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Art, Technique, and Technology in Motion Picture Production Worldwide



Panasonic VariCam 35 Factory Tour

400th Anniversary of the Siege of Osaka Castle



24' screen commissioned by Kuroda Nagamasa showing 5071 soldiers and 21 generals. Osaka Castle Museum. Partial view.

This year is the 400th anniversary of the Two Wars of Osaka.

Also known as the Siege of Osaka, it was the last major battle of the samurai era.

In 1614 and 1615, Tokugawa Ieyasu marched on Osaka castle to conquer Hideyori Toyotomi and his clan, and confirm his position as Shogun, Japan's supreme and sole military ruler.

In December 1614, Tokugawa's army of 200,000 samurai surrounded Osaka castle. But it was impenetrable—protected by a deep moat and double stone walls more than 100 feet high.

Although Toyotomi was greatly outnumbered, his army of ronin and disgruntled samurai were able to hold off Tokugawa's forces. A truce was signed and Tokugawa filled in the castle's outer moat. But in the summer of 1615, Toyotomi began work to restore the moat. Tokugawa was not amused and the Summer Siege began.

The Summer Siege is shown above. The screen paintings were commissioned by Kuroda Nagamasa, a daimyo and commander in Tokugawa's army. Artists were brought onto the battle field to ensure accuracy—a risky style of on-location painting. The attention to detail is incredible. There are 5,071 soldiers, 21 generals, total of 5,092. That is 5K detail—5,092—in 1615.

Tokugawa rounded up another 200,000 samurai (total 400,000) and led a month-long siege against Osaka castle, which fell on June 3, 1615.

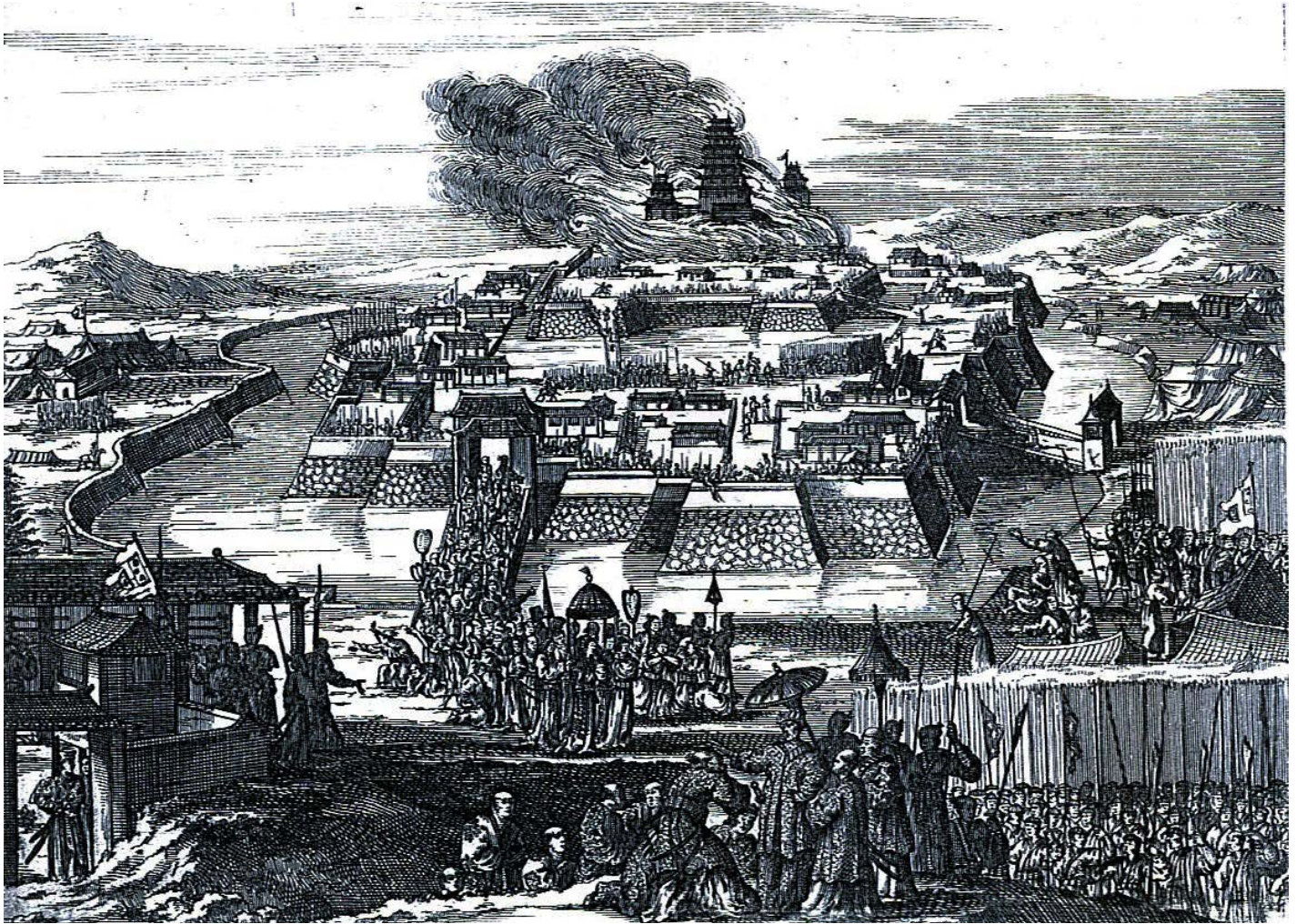
The Toyotomi clan was destroyed along with all other rivals, ensuring the Tokugawa family a long line of Shoguns who went on to rule Japan for two and a half centuries until the Meiji restoration of 1868.

The Tokugawa period is also known as the Edo era (1603-1868). It has been the setting of many films, including Kurosawa's "Seven Samurai," "Yojimbo," "Ran," "The Hidden Fortress," "Rashomon," "Kagemusha," and of course, Jerry London's "Shogun," cinematography by Andrew Laszlo, ASC. Although romanticized, Samurai were no less lethal than crusaders, cowboys, centurions and other characters.

And now a word about art, rice, philosophy, and 4K.

Compare Western and Eastern interviews in FDTimes. Executives and filmmakers from Europe and the US often begin with credits and credentials. Experts from Japan will usually begin modestly by saying how little they know about the topic, even when they are leading experts.

400th Anniversary of the Siege of Osaka Castle



The Siege of Osaka, from François Caron's 1663 book "The Burning of Osaka Castle."

Social psychologist Richard E. Nisbett found that different views of independence and interdependence affect cognitive thinking. For example, Americans are more likely to ignore the context, while Asians are very aware of context and surroundings.

T. M. Luhrmann wrote in the *New York Times* (Dec 3, 2014), "Show an image of a large fish swimming among other fish and seaweed fronds, and Americans will remember the single central fish first. That's what sticks in their minds. Japanese viewers will begin their recall with the background. They'll also remember more about the seaweed and other objects in the scene."

In a *Science Magazine* article (May 2014), Thomas Talhelm ascribed our different ways of thinking to the differences between wheat farming and rice farming.

"The two biggest differences between farming rice and wheat are irrigation and labor.

"Because rice paddies need standing water, people in rice regions build elaborate irrigation systems that require farmers to cooperate. One family's water can affect their neighbors, so rice farmers have to coordinate their water use.

"Irrigation networks also require many hours each year to build,

dredge, and drain—a burden that often falls on villages, not isolated individuals. In comparison, wheat is easier to grow.

"Wheat does not need to be irrigated, so wheat farmers can rely on rainfall, which they do not coordinate with neighbors. The lighter burden means farmers can look after their own plots without relying as much on their neighbors."

Europeans and post-colonial Americans have been wheat farmers; Asians have traditionally grown rice. Could that be why Japan and Asia have been more interested in 4K motion picture and television production than the West? I think so.

Look at Nagamasa's Osaka Castle battle scene, with intricate details of 5092 characters in the group. The castle, which is the property of one individual, Hideyori Toyotomi and his family, sits small in the upper left corner. The splendor is in the details.

François Caron was Director-General of the Dutch East India Company in Jakarta, and one of the first Europeans to visit Japan. His European depiction of Osaka Castle is quite different—the castle is central to the illustration, with broader strokes, larger foreground figures and less attention to the enormity of the group.

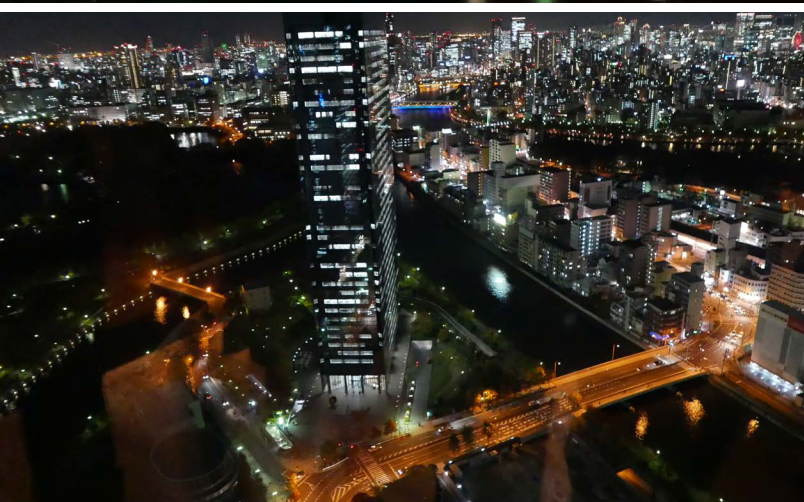
Osaka



“Kuidaore,” means “to eat oneself bankrupt” and describes Osaka’s obsession with food. Osaka is called “Japan’s kitchen,” and its restaurants have been awarded 108 Michelin stars, including five three-star restaurants. (Paris has 82 stars.) The citizens of Osaka

are said to spend more on dining than people in other Japanese cities. Fresh seafood comes from the nearby waters. Spices, fine ingredients, and exotic fruits from far-off places have arrived for centuries on ships landing via the Seto Inland Sea.





Fun restaurants crowd the neon-lit streets near the train stations, serving Yamaimo-yaki (Yam Okonomiyaki Japanese pancakes), Shabu-Shabu, Seafood, Korean Barbecue, Takoyaki, and other specialties (demonstrated by Panasonic's Jim Wickizer, above.)

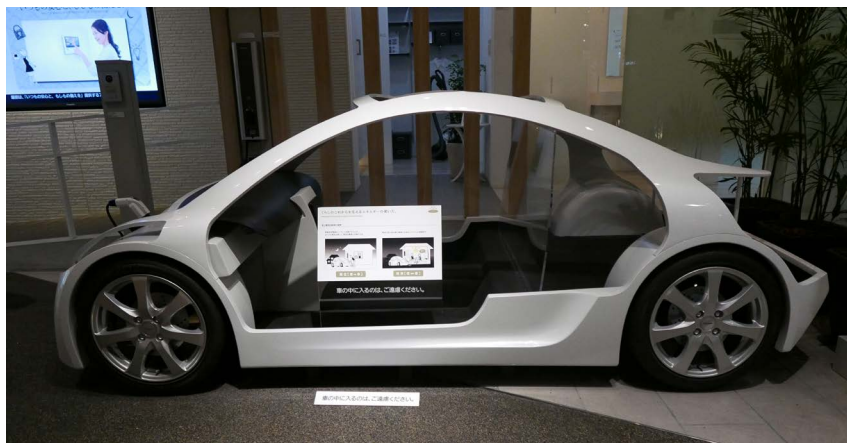
Osaka refutes Fauer's Restaurant Rule #2: *the higher the altitude, the worse the food*, as in airlines and spinning restaurants on top of tall buildings. Osaka's SUN Dynamic Kitchen & Bar, below, offers fine dining with magnificent views. dynac.japan.com/sun



Panasonic Center in Osaka



The Panasonic Center in downtown Osaka displays the company's latest products, from LED architectural lighting to electric cars, cameras, camcorders and computers.



