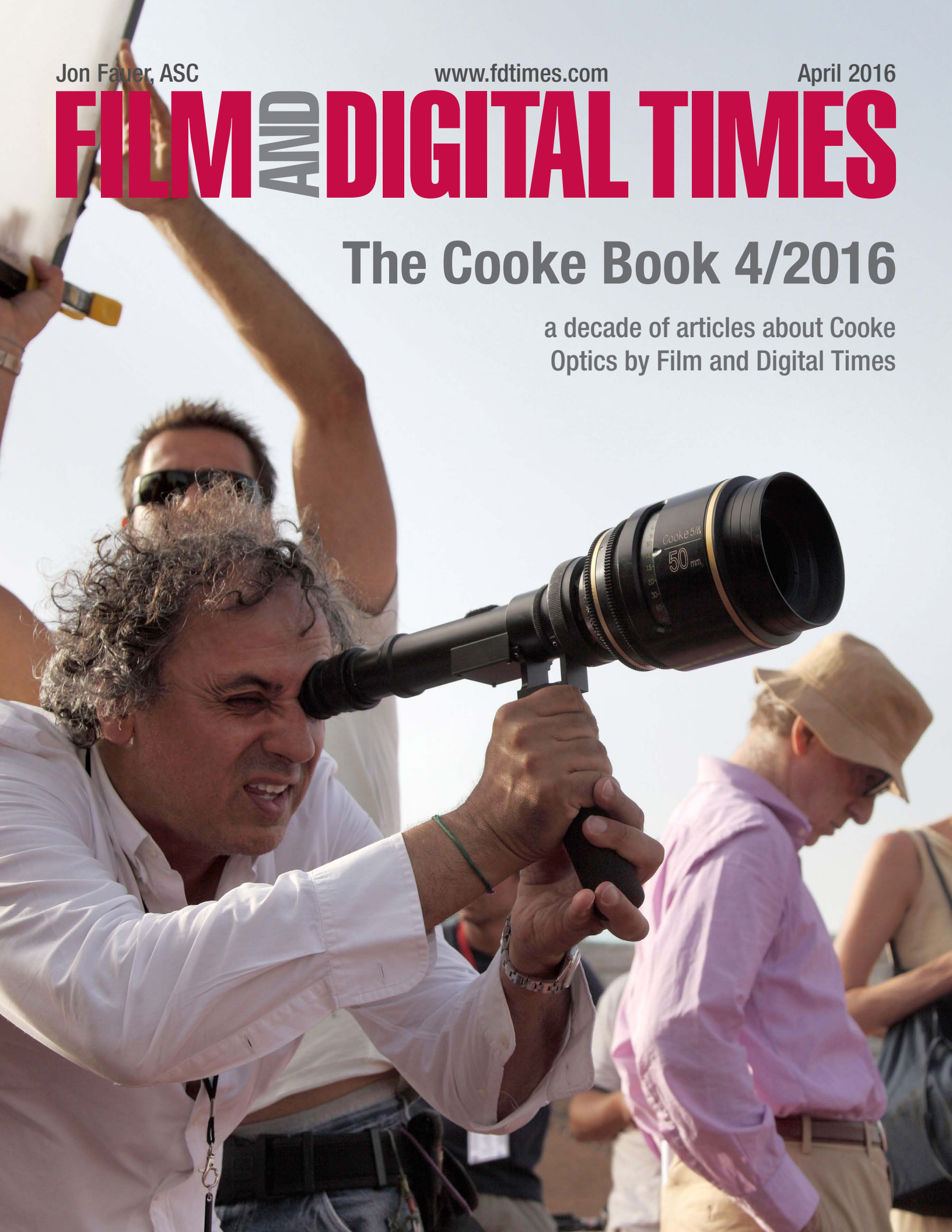
Jon Fauer, ASC www.fdtimes.com April 2016

FILM AND DIGITAL TIMES

The Cooke Book 4/2016

a decade of articles about Cooke Optics by Film and Digital Times



Cooke Optics staff and factory in Leicester, England

This special report is an anthology of Film and Digital Times articles about Cooke Optics. They are presented in chronological order, organized more or less by publication date.

Several errors linger here and there, and will be corrected in the next update. Some specifications and even names of products have changed. Please consider those as blips that occurred during our reporting on a mere ten years in the 131 year history of Cooke Optics.

[Notes and comments made in this April 2016 anthology are in bold type and square brackets.]

35mm Lightweight Zoom - July 2005

Have you been wishing for a lightweight, handheld zoom lens that makes it as easy to shoot documentary style in 35mm as it is in 16mm? Up to now, the choices were Century Optics/Canon 17-35mm T3 conversions, 16mm zooms with doublers or Panavision's LWZ2 17.5-34mm T2.8.

A wide zoom is in the works for your Arriflex 235, 2C, Arricam Lite, Aaton 35-III, Moviecam Compact, or favorite handheld camera. This short/light/fast zoom will be introduced in the next months by Cooke. It covers full silent aperture (31.1mm diagonal, S35) and matches the color and contrast of other lenses in the Cooke line.

Cooke S4 Lightweight Zoom for 35mm

15-40mm T2.0
Approx 6.6 lbs / 3 kg.
Matched to S4 Primes
(www.cookeoptics.com)

16mm Primes

If you're shooting Super16, you can use 35mm format lenses. The math stays the same: a 20mm lens is 20mm in both formats. (20mm in 35 format appears twice as wide as in 16 format.) So, what about really wide angle for 16mm? Cooke and ARRI/Zeiss have new wide primes.

Cooke SK4 Super16 Prime Lenses
9.5mm and 12mm T2.0-T22
Minimum focus: 8" (200mm)
Weight 9.5mm: 4 lbs / 1.85 kg
Weight 12mm: 3.9lbs / 1.8 kg
Front diameter 110mm

35mm Cooke S4i

Cooke has introduced three new S4/i primes lenses: 12mm, and close-focusing 150mm and 180mm. The 150mm focuses to 3' 6" and the 180mm focuses to 4' 3".

This brings the total to 18 S4/i primes:

12mm, 14mm, 16mm, 18mm, 21mm, 25mm, 27mm, 32mm, 35mm, 40mm, 50mm, 65mm, 65mmSF, 75mm, 100mm, 135mm, 150mm, 180mm. All lenses focus close and without breathing.

The "i" in S4/i stands for intelligence, providing all lens data including depth-of-field to LDS-equipped cameras or directly via cable to an S4/i Data Display by Cinematography Electronics.

Iris range is T2 to T22.

Cooke CXX S4i 15-40mm - Jan 2006

The Cooke Short/Fast Zoom 15-40mm T2.0 CXX S4i zoom lens covers Super35.

It is small, light and fast. The zoom barrel is engraved with the same focal lengths as the S4 primes: 15, 18, 21, 25, 27, 32, 35, and 40mm. This one zoom may very well do the job of eight Cooke primes. Color, contrast and geometry are very similar.

There's no breathing when focusing, and mechanics are smooth and light.

So when do you add primes to the order? The primes are individually still lighter and smaller. But if the budget is so bad that the producer is driving his own limo, then you could get away with the wide primes (12, 14) and the long ones (50, 65, 75, 100, 135, 150, 180).

Cooke CXX 15-40mm T2 - T22 Zoom Lens

- Close focus from lens front: 6.94 inches / 169mm
- Length from front of lens to image plane: 11.06 inches / 281mm
- Length from front of lens to lens mount: 9 inches / 229mm
- Minimum marked object distance: 18 inches / 450mm
- Maximum format covered: 30mm image circle (for Super 35 format)
- Diagonal angle of view for 30mm image circle: 90 - 41 degrees
- Iris scales: Both sides, whole and 1/3 stops marked
- Focus scales: both sides, choice of meters or feet
- Zoom scales: both sides
- Angular rotation of zoom scale 130 degrees
- Front diameter 136mm
- Weight 7.9 lbs. / 3.6 Kg

Depth of Field in Cinematography: Why Size Matters - June 2006

by Mark Craig Gerchman and Jon Maxwell

Introduction

Depth of field plays an essential role in all fields of photography. Its use in cinematography differs substantially from still photography. This difference is primarily associated with the dynamic storytelling essence of cinematography, and how the eye examines stationary verses moving images.

With a still photograph, the eye has time to examine an image at a level of detail not possible at 24 frames per second. To support this level of examination, the still photographer may employ a large depth of field so that more detail can be recorded in the image. The opposite is true in cinematography where, by using a shallow depth of field, a viewer's attention is drawn to what the director chooses.

Our eyes see a surprisingly large field of view, yet our ability to see fine detail is restricted to a very small region in the center of the retina, the macula fovea centralis.

Check this out: next time you're in a movie theater, notice how the people in front of you are out of focus when you look at the screen.

Our eyes continuously move so that objects of interest are isolated and their images fall on this sensitive region. A shallow depth of field allows the cinematographer to mimic this isolation and thereby provide a natural look to a scene. By using careful focus pulls, realistic action can be captured in a way that advances the story line, often without the viewer being aware of how this has been achieved.

There are occasions in cinematography when a large depth of field is used. In these instances an unnatural look usually results. Viewers tolerate this unnatural look often because either the eye perceives that the scene it is seeing is intended to be abnormal or because the shot has been held for an extended period so that the viewer can examine it at length like a photograph.

Understanding the factors that influence depth of field for different cinematographic systems becomes critical to their artistic use. In particular, it is the size of the detector (film aperture or electronic chip) that drives the optical speed required to achieve any particular depth of field.

A technical definition of depth of field

Two points define the depth of field for a scene. The near limit point is where the foreground first comes into focus. The scene then stays in focus until the far limit point is reached. The far limit point is where the background just goes out of focus. When specifying these points they are measured from the position of the detector.

In reality, the transition from "in focus" to "out of focus" is a gradual one. However we generally perceive the transition as a threshold. Our perception is based on many different factors (e.g. the image contrast, illumination levels, chromatic content, and individual eye characteristics). Our eyes have, for a given set of conditions, a limit to their visual acuity (angular resolution) that helps to create this threshold. The angular resolution of the standard eye sees this threshold when the out-of-focus blur becomes approximately 1/1200 the diagonal of the overall image size. This is true whether the image is eventually seen in a cinema or on a smaller screen.

We can relate this focus blur-to-image size ratio back to a size on the film or solid-state detector that recorded the original image. The size of this focus blur on the original image is known by the whimsical technical name, the "circle of confusion". Since cine images come in different sizes, they therefore have different circles of confusion. In Super 35mm cinematography the circle of confusion is generally taken to have a diameter of 0.025 mm (0.001 inch). In Super 16mm cinematography this diameter becomes 0.0125 mm (0.0005 inch). And for 2/3-inch HD solid-state cameras it is smaller still at approximately 0.009 mm (0.0004 inch). We mathematically compute the depth of field by taking this circle of confusion and projecting it back through the camera lens and seeing where the limits of focus fall.

Influences on the depth of field

This projection back through the camera lens involves a subtle mathematical relationship. An exact calculation of depth of field involves the following:

- the circle of confusion
- the focal length of the lens
- the distance the lens is set to focus
- the optical speed (f#) of the lens
- the front nodal position of the lens, and:
- the entrance pupil position of the lens.

In general, the equations that have been published to allow the cinematographer to calculate depth of field can only yield approximate results, because nodal positions and entrance pupil locations are seldom known. Rigorous calculations, which are published in tabular form by most lens manufacturers, take into account all of the above influences.

Depth of Field in Cinematography: Why Size Matters

Whatever the source of depth of field information, we should apply it with care and experience, since the eye's criteria of focus is never absolute and the artistic value of the final results is the only true arbiter.

As we have discussed, different cinematographic systems have different sized circles of confusion. The cinematographer's choice of camera system and its detector's size will therefore influence depth of field. The choice of origination image size also plays a part in another of these influences: the selection of the focal length of the lens. To obtain the same angular field of view, the ratio of the focal length of the lens to image diagonal must be constant between systems. For example, since the image on Super 16mm film is approximately half the diagonal of the image on Super 35mm film, then the focal length of the lens required to film the scene in Super 16mm must be half that of its Super 35mm equivalent. To understand how the influence of detector size effects depth of field, it is helpful to use the concept of the hyperfocal setting.

Hyperfocal Setting

When a lens is used at its hyperfocal setting, which is a focusing distance, the far limit of the depth of field is at infinity. In this situation, everything in the scene from infinity to approximately half the hyperfocal setting distance will appear in focus. The hyperfocal setting for a lens is calculated from a closely related quantity: the hyperfocal distance. While the hyperfocal setting is measured to the detector, the hyperfocal distance is measured to the front focal point of the lens. This difference is not generally appreciated.

The hyperfocal distance is given by the formula,

hyperfocal distance = $(\text{focal length})^2$ / (circle of confusion diameter x f#)

Here f# is the aperture setting (or "speed") of the lens. We can use this quantity to see what influence different detector sizes have on depth of field.

The influence of detector size on depth of field

To demonstrate this influence let's shoot identical scenes with two very different systems: Super 35mm film and 2/3-inch digital HD. In this example consider that we are using a Super 35mm lens with a focal length of 40mm. If we consider a typical Super 35mm lens to have a maximum aperture of f/1.9, then the hyperfocal distance for this lens would be just under 34 meters (110 feet).

