Art, Technique and Technology in Motion Picture Production Worldwide

Sophia Loren Canon C500 Rodrigo Prieto Edoardo Ponti Zoran Veselic on location in Naples

"The Human Voice," Sophia Loren, and Canon C500



Sophia Loren stars in "Le Voce Umane" ("The Human Voice") based on the 1930 play "La Voix Humaine" by Jean Cocteau. The 25-minute short was directed in Rome and Naples by her son, Edoardo Ponti. Rodrigo Prieto, ASC, AMC was the Cinematographer.

In 1948, Roberto Rossellini directed Anna Magnani in a "Una Voce Umana" ("A Human Voice"). It was presented as *Lamore*, a feature-length anthology film of two parts. The other part starred a young Federico Fellini, playing the part of a bum, in "Il Miracolo" ("The Miracle"). It was exhibited by Joseph Burstyn in the US as *Ways of Love*, won the NY Film Critics Award and was promptly censored by the NY State Board of Regents. (See US Supreme Court case Burstyn v. Wilson, also know as the "Miracle Decision," affirming film as a form of artistic expression protected by the First Amendment).

"The Human Voice" is about a woman's break-up and breakdown. Her lover calls on the telephone to announce that he is going to marry another woman.

Locations included the Palazzo Real, the Royal Palace of Naples, residence of the Bourbon Kings, exteriors in Naples, a beach nearby, and a beautiful overlook with Mount Vesuvius in the background. Interiors were done at The Studios (formerly De Paolis) on via Tiburtina in Rome.

The Edoardo Ponti production starring Sophia Loren was shot in July 2013 with Canon C500 cameras recording 2K 12-bit RAW files externally on Codex Onboard S Recorders. The almost hidden secret (something I certainly had forgotten) when comparing Canon C500 and C300 is that the C500 does 4K in 10-bit but its 2K is 12-bit, while the C300 only does HD 8-bit.

With the C500, it also turns out that the dynamic range and color space of 2K 12-bit can sometimes be more compelling than 4K 10-bit. Most of us were so focused on the C500 doing 4K (10-bit) that we overlooked its 2K (12-bit) capability.

Tests by this production led to the decision to shoot in 2K 12-bit.

Camera: Canon C500 recording 2K 12-bit RAW RGB444 onto Codex S.

Lenses: Canon zooms, Cooke S4 primes. They matched well.

Accessories: Cinematography Electronics CineTape, Preston FI+Z for camera assistant, Preston Hand Unit for DIT to control iris, ARRI mattebox, OConnor Head, Fisher 10 dolly, ARRI HMIs, Kino Flo units.

Like *Rashomon*, we're going to hear about the making-of from many viewpoints: Director, Cinematographer, Camera Assistant, Canon Technical Representative, and Canon Senior Fellow.

Edoardo Ponti, Director



Edoardo Ponti directed "The Human Voice," a film adaptation of Jean Cocteau's one-woman play, set in Naples, in 1950, starring his mother, Sophia Loren.

JON FAUER: What gave you the idea to do this?

EDOARDO PONTI: It was a dream of my mother's for 40 years to do this. My mother is Sophia Loren. She saw Anna Magnani in a film version that came out in the 1940s. When she saw it, it was one of the reasons she wanted to become an actress.

It was also a play that I was always personally very drawn to because of the immense challenges to be able to tell a story in one room, with one character speaking to an invisible person—a person we don't see, on the other end of a phone conversation.

You probably grew up with this idea.

Well, I grew up with my mother's intention to do it some day. The reason why it never got made is because it's a 30-minute piece and all efforts to turn this into a full-length motion picture failed, because you cannot really extend the piece without diluting it.

Last year I was fortunate enough to direct a short called "The Nightshift Belongs to the Stars." It won at the Tribeca Film Festival and it was short-listed for the Oscars.

That movie did very well commercially in Italy. So I told my mother that we should do "The Human Voice" as purely possible and do it as a short. We don't add anything, we don't extend the story, we don't pair it with something else. We just do it as is, with the same kind of business model as we did "The Nightshift." And she agreed.

What do you mean by business model?

The way the movie will be released in Italy: not only theatrically but also on Blu-ray and on television, almost at the same time.

If I remember, wasn't "Nightshift" released with a book?

That's right. "The Nightshift Belongs to the Stars" was paired with the short story that Erri De Luca wrote, along with a diary that he did about his experience on the set of the movie. In fact, Erri De Luca is also the co-writer with me of this piece. And he's the one who translated it from French to Neapolitan.

So this is done with a Neapolitan dialect?

It is "The Human Voice" in Neapolitan, yes.

Tell us briefly what the story is about.



It is a very simple story. It's the story of a heartbreak. It's a story of what happens when somebody you love leaves you. And all the consequences.

What's the Canon connection?