Konosuke Matsushita Museum



The Konosuke Matsushita Museum is open to the public. It sits at the entrance to Panasonic's vast head office and factory in Kadoma, a large suburb of Osaka. The museum explains the life of the founder of Panasonic, Konosuke Matsushita and the numerous milestones that have marked the Panasonic's development. The exterior of the building is an exact replica of the original head office. www.panasonic.net/history/museum



Ship's wheel on the museum roof. Konosuke Matsushita said, "The head office is like the bridge on a ship, where one sets and steers the course for the whole company."



Konosuke Matsushita was born on November 27, 1894. At age 10, he was apprenticed to the Godai Bicycle Store in Osaka, where he lived with the family of Mrs. Godai, above.

Konosuke Matsushita Museum



In 1914, Konosuke Matsushita married Mumeno Iue. In 1918 he established Matsushita Electric Housewares Manufacturing Works in Osaka. There were three employees: Matsushita, Mumeno and her brother Toshio Iue (who went on to found Sanyo).



1918: the first product was an improved electric socket-to-plug adapter (left) followed by a double cluster socket in 1920. Matsushita saw a big market for convenient and well-made household electric fixtures. By the end of 1918, 20 people were working for the company.



Mumeno Matsushita cooked meals for young employees and took care of them as if they were members of the family. In the beginning, she kept the company afloat by visiting a pawn shop, kept the company books, and is considered a co-founder.



Time spent working in the bicycle shop paid off. An early product was a battery powered bicycle lamp that ran 10 times longer than anything else on the market.



The first head office and factory in the Kadoma suburb of Osaka, built in 1933. A few years earlier, Matsushita had introduced the brand name “National” for the company’s products, which he envisioned in every household in the nation.

Konosuke Matsushita Museum

Konosuke's apprenticeship at the Godai Bicycle Shop had a lasting effect. He learned the disciplines of being a merchant, which included how to greet customers and to bow. "This helped me greatly later in my life," he said. "I grew up in the bicycle industry. I was raised by the bicycle industry."



1952: Panasonic's first bicycle, the National Hyper.



1980: Panasonic's first electric bicycle. Konosuke, who was 83 years old at the time, took it for a test drive.



1956: Panasonic Black & White 14-inch TV.



1965: Mr. Matsushita tested each new bicycle model for many years.



2014: New Panasonic Electric Bike.



1964: Product Lineup, above.

1977: First Panasonic VHS Video Tape Recorder for home use, at left.

Konosuke Matsushita Museum



1951: Mr. Matsushita in New York.



1963: Mr. Matsushita in New York again



1971: Matsushita Electric listed on the New York Stock Exchange.

Below: Konosuke in his garden, Shinshin-an, in Kyoto.



Konosuke Matsushita was a prolific writer. In 1947 he inaugurated PHP Magazine (Peace and Happiness Through Prosperity). “Not for Bread Alone” (1984) is an examination of his philosophy in business and life: a simple, idealistic, people-oriented approach with an emphasis on responsibility and generosity.

1985: The company's first VHS camcorder, the NV-M1, had a VHS video recorder built in.

Below: display case of camcorders manufactured in Panasonic's Okayama factory.



Panasonic VariCam 35



Specs

- Super 35mm 4096 x 2160 MOS Sensor, PL Mount
- 14+ Stops of Latitude
- Variable Frame Rates: 1 to 120 fps in 4K
- 2-piece Modular Design (Camera head docks to AU-VREC1G recording module or can be tethered)
- Body weight: approx. 5.0 kg (body only)
- Body W x H x D: approx 179 x 230.5 x 347 mm (7 x 9 x 13.5")
- Power: DC 12 V (11.0 V – 17.0 V) 69 W body, 99 W with all AKS
- ND filters: 1: CLEAR, 2: ND 0.6, 3: ND 1.2, 4: ND 1.8
- ISO 800 - 12,8000. Dual Native ISO 800/5000
- Shutter: 1 - 358 degrees in .5 degree increments
- Shutter speeds at 24p: 1/24 - 1/250 sec
- Viewfinder: 0.78x OLED approx 2.76 million dots (1280 x 720)

Records simultaneously:

- 4K or UHD V-RAW Master onto optional Codex module (V-Log) with Codex Capture Card
- 4K or UHD AVC-Intra Master (V-Log) onto express P2 card
- 2K AVC-Intra or HD AVC-Intra100 or AVC-Intra200 or Apple ProRes (V-709 and AVC-Proxy)

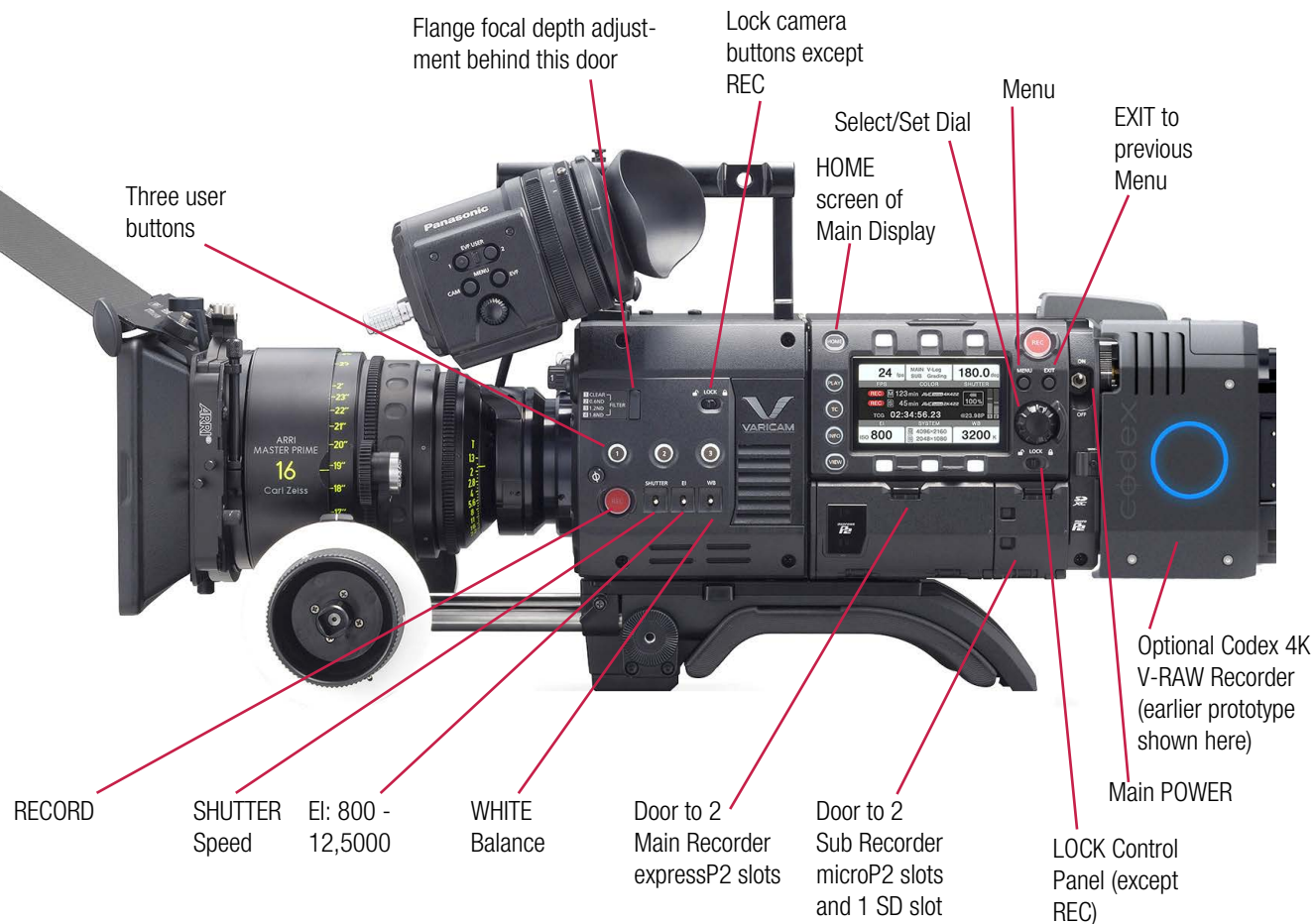
Apple ProRes 4:4:4 and ProRes HQ built-in, to be supported by firmware upgrade