Because the detector diagonals between 2/3-inch HD and Super 35mm are in the ratio of 11 mm to 30 mm the equivalent 2/3-inch HD lens required to shoot this scene would need a focal length of approximately 14.7 mm. To get the same hyperfocal distance as the Super 35mm lens in this situation we calculate (from the equation above) that the HD lens would require an optical speed of f/0.7. While this speed is not impossible, it does turn out to be economically impractical. However, in 2/3-inch HD camera systems there is a prismatic beam splitter that limits the optical speed of the system to a maximum (fastest) aperture of f/1.4. So while the 2/3-inch HD lens is faster than the equivalent Super 35mm lens it cannot produce as shallow a depth of field.

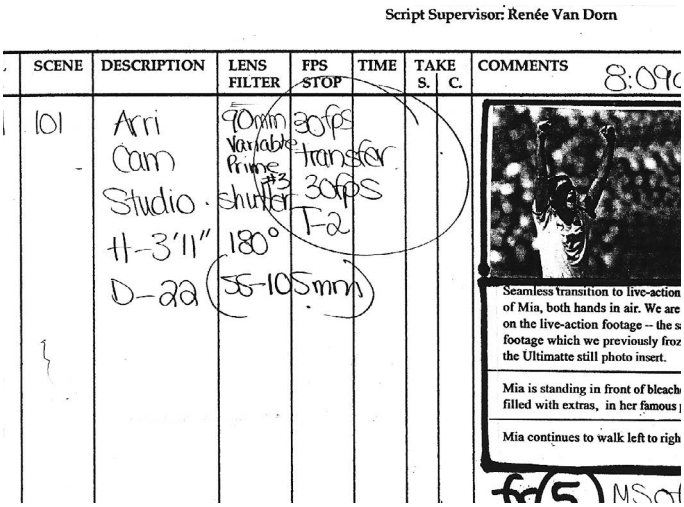
The lack of depth of field when using a 2/3-inch HD system has nothing to do with the digital nature of the detector. In a digital camera where the detector size is the same as a Super 35mm film camera the depth of field is the same. Nor does depth of field have anything to do with the higher resolution required of 2/3-inch HD lenses. This resolution is needed because the detector size is so much smaller than the Super 35mm film. The final image in both cases, however big the screen, should contain the same amount of detail.

Understanding these influences allows cinematographers and directors to use depth of field more creatively in their craft.

Mark Craig Gerchman and Jon Maxwell are optical designers at Cooke Optics Limited in the UK.

The large format stills showing examples of depth of field are by Clive Russ. (www.cliveruss.com)

Cooke /i dataLink - Mar 2007



Script Supervisor: Renée Van Dorn

SCENE	DESCRIPTION	LENS FILTER	FPS STOP	TIME	TAKE S.	TAKE C.	COMMENTS
101	Arri Cam Studio 11-3'11" D-22	90mm Variable Prime #3 180° (55-105mm)	30fps Transfer 30fps T-2				8:09

Above, script notes with lens information: 90mm, T2, focus at 22'.
Below, frame by frame /i dataLink information: 30mm, T8.098, focus at 0.972

SHOOT selecti

	A	B	C	D	E	F	G	H	I	J	K
1	Camera Name	--------									
2	Camera Serial	65535									
3	Lens Name	COOKE OPTICS LTD									
4	Lens Serial Numb	800076									
5	Reel Number	255									
6											
7		Time Stamp									
8	Packet Number	Valid	Frame Cour	Date	Time	Time CLK	Focus Actua	Focus Near	Fous Far	Zoom Actua	Iris Actual
9	1	1	7	11.8.2006	13:34:42	28	0.972	0.611	2.838	30	8.098
10	1	1	7	11.8.2006	13:34:42	29	0.972	0.611	2.838	30	8.098
11	1	1	7	11.8.2006	13:34:42	30	0.972	0.611	2.838	30	8.098
12	1	1	7	11.8.2006	13:34:42	31	0.972	0.611	2.838	30	8.098
13	1	1	8	11.8.2006	13:34:42	32	0.972	0.611	2.838	30	8.098
14	1	1	8	11.8.2006	13:34:42	33	0.972	0.611	2.838	30	8.098
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17	1	1	9	11.8.2006	13:34:42	36	0.972	0.611	2.838	30	8.098
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23	1	1	10	11.8.2006	13:34:42	42	0.972	0.611	2.838	30	8.098
24	1	1	10	11.8.2006	13:34:42	43	0.972	0.611	2.838	30	8.098
25	1	1	11	11.8.2006	13:34:42	44	0.972	0.611	2.838	30	8.098
26	1	1	11	11.8.2006	13:34:42	45	0.972	0.611	2.838	30	8.098
27	1	1	11	11.8.2006	13:34:42	46	0.972	0.611	2.838	30	8.098
28	1	1	11	11.8.2006	13:34:42	47	0.972	0.611	2.838	30	8.098
29	1	1	12	11.8.2006	13:34:42	48	0.972	0.611	2.838	30	8.098
30	1	1	12	11.8.2006	13:34:42	49	0.972	0.611	2.838	30	8.098
31	1	1	12	11.8.2006	13:34:42	50	0.972	0.611	2.838	30	8.098
32	1	1	12	11.8.2006	13:34:42	51	0.972	0.611	2.838	30	8.098

Sensors inside /i lenses provide continual readouts of lens data

Salome the Script Supervisor was the bane of our existence. Just when we were ready to call action, she'd bring everything to a halt with a shrill cry, "Millimeter?" no matter how complex the shot, how many hours had gone into lighting, how delicate the scene or difficult the acting. No matter that our camera assistant had planned on giving her the information after the shot was over, not wanting to distract the talent. If Salome didn't have her millimeters, she wouldn't let us do the shot.

Admittedly, jobs often begin with great expectations of a meticulous log book quickly forgotten when paperwork intrudes on the next setup. The log usually lists every setup's vital 5F statistics: focal length, focus distance, f-stop, frame rate, and filters. This information is important for matching angles, later reference, effects work and dreaded reshoots. But, after a few days, very often the log book is abandoned and the information goes on camera reports which, by some immutable law of nature, rarely wind up in the editing room to which they were promised. Zoom shots are difficult to log: where were we on the zoom barrel at the beginning, middle and end? A few more days into production, and the clever camera assistant has somehow inveigled the script supervisor into including all the camera notes onto the script notes.

Manually writing down lens settings for each and every shot has been compared to monks copying manuscripts in the computer age. There is a better way. The Cooke /i dataLink is a small box, made for Cooke by cmotion.

It mounts (Velcro) to any camera to record the focus, zoom and iris settings of each take. The information is recorded onto a Secure Digital (SD) card, just like the one in your Blackberry 8800 or Nikon D80. What makes it Metadata is that the /i dataLink box can record lens and camera statistics for every frame of film at any frame rate up to 100 fps. The metadata is handed off to post production on the SD card, or downloaded to computer and emailed. In post, the stored data is imported to the editing or effects program and is immediately ready to use without any manual manipulation—a huge cost savings in time and guess work.

Camera Tracking 101

When doing effects work, one of the things you'll encounter is to seamlessly combine a live action background shot with a computer-generated foreground element. Say you're doing a car commercial. The storyboard calls for a car driving, on two wheels only, along the edge of a ridiculously high parapet. You shoot a live-action dolly move along the edge, on a 14mm lens. Standing in for the car is a moveable rig with yellow tennis balls to provide "tracking points." The rig will be replaced by the effects wizards with a computer generated car, shall we say, a flashy Smart Car. How do they do this? And what if they don't know we shot the live action scene on a 14mm lens because the camera reports blew away while the crew was at craft service on the 110th floor? What if the effects wizards generate a CGI Smart Car that looks like it was shot on a 150mm lens? Well, compositing a telephoto shot onto a wide angle shot would certainly look weird and wrong. Here's some technology that can help out.

By Michael Lancaster, Product Director, The Pixel Farm (farming pixels, herding data: www.thepixelfarm.co.uk)

Camera Match Moving, or tracking, is the process of automatically calculating both the camera measurements and the camera motion by analysis of the sequence. This is achieved by placing a number of tracking points, or markers, within a frame and mapping their position from one frame to the next. It is repeated until either the tracking marker position on the sequence can no longer be identified or you get to the end of the shot. In the case of loosing a tracking point the software adds another point elsewhere and carries on.

The next stage is to "solve" these points, which means to convert them from 2D into points in 3D space. This is done by working out the relative movement of points to one another using the principle of parallax. Once calibrated, the tracked points become a 3D point "cloud" that can be exported along with the animated camera data to a 3D animation application.

Within your 3D system you use the imported camera data to view your computer graphics or animation and use the point cloud as a guide to the placing of objects within the sequence. Once rendered and exported, your computer graphics can then be composited back together with the original footage. As all the camera's movement and optical properties have been matched from the original footage, the new elements should exactly match. This process, often called Match Moving, is the basis for many visual effects in feature films and television.

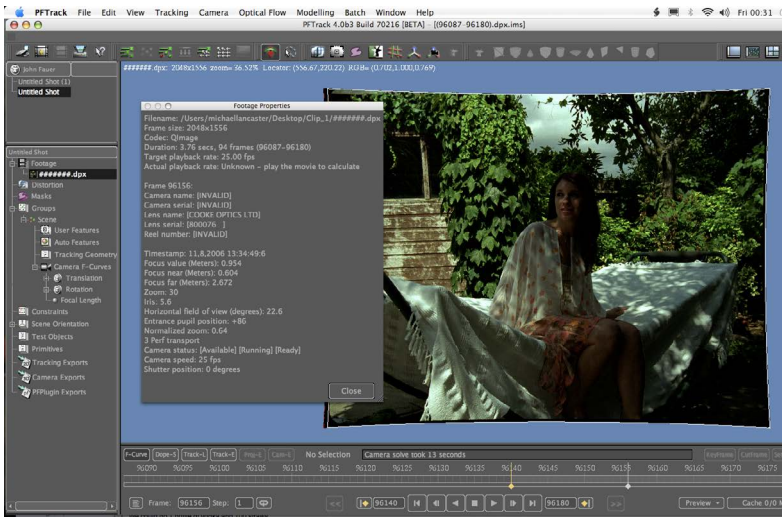
As you can imagine, this process is highly complex and requires many variables about the camera to be calculated: focal length, f-stop, lens distortion and film gate or imager information. Any means to aid this process or to make it more accurate will speed up these calculations and provide better end results.

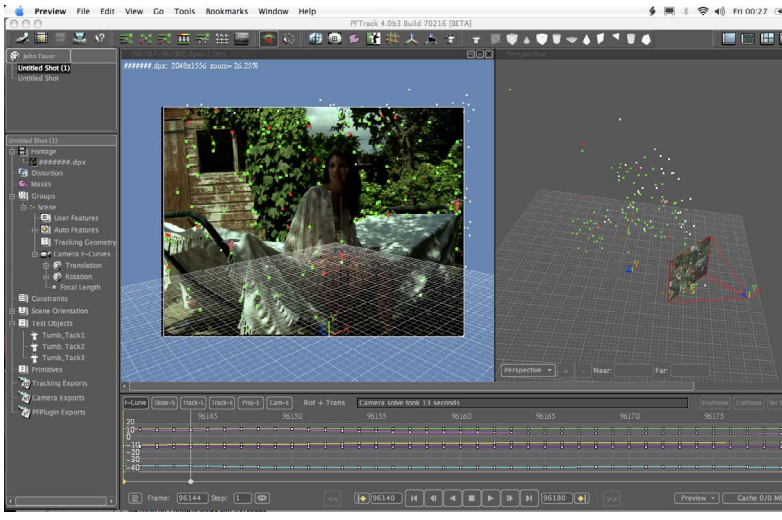
Since its introduction, PFTrack has become one of the tracking tools of choice for high-end facilities due to its ease of use and its powerful toolset. It allows camera data to be entered, when known, to aid in the process. The problem is that this data can be wrong either because the camera data sheet was incomplete or just incorrect. Luckily the software can work without this information but at the cost of speed and pinpoint accuracy.

The release of PFTrack 4.0 takes things to the next level with the ability to import data collected during shooting using the Cooke Optics /i dataLink system. This provides the software with extremely accurate lens data on a per-frame basis and sidesteps the need to perform many of the internal calculations. Compensation can be made for lens optical characteristics by using the lens serial number and a database of distortion parameters. This is a holy grail: any distortions, no matter how small, can be allowed for in the final results.

The use of this data provides more accurate results in faster time, and removes yet another element of uncertainty from the set-to-post information transfer process. Its use will allow more complex shots to be completed and will also allow new types of shots. For example, it will soon be possible for a hand held camera move to be analysed and then used to program a motion control rig giving much more fluid and natural looking results than a standard computer-controlled move.

Not only that, but /i dataLink can help in motion control . You can shoot a complicated shot in real time, and then immediately hand the recorded data over to the motion control rig.