Canon has been very close to me and to my work for years. I met the Canon family through Tim Smith, 12 years ago. I used one of the first Canon 5D DSLRs on a short for the W Hotels called "The Way We Stay." That had quite good traction. It was one of the first projects shot on the 5D. About a year and a half later I did "The Nightshift" and again I asked Tim and Canon for help. They very graciously donated the C300s for that shoot. It was interesting for them because of the total impracticality of our shoot and the fact that it was used at the highest altitude of any C300 up to that time. We were actually rock climbing; there were no effects. We were doing everything in-camera with the very practical, lightweight C300. It's funny—as I was doing the movie in the Dolomites, without really thinking of "The Human Voice," I said one day, "You know, I want to do my next movie in one room, with one actor."

As opposed to rock climbing.

I had to learn to climb for the movie. We all spent a month training. And we did really crazy things. There are two shots in the movie that look like helicopter shots. But they were not done with a helicopter because we had no money for that. So we were shot from the roof of a cable car.

Why not inside the cable car?

Because the people running the cable car said that it was dangerous to be inside and open the door. In their "expert" opinion, it was safer for us to be on the roof of the telecabine. Thirty minutes after we finished our shots, that telecabine got struck by lightning.

After that experience, we were talking with Canon about possibilities for other projects. That's when this opportunity of "The Human Voice" was materializing.

Talk a little bit about the visual style, the look.

The challenge of this piece is that you are, for 25 minutes, in one room with one person. That's a big challenge. When you make a "normal" movie you are usually guided by the dynamic between two or more actors in a dialog scene. Shooting this movie with one actor, you realize how much you rely on the energetic contact of more than one person in the scene. That becomes an anchor.

Edoardo Ponti, cont'd

When you don't have that anchor, it's almost like being on a ship without a sail. Anything can happen. That kind of freedom is very dangerous, because it allows you to do almost anything you want.

The biggest thing for me from the very beginning was to have a very strong sense of discipline of "who" the camera was. The camera plays the emotional subtext of this woman. The other important thing was that the movie had to feel very romantic and very beautiful and very sensual. The drama is taken care of by the text. Our job was not to increase the drama visually, but to increase or take the opportunity to make this as beautiful and romantic a movie as possible. After all, this is a love letter to love. The feeling I want the audience to come out with is, regardless of the pain, regardless of the suffering this woman goes through, the pain that was her love for him was worth all the pain.

In order to do that you have to create a very romantic, very beautiful picture within that context of suffering.

How did you meet your cinematographer Rodrigo Prieto?

I met him by chance at the Tribeca Film Festival. We were in the same program. Very simply, we hit it off. One night I told him about this project. I sent him the script. He replied with an e-mail that I'll never forget. It was a Sunday night. He started the email with, "Dear Edoardo, I read the script..." I scrolled immediately to the end, waiting for the rejection. And there was no rejection. He had accepted. And that was incredible.

Talk a little bit about the studio work.

One of the challenges was setting this in one room. All the movies of "The Human Voice" have been set in real time. The conversation is 25 minutes long. The films are 25 minutes. What I did, in order to differentiate, was to have three different looks for the room. The phone call doesn't happen in real time anymore. It happens in the span of maybe 4 to 5 hours. That allowed me to have three different light changes in the room as the telephone call progresses. We start with sunlight streaming through the windows at 5:00 in the afternoon. The next look is when the sun has set, but there's still daylight outside. You have a more desaturated look. And then it's nighttime, with the blue of moonlight and interior practical lights on. Of course, that kind of lighting progression also follows the emotional progression of the phone call.

And what about the locations, and Naples.

The locations in Naples are also an addition to the movie, depicting the flashbacks of her love. We never see the man's face. The most we'll see of him is an unfocused shoulder or the back of his head, [or his hand, in a cameo appearance by the hand of Jon Fauer]. The locations in Naples are happier moments. Naples brings an entirely larger cinematic scope to the piece. It is one of the most beautiful cities in the world. The beauty of the landscape adds a romantic layer as well.

Talk a little bit about editing and the post.

Normally I'm a director who covers himself very thoroughly. I will do many shots just so I have some options, some alternatives. This film is almost shot the way the French filmmakers did in the 60s. I don't always do it because I have a second camera that allows me to cut in between takes that I like.

You're shooting with two cameras?

As much as I can, yes. When my mother has very long monologues of 2 minutes or more, I like to have a second camera to be able to bridge two different takes together. So if I like the beginning of one, and the halfway point of another, I have the ability to do that.

Focusing on the same actress, not cutting away to a reverse.

Absolutely. There are no reverse angles.

What influenced your decision to do this in 2K?

Having seen the tests, I was very impressed by the 2K resolution and the increased dynamic range that 2K provides on the Canon C500, as opposed to 4K. That was very important because this movie lives in shadows and in details. The textures of the movie are key—not only of her face, but also what my mother wears, the sheets on the bed, the wallpaper. With 2K, and given its range, you really see and feel these textures and fabrics. You are not only seeing the room, but you're living it. You're almost wearing it.

Where did the color palette come from?

