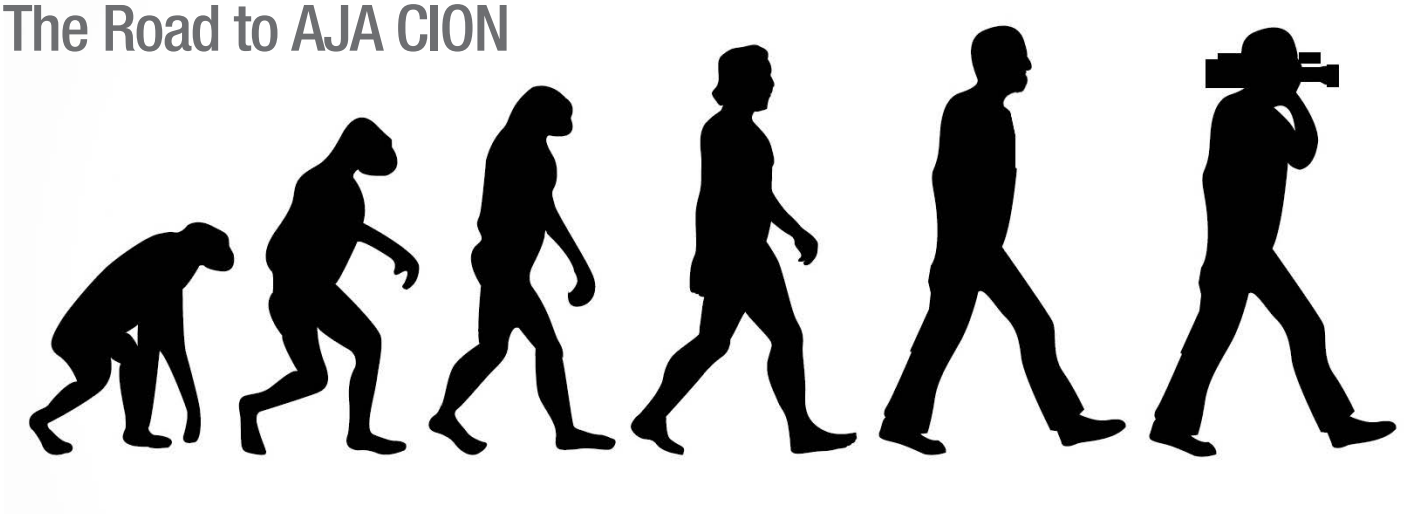
Foam Model

Camera Head with Ki Pro Quad

Prototype CION

Production CION

The Road to AJA CION



JON FAUER *talking with Nick Rashby and Jon Thorn:* What was so special about AJA's Io HD?

JON THORN: The Io HD came out in 2007. It was really the first ProRes hardware encoder that existed. ProRes, which is a codec, came from Apple, and it was available to people who were on Mac OS. They could use it in software. That was wonderful, except that there was a demand for ProRes encoding in more mobile situations. The laptops at that time weren't capable of encoding to ProRes.

By offloading that burden onto a separate device, you could hook it up via FireWire 800, actually take it in the field, and record. We had some people do that on an early feature film. They wanted to shoot the best compact compression scheme they could. Uncompressed was too unwieldy for them. They wanted a 10-bit, high-quality codec that they could use effectively in post-production effectively. That's a great example of its first use in production. The exterior design of the Io HD may look a little bit primitive compared to everything else we have right now.

It provided all kinds of connectors?

If you think about, here's a box with all the connectivity in the world. I mean, you still have S-Video on this thing because remember that in 2007, you're still in a transitional period from SD to HD. This device is packed with connectors in order to work with a wide array of cameras or VTRs at the time, feeding into a non-linear edit system and encoding to ProRes. This was the first time that we put a user interface on the product itself, not just on the computer. We'd always had a nice control panel application, but we never really had an interface. So now we had a vacuum fluorescent display that actually would give you the format you were in and whether you were converting stuff. We gave it VU meters, and we took the Io HD to NAB in 2007. Invariably someone would say, "Where do I put the hard drive into it?" I would reply, "No, no. It's a capture device for your computer." And they'd say, "If it could go straight to the hard drive, that would be even better." And then people would ask, "Where does the battery go?"