Downloads: tinyurl.com/varicam35

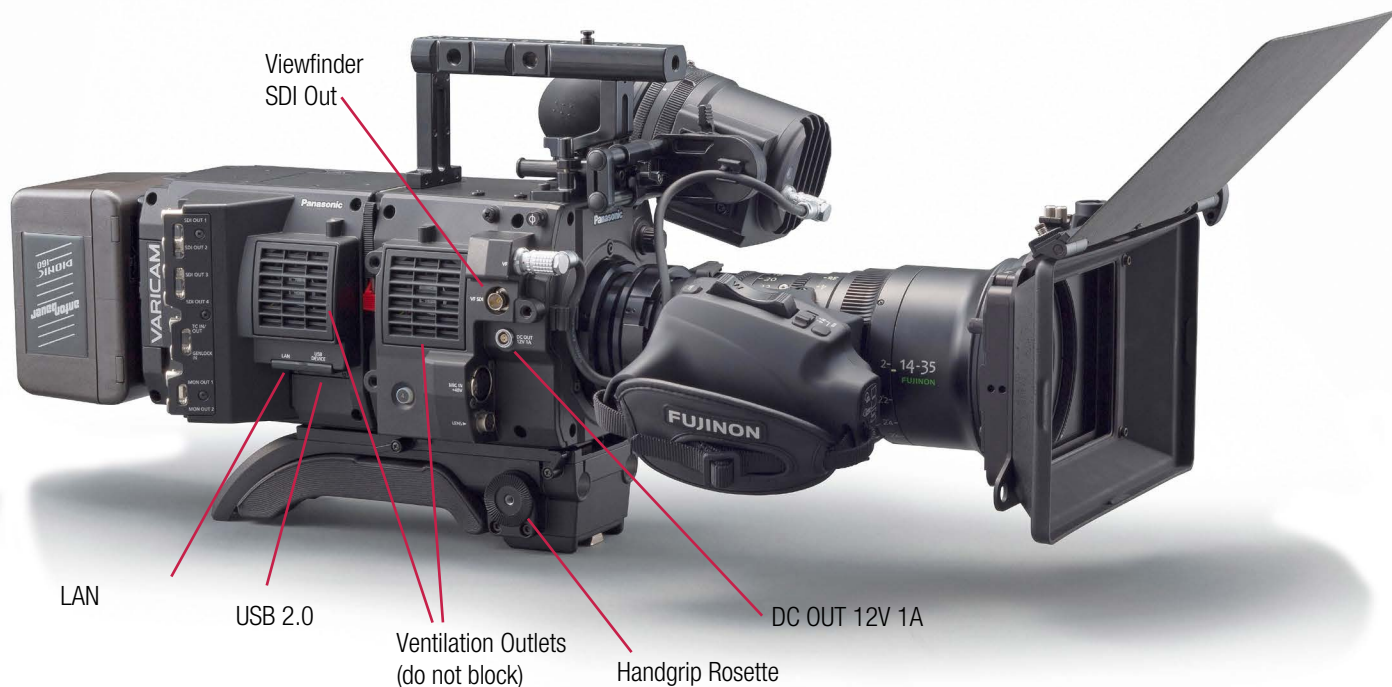


VariCam 35

Left



Right



VariCam 35

VariCam 35 Camera Head



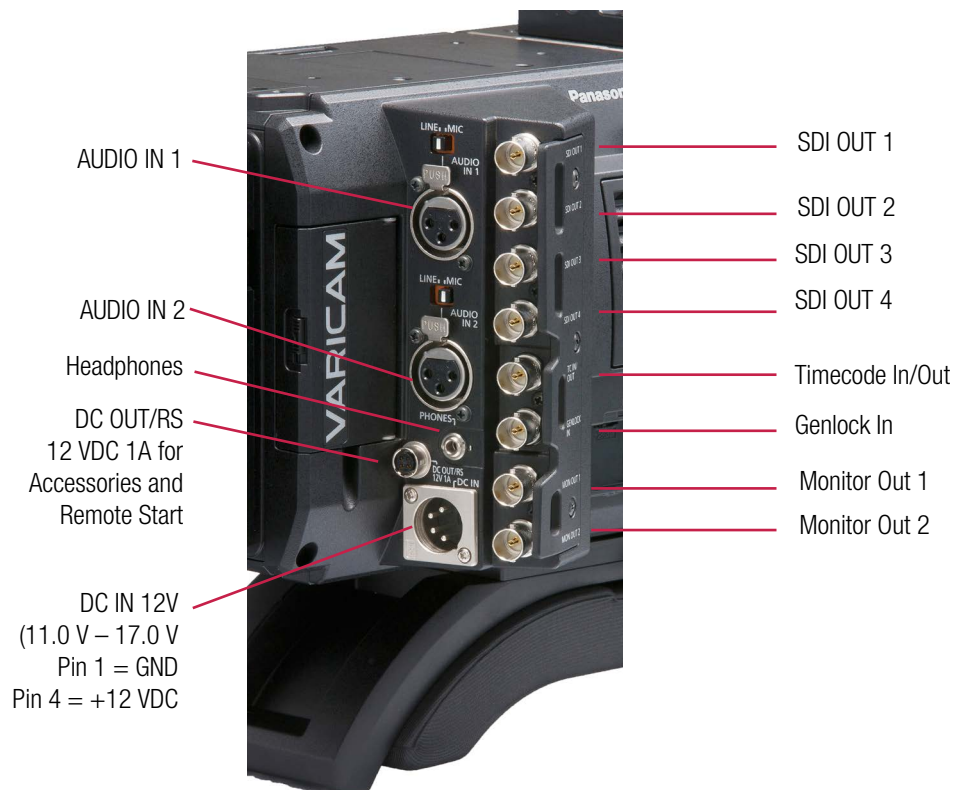
VariCam 35 Recorder



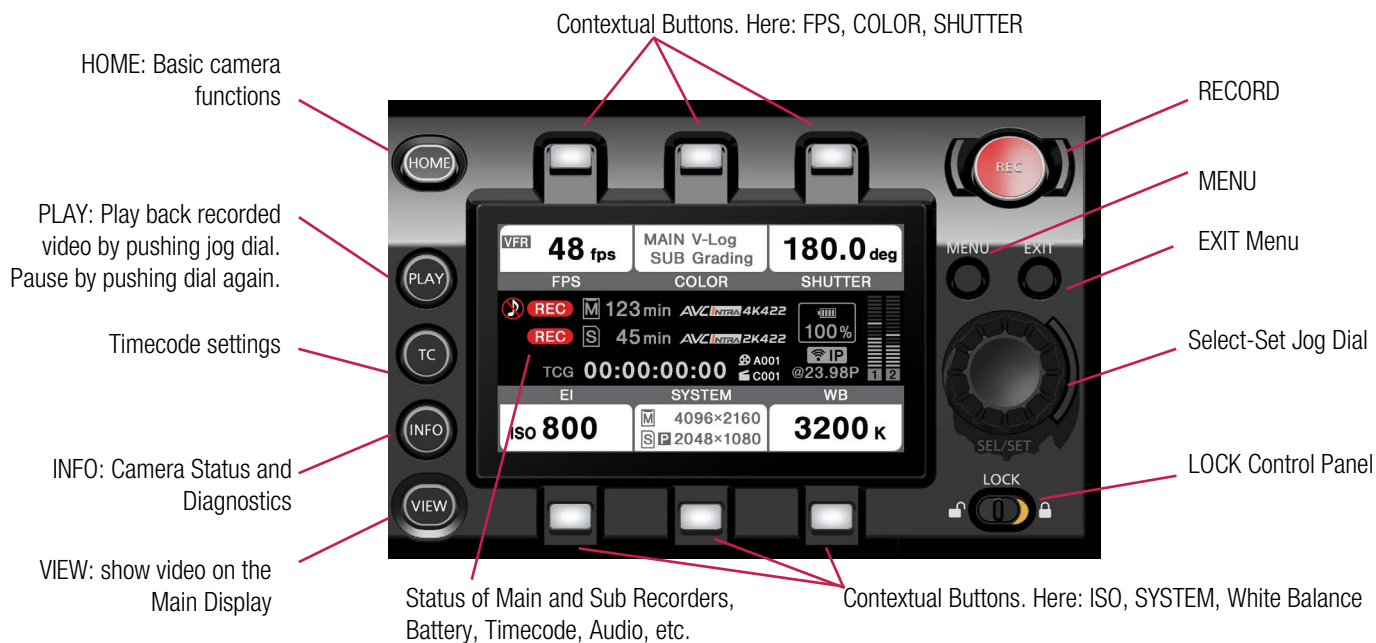
Front



Rear



Control Panel, Main Display and Menu



The Main Display normally is attached to the camera left side.



The Main Display can also be mounted on the camera right side.

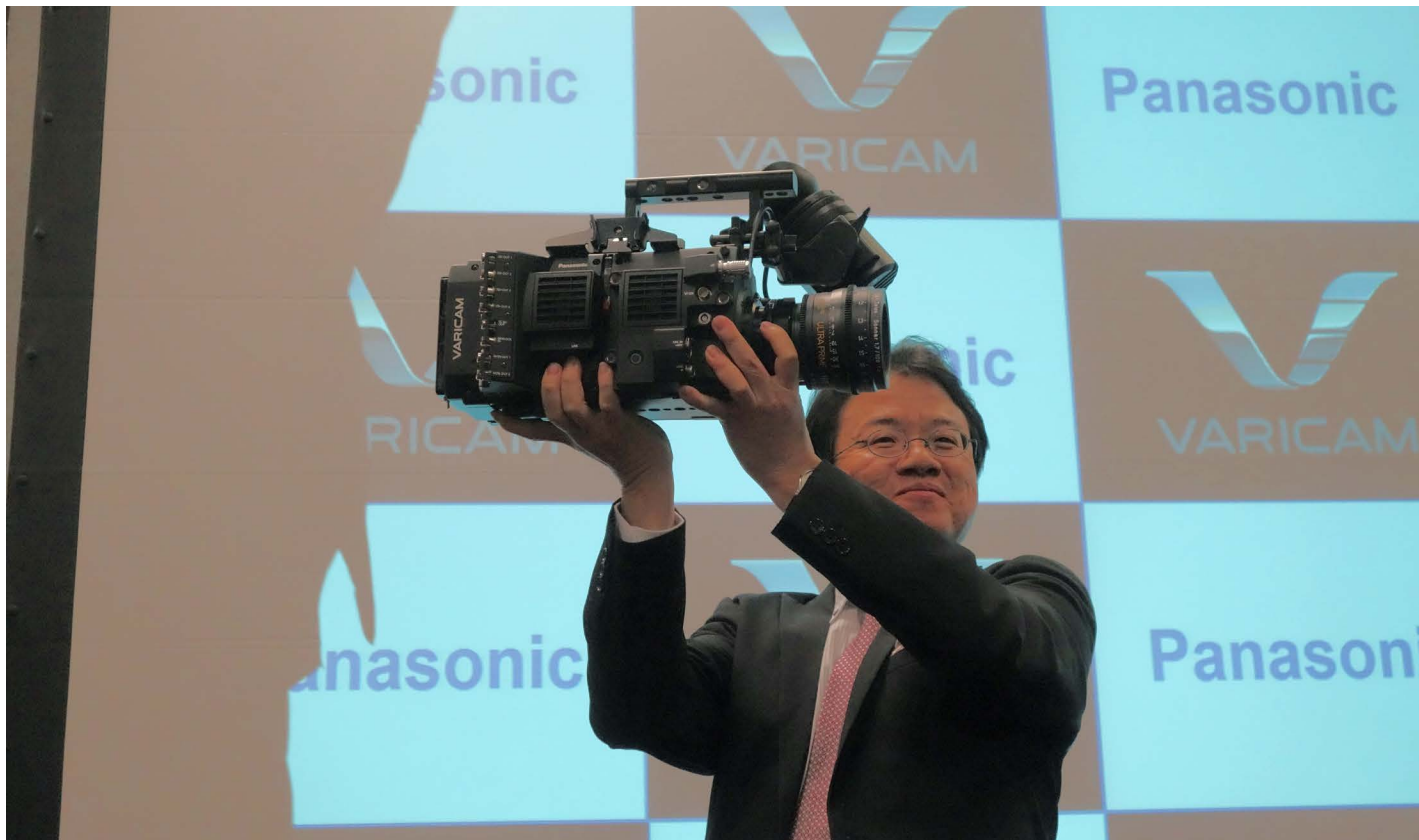


The Main Display can be used remotely.



VariCam 35 Shoulder Mount

VariCam 35 and Codex 4K V-RAW Recorder



Above: Kunihiko Miyagi introduced Panasonic's 35mm 4K VariCam at NAB 2014.

Below: At NAB 2014 with prototype camera and prototype Codex Recorder. Kunihiko Miyagi, Director of the Panasonic Professional Video Business Unit, and Rainer Hercher, Codex Business Development Manager announce strategic alliance for development of Codex 4K V-RAW Recorder that docks to back of VariCam. I am especially grateful to Rainer for introducing me to Mr. Miyagi and the entire VariCam Team.



VariCam 35 with Codex 4K V-RAW Recorder

VariCam 35 with Codex 4K V-RAW Recorder attached



CODEx V-RAW RECORDER

Panasonic and Codex have joined together in a strategic alliance to develop a dedicated recorder to capture uncompressed 4K VariCam RAW (V-RAW) at up to 120 fps. Because the VariCam 35 is a modular camera, the Codex V-RAW Recorder will attach directly to the 4K camera body, eliminating any need for cables and simplifying the use of the system.

The V-RAW Recorder uses production-proven, industry-standard Codex Capture Drives, which are the gateway to the entire Codex universe, with Codex Vault or Codex docks.