It all came from extensive research of Neapolitan paintings. Our Production Designer Maurizio Sabatini, and the Set Decorator Maurizio Di Clemente, are among the best in the business here. I always felt that the room should be blue. But it was a combination of looking at Neapolitan paintings and interiors to understand really what the textures, hues, and colors were.

It's interesting, for example, that the wallpaper of the set was applied on the wall exactly the way it was applied in the '40s. You paint the wall a base color, and then you have special paint rollers that have the pattern on them. You dip it in the paint and then you basically roll the pattern on.

The props are very realistic.

They're all vintage. There are all antiques. The advantage here is that it's all available. Even if you had all the money in the world you would still need to shoot it here. Because the prop houses here have all the real pieces from the '40s and '50s. Look at the curtains and the sheers. They are stunning, amazing work in lace.

How did you start in film?

I went to school in Geneva, Switzerland. Then I went to USC Film School. I was always doing films as a kid. More than doing films, I was always telling stories. Always writing, always interested in creating moments. Because films are a series of moments. I was always interested in creating these moments.



Rodrigo Prieto, ASC, AMC



JON FAUER: What influenced your decision to shoot 2K as opposed to 4K?

RODRIGO PRIETO, ASC, AMC: When I first came across the Canon C500, I originally tested it at 4K 10-bit and that's the way I had used this camera up to now. I liked the image on the tests that I did for *The Wolf of Wall Street*. But I wasn't aware that I had the option of gaining a little bit of color depth and latitude by shooting in 2K at 12-bit.

We felt that we didn't need a 4K image for "The Human Voice." In fact, I did some tests in pre-production to compare 4K to 2K and we felt that some detail was a bit too much for what we needed. So 2K was better to start with. Then we also noticed something else on the tests where I overexposed, underexposed, did all sorts of color testing with fruit bowls in frame and skin tones. I realized that the 2K 12-bit color depth gave us a more pleasing skin tones and more latitude than the 4K 10-bit.

I could see more into the shadows in our testing. Now that we've been shooting, I've been in situations with very high contrast, for example, silhouettes of Angela, Sophia's character. Or in a gallery with arches, with the sun streaming in and no other additional lighting. It is very bright compared to the dark interior inside of this gallery. And yet we were able to retain detail in the highlights of the sun and also deep in the shadows. So I think that was a big advantage of shooting with 12-bit as opposed to 10-bit. Having that option was very good for us.



How did you establish the look on this film?

Edoardo and I had several conversations on Skype at first, since we were in different countries. He was talking about an image that



would not be as dramatic as the drama itself. I typically design the cinematography to enhance or accentuate the storyline. In this case, we wanted to go against it a little bit, and create a more romantic feel, if you will, for Angela in her room. Especially in the beginning of the story. I lit it in an unobtrusive way. We chose Cooke lenses, because I felt that they would give us a little bit of that creamy feel, a warmer feel. I also used Tiffen Soft/FX 1 filters. This was after testing many different filters on the Canon C500, including Tiffen Pro-Mist, Black Pro-Mist, Black Diffusion/FX, and Schneider Classic Soft.



The look was a combination of these things along with very soft ambient light and golden sunset light streaming in through the windows. It created a romantic feel for the beginning. When the story becomes sadder, we progress to a sadder look. The sun disappears behind the edge of a building, and dusk settles in. We changed the LUT and changed the lighting to represent a softer, but cooler and little bit darker feel. As the story progresses naturally we went into night with more contrast and deeper shadows. That was basically the arc of "The Human Voice" in terms of the look and the lighting. And then we have the flashbacks; we decided to do them handheld—to give more the feeling of memory, of a presence of serendipity, of things that happened and are fleeting.

By the way, during the scene in the bedroom we mixed the camerawork with dolly shots and static shots. And sometimes handheld as well, depending on the moment, on the script itself. Edoardo had very specific ideas about this. In the middle of the film suddenly you'll have a handheld shot of her, simply because he felt that moment required that energy. And the next shot is not handheld, for example. I think that was interesting.

Rodrigo Prieto, cont'd



Tell me more about your choice of lenses.

For me, the choice of lenses is essential for any film you do. I don't have a preference of lenses. I like to choose what I think are the best optics for a specific film. When I first started planning this project, I thought the Cooke S4 lenses would give us the kind of image we wanted. In fact, the last time I used them was on *Brokeback Mountain*. Lately I have been using Zeiss Master Primes, or even Ultra Prime lenses, or Hawk anamorphics. The Master Primes are a little harder and punchier.



But for this film, I thought that the Cooke's little bit "creamier look" would be better. I did not need that ultra sharpness of the Master Prime. So the Cookes were, I think, a very nice choice. The way they looked with the C500 sensor was really beautiful. We also used the Canon zooms, which I like. That included the Canon Compact zooms that are lightweight and I could use handheld.

We had Canon zooms that would cover a range from 14.5 to 300 mm: 14.5-60, 30-300, and the Compact 15.5-47 and 30-105 mm.

Did the Cooke primes and Canon zooms match?