Jan 2007
FILM AND DIGITAL TIMES

Cooke Tour

by Jon Fauer,

David Nettleton, Cooke Chief Engineer, demonstrates the robustness of a Cooke S4/i. Although the lens survived, you should not attempt. May void warranty.

We're on the outskirts of Leicester, two hours north of London. The Cooke factory has relocated from the Dickensian industrial revolutionary ancestral home I remembered to this modern facility on the outskirts of town.

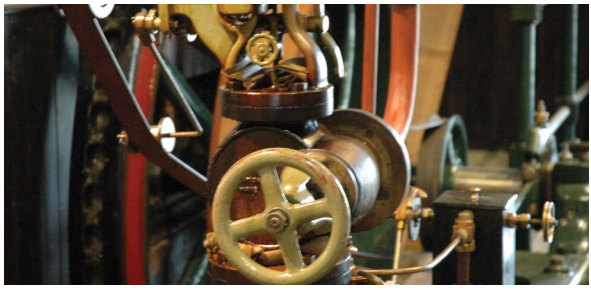
Inside the factory, there are film posters everywhere. Every square inch of available wall space is festooned with posters of major motion pictures: *Da Vinci Code, Harry Potter—Goblet of Fire, Prisoner of Azkeban, Kingdom of Heaven, Cinderella Man, Casino Royale, Brokeback Mountain, Munich, The Interpreter, Jarhead, Apocalypse Now, Chocolat,* and more.

It is clear the people who work here love movies—especially ones supplied with Cooke lenses. Pat Webb *(above)* saw 250 films this year in movie theaters. He has worked at Cooke for 42 years, and is the materials controller, tracking the arrival and deployment of countless parts.

Lens design is all about math. It's about funneling what you see down a little hole in your camera. Stuffing a 24 mile swath of Moroccan desert in *Babel* onto a 24mm x 18mm piece of plastic requires a different set of calculations than the 10' wide stacked telephoto astronaut hero shot in the *Right Stuff.* A flat piece of glass will pass light (the image) straight through. But, look through a raindrop on your window and see how the curved surface does interesting things.

It became clear after many centuries of peering through raindrops and other curved surfaces that the way light behaved could be described in mathematical formulas.

Cut to Leicester, England. In 1885, brothers William and Thomas Smithies Taylor moved to Leicester to set up a business as "Manufacturers of Optical Instruments" in Slate Street.



Cooke, cont'd

This was the Silicon Valley of the Industrial Revolution, where an abundance of coal to power the steam engines that ran the mills fueled the development of railroads, the dimpled golf ball, a knitting industry that supplied most of the world's socks and, of course, camera lenses.

The Taylor brothers were mechanical geniuses, having opened their first workshop in North London while still at school. They built their own lathe and concentrated on optical engineering.

In 1881, the Taylors built magic lanterns from brass and mahogany, with lenses ground by hand from solid glass blocks. It was actually two projectors, one above the other, illuminated by separate "limelight" burners. They were used alternately on the same screen to provide dissolves and transitions between slides—something Powerpoint still does.

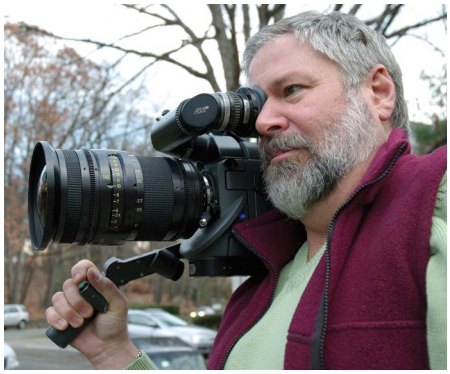
An original Taylor magic lantern is on display at the Snibston Technology museum, not far from Leicester.

In 1887 William Hobson was taken on as sales manager, and the firm was named Taylor, Taylor & Hobson. The first Cooke lens was made in 1894, after T. Cooke & Sons of York (makers of telescopes) offered Taylor, Taylor & Hobson the manufacturing rights to a Triplett (3-section) photographic lens that solved the problem of edge softness.

Speed-ramp through the next 100 years: almost all feature films made in Hollywood during the first half of the 20th century were shot using Cooke lenses. Major innovations included the 1921 Speed Pancros (f2.0), and the first production zoom lens (circa 1936).

The Taylor brothers died in 1937 and 1938—the company was renamed Taylor-Hobson. In 1945, it became a subsidiary of the Rank Organization, with the familiar gong logo. Its founder, J. Arthur Rank (later Lord) was the British Mogul and Methodist who began by producing religious films and wound up controlling half the theatres in England and most of the production studios.

But, as Rank's fortunes dwindled (familiar story—mergers, diversification into real estate and the Hard Rock Cafe) Cooke lenses became a neglected division of the company. By the 1990s, there were reports that "the place was so run down that seagull feathers would float through holes in the roof."



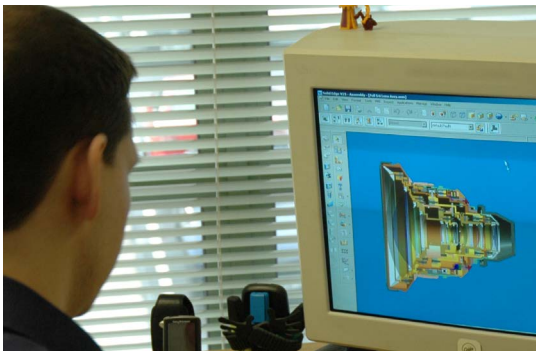
Enter Les Zellan. The Wall Street Journal wrote, "In 1998 an American wearing jeans, a bright yellow shirt and a 20-year-old red tie, with a beard and a short business plan, rescued the company."

Lens making for motion picture cameras is as much an art as a science. What makes it especially interesting is the need to focus smoothly on actors and things that move during the shot, and the exquisite tolerances needed to prevent any differences between actual eye focus and focus marks on the lens barrel.

Lenses begin as clear, bubble-free, scientific glass. This comes from Schott in Germany and Ohara in Japan. Over 70 different types of glass are used, with different refractive and chemical compositions. To save time, stress on the glass and waste, they are supplied already molded close to the required shape, with about 1mm excess. The outer surfaces are rough; you can't see through this glass. Only when ground and polished with very fine abrasive (cerium oxide) will it appear clear—just as toothpaste makes scratched Plexiglas look clear again.

Grinding with modern CNC (Computer Numerically Controlled) machines, and also on the same machines used 90 years ago, puts precise curves in the glass.

Cooke's Tour: The Adventure Continues



History Review

We've heard about the history of Cooke, founded in 1886 by the Taylor brothers, "Manufacturers of Optical Instruments" and inventors of the dimpled golf ball.

Located in a modern building on the outskirts of Leicester, England, the Cooke factory today employs over 65 highly skilled craftsmen and women. While other optical companies around the world make lenses for many purposes, Cooke still specializes in lenses for the motion picture industry.

So, let's get started and build some lenses. It only takes about 40 hours from start to finish to assemble a Cooke S4/i.

How to Build a Lens

Grinding globs of glass into fine optical-mechanical instruments is a highly guarded, highly skilled industry matched in secrecy only by that other high-end grinding business: diamonds.

This Cooke's tour was the first time a mortal cinematographer was allowed unrestricted access with a camera into the inner sanctum and holy of holies of lens creation.

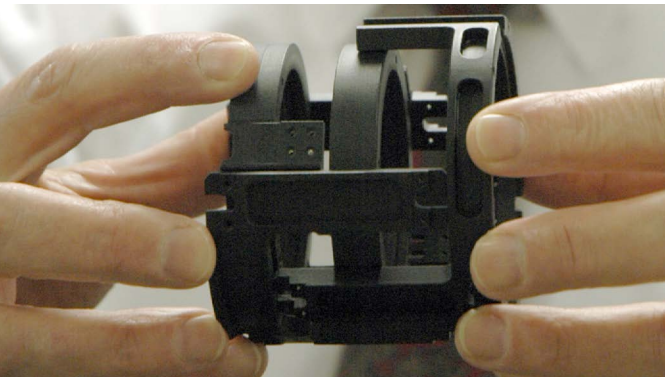
Lens design is mostly math, physics and formulas. Venerable Taylor Hobsons and Speed Panchros began as long lines of numbers pencilled into voluminous notebooks, still on display and often referred to in the Cooke design offices. Now they use computers. Paul Nettleton uses 3D CAD, middle left.

In a switch on stereotypical generational behavior, it's the dad, David Nettleton who mischievously bounces S4/i lenses off the floor to prove lens resilience. As we've said before, although the lens survived, you should not attempt. May void warranty.

Cooke, cont'd

"The safe-house is north," says the driver. We have driven through fog and rain to a row house on the outskirts of Leicester. The driver knocks three times. It could have been a scene from John le Carré. No, more J. K. Rowling. The street looked like Privet Drive in Little Whinging, with wizards lurking in the shadows, streetlights flickering.

We're in Mountsorrel, a village on the outskirts of Leicester, where wizards and designers stay when working at the Cooke factory just down the road. Lots of late night arrivals and departures have inspired imaginative neighbors weaned on Smiley and 007 to call it "the Safe-House." Its real name is "The Gatehouse." Guy Genin is the "G" of ZGC, Inc. Guy is on one of his frequent trips to the factory. Guy services most of the Cooke lenses in the US at ZGC in New Jersey, and was my gracious factory, tour and restaurant guide for three days.



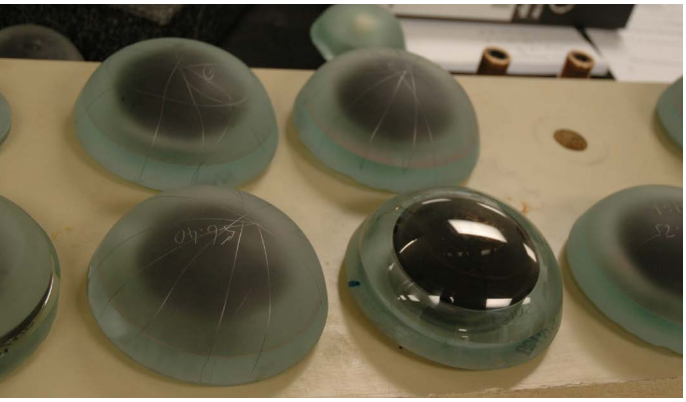
Lens theory 101 in one sentence: glass elements are moved toward or away from the image plane to achieve focus.

Lenses are made of groups of polished glass disks—called elements. Each element is ground according to exact specifications: for curvature, spacing, arrangement, thickness and diameter.

To move the glass, metal carriers hold the elements and move them with great precision, smoothly and in exact alignment with the focus scales engraved on the outer barrel. Oh yes, and they must endure the abuse of life in production, extremes in temperature, being dropped, left out in the rain, and all kinds of other horrors that make any designer cringe.

The mechanical part of the optical-mechanical-electronic trinity is an array of precision machined barrels that move the internal elements in exact harmony with scribed focus and aperture marks on the outside.

Recently, with the introduction of smart lenses, electronics have been added to the mix in the form of /i "Intelligent" Technology. Sensors provide continuous updates on distance, f-stop, and focal length.



A famous British industrialist said, "If you can't measure it, you can't make it." So, there is as much measuring as grinding, polishing and fitting at Cooke. Oh yes, and coating. All glass surfaces reflect 4% of the light passing through. If your lens had 22 elements, with 44 surfaces, not much light would get through.

Cooke lens coatings reduce refections to .1%. A brew of silicon and titanium, hardened with magnesium fluoride coats each element. It is 1 nanometer thick, which is 1 millionth of a millimeter. Your whiskers will grow longer than that in 1 second after the swipe of your razor.

Cooke, cont'd

The glass is selected and precisely pre-edged to an exact diameter on a CNC machine. This diameter will be held through the process until final edging is done.

The Computer Numerically Controlled machine grinds both sides, establishes the optical center, curves and thickness. CNC machines are also used to make aspheric lens elements, which we'll see a little later.

With a CNC machine, you can grind one element at a time in about 15 minutes. It's been compared to a microwave that can heat up your dinner one plate at a time.

When they invite more cinematographers to dinner and need more dinner plates, they use D-type polishers, designed and built in 1913 and still capable of precisely polishing 120 elements on 6 spindles in 8 hours.

Here's Dave Stevens, managing director (left), to whom we are most grateful for his encyclopedic knowledge of facts and figures, history and science, and above all, nanometers per second tonsorial growth rates.

The glass elements are held onto the base of the polisher with a sticky, black pitch. The top "cone" randomly orbits the glass, slowly polishing with a serium oxide sludge.

Polish is periodically added with a brush.

There are numerous shapes on hand for polishing the elements that go into Cooke lenses. Here we see many elements being worked on at the same time.

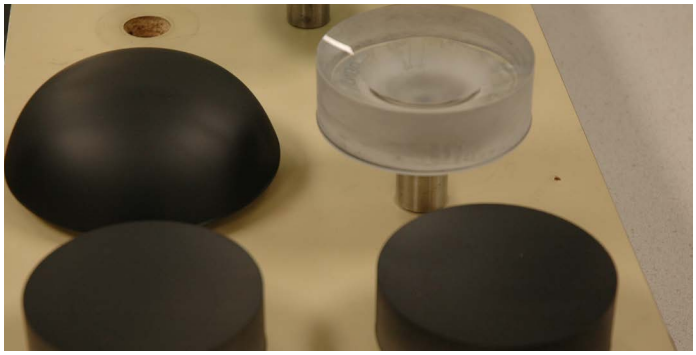
The shapes define curvature of the lenses, as defined by the mathematical formalae that have been established.