Codex will probably show the V-RAW Recorder for VariCam 35 at NAB, along with RAW footage.

CODEx CAPTURE DRIVE 2.0 TB

Codex designed the Capture Drive 2.0 TB to meet the demands of the latest generation of digital cameras, including the Panasonic VariCam 35. Designed around the latest and fastest PCIe flash storage solid-state media for professional media applications, the Capture Drive 2.0 TB combines very high performance with production reliability in a compact package.

Key features:

- 2 TB of memory delivering data up to 20 Gb/s
- Engineered by Codex
- Advanced thermal design
- Records 4K at up to 120 fps from the Panasonic VariCam 35



Codex V-RAW Recorder, camera right side viewed from rear.

Codex Capture Drive 2.0 TB



VariCam 35 with Codex 4K V-Raw Recorder



Codex 4K V-RAW Recorder for VariCam 35



Codex 4K V-RAW Recorder attached to Panasonic VariCam 35



Codex Capture Drive 2.0 TB

Codex V-RAW Recorder, camera left side viewed from rear.

Recorder attaches via battery connectors (Gold Mount shown here) and multi-pin connector on top.



Codex V-RAW Recorder, camera right side viewed from rear.





Codex Vault Cart



Codex 4K V-Raw Recorder attached to Panasonic VariCam 35

CODEX VAULT PLATFORM

Codex Vault treats the camera original file (digital negative) to a standard, proven, protected, secure workflow, saving time and money. It's used on-set, near-set, on location and in post around the world by all kinds of productions. Help is provided by Codex's 24-hour support team. Vault Platform is flexible: it runs on Vault S, Vault XL, Mac Pro or MacBook Pro. Choose and configure the most suitable hardware for the needs of your particular project.

Vault has a simple task-driven user interface that is easy to use. The way it handles data can be customized and locked at the beginning of production, which speeds up the process by not having to redo settings. During production, there's a detailed record of exactly what's been copied, processed and archived.

Multi-output GPU-based processing (with Codex Review) generates deliverables for review, post production, archiving and VFX—at speeds much faster than real-time in all the formats required. Depending on the project, these might include Avid DNxHD for editorial, Apple ProRes, DPX or H.264 for iPad executive dailies. Each format can be generated with or without LUTs and burn-ins, with all the associated sidecar files and metadata. Codex Vault Platform and Review also support ACES and can generate ACES Open EXR deliverables.

Codex lets you review the recorded images for defects, checking focus, exposure, associated metadata, and ensuring that clips are named correctly. With Codex Review, source footage can be played back at the original resolution and frame rate in the correct color space. Codex QC allows for annotation and comments down to the exact frame and even has some preset annotations—such as “boom in shot,” “tail slate,” “out of focus,” etc. Detailed reports can be generated of what has been shot, with or without thumbnails, so that everyone has all the information that they need.

New Codex Review Live creates looks on set. It has an easy-to-use User Interface. Review Live works directly with the live camera feed over HD-SDI to create and preview looks and grades that can be used to communicate the creative intent on-set and as a starting point for dailies and post-production. Looks can be applied automatically when generating deliverables via Codex Vault, or exported in various formats (ASC-CDL, 3D LUTs in various formats, and Look Files) to be used with other software. Review Live works with Tangent panels for interactive color grading and with the Fujifilm IS-mini 3D LUT box for on-set camera preview.

Text by Sarah Priestnall. Renderings by Codex.

Kunihiko Miyagi and the VariCam 35



Mr. Kunihiko Miyagi is Director of the Professional Video Business Unit, Imaging Network Business Division, AVC Networks Company, Panasonic Co., Ltd. We spent several hours together at company headquarters in Osaka discussing the VariCam. The next day he was in New York, and a few days later in London.

JON FAUER: Mr. Miyagi, where did you study and how did you get started in this business?

KUNIHICO MIYAGI: I graduated from Kyushu University in 1983 where I studied Electrical Engineering. Immediately out of university, I joined Matsushita Electric (Panasonic) and started working in the Broadcast Division. I have been working here on professional video products ever since.

The next 20 years after I joined the company involved a great deal of competition with Sony for professional formats. It was kind of a format war, with each of us continuously bringing out a new one. In 2004, I was named head of the System A/V Technology Center, which is responsible for everything related to professional audio and video.

About 12 years ago, I was one of the main proponents on the team that made the decision to move away from tape. It seemed like the industry was moving to disk instead of trying to go one step further to memory-based recording.

What was your first product when you joined Panasonic?

The MII VTR (1986), a ½" analog videotape recorder. Last month I was visiting a broadcaster in China. They had a small museum display set up, and I saw one there. I felt very nostalgic.

In just the last 25 years we have seen perhaps 50 audio and video formats come and go from all the manufacturers.

Yes, there have been a lot— major ones and minor ones. It was basically a 20-year campaign of going broadcaster to broadcaster trying to get them to use our format instead of the competition's. Looking back, it was actually quite fun. My policy, or motto, is "no challenge, no success."

How do you spend your precious little free time?

I like to fish, golf, play video games, and go out for drinks.

And you have a nice blog that I read.

Another part of my job for the past 12 years since we made the original VariCam, in addition to the format wars with Sony, has been working on the new generation of production cameras.

From the start, our division was mainly focused on broadcast. But there were also some products that were aimed at the motion picture production market. I wanted to become more involved with that market from early on. Our D5 format (1994, ½" 4:1 intra-frame compressed digital component 10-bit recording) became very popular in Hollywood at one point, but I always wanted to gain acceptance with a camera as well. We started talks 14 or 15 years ago about how we could get our cameras to be more focused on the cinema production market.

These ideas eventually culminated in making the original VariCam AJ-HDC27, which came out in 2002. At that point, it was a given that you captured an image 60 times a second for broadcast. With the VariCam, we were the first to make a video camera that, instead of recording at 60 frames per second, was recording at 24p. Once we had 24 fps, we then allowed for variable frame rates to do fast and slow motion (1-60 fps). That's why it was called the VariCam: the variable speed camera. While making the camera, we engineers were all looking at the images and we were very scared because, to us, the pictures moving at 24 frames looked like they were very stuttery. We were quite worried that it wouldn't be an acceptable look.

Although motion picture audiences were accustomed to this.

Yes. In addition to 24 fps, one of the main things we considered with the original tape VariCam was the color and creating a specific look. As engineers, we were familiar only with making broadcast-standard cameras with color that was suitable for broadcast. When we first started experimenting with Cinema Gamma, we were not really sure how best to do it. After a number of tests with the original VariCam 12 years ago, we had fairly good success in Japan among production people and cinematographers. But we found that when we took it to the United States there was a lot of resistance in Hollywood because it did not look the same as film. We kept working hard on the Hollywood market and eventually the VariCam was accepted quite widely and we were happy. From a business perspective, we felt that it was successful and that we had created a good product.

In 2002 we released the first DVX100. The concept was to take as many of the features from the VariCam as we could, and put them into a compact, handheld camera. The DVX100 camera was very popular with indie producers.

I feel that Panasonic has been a pioneer in bringing digital

Kunihiko Miyagi and the VariCam 35

technology as close to the look of film as possible. Unfortunately, after the success of the first VariCams, we concentrated more on the broadcast industry and we lost focus on the production industry for some time. That's one thing I regret. I wish we had worked more in that area. So, RED released their cameras, and ARRI released the Alexa. These have been very popular. Sony has released cinema cameras, which were somewhat expected. Then Canon came out with a line of cinema cameras, then Blackmagic and AJA. All kinds of companies had cinema cameras, but we didn't. We knew that we had to do something. We at Panasonic had to create a very good camera that could be used in digital cinema. We began preparations.

What year did the Varicam 35 project first start?

Officially it was about two years ago. But, in fact, about three to four years ago there were a couple of people who had the idea that they wanted to make the camera and they started working hard on it.

We were very impressed by ARRI's Alexa camera and we think it's a wonderful camera. As our first step, we decided to study, very carefully, what made it so good. We found out that the answer to that question was very simple. They went to their customers, the cinematographers and rental houses, and asked them in great detail what they would like to see in a camera. We decided that was exactly what we had to do, but we had to do it even better and even more thoroughly than they had. We started doing that about two years ago.

You interviewed many DPs, rental houses and production companies?

Yes. When ARRI was making the Alexa camera, we think they were looking at it from the point of view of making a digital camera that's similar to a film camera. When we started asking DPs their opinions, we were on a similar level, but then we also had the advantage that the Alexa and some other cameras were already out on the market. In addition to asking about what they would like to see in comparison to a film camera and how to be able to use it like a film camera, we could also see the shortcomings of the cameras that were on the market and see what new things we could add.

In those hearings, we found that there were three things that we needed to really work on. The first was the sensor—making sure we had a sensor that was better. The second was that we needed a way to make the workflow more efficient. That's what takes up a lot of time and money during productions and in post. And the third thing was to make small changes that could make things a little bit better. In summary, three points: imaging sensor, workflow, and small changes.

As for the imaging sensor, within this industry there are only a few companies that are able to make their own sensors in-house for cameras: Sony, Canon, JVC, and ourselves.

We knew we had to make an imaging sensor at least Super 35 mm in size. Panasonic already had a lot of technology related to making MOS sensors. The challenge when we were making this image sensor was that we knew we had to make it with very wide dynamic range, very low noise, and able to produce high resolution 4K images at very high speeds. But those parameters are all things that work against each other. If you could ignore one of

them it would be easy to make the sensor, but to be able to grow in all areas you have to have very strong semi-conductor technology.

Since we had the semi-conductor technology at Panasonic, we were able to start developing the sensor for this camera two years ago. Along the way, we made some changes to the basic sensor design and changed the circuitry to allow for what we call dual native ISO.

800 and 5000 ISO with very low noise?

Yes. Normally if you boost the gain then the noise will become bad. So we added a separate analog circuit for the 5000 ISO mode. With a traditional sensor, as you switch to higher ISO settings, the noise grows. On most cameras, as you move up to 5000 ISO you see a lot of noise in the picture, but with ours it's nearly noise-free. It's very useful and impressive for nighttime skylines or shooting by moonlight or by candle light.

Moving on to our second point: workflow. Up until now there have been many steps that were very time consuming and expensive. It was just assumed that's the way it is. With the VariCam, this time around, we tried to look at some of those steps and eliminate them where possible. We're well aware in the digital cinema arena that the recorded image often looks nothing like the finished product. You're shooting RAW or log or whatever—that's been the accepted practice. You shoot a flat picture and then you grade it afterwards.

But with the VariCam we've added the ability to apply your color grade as you're shooting. So, you can simultaneously keep a pristine log version of the file as well as have another file with the color grade already applied that you can be checking on set. This feature was requested by Michael Cioni of Light Iron and we're happy to include it in the camera.

We were able to achieve this because we have had a long history and lots of experience with compression technology and color reproduction since the original VariCam. We're well aware that DPs have very specific ideas about the colors that they want to see and we made it possible for them to achieve those colors. DPs feel proud about being able to produce splendid images. We also feel proud that we can provide them a tool that has the flexibility to create those images.

The third point that we discussed was about the small changes. We think that since we've included so many small changes in the camera that they all add up to be a really big change. The main thing we were told about building the camera was to make sure it's tough and durable. So it's a fully aluminum body and I'm very confident that it can take quite a bit of punishment. This came from looking at Alexa and determining to make ours as tough or even tougher.