The Canon zooms were slightly sharper, a bit more contrasty and a little bit harder edge. But they matched and worked very well for certain wide shots where we wanted a little more detail. I think the combination of the Cookes and the Canon zooms were a very good choice.



You're framing for widescreen, 2.39:1. Tell us about that.

From the beginning, Edoardo had that idea of shooting 2.39:1. But when we started scouting the locations and I saw the set I proposed to him to actually shoot in 1.85:1. I felt that lots of places in Naples, with the big arches and the buildings and even our set, had very high ceilings. I was also thinking of the character Angela that Sophia plays, and how to see her body language. The day we were testing, I made a background that looked like the set a little bit. I put up panels with the colors of the set and some of the furniture and the low lamp and things like that to represent our world in terms of color—to test the costumes and all that. Edoardo asked me at that point to show him the difference in the various aspect ratios. We did a comparison live on the monitor through the camera.



He liked the 2.39:1 better. What he saw felt more epic, he said. Also, since we're in one room of an apartment for most of the film, 2.39:1 would give us more a sense of the place. It opens the space up. Although it's a tight space, the wide frame, he felt, wouldn't be as claustrophobic. And then it was really interesting in Naples. It does give this short film a more epic look.

In the studio, how did you get that golden light?

We had ARRI T-12s streaming in through the windows. We rigged them on a truss. For the ambient light outside the windows we had space lights. That created the golden sun, which was simply gelled with ½ CTO. In combination with a lookup table that was slightly warm, these lights gave the sense of late afternoon or sunset. In terms of lighting Sophia, we wanted her to look as Edo-ardo described her. Sophia is a very beautiful woman, no doubt one of the most beautiful women I've ever filmed.

Rodrigo Prieto, cont'd



It was really interesting to figure out how to light her face and keep interest and depth in the background. That was a learning curve for me from the day of the test and even the first couple of days of the shoot. I felt I was still figuring it out and discovering little tricks that helped more and more. I think by the third day I got it. There was one position for the key light, which was a big, soft light. Close to the camera, and close physically to her, it made her glow specifically on the right side of the camera. And bringing it close to her created a drop off, so the background stayed relatively dark. That was kind of the secret to it—having this big soft source close to her. As close as the camera would allow. I usually had it practically next to the lens. So then she would glow and the background would be dark.

I used an Octodome, which is an umbrella light by dedolight with a Chimera style diffusion. It is very lightweight and very quick to move round. It has a 5 foot diameter. It's a 1K light, but it was too bright. So I had to put scrims on it and dimmed it down a little bit. I also used a blanket light and egg crates to control the soft light and keep it off the background if we were close to a wall. It's a 16 bulb 6x6 foot Kino Flo. Sometimes with the blanket light, I diffused it more through full grid cloth and also through a heavy diffusion frost. I used small Kino Flos sometimes around the lens. In fact, for one handheld scene which was a 360 degree shot, we made a light with LEDs and full grid and attached all around the lens. It was kind of a ring light, but square.

Tell us about DITSs, LUTs, and data.

Francesco Luigi Giardiello, our Digital Imaging Technician, worked very closely with me in finding two or three different lookup tables for different moments in the story. In particular, the film begins at sunset. Sunlight is streaming into the set that we built. For that, we had a warmer feel, a little more red. And then the sun disappears as if it were dusk, so we created a cooler and darker lookup table. As the story progresses and her character gets into a more dramatic state, the light becomes cooler and darker at dusk. And then we transition into night. For night we used another LUT—somewhere in between the first and second LUT, that was neutral in color. There was some warmth in the look of it, simply because of the practical lamps on the set.

For the exteriors in Naples, we used a basic neutral lookup table, which is again based on the Efilm lookup table. I do some color timing on set. That has been a very enjoyable process for me, to be able to look at the image on the monitor and color time it. The timing that I do is in points of color and density. I rarely adjust the contrast and the saturation, because I'm used to color timing in the film lab with points. It's very precise this way, and it's not a vague statement like, "Make it warmer, make it cooler." I tell Francesco, in the DIT tent, to give me 1 point of yellow. Just 1 point, and I'll see it. "Give me 1 more, now give me a red." I can be very specific and precise about the color timing. If we want to add contrast or anything else, I can do it. We were even able to do some "power windows" and track with the actors. There's a scene with a pillow where the camera is moving, and of course, the pillow compared to the face was too bright. We made a "power window" and the camera is panning and Francesco is able to track with it. This kind of sophisticated color timing on set was a big plus for me. I enjoyed that very much.

Are you going to do the final grading—where and how?

Yes, Efilm in Los Angeles and with Yvan Lucas. I've done all of my films since *Frida* with him.

You were talking about eyepieces yesterday...



That's the one thing that's frustrating for me with working digitally. The eyepiece doesn't look good—on any digital camera. Since I like to operate, I'm used to judging the lighting through the eyepiece. But I can't with these electronic viewfinders. So I have to run to the DIT station and look at the monitor and then run back to the camera and that's troublesome. When I have an optical viewfinder, I understand it, I understand the lighting. I would love to have a much better digital eyepiece that would be calibrated and would look like the DIT's monitor.