Despite the speed of CNC polishing and grinding, perhaps it is the traditional handmade craftsmanship of the D-type polishing that gives Cooke lenses their unique characteristics. I think these lenses can often be described in terms usually reserved for tasting fine wines: having roundness and full body, with a smooth and delicate finish.

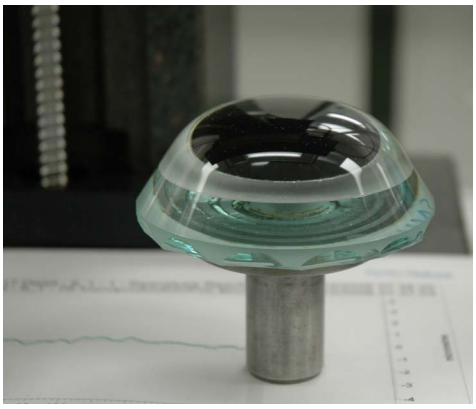
Cooke, cont'd

Over 5000 test glass gauges are available to enable almost any size element to be made at the designers' discretion.

Mick Maher (right), one of the skilled polishers, smoothing the elements prior to polishing.



Spherical lenses have consistent curves. To make an aspherical lens element, imagine slicing a volleyball in half, and glueing it onto the top of a Frisbee—but on a much smaller scale. Because the outer edge of the lens has a different geometry, the element can be smaller and lighter, with less edge distortion. The Cooke CXX 15-40mm zoom and SK4 6mm use aspheric elements.



After coating, Brian Crow (right) does the final grinding of the edges and remeasuring. He grinds the diameters slightly undersized from the final tolerances to accommodate the next step: edge blacking.

The edges of each element are sprayed with a specially formulated black epoxy paint.

If the edges were left clear, light would bounce around between the elements, the metal housing and create reflections, flare and ghosting. Spraying with the airbrush is a very delicate process, done with great care.

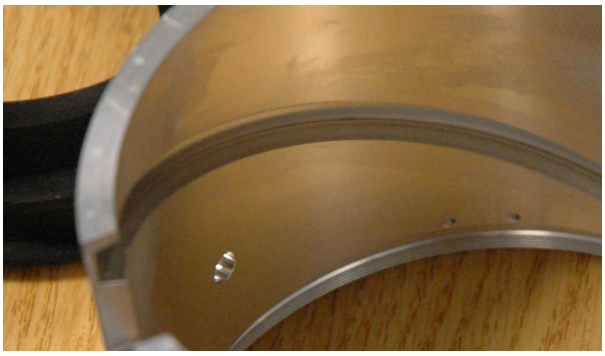
It's time to put all the pieces and parts together. Barrie Billington (left) is the assembly manager, shown here in the assembly room.

They call it the "fitting room," a term that reminded me of bespoke suit makers and custom shirt fitters in Jermyn Street.

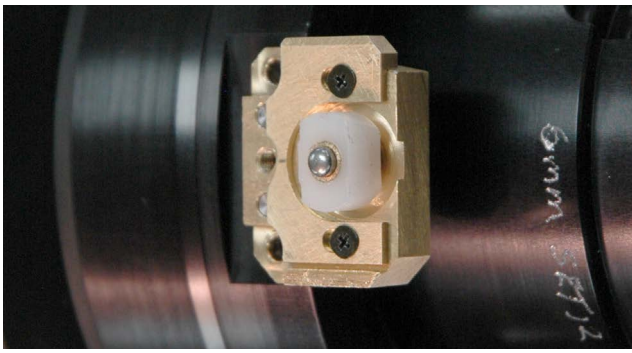
Cooke, cont'd

There are between 10 to 14 elements and 60 mechanical parts in an average Cooke S4 /i lens.

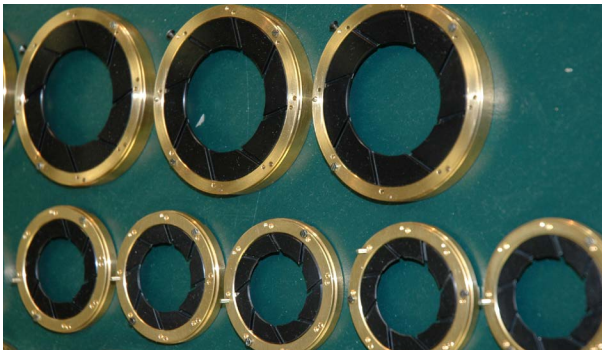
The lens barrels are machined from aluminum tubes and then anodized.



Element assemblies ride on two sets of precision bearings inside the barrel, precisely guided by the famous Cooke cams (left), which are essentially "channels" or freeway on-ramps in which the cam followers (right) travel.

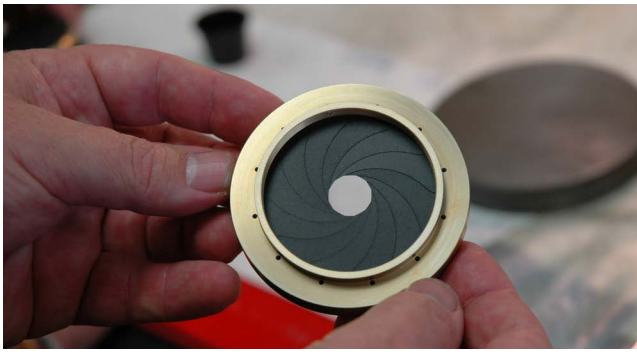


The cam and cam-follower present much less friction than threaded lens barrels. The threads require grease to provide smoothness.

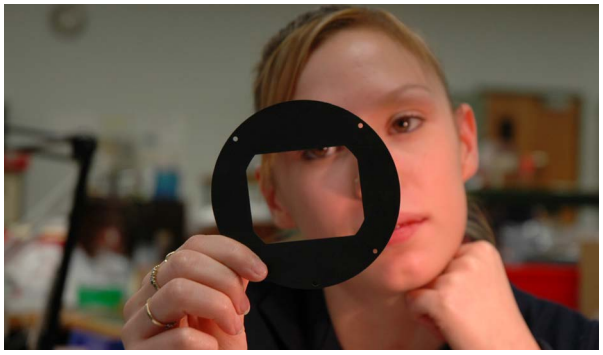


Cooke S4/i lenses work smoothly in temperatures from -25° C to 55° C.

The cam-follower is made of Delrin, which is very durable and does not need lubrication.

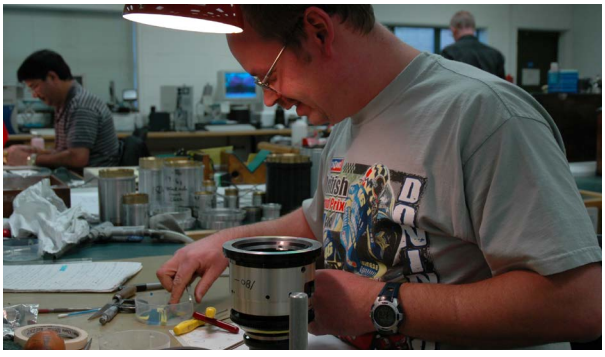


Next, add an iris, (left and right). They have 8 blades.



Apprentice Simone Ryan (left) selects a front element mask.

This one is fitted to a 35mm format S4 lens when shooting in Super16 format to prevent internal barrel flare by blocking extraneous light from the wider, unused "diameter."



Once the lens is assembled, like a Russian doll, it is taken apart again—totally stripped down.

The next steps involve carefully cleaning all the elements and parts again.

All the individual parts of each lens are kept together until reassembled.

Cooke, cont'd

The optical elements are "washed," and the entire lens is carefully put back together in a totally dust-free clean room.

I asked Adam Woolley (right) what's the best cleaner for lens elements when they are smudged.

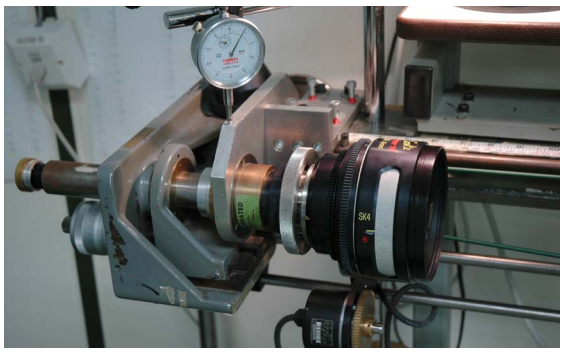
He likes acetone on a cotton ball.

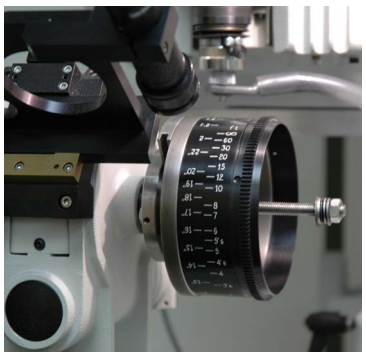
Apparently the epoxy edge blacking and the coatings are hard enough to withstand acetone. I cannot vouch for any other lenses until I check with their manufacturers.

Focus is checked for each increment of critical focus.

Focus scales are then engraved according to the computer data entered for each lens.

Cooke /i lenses are checked by computer with readouts of all information and metadata that will be used during production.





In 1667, Francis Smethwick ground the first high-quality aspheric lenses and presented them to the Royal Society in London—documented in his paper "An Account of the Invention of Grinding Optick and Burning-Glasses, of a Figure Not-Spherical, Produced before the Royal Society."

340 years later, the craftsmen and women at Cooke Optics are carrying on the tradition of fine optics.

There. That wasn't so difficult to build, was it? "Minor" assembly required.

Here's a finished Cooke S4/i 150mm lens, ready to go out into the real world of production.

Cooke Sees RED - Dec 2007

What were Jim, Ted, other heads of RED, and Les Zellan (head of Cooke) thinking?

It might have gone like this: "Remember the opening of Warren Beatty's *Reds*, shot by Vittorio Storaro, ASC, AIC? Deep, dark black backgrounds. Like the picture above. Reminds you of Red October, Red Square, Red Army, Red Menace, Red Flag, Bolsheviks, 1917, Russian Revolution, 1918, Civil War, Red Army (radical communists and revolutionaries) versus the Whites (monarchists, conservatives, liberals and moderate socialists). Maybe earlier—1851, Second French Republic (the Red Republic), "Red" for "radical. Red as symbol of French Revolution, 1793, *Bonnet Rouge*. The symbol of Britain's Labour Party is a red rose (and their song, *The Red Flag*). Aren't British Conservatives usually associated with the color blue? Here in the colonies, things are opposite. We have Red Blooded Americans, Rednecks, Redrum (*The Shining*), Red Carpet, Red Lights, and, of course, Red States.

"Wait. Once upon a time, in our land of NTSC, NBC's maps used Red for Democrats and Blue for Republicans. David Brinkley called Reagan's 1984 landslide of 49-states a "sea of blue." Ten blocks west, CBS used the opposite scheme—Red for Republicans. And remember, ABC used yellow. In 2000, for the first time, everyone agreed on Red for Republicans and blue for Democrats."

Meanwhile, back in Leicester, England, they're buying buckets of red paint. Cooke is offering a set of S4/i lenses, lettered red, presumably in response to the question, "Can we use high-end 35mm PL mounted film lenses on the digital RED camera?" Yes, and Peter Jackson and cinematographer Richard Bluck did just that, using Cooke S4/i primes on the RED demo *Crossing the Line*.

The Cooke RED set consists of the same 35mm format, PL mount, S4/i lenses used on motion picture cameras. The set is about $1,000 less than buying each lens individually, comes in a special rigidised case, and includes a Cooke S4/i 15–40mm, T2.0 CXX Zoom Lens (with a clear cover glass to protect the aspheric front element—a good idea no matter what format you're shooting) and three Cooke S4/i Prime Lenses: 50mm/T2.0, 75mm/T2.0, and 100mm/T2.0. The lenses come with Cooke /i encoders and contacts that can be read by RED, and many other cameras, film or digital. Cooke /i stands for intelligent, or "I'd be an idiot not to use it." It's automatic, and provides important lens and camera data for every frame.

The RED lettering is catchy, clever, but cosmetic, covering the outer housing only. I suppose, if you ask, Cooke might sell you spare jars of yellow and red paint, as you alternate back and forth between the film and digital worlds.

First Look: Cooke Panchros [later renamed mini S4/i] - April 2009

Like the Phoenix rising in Harry Potter, the venerable Cooke Panchro name is being revived, or should we say, reinvented. Film and Digital Times has learned that Cooke is working on a new set of PL mounted lenses for 35mm motion picture film and digital production. The six new Cooke Panchros—18, 25, 32, 50, 75, 100 mm, all T2.8—should be ready by the end of the year, available individually or as a set. Panchros are designed, manufactured and assembled in Leicester, England by the same team that created the S4 lenses, at an affordable price. They are clearly aimed at the large and vibrant community of up and coming cinematographers.