With regards to this display, there were people who said it should be on the left side, people who said it should be on the right side, so we decided, "Well, why don't we just make it removable?" And another idea was that we make the recorder and the camera as separate modules.

Right from the start, our design included a connector on the camera so that it could be easily used with third-party products. That culminated in Codex producing a RAW recorder that attaches seamlessly to the camera.

Kunihiko Miyagi and the VariCam 35

Another thing that we heard from a lot of people was that focusing was difficult on most digital cameras, especially in 4K, so we put in a lot of different features to make focusing easier.

We fitted our electronic viewfinder—EVF—with an optical zoom. You can optically zoom in on the image to check focus.

We also created a new feature called “focus squares.” Green squares appear on the viewfinder screen, and the squares get bigger in the areas that are in focus. The more they are in focus, the bigger they get. It’s very easy to quickly and accurately check focus. Another request by users was to include wireless capabilities. For example, we can wirelessly apply color lookup tables from a computer to the camera. We had some of those features in our broadcast cameras and we were able to successfully port them over to the cinema camera. With the original VariCam that we made in 2002, our hope was to make a digital camera that approached the looks of film. But with this VariCam 35, we feel we achieved it—the images that you get from the camera are as close to film as possible.

And we feel that this camera is even more functional than a film camera. I am very proud of the camera and feel that it’s a product that can definitely be useful for anyone who’s shooting cinematic images. I’ve been rambling on for a long time now, so if you have any questions, please.

Why do you feel strongly about 4K? Others are not convinced.

It’s a very difficult, but very interesting question. As I was visiting rental companies in Hollywood, I was asked the same thing by many people. Personally I think that even if your final product is in HD or in 2K, you should be shooting the highest resolution you can. I’m sorry, but you should be shooting 4K.

Can you explain a little more about your relation with Codex and the Codex recorder, please?

Panasonic has very strong history in compression technology and AVC-ULTRA is a popular codec that has a 4K mode. It can record 4K with very high quality at a very efficient data rate. But in a world where shooting RAW is becoming increasingly common, we realized that offering only compressed AVC-ULTRA would not keep our customers happy and our product would not be successful.

We knew there had to be a way to give customers the option to shoot RAW. There are many companies that make RAW recording systems. We looked at all of them, compared them, and decided that Codex was most suitable company for us to partner with. At a very early stage in the camera development, we decided that we would work with them. The engineers from both sides talked and decided how to build the products together and how to send the data out to their product.

I think you know Rainer Herscher from Codex very well, and I’m trying to remember how many dozens of times I’ve met him this year. Rainer attended the VariCam 35 announcement at NAB, the press event, and he’s also attended the launch events for VariCam in every region—in India, China, IBC, and in Tokyo when we held a Rental House Summit.

In your experience visiting different productions around the world, what percentage are shooting in RAW?

There’s a lot of variation based on the region. We think it’s very

high in the U.S., gaining in Europe, and in India they are pretty much 100% shooting in RAW.

We’ve had many Indian customers and distributors telling us that unless the Codex recorder were available we couldn’t sell them VariCams.

I guess this camera will make RAW more affordable and more accessible. You mentioned that one of the problems with 4K in the past has been the really long downloading and cloning time. Basically, this camera almost has a DIT station built into the camera itself. Tell us about the team who worked on the camera?

The people who did the hard work are the engineers. Getting the core details of the camera really only took place beginning the summer of 2013. The instructions that I gave at that time was to be absolutely sure there would be a working model at NAB 2014. And make sure the product could ship by the fall of 2014. Normally when there’s a tough timeline set down like that, the engineers complain and say it’s not possible, but this time they didn’t complain. They didn’t say no. They said that even with that tough schedule, they would make it happen and they were actually begging me to approve the plan to make the camera.

There’s a famous saying about engineers. Usually with the first thing engineers say is, “Impossible.” Next they do it. In the end, they become heroes. Within Panasonic’s imaging groups, is there a unity of color science that goes through all products?

It depends on the specific sensor being made and on the product that it goes into. There are definitely portions that are mutual between all the Panasonic products. One difference is that our consumer cameras or camcorders are generally set up with bright, vivid, saturated colors, while our professional products are set up to give more natural colors.

You must go to the movies often?

I like watching movies, but recently I’ve been very busy and don’t get to go to the theater very often.

You watch them on airplanes?

Yes. Most of the movies that I’ve seen recently have been on airplanes.

Where every screen looks different!

If I watch it on the airplane and it looks good, then I buy the DVD so I can watch it properly. And when there is a movie that I really want to see, I make sure to make time and go to the theater.

We’re very happy there’s so much interest in the VariCam at this point, and we will be even more delighted for customers to use the camera. We feel that they’ll be very happy once they do so.

Let’s talk a little bit about the VariCam HS, your 2/3” 3-chip 1080p Highspeed Camera. Which market is bigger, how they differ, and how did that influence the design?

Both markets are important and probably around the same size.

The idea and the plan for the VariCam HS came first. The reason is that the sensor needed for the VariCam 35 was not yet ready. Once we finalized the plans for the sensor and knew when it would be ready, we at first considered delaying the HS and just focusing on the 35.



Paul Boyland (Business Development); Megumi Sato (Marketing & PR); Kunihiko Miyagi (Director, Professional Video Business Unit); Megumi Tsuneyama (Manager, Marketing & PR); Jim Wickizer (Marketing Manager, Panasonic).

But the engineers insisted on making them both at the same time and making the modular designs so that they could be used together. Going ahead with the plan to bring them both to market at the same time convinced me of the competitiveness of the engineers. They didn't shy away. They insisted on doing them at the same time.

As I think you're aware, the VariCam HS is aimed largely at the sports and documentary markets. For those types of productions where you need very long lenses, it can be difficult to go with a PL mount. We had lots of meetings with companies to see what should be included in the HS. The goal was set very clearly for a camera that was able to shoot in high speed at HD resolution, not necessarily super slow motion, but there was very clear target of 240 fps in full HD. We made that and we think it could be quite useful in those markets.

Is there anything that I should be asking you that I didn't ask?

I read the article in Film and Digital Times about the ARRI Factory. You'll be going to the Panasonic Factory tomorrow, and it's different, I think, from the ARRI Factory. We'd really like customers to understand the strong points of the Panasonic Factory as well.

Japan also has very strong tradition of high-quality manufacturing, and I hope that after visiting the factory, you may come to appreciate what you've seen. We Japanese have a word for it. It's called "monozukuri" and it is "the art of making something." The word has a deeper meaning: it's the art of skilled craftsmen putting all their effort, heart and soul into their work, striving for perfection. At the factory, you'll see passionate craftsmen and women doing everything they can to ensure the high-quality

of the products, the high-reliability of the products. The people working in the factory are always thinking of the customers point of view when they're making the products.

And it's interesting that you at Panasonic make everything. You make the sensor, the electronics, the software, the hardware. You make everything that goes into the camera, and then you assemble it.

Other than cinema lenses, we make everything.

Where do you think the future of this business is going? The motion pictures shot by your 4K cameras will be screened where? On 4K displays at home? In the theater? Where are people going to be watching the products that are coming out of your cameras?

In every country around the world, I think the idea of looking at images is breaking into two segments. The first is the movement to very high-quality. Japan has 4K and is already working on 8K. Whether 8K will come into the home remains to be seen. But 8K will, I think, be mainly for theatrical viewing, large displays, and arenas.

The other segment is video in the most convenient format possible. It's in your smartphone or wherever you are. Panasonic is planning to create tools that facilitate the creation of content for both of those areas. Right now, we are talking about the VariCam, which is designed to be used to make content for all those high-end areas. We also make 4K displays that will be suitable as well.

Congratulations on a really good camera.

Takahiro Mitsui and Development of the VariCam



My next meeting at Panasonic was with Takahiro Mitsui, above left, Lead Engineer and Strategic Marketing for the VariCam. Shoichi Fuse, Lead Engineer, at right.

JON FAUER: At IBC, you invited me to learn more about VariCam by visiting Osaka to see where it's designed and built.

TAKAHIRO MITSUI: Thank you for coming to Osaka today. I know it's long long flight. I was on the VariCam team, and now I'm also in charge of our strategic marketing. I started at Panasonic in 2003. My first "baby" was the HVX200. Other "small wonders," my "babies," included the HPX500, HPX170, HMC150, HMC40, and AF100. I moved to the U.S. in March 2011, where I spent almost 3 years.

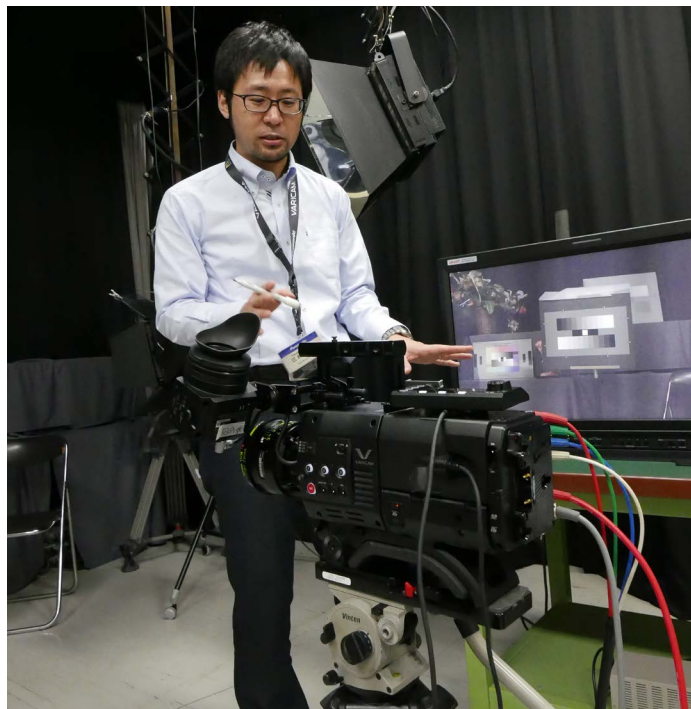
Now I'm in charge of the VariCam development. My expertise is image sensor technology, signal processing, and system architecture. Mr. Shoichi Fuse was my teacher and mentor (sensei). All the technological knowledge I have is what he gave me.

Now, let's go behind the scenes of the VariCam. Before starting the VariCam development, we met many people and had many focus groups. We visited a lot of cinematographers, rental companies, resellers, post houses and conducted focus groups with end users for market research. We had very good discussions in each visit. It was quite an exciting and fun experience for me. Everybody we met gave us lots of insights for future products. This new VariCam was definitely developed based on their voices.

You kept it pretty secret—they must have had serious NDAs.

We just had gentlemen's agreements, and they were all gentlemen and women. During these visits, I could feel the VariCam brand was very much alive. People still remembered the revolutionary workflow, VFR, FilmRec, and the VariCam look. We decided to take a similar approach with this camera. Our concept for the new VariCam was "Emotion and Revolution".

Let me explain the Revolution side first. We wanted to provide a user experience that would offer dramatically advanced workflow



options. But in the beginning, we were not totally sure what that would be. That's why we had strategic discussions with Michael Cioni of Light Iron (now partnered with Panavision) because, as you know, he runs a post house and is also an on-set tool provider. He knows both on-set and post processes.