Summarize your decision to shoot 2K vs 4K with this camera.

With the Canon C500, we have the alternative of shooting in 2K or 4K. What I didn't know, and I learned on this project, was that with 2K you get 12-bit image, and with 4K you get a 10-bit image. So the 2K 12-bit iamge was able to see deeper in the shadows and we got a little more detail there. We could see the difference. In terms of color also. Especially on some fruit I put on the set during a test. On a pepper, I could see all the nuances and subtleties of different colors, how the red graded into a little bit of green. I didn't notice a difference in the highlights. But it did allow us is to go deeper with the stop—to retain detail in the highlights and still have the shadows. When I compared the tests of 3 or 4 stops overexposed, I couldn't really tell the difference. But on the low end we could tell the difference. I have been able to stop down and keep detail in the highlights.

Tim Smith, Canon Adviser



Tim Smith is an adviser with Canon's Film and Television Division.

JON FAUER: Good to see you in Rome. Tell me about it.

TIM SMITH: I'm here to make sure everything goes well. It's such a high profile piece, we wanted to support the experience for the the Director, Cinematographer, Crew, and the DIT and IT.

Tell us how you got involved in this production.

Edoardo Ponti was at Sundance with his film "Nightshift," which was done with Canon C300 cameras. We gave him a hand on it last year. During dinner at Sundance, he was talking about trying to get this film made—"The Human Voice." As fate would have it, we were looking for a project that might help us explain how the C500 works in a 2K 12-bit workflow. We had already talked a lot about the Canon C500 as a 4K camera, but we might have overlooked its 2K capabilities. We really think that's an important choice for filmmakers. It's not always about resolution. Sometimes it's about how you create the image. All the stars lined up. Edoardo invited us to be part of the film, and here I am in Rome.

Tell me a little bit about the difference between C500 and C300.

The thing to remember is they both have the same 4K sensors. But there a definite differences. The C300 doesn't record 2K. It will do HD 1920x1080, in 8-bit color space, compressed, at 50 Mbps to the internal CF card. It's a very efficient, very effective compression. But it doesn't output any more than that. It's strictly a 1920x1080 High Def camera.

The C500 has the same capability to record HD 1920x1080 to internal CF cards, but it also has 3G connections on the side that will let you record 2K 10-bit, 2K 12-bit and a 4K 10-bit externally. And by the way, you can do this simultaneously, so you get an immediately editable HD proxy from the CF card, and externally recorded 2K or 4K.

In testing 4K 10-bit and 2K 12-bit, what are the differences?

We had about a week to prep. Rodrigo and Edoardo shot tests of the sets, makeup, and costume designs. They shot in both 4K 10-bit and 2K 12-bit. We were able to screen it at Deluxe to really appreciate the differences. We found the 2K 12-bit mode was able to lift a little more out of the shadows—subtle, but just enough to see the detail. The curve worked really well on skin tones, in terms of being flattering. Certainly 4K has a place in the world, no question. But many people are also thinking about 2K production. Obviously there are so many films out there being done in 2K, winning awards all over the place. We just want people to remember that Canon can do that as well.



How is Canon supporting this production?

We're here mostly with the gear and personal technical support. We shipped three C500 PL cameras [they come with a choice of PL or Canon EF mount]. One was the A-camera, another was the B-camera and one was a backup (which we did not have to use.)

We shipped all of our cinema zooms: the two Compacts (15-47, 30-105 mm) and the two regular Zooms (14.5-60 and 30-300 mm.) Rodrigo used all of them. For primes, he used the Cooke S4/i set. The Cookes matched our zooms very well. That was one of the other things Rodrigo tested. He created variations of the Efilm LUT to show what the final project would look like. One of the initial questions was whether there would have to be separate LUTs for the zooms and a different LUT for the primes. We're using the same LUTs across the board, they're that close.

Talk a little bit about connecting to the Codex Recorders.

We felt that Codex was the way to record for this particular production. The data management system here in Rome and Naples is much more sophisticated compared to what I've seen back in the States. Our DIT, Francesco Luigi Giardiello, is amazing. The Codex Recorders are living and being controlled right at the DIT cart. They're Ethernet connected. We're not mounting them on the camera. I like this idea. We can monitor the recorders right at the DIT tent. One of my jobs on set is to make sure everything goes well. And it seems that when the Codex is mounted on the camera, and I know that there are many good reasons to do that, in order for me to see what's working, I have to look through 10 people. Every time somebody bumps something my heart stops. This way, I can walk into a nice quiet DIT tent and look down, and I see that little blue light and I know everything is recording without errors. The Codexes have been flawless.



Tim Smith, cont'd

Are you recording internally as well?