And I realized that they were right. Our device ran off 117 VAC. But people wanted to take it in the field. They could use an inverter, but that got my wheels turning. Driving home from NAB, we're all excited.

NICK RASHBY: John Abt and I were driving back. And we were all excited, Apple had helped us launch it at their big event. We were thinking this is the greatest thing ever. And the mobile phone rings, and it's Jon Thorn calling from another car. And we said, "Wasn't that great?" Jon replied, "Yeah, yeah, yeah...but you've got to listen to this…here's what we should do next…"

JON THORN: The phone was breaking up because we're driving. I remember I actually said, "We should make a camera back." But the phone connection was bad, and they didn't hear the word "back. They just heard "camera." And they replied, "We can't make a camera."

I said, "No, no, a camera back. There are all these new cameras, and we could make a thing that just docks to them, just like earlier video camera heads that docked to a VTR."

And that led to the Ki Pro. It shared many similarities with the Io HD in terms of lots of connectivity. We were talking about a more compact form factor. As you can see in our timeline of development, it would shrink in size as time passed.

The Ki Pro was the first ProRes recording device that was standalone, no computer required. That really changed the way everybody thought about acquiring their data. Now you were moving the post-production codec into production. That was 2009.

Ki Pro ran off 12 volts?

JON THORN: Yes, it ran off the camera's 12 volt battery or power supply. The other great thing was it connected with all kinds of cameras. You could connect it to small box cameras and you could connect it to big high-end cameras. That was the first inkling of CION.

Before ARRI had the ALEXA, their rental fleet had our Ki Pros docked onto the back of their D-21 cameras. There was a natural progression in high quality codecs that were manageable in post-production. So, after we brought out the Ki Pro, people were really excited, but the next thing they started to say was, "When are you guys going to make a camera?"

I would ask you that question every time we saw each other, and you would only smile slyly.

JON THORN: We tended to be quiet about it because you have to consider the viability of whether or not you can make the product. Question number one is usually what could you make that would be a benefit for people? What do they want? And then, can you make it? Essentially, we had the back end of the camera. When you see the Ki Pro and a small camera head together, you realize all it takes is this part connected to it, and you've got a camera.

I remember I wrote a proposal, but I also had this little tiny box camera. It was super simple. I wanted something really small. I hooked it up, and we were excited about it. But there was also a healthy skepticism because actually building a camera would be major undertaking. It wasn't an outright no. It was more of a "Let's consider it."

Sorry to interrupt. If you guys at AJA can do this—build both the camera head and the recording module--why don't more companies do the recording? What's the intellectual knowledge that you have that is unique?

NICK RASHBY: We have a lot of IP in video signaling, embedded systems, and standards conversions. That's what the company was founded on — converting formats. We may not have more experience, but I think we can do things quickly because we're a very nimble company. We are the masters of our own fate, not the stock market. That lets us decide what's best.

JON THORN: We're very interested in open standards. As you know, Apple ProRes doesn't exist only in Apple's world. It works on Windows. It works on the Mac. It works on multiple nonlinear editing systems, so that's a huge advantage. Traditional camera manufacturers have tended to work sealed off from each other somewhat. So one company creates AVC-Intra. Another creates XAVC. Another company creates another variant. They don't do it out of ill will. They're all doing it because they think that their codec is a viable solution for their customers. But it does create a disjointed environment.

The original Ki Pro was actually used often to let disparate cameras work together. It was used more as an external recorder than as a camera attachment. For example, let's say you had a multi-cam shoot with a 720p camera and a 1080i camera and a really good SD camera. Usually, you'd have to record them independently, work with them in post-production, and do all kinds of work to try and make them match.