In previous cameras that we developed, we always focused on the DP and the on-set details. But the current generation of production is, I'm convinced, much more oriented towards workflow than before. That's why we wanted to get a better sense of the process from on-set to post-production. I brought a big sketchbook. Michael and I drew up a lot of ideas, like cloud workflow and live color. And then we came up with one big idea, which is in-camera dailies. To me, on-set color grading can be kind of a nightmare today because you have to find the individual grading file for each clip manually when doing the final online or DI. You have to manage a lot of clips and files. At the same time, there is also an incentive to reduce turnaround time for dailies, grading, and post.

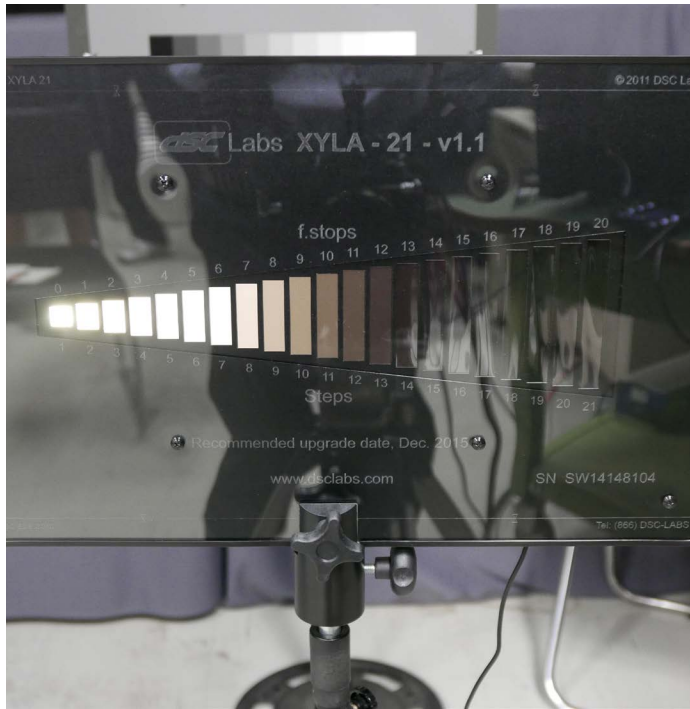
To solve this, we implemented two important functions. One is in-camera grading. The other is double recording. It's like having two recorders inside the camera. One recorder can be 4K or UHD, using express P2 cards. The other is a microP2 card simultaneous sub-recorder for 2K or HD.

With the Codex V-Raw 4K Recorder coming soon, you will actually be able to capture simultaneously to three recorders?

Yes, there are a lot of options. We can record in different formats and different color spaces at the same time. Let's say we are recording 4K V-Log internally. The DP can set the look for those files non-destructively. The 4K V-Log files are not changed. The CDL or 3D LUT metadata accompanies the 4K V-Log files all the way through post-production. In addition, the camera is simultaneously recording an HD or 2K proxy. The look established by the DP is baked in to these proxies.

In summary, we can apply different color spaces individually and we can make the dailies in camera.

Takahiro Mitsui and Development of the VariCam



When we record the 4K master file, the grading file will be recorded with the same name as the clip in a different folder of the same data card. Panasonic VLUT can be a common language in the entire production. What's revolutionary about this? We think it's the in-camera dailies.

Second is Emotion. We wanted to give users as much flexibility as possible to bring their ideas and creative imagination to life on-screen. But what's the emotion? Many people loved the VariCam look, but that was almost 10 years ago. We wanted to redefine today's VariCam look. That included rich color, rich skin tone, and our dual native ISO (800 and 5000 ISO).

So, we brought a very early engineering sample to Hollywood to shoot test materials and test it with a colorist. There were two objectives: to check the accuracy of the IDT (Input Device Transform), and to analyze the VariCam Look elements, Gamut and V-log curve with the colorist.

When you were shooting tests, would you come back here and tweak the software of the sensor to adjust the look?

Yes. We had a lot of homework. We brought files back to Japan and tweaked. We worked with our color scientists in our factory. The result is what you've seen in our demo reel.

Another big emotional thing that we've done in VariCam is "Dual Native ISO". VariCam has two native ISO settings: 800 and 5000. One of the customers we met said, "Film cameras are better than digital because we can choose and use different film stocks on a scene by scene basis." This comment awakened our engineering brains. We had never thought about that. Consequently, we started to discuss this concept with our Image Sensor Division.

Usually noise is introduced in the gain process of rating ISO in digital cameras. What we've done with the VariCam sensor is to implement two dedicated analog circuits for each native ISO before the gain process. This can bring us much higher sensitivity without increasing noise. It's like there are two film stocks inside the camera.



Above: Shoichi Fuse, Lead Engineer, above, testing dynamic range.

Below: Takahiro Mitsui in the VariCam 35 test lab. 5000 ISO and lighting with one LED from an iPhone.



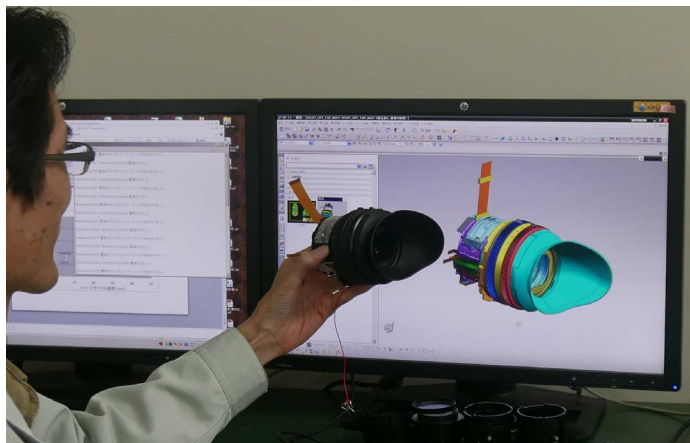
So, that is the story of today's VariCam which is developed based on the concept "Emotion and Revolution". Emotion is today's VariCam look and Dual Native ISO. Revolution is new workflow, like dailies in camera. I would say that we at Panasonic are always trying to provide a new "UX" (User eXperience) to the market, such as the first VariCam, DVX100 and HVX200.

I hope many creators will benefit from new experiences with VariCam's Emotion and Revolution, and enjoy the creative results. Because, again, this product was truly developed based on their voices. That's my brief story behind the scenes of the camera's development.

Panasonic VariCam Development



The VariCam Development Team at Panasonic Headquarters in Osaka.



The EVF has an OLED display of about 2.76 million dots (1280 x 720).



Diopter adjustment has click stops, which is nice because it prevents turning accidentally.

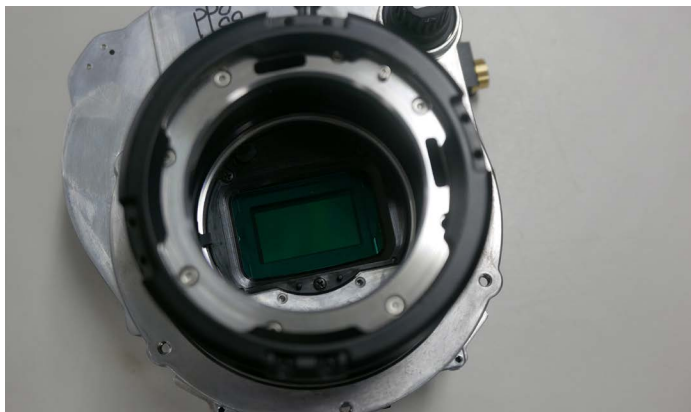


VariCam 35 PL mount

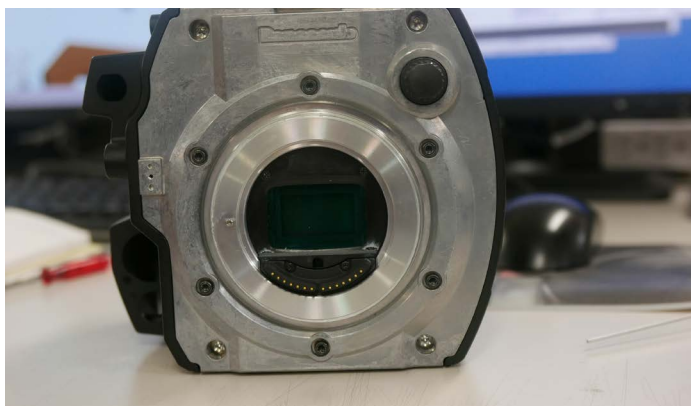


Third-party lens mounts, for example Panavision PV, can be attached.

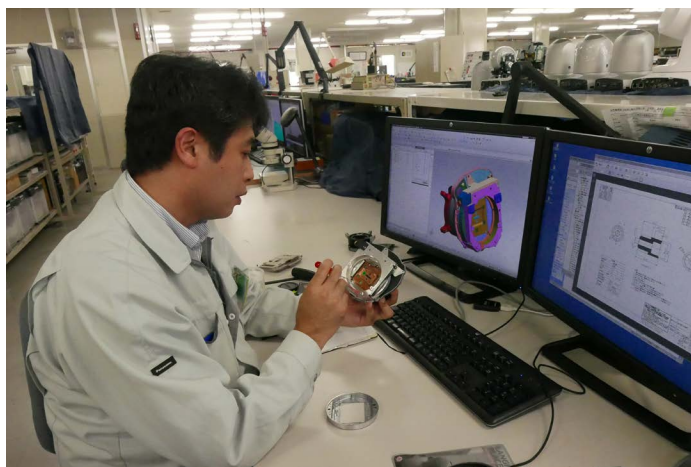
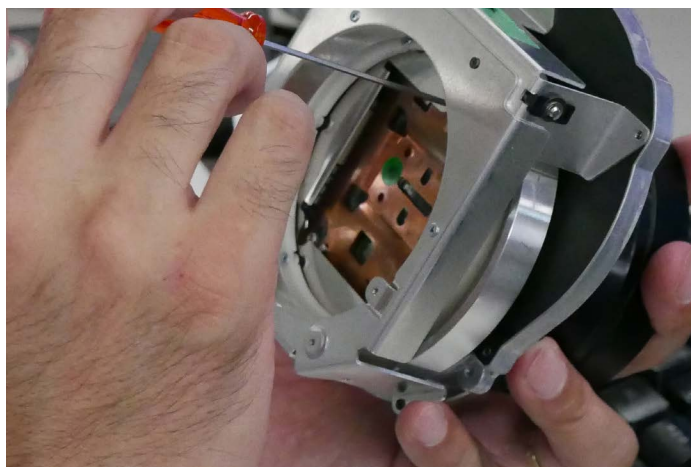
Panasonic VariCam Development



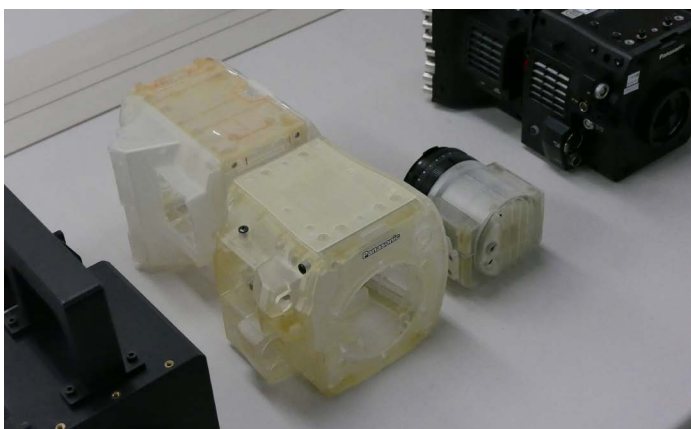
VariCam 35 PL Lens Mount, ND Filter wheel, and Sensor Assembly.