Yes. And we are recording in many ways. On the DIT cart, the 2K 12-bit output from the camera goes into tthe Codex-S Recorder. Actually there are two Codex-S Recorders—one for each camera. The Codex records to Codex Capture Drives. These go to the Near-Seat Cart, where dailies, clones, backups, and low res versions are made. Whenever the cameras roll, the CF cards inside the C500s are recording as well. Every morning, I load each C500 camera with a CF card. That gives us HD 1920x1080 8-bit proxy files. We have not referred to them yet. They're really just there as insurance or fail-safe backup. We haven't run into any situations where we had to go with it. We're also giving video village a feed where they're using AJA Ki Pros to record and play back HD ProRes 422 for the Director, Script Supervisor, Art, Prop and other departments who need to check performance or continuity. There are 1920x1080 monitors all around the set.

How will it be edited?

Chiara Griziotti, the editor is getting 10-bit (HD) Avid DNxHD .MXF files.

Why not edit from the proxies and the CF cards?

For editing, they prefer the higher quality 10-bit color space. I can load one 32 GB Compact Flash card and get the whole day's work on it at 1920x1080 8-bit HD—as backup. With the 2K 12-bit, we're recording probably 800 GB in an hour, maybe more.

Describe the differences between what's done with the on-set and the near-set cart.

The on-set cart in the tent is where the creative side happens. The near-set card is a traditional DIT station where they're making dupes, backups, and dailes.

Let's talk a little bit about the process. Workflow. Take us along the data path from camera to tent and beyond.

Good title: "From Camera to Tent and Beyond." Could that be our next marketing campaign? That's what we need to explain to the cinema community. How do we go from the camera to the tent and on to the screen? How does the C500 fit into that world?

Canon's recommended ISO for the C500 is 850. We're rating it at ISO 800 instead of 850 because most light meters have an 800 setting, but 850 doesn't exist. There's not a significant difference between 800 and 850.

Color temperature is set at 3200 for interiors and 5600 for exteriors.

We're shooting in Canon Log. 2K 12-bit video comes out through 3G SDI connector(s) at the back of the C500. The cable goes to the DIT on-set cart. Everything is funneled through the on-set DIT tent. The LUTs are applied at the tent. The DIT cart is the hub from which cables go to the video village and monitors. We have a monitor for the script supervisor. We have a monitor for Edoardo. We have monitors back on the set. We're all looking at a colored graded image. Unfortunately, the only person who's not looking at a color graded image is the camera operator—usually Rodrigo, who is not only the DP, but he also operates the A-camera. Graded EVFs are a requested software upgrade.

What Rodrigo or the operator sees in the Cineroid Electronic Viewfinder is Canon Log, and the LUT is not applied in the EVF. It's strictly for framing.

How and where is the LUT applied?

The LUT is being applied at the DIT cart with a Blackmagic Design HDLink using an Efilm LUT, tweaked by Rodrigo according to his three different established looks. Rodrigo has a spectacular eye for this stuff. He'll go to the TV Logic XVM24 monitor on the DIT cart, call for 2 points of blue, and it can make all the difference in the world immediately. It's like a color grading session on set. That's what he's doing before we roll the cameras.

Does he correct from shot to shot?

He's looking at every shot and every lens change very specifically. There are three pre-done looks for the different times of day. But it still is tweaked. Francesco (DIT) sets the iris from the DIT station in the tent. Rodrigo calls the stop with his lightmeter. Once the stop is set, if there are any aperture changes that need to be made during a dolly shot, Francesco uses a Preston wireless Hand Unit. There was an interesting handheld shot where we follow the actress in a complete circle around a couch. She has to hit marks for the lighting. And they were riding the iris throughout.

Do they rehearse these iris changes?

Yes. Because Rodrigo is operating, they'll rehearse the whole move with our stand-in, rehearse the lighting and then if the exposure needs a little bit of an adjustment, Francesco will ride that.

In the tent you're recording to what?

There are two Codex-S recorders, one for each camera. Francesco does the quality control (QC) checking and changes the Capture Drives (SSD) when full.

The camera is outputting a 2K 12-bit RGB RAW video stream through its 3G SDI connector. The Codex wraps that as a DPX file—which can be undone in postproduction to restore linear space RGB video.

By the way, the Codex-S Plus comes pre-loaded with Canon RAW for 4K. But in this case we're not shooting 4K RAW. These signals are 2K RAW in that they only processing applied in the camera is Gain adjustments and Canon Log.

When you shoot in 4K RAW, they'll do the debayering in post. Here, the three 2K 12-bit RGB444 video components have been directly read out from the 4K image sensor with no debayering process at all—a huge advantage of the C500. Unlike 4K files, I can make a copy of the untouched 2K files right from the SSD and open them up on a Mac laptop. This is unheard of in a 4K environment. I fully understand the wonders of 4K but it is an enormous amount more data to deal with.

Will the C500 do anything in 4K non-RAW?

No. 4K from the C500 only comes RAW as an RMF, a RAW media file. That's it. How they wrap it or handle it on the recorder varies.

OK. The Codex Capture Drive is ejected from the Codex. Where does it go next?