With the Ki Pro, you could record everything to the same codec, which was ready to edit, and you could use the built-in conversions in the box to make them all the same thing. So if your deliverable was 720p, even though you had these disparate elements, you could come up with one format, which is way faster in post-production.

NICK RASHBY: And that's the strength of the conversions that we have. We're able to do conversions all with the same quality. All those little individual converter boxes we've been making were the genesis of how we could put all kinds of connectivity into one box. That was a jumping off point. That's when we started down the road of internal discussions about a camera.

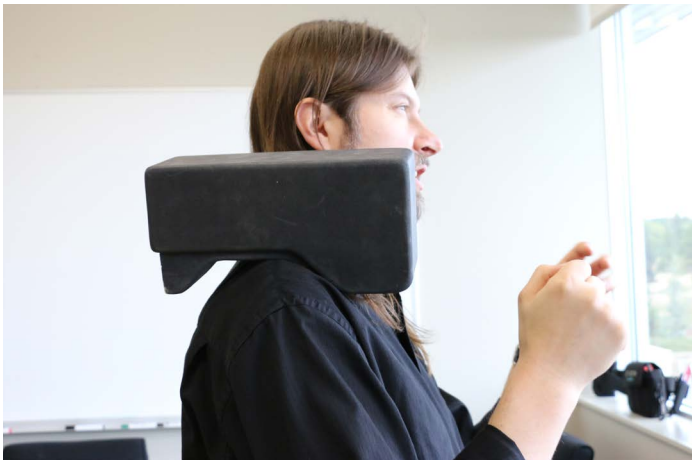
When did you start talking about building a camera?

JON THORN: The Ki Pro came out in 2009, so 2010 was the first time I ever wrote anything down that said we should make a camera. There was a lot of brainstorming and the clay models were done in 2011 to 2012. The first one told us we couldn't make it quite this little. It gave us an idea of ergonomics. The foam models came later in 2012, with weights added to determine the balance of the camera on your shoulder.

ALEXA came out in 2010.

JON THORN: Yes, and the Ki Pro actually pre-dated ALEXA and was being used with the D-21. It was pretty interesting because we didn't know they were going go the route of ProRes. Arguably, they also popularized ProRes as a legitimate format. And then the floodgates were open.

Form factor was a huge consideration because ergonomics of cameras, in my opinion, started to decline dramatically. If you wanted a cost-effective camera, you ended up with something that was held out in front of you with a weird ponytail viewfinder.



You had to jam your eye into the finder at the back of the camera, and you ended up wedged against it for stability. And there were flip-up monitor things. If you wanted better ergonomics, you had to step up in the tiers of cameras, so to speak. I found that kind of frustrating. A lot of those cameras tended to have fixed lenses. The DSLR craze had taken off in 2005. Part of that was because people wanted interchangeable lenses.

Your alternatives at the time were solid-state recording cameras that mostly had a fixed lens. Their form factor was "handheld" and you literally held them with your hand out in front of you. Or you could buy a stills camera to get the interchangeable lenses and then have to rig it all up. And I was asking, "Why did we forget how cameras used to be?" We had Aatons and 16SRs and Eclairs and all these wonderful things that you could pick up, put it on your shoulder, and shoot. They were relatively well balanced. They were compact.

But on the video side, you had ENG cameras that were always shoulder resting.

JON THORN: I would argue that those ENG camera were much, much larger than a 16mm camera.

So now we get to a really interesting phase in development of the CION. You can see the beginnings of trying to figure out shape volumetrically with 3D printed models. And then we got into the real world of engineering pieces like the sensor assembly.

At the same time, we were working on developing next gen recorders. The Ki Pro Mini came out late 2011, early 2012.

NICK RASHBY: And then we introduced the Ki Pro Quad in 2013. This was our first 4K recorder.