Front of camera without lens mount.



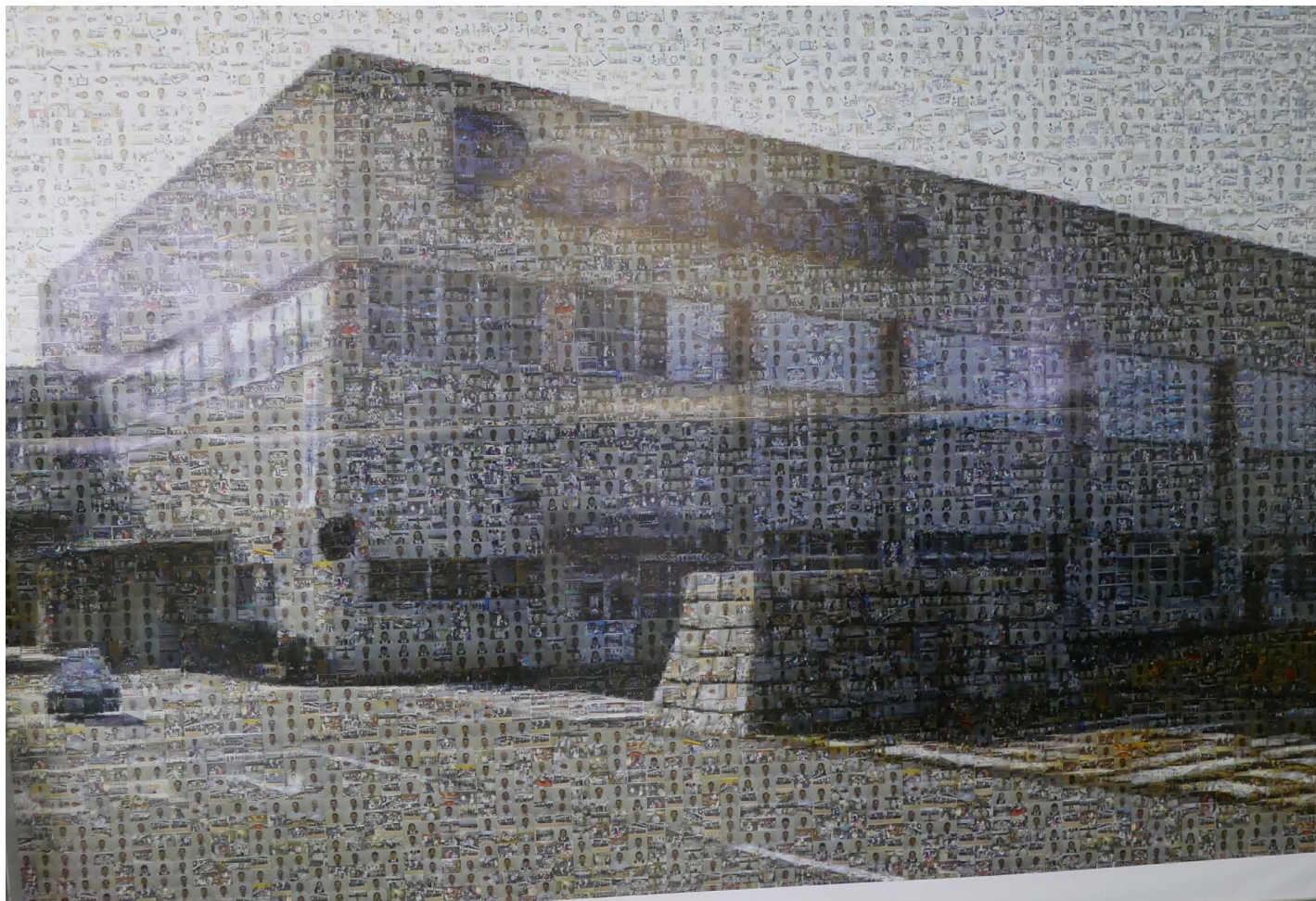
Development Team with early mock-ups of camera body.



Wood and plastic models.



Tour of Panasonic's Okayama VariCam Factory



More than 6 million units of Panasonic professional video products were built in Kadoma, Osaka from 1985 through 2011. In January 2012, Panasonic's professional video factory moved to Okayama, 180 km (111 miles) west of Osaka. The picture above was composited from portraits of every employee.

At Okayama, the entire manufacturing process from parts mount-

ing to final assembly takes place on a single floor. This layout improves logistics and speeds production. The new factory has gigantic clean rooms for assembly of optical units in the cameras.

Panasonic controls the entire process—making everything from the sensors and optical assemblies to the circuit boards, mechanical parts, housings, and components.



Tour of Panasonic's VariCam Factory



The Okayama factory produces consumer and professional video products. This is part of the team that builds VariCams.

It's a one-hour train ride from Osaka to Okayama, past pampered beef in the city of Kobe, and the ancient pottery and sword workshops of Bizen. Bizen ware is known for its reddish brown color and extreme hardness. The pottery kilns and sword workshops date back to medieval Japan. From Okayama station, it's a short taxi ride past rice fields and Okayama Castle.

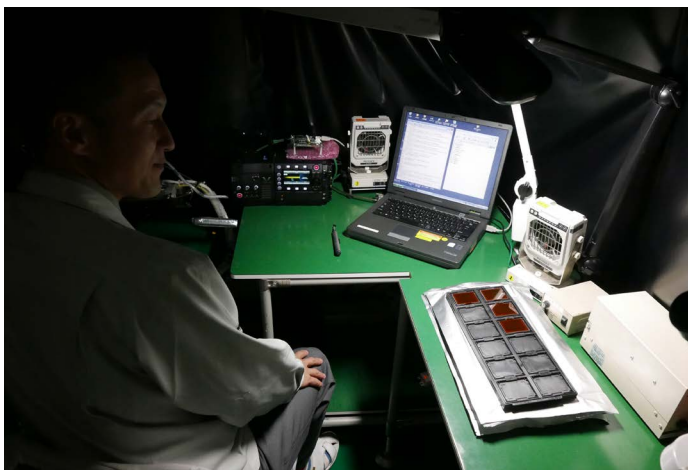
Okayama Castle was completed in 1597 by Ukita Hideie, Daimyo of Bizen and Mimasaka provinces (modern Okayama Prefecture). It was mostly painted black, hence the nickname Crow Castle. In 1600, Hideie surrendered the castle to Tokugawa after an unsuccessful alliance with Toyotomi (the same cast of characters from the Siege of Osaka a few years later).

Okayama Factory Manager Ryouji Hirota welcomed us with an explanation of the main products built there: professional and

consumer camcorders, recorders, switchers, and of course, the new VariCams. Optical technology encompasses everything from raw glass to polishing, coating, assembly, inspection, and alignment. Mechanical and electronic production involves everything from molding and machining to construction and testing.

Mr. Hirota pointed out the extremely high level of skills demonstrated by the employees: 538 Meisters with more than 10 years' experience and a National exam, among 2791 with special production certificates.

With that, the factory tour began. At the conclusion, Mr. Hirota presented beautiful Bizen pottery, fine examples of how the long tradition of exception Japanese craftsmanship has continued from the 8th Century to the present day.

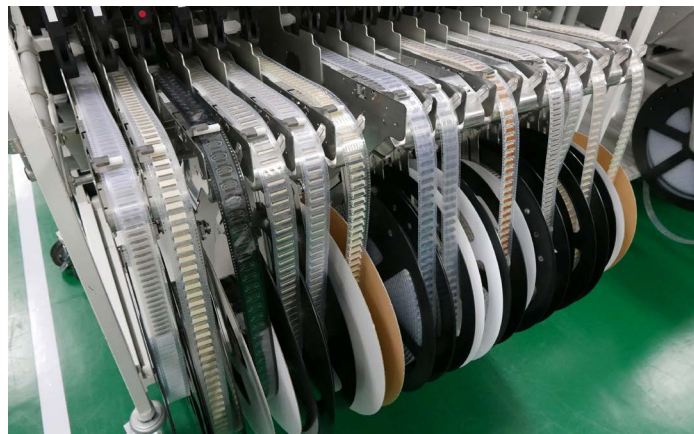
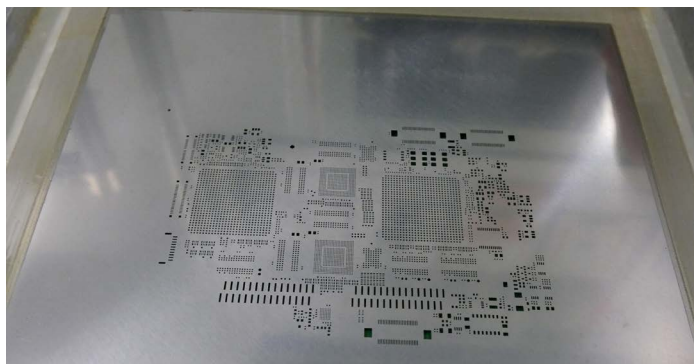
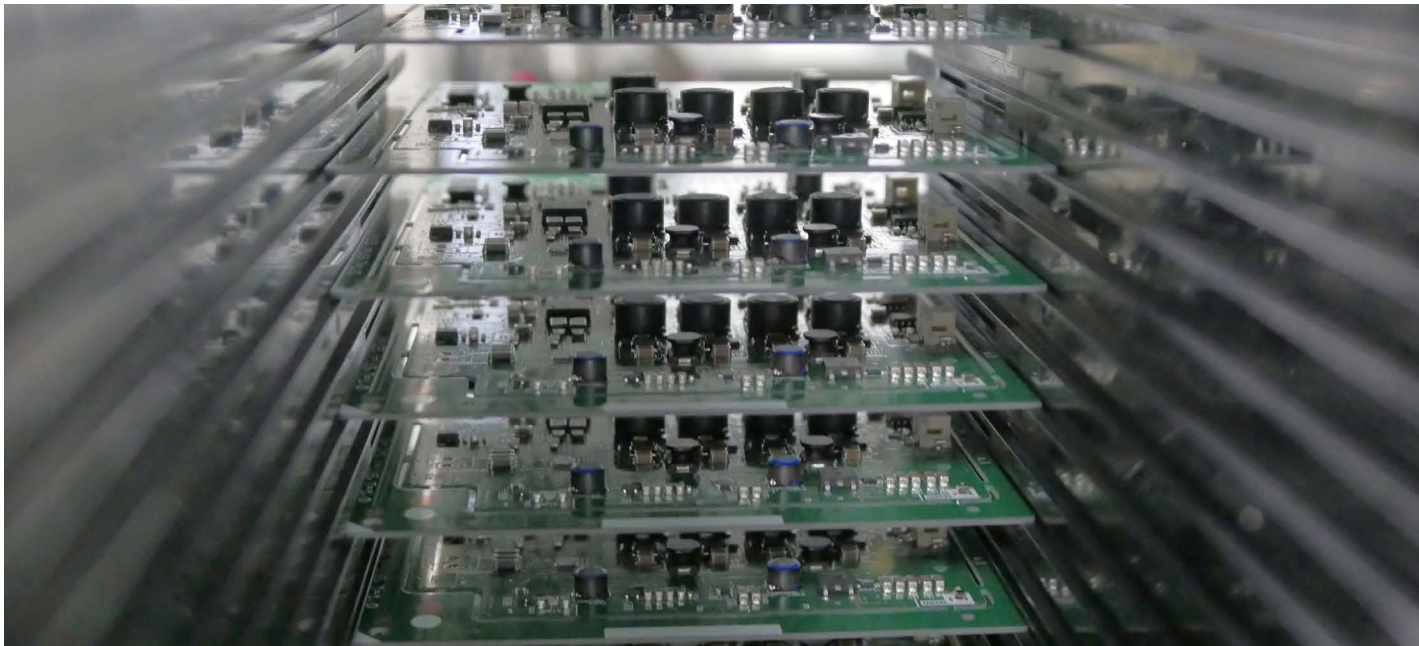


Testing VariCam Super 35mm 4096 x 2160 MOS Sensors.