The Codex SSD card comes out and is carried over to the near-set cart, where the files are copied to a RAID array of drives, copied, backed up to LTO. They will create sync-sound dailies. They're making the DNxHD files for Avid editing. So, there are a lot of hard drives over here. And from here they will go to postproduction in LA, and soon to a screen near you.

Canon Cinema EOS C500 for 2K and HD

by Larry Thorpe, Senior Fellow, Canon

Canon began its rollout of the Cinema EOS family of cameras in the Fall of 2011. The EOS C300 made its debut in November 2011 as an HD-only camera that captured to in-camera Compact Flash cards. It had a new Super 35mm 4K image sensor to originate that HD.

The EOS C500 followed in 2012 as a digital cine camera having a far broader capability. It delivers a choice of 4K, 2K, or HD uncompressed files for external recording. It also records HD to in-camera Compact Flash cards, like the C300. It is intended for high-end origination of movies or television production.

Finally, the EOS C100 flanks the family, at the lower-budget end—it too is an HD-only camera.

What are the differences between the EOS C500 and the EOS C300 – especially in the context of HD or 2K digital origination?

Imaging Section of EOS C500 and EOS C300

The two cameras share identical Super 35mm 4K CMOS image sensors specially developed by Canon for digital motion imaging. Accordingly, the two cameras share the high sensitivity, wide dynamic range, and high picture sharpness produced by this sensor.

The EOS C500 and C300 cameras employ the classic Bayer Color Filter Array with an alternative strategy. No demosaicing processes whatsoever are employed.

Within the 4K CMOS image sensor there is an innovative mechanism that directly reads out four 2K video components in parallel. They are R, Gr, Gb, and B (each at 1920 x 1080 or, in the case of the C500, they can be selected as 2048 x 1080 depending upon the particular choice of "2K"). Because of the nature of the Bayer pattern, the two green components Gr and Gb are spatially offset with respect to each other. When they are summed to form the final 2K Green component, the traditional first order horizontal and vertical sidebands cancel which eliminate a major source of aliasing. As a consequence the optical low pass filter can be better optimized for an unusually high green MTF.

The chart below shows the similarities of the two cameras' imagers. The pixels are 6.4 μ m on both. In fact, the main difference is the actual image format size. The C500 sensor is 26.2 x 13.8 mm (29.6 mm diag) and the C300's is 24.6 x 13.7 mm (28.2 mm diag).

Sensitometric	Sensitometric Controls in EOS C500 and EOS C300	
Controls	EOS C500	EOS C300
Image Format Size	Super 35mm 26.2 x 13.8 mm (29.6 mm dia.) 6.4um	Super 35mm 24.6 x 13.8 mm (28.2 mm dia.) 6.4um
ND Filters	Clear Electrical 2-stops Control 4-stops 6-stops	• Clear • 2-stops • 4-stops • 6-stops
Video Shutter Modes:		
Shutter Speed Range	1/60 - 1/2000 in 1/4 or 1/3 stops	1/60 - 1/2000 in 1/4 or 1/3 stops
Shutter Angle Settings	360 - 11.25 degrees in 12 steps	360 – 11.25 degrees in 12 steps
Clear Scan Range	59.94 - 250.70 Hz	59.94 – 250.70 Hz
Slow Shutter Speed	1/4, 1/8, 1/15, 1/30	1/4, 1/8, 1/15, 1/30
Master Gain	-6 to +30db in 9 Steps ISO 320 to ISO 20,000	-6 to +30db in 9 Steps ISO 320 to ISO 20,000
Color Temp (Degrees Kelvin)	2000 to 15,000 (100K Intervals)	2000 to 15,000 (100K Intervals)

EOS C500 for high performance 2K or HD Acquisition

Where the C300 is intended as a compact camcorder with HD on-board MPEG-2 recording, the C500 is intended to originate considerably higher performance 2K or HD digital component video which is then captured on a broad choice of external digital recorders.

What is Unique about 2K or HD Video in EOS C500?

- 1. Full and equal bandwidth RGB 4:4:4 video components.
- 2. Selectable as 12-bit or 10-bit RGB components.
- 3. Because no debayering process is required reconstruction errors and associated aliasing artifacts are avoided.
- 4. No compression is applied to these RAW signals.
- 5. The direct readout of the four separate video components: R Gr Gb B as a 4:4:4:4 set of 1920 x 1080 (or 2048 x 1080) is followed by the digital summation of the two green components Gr and Gb – to produce the "Super Green" that has been one of the differentiators of the C300, C100, and C500 cameras. That special Green video has enhanced dynamic range, higher resolution, and virtually zero aliasing.
- 6. RGB 444 at 12-bit is available at all international standard frame rates up to 60P. If desired, this can be switched to 10-bit.
- 7. For higher frame rates than 60P the EOS C500 can be switched from 12-bit RGB 4:4:4 to 10-bit YUV 4:2:2 and this component set can be originated as high as 120 progressive fps (selectable in 2-frame steps from 62 to 120 fps.
- 8. Canon Log is applied to each of the RGB components which are then delivered as 12-bit RAW components for record-ing.
- 9. To restore a linear light representation from Canon-Log in postproduction, conversion can be done to linear space.