But these are not training wheels for your top of the line Cookes. When you get your ASC or BSC award, you are not obliged to trade these Panchros in for S4 lenses, much as Cooke owner Les Zellan would be delighted you do. The Panchros sacrifice nothing except a stop of light (T2.8 on Panchros vs T2.0 for Cooke S4). The resolution is expected to be as good as an S4 at T2.8. They are about 20% lighter and smaller. The new Panchro line is being designed with 4K (and beyond) digital and film production in mind. The aperture is linear. Focus mechanisms are still cams. Focus scales are generous. And Cooke /i Technology is included.

Preliminary technical specs are printed on the next page. The Panchros are still a work in progress, so details, specs, shapes and other things may change. One thing is not going to change: the inexorable demand for more PL mounted lenses to put on all the new film and digital cameras, including the Sony F35, ARRI D21, RED, Aaton Penelope and the hundred-thousand existing PL mount cameras. Panchros have a prestigious provenance. The majority of feature films made in Hollywood during the first half of the 20th century were shot using Cooke lenses, and many of these were Panchros. In 1921, Horace W. Lee designed the Cooke Speed Panchro, a prime lens with a wide aperture for filming in low light.

In September 9, 1926, Kinematograph Weekly reported: "Over a hundred Taylor-Hobson Cooke lenses of various focal lengths are used by the photographic department of the Famous Players-Lasky studios. This interesting information is contained in a letter from Frank E. Carbutt, Famous' Director of Photography. Mr. Carbutt adds that these lenses have, without, exception, given perfect satisfaction and that they have yet to find a poor Cooke lens."

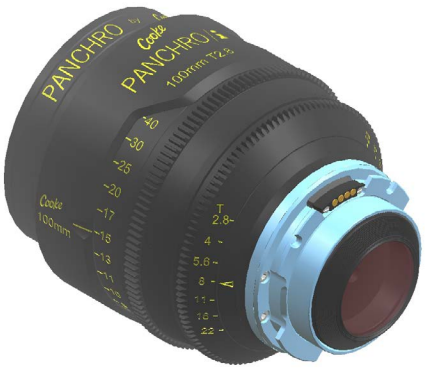
July 1930, from an article in The British Journal of Photography: "It deserves to be better realized in the photographic world to what extent Taylor-Hobson lenses have come into favour in the sound-film and silent-film studios in England and in Hollywood. The Cooke lenses of very large aperture have been establishing themselves increasingly in film production for several years past, and are now in use to an extent which is very gratifying to those knowing the merits of British products. In the same way Taylor-Hobson projection lenses have secured something like a monopoly among the 'super cinemas' in this country for projecting these same films. Frequenters of the movies may reckon therefore that most of the pictures which they see are both produced and projected by means of lenses made in the Leicester factories."

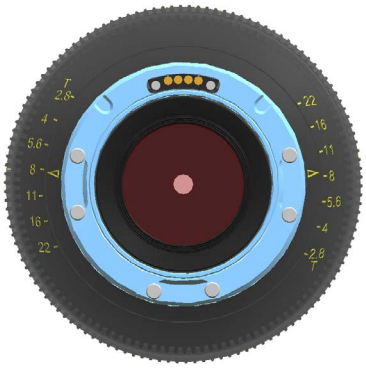
By 1935, Cooke Speed Panchros for cinematography were supplied in 8 focal lengths: 24, 28, 32, 35, 40, 50, 75 and 108 mm. They all covered the standard or "normal" 35mm 1.33:1 format of 0.631 x 0.868 inch.

"Those who fail to learn the lessons of history are forced to see it repeated," said a famous statesman. It seems that Cooke has not failed in their history lessons and are repeating the success of one of the most popular lens sets of all time.

Cooke will be at the P+S Technik booth (SU9924G) in the Bavarian Pavilion at NAB, on the upper level of South Hall, near AVID.

Cooke Panchros: Preliminary Specs





Cooke Panchro Lens		18mm	25mm	32mm	50mm	75mm	100mm
T-stop range		T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22
Angular Rotation of Iris Scale	degrees	60	60	60	60	60	60
Minimum Marked Object Distance	mm	250	250	320	500	750	1000
	inches	10	10	13	20	30	40
Close Focus from Lens Front	mm	79	79	143	329	579	829
	inches	3.1	3.1	5.6	13.0	22.8	32.6
Angular Rotation to MOD Endstop	degrees	270	270	270	270	270	270
Maximum Diagonal Angle for S53 format	degrees	80	62	50	34	22	17
Length from Front of Lens to Lens Mount	mm	120	120	114	120	120	120
	inches	4.7	4.7	4.5	4.7	4.7	4.7
Max Front Dia.	mm	110	110	88	88	88	88
	inches	4.3	4.3	3.5	3.5	3.5	3.5
Total Weight	kg	1.45	1.4	1.36	1.27	1.23	1.54
	lbs	3.2	3.1	3.0	2.8	2.7	3.4
Max. Format Covered	30mm diagonal Super 35 format						
Focus Scales	Two opposing focus scales - metric or footage						
Focus Drive Gear	126 teeth 0.8metric module x 5.0mm wide x 103mm from image plane						
Iris Scales	Two opposing linear T-scales - whole and third stops marked on both sides						
Iris Drive Gear	119 teeth 0.8metric module x 2.75mm wide x 83mm from image plane						
Fitting Filter	Internal thread for filter adapter M82.5x0.75 pitch						
	(fitting filter not applicable for 18mm and 25mm)						

Cooke - June 2009

Les Zellan, chairman of Cooke Optics (above, at NAB Press Conference), announced the rebirth of an iconic lens, the Cooke Panchro lens. The PL mounted lens for 35mm film and digital production is a modern redesign of the original Cooke Panchro lenses that were widely used in Hollywood. The legendary lens is expected to be available at the end of 2009.

The Panchro by Cooke lens is designed by the same team that produces the Cooke S4/i lens; it is calibrated and color-matched to existing Cooke lenses and incorporates Cooke's /i technology, so it is interchangeable with the Cooke range.

The new Panchro sacrifices one stop of light (T2.8 compared with T2.0 for Cooke S4), thereby offering a smaller, lightweight and affordable choice when a faster lens is not crucial or when shooting in difficult situations such as crash scenes or VFX shots. The price point also brings the benefits of Cooke lenses to independent filmmakers, film students and documentary makers, while the reduced size, weight and true focal length markings make Panchros ideal for 3D stereoscopic productions.

Les Zellan, chairman of Cooke Optics, said, "We are so excited to bring Panchro By Cooke back to the film industry. With the credibility of film history and over 100 years of development behind it, the Panchro by Cooke lens is a serious yet affordable piece of equipment for professional film makers."

The Panchro lens has played a major role in the history of Hollywood. Horace W. Lee designed the original Cooke Speed Panchro in 1921; it was a cine prime lens that chromatically enhanced an image when filming under low light. The advent of sound films created a great demand for faster lenses since arc lamps were difficult to use because of the noise they made, making most existing lenses obsolete. The Speed Panchros were born out of the industry's need for faster lenses to cope with lower light levels brought about by the new sound requirements on the set. Cooke Speed Panchros combined a relative aperture of f/2 with an angular field of view and definition previously impossible with much smaller apertures. The Cooke Panchro was also instrumental in the introduction and success of Technicolor in the 1930s because the Panchro's unusually high correction for chromatic aberrations made it suitable for color photography.

The six Panchro By Cooke prime lenses - 18, 25, 32, 50, 72 and 100mm – will be available to purchase individually or as a set. The lenses are expected to be available at the end of 2009.

Cooke also announced that the popular Sony F35 CineAlta camera will incorporate support for Cooke's /i Technology. The /i Technology protocol enables the recording of extremely accurate, frame-by-frame lens and camera data seamlessly on the set. This can save visual effects artists hours of time in post-production by eliminating the need to guess lens parameters and camera information. This information enables artists to produce more realistic-looking effects, more quickly. In August, Geoff Boyle (below) conducted a London /i test near the London Eye for Cooke and Pixel Farm on an /i equipped Sony F35. Details of the compositing test will follow.

Cooke's /i Technology is supported by many leading camera and content creation companies including RED, Aaton, ARRI, Avid and Pixel Farm.

Cooke S4/i lenses were recently used on award-winning films and television shows including *Milk*, *Frost/Nixon, 30 Rock* and on cameras throughout the NAB show. As well as demonstrations at the P+S Technik booth, the S4/i lenses were also in the Canon, JVC, Sony and Band Pro booths.

Cooke Look x 3 - June 2009

Picture this:

...THE LONGEST TRAVELING SHOT IN THE HISTORY OF THE WORLD...

BUTCH

-- okay, you jump first --

SUNDANCE

-- no I said --

BUTCH

What'sa matter with you?

SUNDANCE

(bigger)

I can't swim!

...BUTCH

You stupid fool, the fall'll probably kill you.

...THE BIGGEST SPLASH ever recorded....

Now, picture how you're going to shoot *Son of Sundance Kid*, or a similar scene with one of the biggest stunts the world has ever seen. Next, imagine the look on the face of the world's most quintessential producer, as you explain how you're going to cover it with 12 multiple cameras and deploy 12 matching sets of the latest and most advanced lenses the world has ever seen.

"In two words...IMPOSSIBLE," shouts the producer.

Of course, you knew all along that there were two chances of finding 12 complete sets of Cooke S4/i or 5/i Primes with one day's notice: slim and none. On previous jobs, with multiple camera stunts, you invariably wound up with an eclectic collection of lenses from many rental houses, of various vintages and multiple manufacturers. One thing was sure: your days timing the scene would be many, trying to match the look from one lens to the next. If you were lucky, the cuts would be quick; if not, you could abandon all hope of an envelope please.

At Cine Gear 2009, little did we know that this was the calm before the storm: the Cooke Panchro/i series, introduced two months earlier at NAB would be followed by a 5/i series at IBC. What would this mean? Like small, medium and large orders of fries, there would be 3 complete sets of Cooke Primes: the 5/i series at T1.4, the S4/i set at T2.0; and the Panchro/i set at T2.8.

The biggest splash ever recorded is most likely DAY - EXTERIOR, and you're not going to shoot it at T1.4. A set of Cooke Panchro/i primes will make the producer's day, because they cost much less to rent than the faster S4/i or 5/i sets. All 3 sets of Cookes match, intercut seamlessly, and have /i technology for smooth handling of metadata in post and effects work.

There are 9 lenses in the Cooke 5/i series: 18, 25, 32, 40, 50, 65, 75, 100 and 135mm, all T1.4-T22. They cover Super 35mm format (30mm diameter) and have a front diameter of 110mm.

There are 6 lenses in the Panchro/i set: 18, 25, 32, 50, 75, 100mm, all T2.8-T22. The front diameter is 87mm for all lenses. Angular rotation from infinity to minimum object distance (MOD) is 300°. Focus and iris gears on each of the S4/i, 5/i and Panchro/i series have the same pitch and are consistently located in the same position relative to the lens mount.

With apologies to William Goldman, screenwriter of *Butch Cassidy and the Sundance Kid*, and thanks to Script City where you can purchase most of the scripts the world has ever seen. www.scriptcity.com

Lens distortion? Distorted architects? Geoff Boyle tests the limits of Cooke /i data technology outside London's leaning City Hall, near the London Eye and Tower Bridge.