CNC Machines make bodies, housings, and components.

Printed Circuit Board Manufacturing



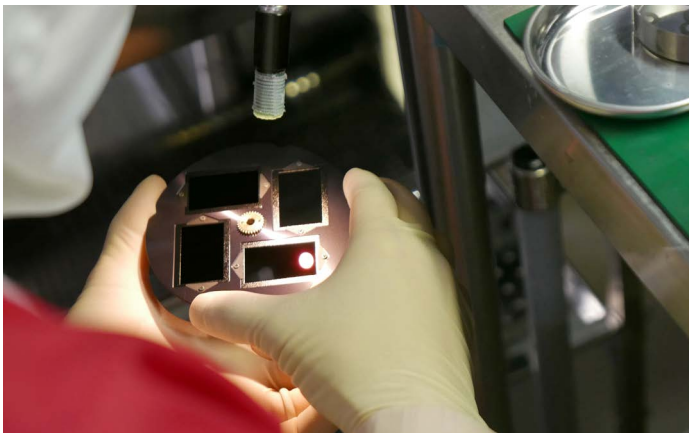
Into the VariCam Cleanroom



Through the air lock and air shower. "Human beings are the dirtiest things that enter a cleanroom," a NASA supervisor once said.



VariCams and other products are assembled in this vast and immaculate cleanroom, well protected from dirt, dust and particles.



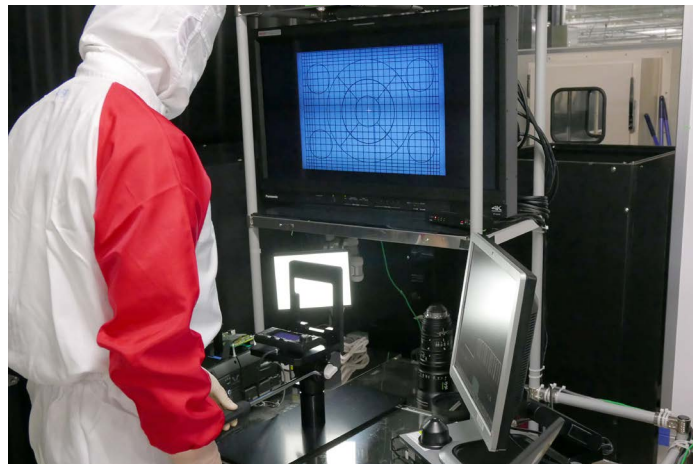
Fitting the in-camera behind-lens IRND filter wheel.



Filter wheel: Clear, IRND 0.6, IRND 1.2, IRND 1.8.



Rear view of lens mount and sensor assembly.



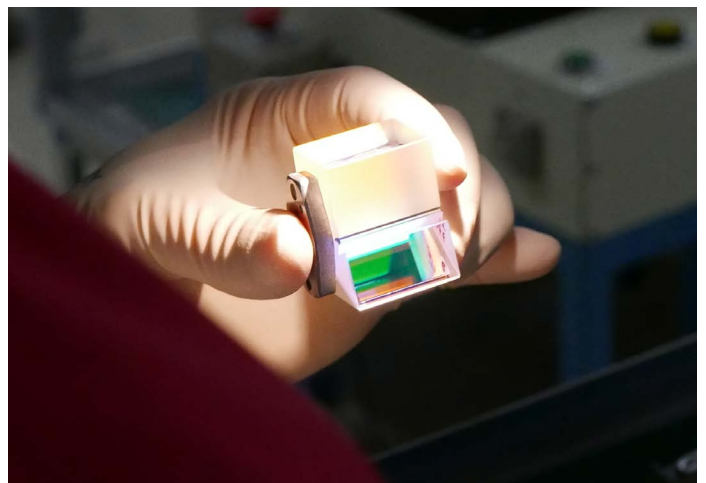
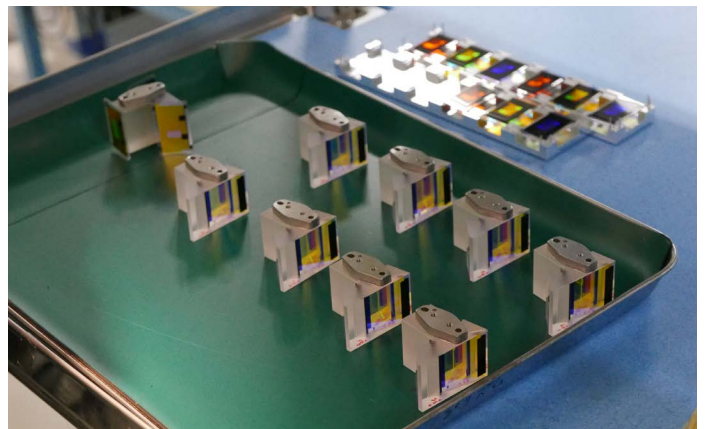
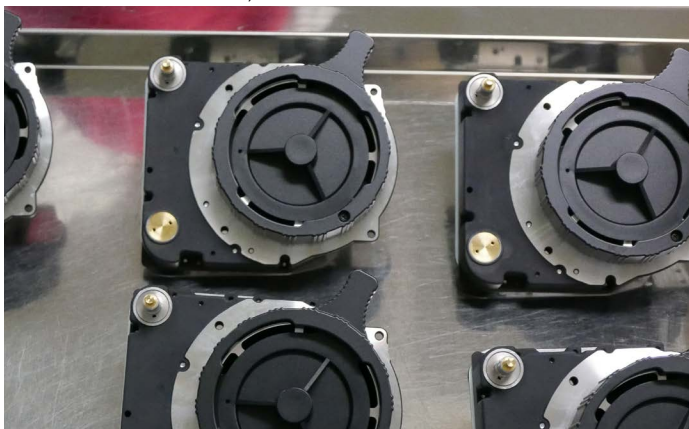
Testing in the cleanroom.

VariCam Lens Mounts

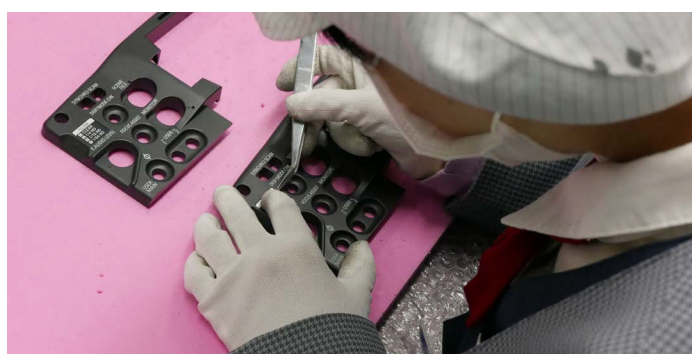


PL Mount for VariCam 35 above.
B4 mount for VariCam HS, below.

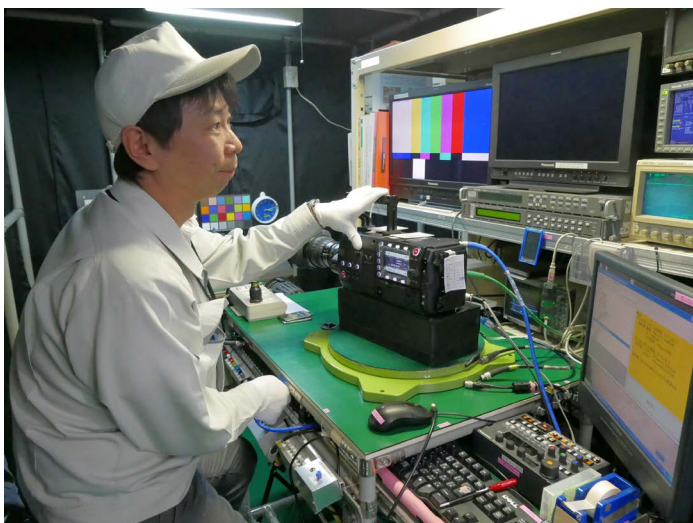
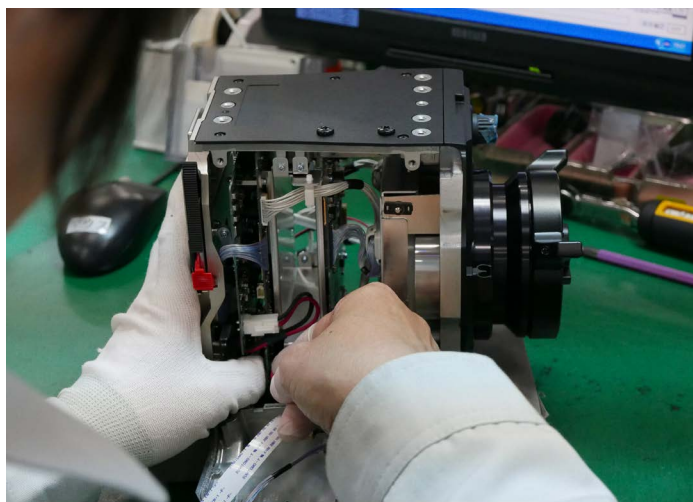
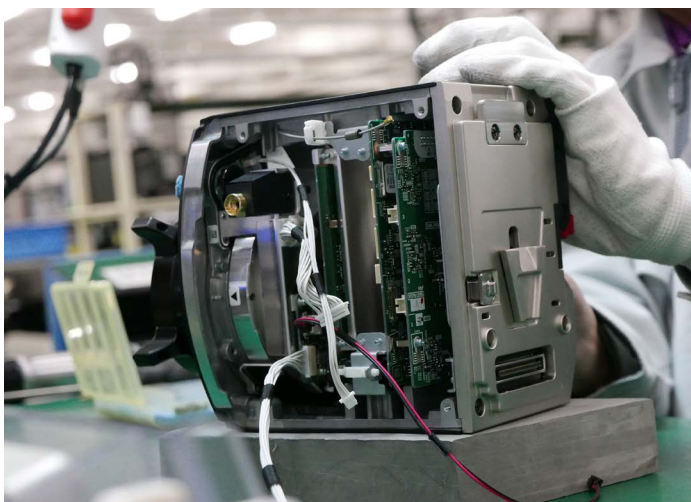
VariCam HS prism assemblies, below.



VariCam Final Assembly



VariCam Final Assembly



VariCam Final Assembly



Panasonic

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