JON THORN: While the shape of the camera was changing, we were looking at what was really available in terms of sensors? And asking where's the market going? We thought 1080 was great, but tomorrow's format would be 4K and UltraHD. The next model put our Ki Pro Quad next to a camera head with sensor, lens mount assembly, and user interface.

Then there were other design changes. For example, the top handle parts were altered. Our designers kept wanting to make record buttons blue, in AJA Blue because they thought that was kind of hip. And we said, no, record buttons are red. The location changed over time. Originally, we put the record button low, like on a lot of Super16 cameras. But it was a too close to the rosette. It meant you'd have to hang electronics lower in the body. You're interrupt the air circulation. A knob became a click wheel. Buttons changed over time. Labels and menus were too cluttered. They were not very legible. Everything had to be just one line of text.

When we seemed to be fairly close to what we wanted, we started looking at fit and finish, colors, and different wood samples for the handles.

Mahogany, cherry, walnut, olive—like Olivander's wand shop in *Harry Potter.* Does the handle choose the cinematographer?

JON THORN: Absolutely. And because we're working with natural wood, not every handle is going to be the same, which is nice.

Are you offering custom handgrips?

NICK RASHBY: No. We are encouraging third parties. Shoulder pads, alternate handles and handgrips. We've always partnered with other company and part of our success is having an open approach, with few things that are proprietary. Even though we make a certain limited number of accessories, we want people to be happy and use what they like and is easy to find.

JON THORN: If you don't want the AJA accessories, there are third party ones from companies like Vocas, Wooden Camera, Zacuto, MTF, and others. For example, our cheese plates don't have a weird pattern. We use the industry-standard spacing of 9 mm center to center. We try to make accessories fit as tool-less as possible. This makes it easy for the after-market manufacturers.

How did you pick the suede for the shoulder pad? It's real leather? Do you guys go hunting during lunch hour in the hills around here for shoulder pads?

JON THORN: Funny you mention that because I'm a vegetarian. I eat fish, so technically that makes me a pescatarian. But the shoulder pad is real suede leather. We tested all kinds of varieties.

We also tested Alcantara, a polyurethane and polyester textile substitute for suede that's used in cars, aircraft, furniture, helmets, earphones, and for flame retardant seats in Formula One racecars. But it was a little more slippery and didn't have quite the same grip as suede. Nevertheless, I kept a few samples because I felt if someone were a vegan and felt offended, I have two of these in my office. I don't have a whole box of them, but if someone really had a moral dilemma, I would be willing to consider it.

The shoulder pad is actually a separate piece. The advantage of that is if you don't like the one we provide, you can add your own. It's held with just two ¼-20 threads.

What's the body made of?

JON THORN: Magnesium. We started with aluminum. But the move to magnesium was pretty quick. The magnesium is lighter and much more rigid. I don't think that you would say it's difficult to work with. It's just that not anyone can do it. There are really specific tools and production methods to make the material work.

The image plane tape hook fits either on the side or on top.

NICK RASHBY: That was my main technical contribution to the project, wasn't it? *(laughs)*

JON THORN: At first, I just wanted to just scribe the image plane witness mark on the camera body.

NICK RASHBY: But I wanted the physical tape hook as well.

JON THORN: Then Nick and I duked it out on whether it should be on the side or on the top. In the end, it's in both places, which is nice because you can move it either way.

It's nice that you both were camera assistants and cameramen in your earlier careers. Your experience shows in the thoughtful design on the CION.

JON THORN: On our earlier designs, the cheese plate was built into the camera body. The danger was, if you stripped the threads, you would have to replace the whole body. Our final design made the cheese plates removable.

How do you paint it?

JON THORN: That is an exercise in itself because there are special things you have to do in order to paint it properly. Then, in assembly, the pieces sort of suck themselves and the body together. If you look at all the edges there are no visible, exposed screws. This reduces the chance of catching on things.

Good design. And there are no sharp edges.