London /i Test

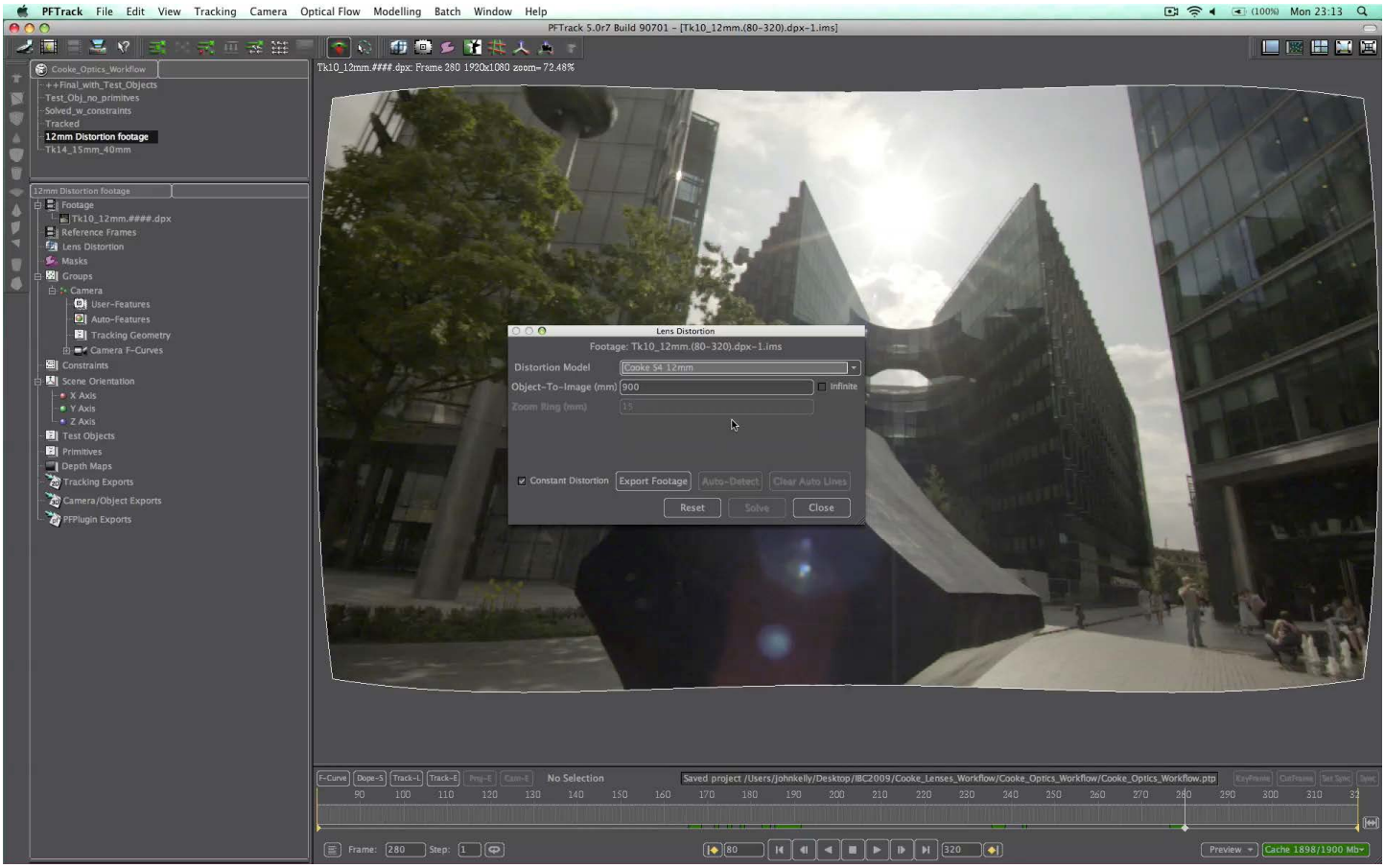
A couple of weeks before IBC, Geoff Boyle tested Cooke 4/i, 5/i and CXX 15-40mm lenses on a Sony F35 camera with a team from Cooke and Pixel Farm. The purpose was to show how /i metadata could help speed the post-production process when using Pixel Farm's PFTrack for visual effects compositing.

For the test, Geoff deliberately gyrated and gamboled while handholding shots to be used as background plates.

Normally, this kind of irregular movement would add a lot of frame-by-frame workload for the visual effects artist's workflow. However, by storing lens information, focus (and sometimes zoom) settings for each frame, Pixel Farm's PFTrack was able to save time and add accuracy to the process.

Since i/data identifies the individual lens to the post-production computer, it can seamlessly correct lens distortion. Yes, even the best lenses have some distortion somewhere—although I'm not sure what they can do for the wonderful building on the opposite page.

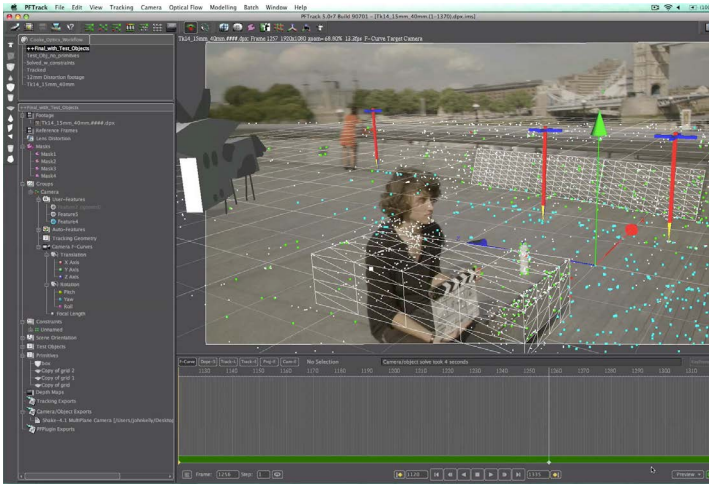
Match Mover, Match Mover Make me a Match



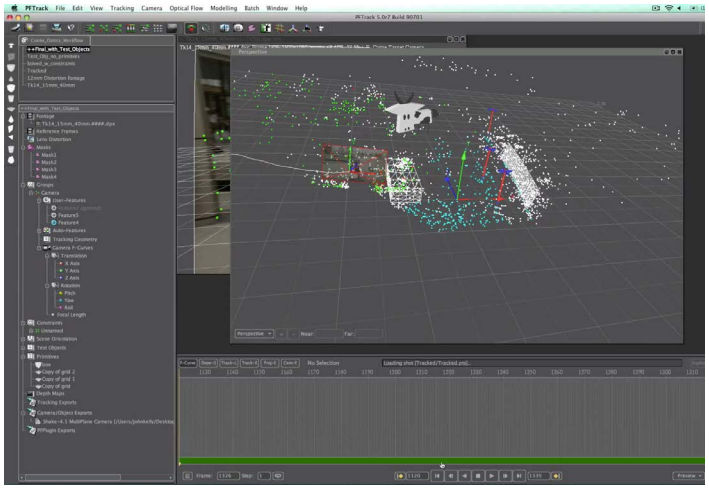
PFTrack is the sophisticated Match Mover software package from The Pixel Farm (www.thepixelfarm.co.uk).

What is Match Moving? Match Moving is the art of making your virtual camera—the one that "shoots" all the CGI—move and behave exactly like its real, live-action counterpart. Most major motion pictures use it. Let's say you're shooting *Harry Potter Returns as Hogwarts Headmaster.* For the opening Quidditch Game, you've managed to talk the Completion Guarantors into letting you dangle Daniel Radcliffe and his broomstick from a construction crane somewhere in the Scottish Highlands. But there's no way they're going to let you crash him through the spectator stands. You're going to have to composite those computer-generated elements in post.

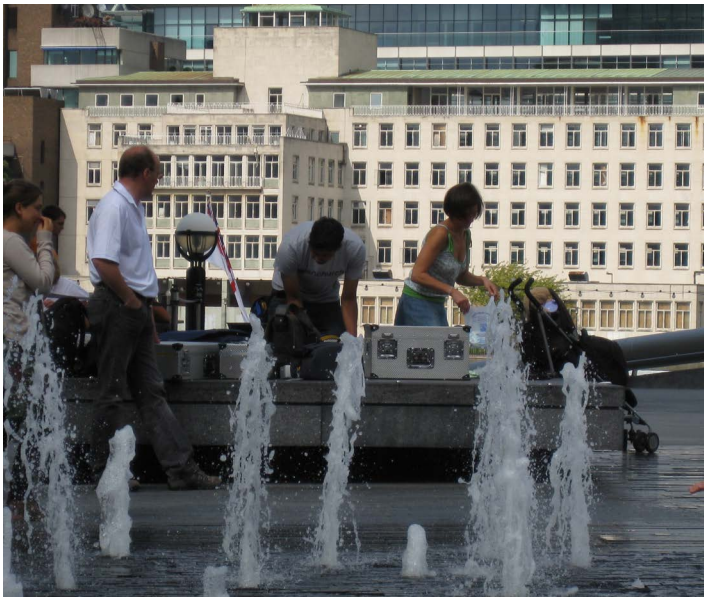
If your producer was wise enough to have listened to the DP's request for /i lenses and the hardware to record it, you have just saved the production lots of time and money during the happy "marriage" of live-action to CGI (Computer Generated Images). How? As mentioned, every lens has its own particular characteristics and geometric distortions. Look at the example above. We see that it was shot with a Cooke S4/i 12mm lens. PFTrack has mapped the geometry of that lens, and can quickly adjust the CGI shapes to both the focal length and the geometry.



PFTrack adds tracking points. This is a handheld shot, moving left to right. Note the targets and sticks indicating CGI elements to be added.



A wider view of the live-action and CGI, including The Pixel Farm's pet CGI cow, which must also "follow" the live-action handheld move..



I imagine the fountain discouraged curious bystanders from looking at the new, top-secret (at the time) Cooke 5/i lenses.

Geoff Boyle with Sony F35 handheld, with Tower Bridge of London in background.

Left ot right: Les Zellan, John Kelly (Pixel Farm), Michael Lancaster (Pixel Farm), Danny Gagatt (DIT/AC, *kneeling with Sony F35*), Geoffrey Chappell, Geoff Boyle, Robert Howard. Photo by Daniel Gould, camera trainee (in PFTrack picture, opposite page, bottom left).

Transvideo and /i data

At IBC, Transvideo presented some compelling reasons to embrace /i lens data technology. This was actually the first time the previously arcane subject of camera and lens metadata actually made sense to me. I had always thought of it as lots of information that you stored and handed to the post production house, who either didn't have the right tools to use it or who were still working on making it work with their system.

It was one of those subjects like timecode on film: a solution in search of a problem that only two French people in the world understood or could explain. Jacques Delacoux is one of those exalted two.

Jacques, along with Les Zellan and John Kelly of the Pixel Farm, enlightened me on the mysteries of /i. I'll try to share what they taught me.

/i data begins with encoders in the barrels of cine lenses. It's in all the Cooke lenses marked /i. It appeared that other lens manufacturers at IBC were interested in joining this open-architecture coalition.

ARRI LDS is sort of similar, but proprietary, and requires a camera with LDS contacts in the lens mount.

/i lenses send data either directly through the lens contacts or via a receptacle sticking out of the lens. It can be stored to an SD memory card, recorded to tape or drive, employed to tell wireless remote controls what kind of lens they're dealing with, or display the information on a monitor with /i data circuitry.

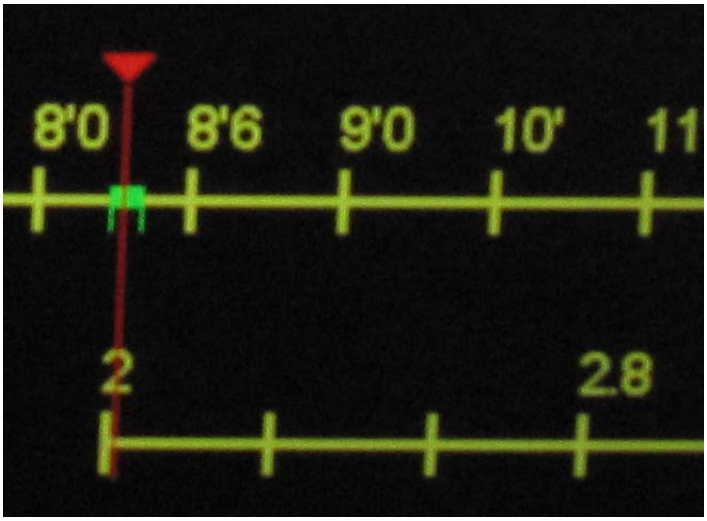
Here's the cleverness of what Transvideo is doing: take the /i metadata, and use it to display focus, iris, and depth of field right on the monitor.

Transvideo CinemonitorHD/i's ability to evaluate focus is a breakthrough new tool for video village.

No matter how much we complain about relegating the DP to a dark tent, it is often inevitable having to check focus of some of the latest cameras with eyepieces so vague the camera operator is often the one in the dark.

The vigilant DP, watching the shot, can instantly see whether the shot is sharp or soft by looking at the the edge outlines (blue edges in the picture above and below.)

The DP and camera assistant can also help decide whether it may or may not be necessary to do another take, having consulted the graphical depth of field display on the CineMonitor, what's in focus, and whether the depth of field allows any leeway.