External Recording of 2K or HD

The EOS C500 delivers 12-bit RAW RGB 4:4:4 video components to an external recorder via a standardized 3G SDI serial interface. A single 3G SDI connection will support all progressive frame rates up to 29.97P. Two such connections will support RGB components up to 59.94P. Note that the C500 only originates progressive frame rates in contrast to the C300 (the C500 in-camera interlaced formats are derived from the progressive).

Summary

The C500 is different from other large-format single-sensor digital cinematography cameras in that it directly originates from a 4K Bayer CFA Super35mm image sensor three full bandwidth RGB 2K or HD video components that are clean of artifacts. Combined with the exceptional sensitivity of the camera and its 12-bit depth and 12-stop exposure latitude, its 2K capabilities have made it the format of choice on certain productions (compared to using the C500 in 4K at 10-bit).

The summation of the two green components endows the final matriced Luma with high sharpness and freedom from aliasing across the 2K passband. This, in turn, allows any downstream image enhancement to be dispensed with – further contributing to the cleanliness of the imagery and providing a natural sharpness that is especially valuable for portraits and close-ups.

Zoran Veselic, Focus Puller



Zoran Veselic was the First Camera Assistant, Focus Puller on "The Human Voice." He works with Rodrigo steadily, and received the 2012 SOC's Camera Technician Lifetime Achievement Award.

JON FAUER: Tell me about how you set up the camera.

ZORAN VESELIC: During prep I took a good look at the camera and figured out how to make it work for our particular needs. I had seen various rigs at Cine Gear. I got together with Tim Smith at the Canon Center in Hollywood first. Knowing Rodrigo's style, the way he works, and his habits, I had to figure out how to accommodate that. So I stripped the package down to its essentials because most rigs are way too long, too big, and too cumbersome. Rodrigo likes to switch quickly from handheld to studio mode.

You're sort of in handheld mode, even when on a fluid head?

Yes, exactly. I needed to figure that out. I don't want to go through rigging and derigging, changing from studio to handheld mode. That's very time consuming. We have to be really quick; our schedule is very tight here.

Tell us about the accessories that you have mounted on the camera, take us on a tour from the front to the back.

We have to mount all these accessories on the camera. Mattebox in front, rods, lens motors. CineTape in front and the readout on an arm. There's a Preston MDR and at least 2 motors. If you zoom it's three motors. I had to figure out what kind of rods would be optimal, and the length of the rods. And then we chose not to use Codex on the camera, which I head seen at Cine Gear. I thought it made the camera heavier and longer than we wanted on this job. So the Codex went on the DIT cart. That made the whole camera much smaller.

There's another issue. We powered the C500 with its own little onboard battery. But that wouldn't provide enough power for all our accessories. That's why I had a big battery on the top and a box with lots of accessory power connectors.

The idea was more in terms of how to make the C500 have the smallest footprint. We worked to make it smaller, more versatile, and workable in going from handheld to a studio mode. That happens with Rodrigo a lot because that's how he works. Not just on this project but always.

From Camera to Tent and Beyond



FDTimes readers will recall how I go to desperate measures to avoid using the word "Workflow." I am equally bemused by neat Powerpointy workflow diagrams that make all the work look so flowy simple. It never is so neat. And every job is different. There's a spaghetti of cables, caravan of carts, more monitors than a Best Buy showroom. I sketched the flow below on "The Human Voice" set in Rome to show the data path from camera to tent and beyond. Don't try to follow it. The next page is a cleaned-up, graphic, and hopefully legible version.



Moving C500 2K Images from Camera to Tent and Beyond





It all begins with the scene. Sophia Loren in The Human Voice





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"The Human Voice" Workflow



Canon C500 with Codex Onboard S for 2K or 4K

This is a simplified view of the basic functions. Your actual configuration may vary.



Firmware upgrade for the C500 as of Sept 4, 2013

ACESproxy: Part of the ACES standard, live ACESproxy output from the C500 allows the footage to be graded on set using a compatible ACES monitor using ASC CDL. The grade can be used for dailies and editorial. It gives an accurate representation of what will be seen in DI during final finishing. By using ACESproxy, the look established on set is preserved throughout the post process.

DCI-P3+: This color space uses the same white point as DCI-P3, but encompasses a greater range of color.

Cinema Gamut: This is the widest color space available for the C500 (wider than DCI-P3+).

80,000 ISO: The maximum ISO value has been increased up to 80,000 ISO.



Vocas Cinema EOS Rig

Here is one example of one company's ergonomic support system for Cinema EOS cameras: shoulder pad, Codex bracket, mattebox, rods, and hand-rubbed Tuscan walnut wood handgrips (co-developed with Cam-A-Lot). Additional systems are shown elsewhere in this issue.



Power cable for Codex S. The Codex bracket shown here mounts two of the same batteries used in the C500 for power.

For 2K 12-bit 444 RGB, connect one cable between the C500's 3G-SDI output and Codex S.



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