The lens mount was always planned to be a removable piece. Four screws hold it in place, making it very easy to use third-party mounts for almost any brand of lenses. The flange focal depth to the sensor is very shallow, so even mirrorless camera lenses (18 – 21 mm depth) can be accommodated.

The sensor is 35mm format?

NICK RASHBY: Yes, it's nearly Super 35.

We partnered with MTF, Wooden Camera, and other camera companies that make lens adapters and mounts. We've provided the engineering drawings to them.

Let's say you want to use a zoom lens with powered servo. Where do you plug it in?

JON THORN: There's a P-Tap power connector in the front.

***(Jon Fauer, lifting up the camera)* Wow, it's so lightweight.**

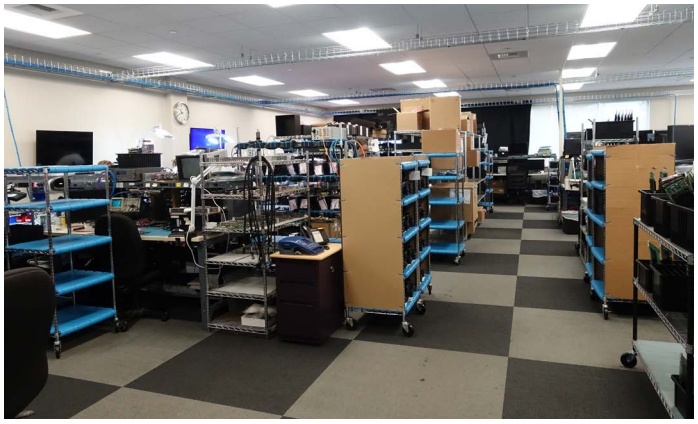
JON THORN: Yes, isn't it crazy?

Completed AJA CION

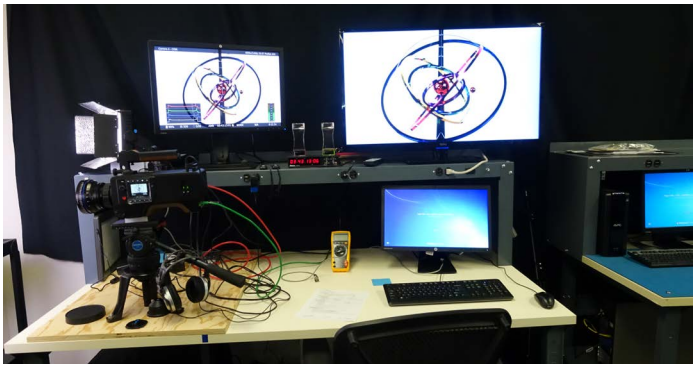
Assembling CION

AJA's corporate offices and manufacturing facility in Grass Valley, CA

AJA's R&D building next door



AJA CION assembly area



AJA CION testing

Assembling the camera base

CIONs ready to ship

No visible screws on the external surfaces

More CIONs ready to ship

CION AKS

Wooden Camera is developing several alternate lens mounts for CION, including Canon, Nikon, and Leica M. Using DSLR lenses on CION provides a wide range of creative choices at an affordable price point. "The CION's adherence to industry standards allows attachment of accessories like our top plates, quick release top handle, EVF holder, rod support system, battery mount, and rosette based handgrips," said Ryan Schorman, President of Wooden Camera.

Vocas has an array of standard camera accessories that work with CION, including matte boxes, focus controllers, cheese plates and a new Limited Edition with a knob and palm rest made of walnut wood.

Alphatron's electronic viewfinder (EVF-035W-3G) fits onto CION and attaches with standard connectors.

Zacuto's new Gratical HD EVF will have 5.4 million dots, and is expected to deliver in a few months.

MTF Services, Ltd has new lens adapters in production including Nikon/G to CION, Canon EF to CION, Canon EF (with hot shoe pins) to CION, Canon FD to CION, ARRI Bayonet to CION and an optical B4 to CION.

AJA Factory Tour
by Jon Fauer