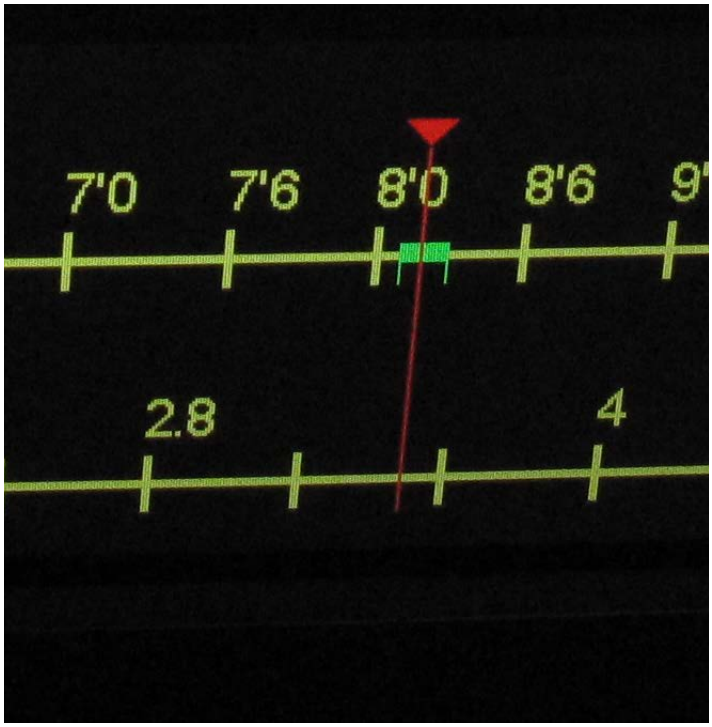


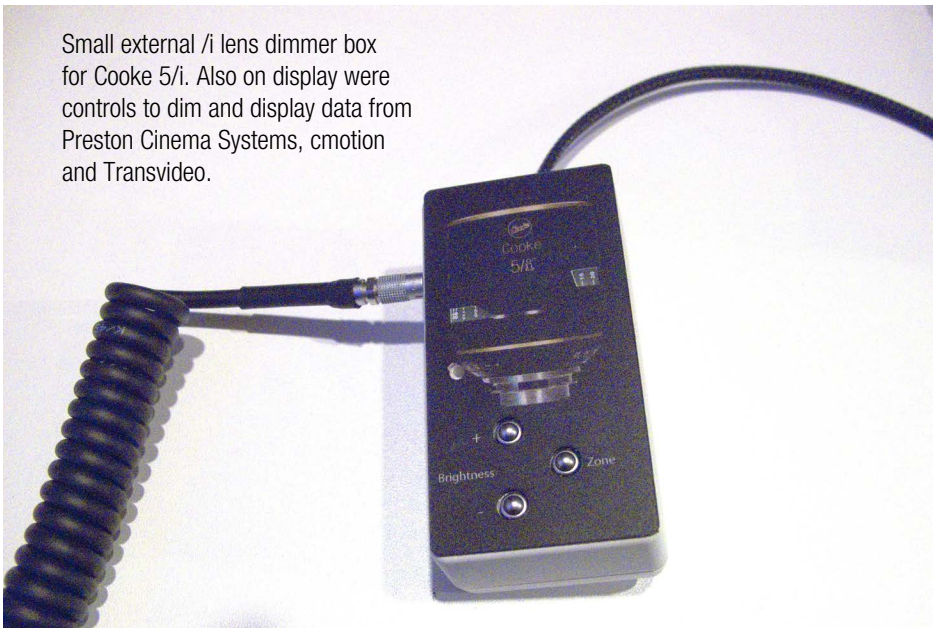
Transvideo's CineMonitorHD/i Evolution Monitor is not only for Directors and DPs, but also for Camera Assistants and Script Supervisors. Put away your Kelly Calculators. Transvideo's new film and digital tool, shown at IBC, constantly updates you on depth of field in an easy-to-read display.

In the example above, the Cooke i lens is set to T3.47 and the focus is 8'2" (shown with the red line). The green box shows how much (or little) depth of field you have. This can be also helpful to camera assistant—it constantly updates your depth of field without having to enter any data manually.

The Cooke /i data system can also be a huge time-saver for any script supervisor who has a dedicated CineMonitor—I'd recommend the HD10 in wireless configuration. No longer does the scriptologist have to shout across the set to the AC, "What's your millimeter? T Stop?" Few things in life are more distracting to an actor poised behind the clapsticks, only to go into script-supervisor holding pattern while lens and camera data is painstakingly or painfully discussed.

There's also a histogram, timecode readout, and soon you'll be able to freeze, store, recall shots, monitor voltage, check audio, and remotely dim the Cooke 5/i focus scales from the monitor.





Small external /i lens dimmer box for Cooke 5/i. Also on display were controls to dim and display data from Preston Cinema Systems, cmotion and Transvideo.

The /i's have it.

5/i

Just slightly less secret than P+S Technik's introduction of their 16Digital Magazine, Cooke surprised everyone at IBC who thought the big news was going to be delivery of the anticipated Panchro /i set of lenses.

Cooke unveiled an entirely new set of highspeed primes trimmed in gold: the new 5/i Prime Lens Set. All lenses are T1.4.

Focal lengths: 18, 25, 32, 40, 50, 65, 75, 100 and 135mm - designed for all PL mounted film and digital cameras.

They come with /i Technology, which is Cooke's open-architecture lens data system.

A really unique and helpful feature is the illuminated focus ring. No more Maglite cigars on night shoots. Tiny LEDs illuminate the focus scales on both sides of the lens. You can dim the lights with the iris ring (after tapping it to its end stop) or with external controls.

The simplest and fastest way to dim the illuminated focus scale is with the small, external Cooke control box. You plug one end into the camera's RS receptacle and the other end goes into the /i receptacle on the lens. It controls intensity of both sides of the lens together or separately. These accessory boxes can be velcroed or attached to the camera body. I expect the next version will be smaller.

Wireless control of focus scale illumination was also shown on Preston Cinema System's FIZ and on Transvideo /i Monitors. (See Transvideo article in this issue.)

They must be working overtime in Leicester: delivery is expected later next month, and the first production run is reported to be sold out.

Panchro/i

Skeptics in the cinematographic community muttered, "Who's going to pay $7,400 for a T2.8 lens?" I guess they misunderestimated (*sic*: *Bushism*) the Cooke brand name, the color matching to other Cooke lenses, and the need for additional primes (smaller, lighter, more affordable) for multiple camera shoots.

The line was long for new Panchro /i series lenses, with the first production run sold out.

The Panchros are available individually: 18, 25, 32, 50, 75 and 100mm. A set of 5 lenses (25 through 100mm) gives you a break at $33,600.

While testing the Panchro/i 100 mm T2.8 (at T2.8, above), there were several surprises, all good. It looks, feels, and acts like the Cooke S4/i and 5/i series lenses: the same silky, floating feeling as you pull focus...no binding or resistance...and the smooth cosmetic Cooke Look. This is by no means a Cooke Lite, less filling and wimpy. Not so. Panchros fill a void hitherto unaddressed. Because the Panchros are color matched and perform like their siblings, you can confidently order them by the dozen for your multi-camera shoots, to supplement your S4/i and 5/i "A" camera lenses.

Surely you know the producer is going to froth at the mouth if you suggest renting ten complete sets of S4/i or 5/i primes for every multiple camera and crash housing covering the shot. The answer is a plethora of Panchros: lighter, smaller, less expensive than the S4/i or 5/i, slightly slower, and still very impressive.

There are 6 lenses in the Panchro/i set: 18, 25, 32, 50, 75, 100mm, all T2.8-T22. The front diameter is 87mm for all lenses. Angular rotation from infinity to minimum object distance (MOD) is 300° and the 100mm is 137mm/5.39" long. Focus and iris gears on each of the S4/i, 5/i and Panchro/i series have the same pitch and are consistently located in the same position relative to the lens mount.

Cooke Panchro/i [renamed mini S4/i

Cooke Panchro/i [renamed mini S4/i

Stop the presses. Cut cameras.

Although there were CAD drawings of the Cooke Panchros at NAB, we weren't really sure what to expect.Today, August 24th, we are not only staring at a real production model of the Panchro /i 100 mm T2.8 , but also are about to shoot a test with it.

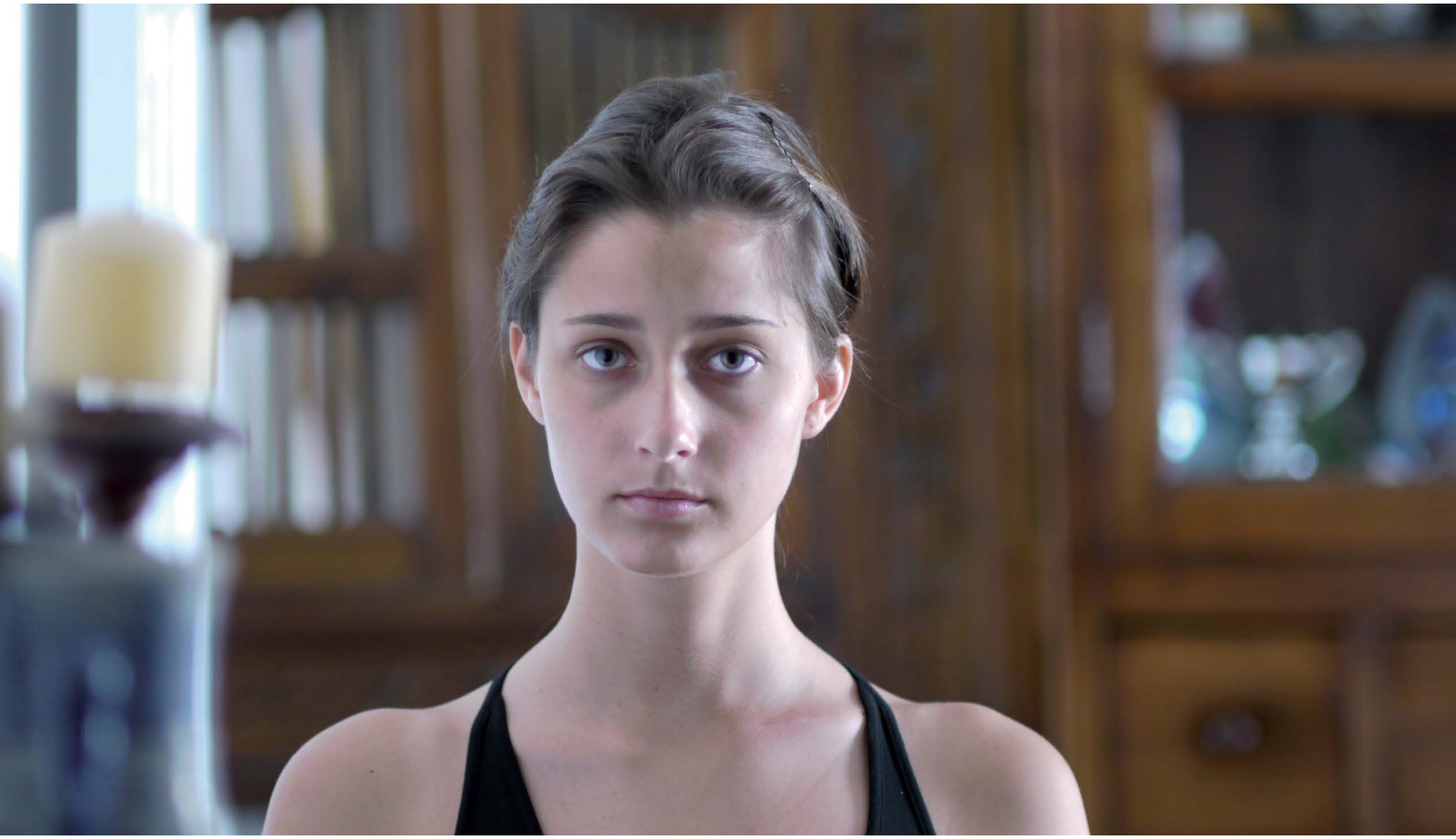
Several things come as surprises: all good. This looks, feels and acts like the Cooke S4 series: the same silky, floating feeling as you pull focus...no binding or resistance...effortless focus riding on its cams.

AT NAB, there was chatter and twitter that this would be a Cooke Lite, less filling and maybe less impressive. Not so. If anything, it fills a void hitherto unaddressed. As Geoff Boyle so eloquently put it on the phone yesterday, the fact that the Panchros are color matched and perform like their brethren means you can confidently order them by the dozens and dozens for your multi-camera shoots.

For example, a normal camera and lens package for the bulk of your single-camera show might include a couple of zooms and a set of S4/i lenses. But, now it's time for the big stunt end scene, you know, where they jump off the largest cliff the world has ever seen, or something equally impressive and equally demanding of at least ten cameras running concurrently.

Now, you know the producers is going to pull out the Pepcid pills for acid indigestion if you suggest renting ten complete sets of S4 primes for every crash camera covering the shot. And you're certainly not going to volunteer your own personal set. The answer is a plethora of Panchros, lighter, smaller, less expensive than the S4 set, one stop slower, and very impressive. The rest of the set is coming soon.

Cooke Look - Sept 2009



The lensmakers in Leicester must have been working overtime. Just when we thought the big lens story was the reintroduction of the legendary Panchro series, Cooke surprised us with yet another new series: The Cooke 5/i. There will initially be 9 lenses in the Cooke 5/i series: 18, 25, 32, 40, 50, 65, 75, 100 and 135mm, all T1.4-T22. They all cover Super 35mm format (30mm diameter) and have a front diameter of 110mm.

A few days before going to press, we tested 100mm pre-production samples of the new 5/i and Panchro/i lenses, along with a Cooke S4/i 100mm. The Cooke Look isn't imaginary—it's really visible. The frame-grab (above) was shot "wide open with a wrench" on the Cooke 5/i 100mm at T1.4.

Notice how the focus "rolls" off instead of "falls" off. You know the location was dark by looking at the model's pupils. Cooke lenses look the way they feel: the silky lustrous look mirrors the smooth feel of the focus ring. Our tests showed that on all three lenses, faces are consistently cosmetically silky smooth, romantic, definitely not "soft," but rather pleasantly blended. Describing the Cooke Look requires the vocabulary of wine tasting, with words like full, round, and luminous.

We compared line pairs and MTF until our eyes glazed over, and, of course, the 5/i was sharper, richer, and performed a little better than the S4/i and Panchro/i at all apertures. But what we really want to know is, "what do these lenses really look like?"

The new 5/i, S4/i, and Panchro/i intercut well: color and contrast is consistent. It seems to be mainly a difference of speed versus cost: the faster the aperture, the more Euros it will cost you. This isn't as hard-hearted as it sounds, because the higher rental rate of a T1.4 5/i may be offset by a savings in lighting rental, or being able to do see into the shadows of a night exterior that might otherwise be murky black. The first question you might ask is, "when do I use the 5/i and when do I use the S4/i?"

I think there are two important differences. The 5/i lenses are slightly sharper and more contrasty, making them important for effects work and big budget sweeping vistas. They are heavier, so Steadicam operators may still prefer Series 4 or Panchro. But the big deal will be using the 5/i series for Night Exteriors.

Since the 5/i lenses will surely be on location at night, in dark places or dimly lit sets, they have an industry-first built-in, dimmable light to illuminate the focus scale. Although this feature might impact heavily on sales of cigar-like Maglites, there are obvious advantages to avoiding accidental illumination of the actors in front of you as you turn from scene to lens and back again, not to mention the aluminum aftertaste.

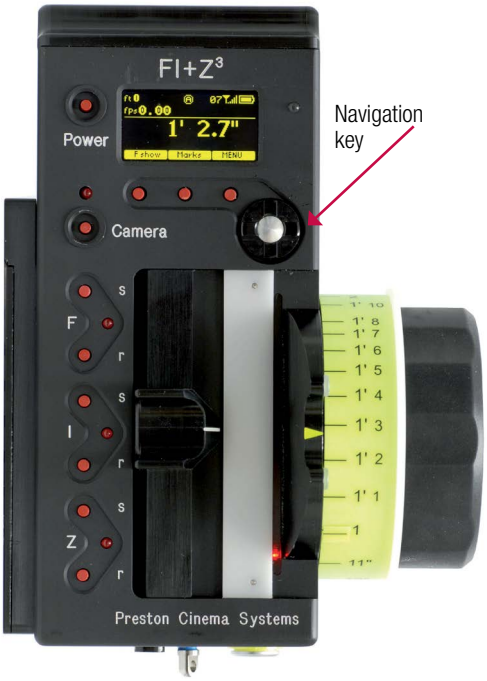
left to right: Cooke 5/i 100mm T1.4, Cooke S4/i 100mm T2.0, Cooke Panchro/i 100mm T2.8

Above, left: illuminated, dimmable focus scale of the Cooke 5/i.

Below: Helpful notation of Entrance Pupil (E.P.) position in mm and inches from the lens mount flange. This is the optical "pivot point" to be centered on nodal heads to eliminate image shift when panning.

How do you dim the 5/i focus scale?

In addition to a control on the lens itself, new software for Preston's FI+Z Hand Unit 3 and MDR2 support both the display of Cooke /i information and also enables wireless dimming control of the 5/i focus scale light. The 5/i focus scale is adjusted by pressing the Navigation key's right or left side. (The top and bottom of the Navigation key are used to brighten and dim the LED's of the Preston FI+Z.)



Preston cable #4544 connects Cooke /i lenses to the serial receptacle of the MDR2 receiver. Once the MDR2 establishes communication, the HU3 display is automatically updated with the Cooke lens data.

Transvideo's new CineMonitorHD/i supports Cooke's /i lens data system with remote control and lens information on screen. To read more, go to page 15. In our next issue, we'll continue to discuss Transvideo's new products, along with other companies using Cooke /i data in productive ways.

Meanwhile, camera crews worldwide will be clamoring for Cooke's bright idea for wirelessly dimming lens focus scales in the dark.

Cooke Triplets - Apr 2010

The three Cooke clans were in their prime at the AFC Micro Salon: the fast 5/i bunch, the ever-popular S4/i set, and the trendy Panchro/i family. They arrived in the trunk of Geoffrey Chappell's car, having endured a harrowing 14-hour drive from Leicester, England, to Paris, delayed by icy roads and a winter storm.

These triplets have nothing to do with their historic ancestors, the original Cooke Triplets, other than our catchy title. The famous Cooke Triplet lens was designed and patented in 1891 by H. Dennis Taylor, optical manager of T. Cooke & Sons of York. It was the first photographic lens with uniform sharpness and contrast from its center to the edges. The Cooke triplet was made of three lens elements—hence the name.

The new Cooke lenses have many more elements than the original triplet lens, and all are equipped with /i intelligence. They will all be at NAB, in booths C5347 and 5348. For more information: www.cookeoptics.com

If the camera you're using doesn't have data contacts in its lens mount, you simply plug a cable into the 4-pin Fischer DBP 102 A 053 - 130 connector of your /i lens. Here's the pin-out:

Pin 1: Data from lens
Pin 2: Data to lens
Pin 3: Supply and signal GND
Pin 4: Power supply for S4/i lens

4-pin Fischer connector for external /i data link

/i data can be retrieved either through the 4-button contacts at the rear of the lens *(right)*, or the 4-pin Fischer connector (*left*).

4-button contacts for /i data lens mounts

Trio of 100mm Prime Cookes, *left to right*: 5/i, S4/i, and Panchro/i

/i Technology

The idea behind Cooke's /i Technology is a universal, license-free, open-architecture standard for sharing lens information. The picture at left shows the inside of a Cooke prime lens, with the simple circuit that collects the lens data and sends it via contacts in the mount or by cable to any device that wants this information. This circuit tells you focus distance, iris setting, what kind of lens it is, serial number, depth of field for any given setting, and more.

This is "metadata," which is the redundant equivalent of "shrimp scampi" (shrimp shrimp). If *Meta* is Greek for "with," then "with data" is still "data" in my book, with or without classical vocabulary.

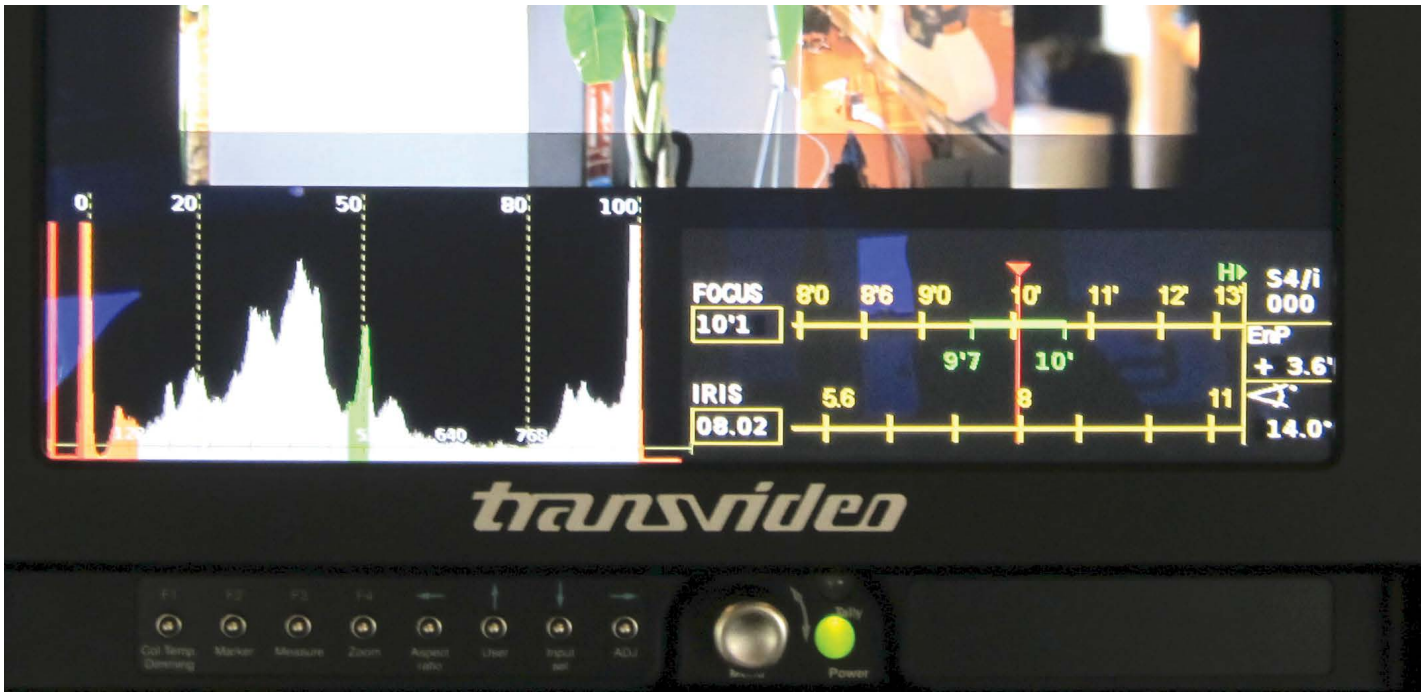
"And what can you do with all this lens data?" you may ask.

Camera assistants get instant and continuous depth of field readout. Stereographers can match lenses easily. Script supervisors get instant information. Special effects teams can track shots continuously. DPs get camera notes. It doesn't stop there: it's an open system, and camera agnostic. The circuit can be external, and the data could include any other information you'd imagine should be included.

For complete information:

www.imetadata.net

The Transvideo CineMonitorHD, *below*, can read /i Technology lens data. It displays focus, iris, zoom, and other information on screen. Note how the depth of field is displayed in real time with a graphic bar and green numbers.



Angénieux and Cooke agree on /i - Apr 2010

Anglo-French cooperation began when Celts on both sides of the Channel united to oppose Julius Caesar's All-Gaul policy, and the alliance continued over the centuries. Then came the Aérospatiale-BAC Concorde, followed by the Chunnel Tunnel. Now, the latest development is a combined effort between Leicester and Saint-Héand. Lens companies, not football.

Film and Digital Times snapped this picture at the AFC Micro Salon in February. Yes, that's Les Zellan, Chairman of Cooke Optics (in the middle), shaking hands with Philippe Parain (right), Managing Director of Thales Angénieux. Dominique Rouchon-Picariello, Zoom Business Unit Director, is smiling at left.

The cause of their delight is an agreement so intriguing that not since the DaVinci Code has a witness been sworn to such secrecy. All is revealed at a joint press conference at NAB on April 11.

Cooke Optics Ltd. and Thales Angénieux have announced a partnership agreement in which Thales Angénieux will incorporate Cooke's /i Technology into its line of lenses.

As we've discussed before, /i Technology enables film and digital cameras to automatically record key lens and camera data for every film frame shot. This digital information can be used in real time on set. It is also invaluable for post-production work. The technology streamlines the entire process from production through post. It saves significant time and cost, and eliminates guesswork. It's especially important if you're an effects house, and you're compositing a live-action scene shot on a zoom lens that is zooming. Of course! Every frame is a different focal length.

At NAB, we'll most likely see a small external /i data box that connects to the Angénieux lens. In the future, i/ Technology will probably be built into new Angénieux lens designs.

"/i Technology is an astounding development for our industry and one which drives it forward. We are delighted to work with Cooke to incorporate this technology into our lenses, in order to advance in the streamlining of the film production process," said Philippe Parain.

"We have great respect for Thales Angénieux and are thrilled to welcome them to the growing /i family," said Les Zellan.

Thales Angénieux is the latest in a distinguished group of companies to adopt /i Technology; the growing list includes the following companies and products: Aaton Penelope, Arri 435 Xtreme, Arricam, Avid, Cinematography Electronics, cmotion, Preston Cinema Systems, Red, Service Vision, Silicon Imaging SI-2K, Sony F35, Transvideo, The Pixel Farm, The Foundry, Mark Roberts Motion Control and other effects companies.

Angénieux and Cooke see /i to /i

Left: Les Zellan, Chairman, Cooke Optics
Right: Philippe Parain, Managing Director, Thales Angénieux

On April 12th, the opening day NAB 2010, Cooke Optics Ltd. and Thales Angénieux announced a partnership agreement in which Thales Angénieux will incorporate Cooke's /i Technology into its line of lenses.

The external box, shown above on an Optimo 24-290 zoom, uses /i Technology to automatically provide key lens and camera data for every frame shot. Philippe Parain, Managing Director of Thales Angénieux, France, said, "/i Technology is an astounding development for our industry and one which drives it forward. We are delighted to work with Cooke to incorporate this technology into our lenses in order to advance the streamlining of the film production process."

Les Zellan, Chairman of Cooke Optics, said, "We have great respect for Thales Angénieux and are thrilled to welcome them to the growing /i family," Thales Angénieux is the latest in a distinguished group of companies to adopt /i Technology. The growing list includes Aaton Penelope, Arri 435 Xtreme, Arricam, Avid, Cinematography Electronics, cmotion, Preston Cinema Systems, Red, Service Vision, Silicon Imaging SI-2K, Sony F35, Transvideo, The Pixel Farm, The Foundry, and others.

Cooke 5/i Lenses Delivering Jun 2010

Clairmont Hollywood is the first US rental house with the new Cooke 5/i Primes. They are all T1.4, include /i Technology Lens Data and have illuminated focus scales.

Focal lengths: 18, 25, 32, 40, 50, 65, 75, 100, and 135mm. T1.4

Cooke 5/i Primes are color-matched with Cooke S4/i, Panchros, CXX 15-40 mm T2 Zoom, Cooke Zooms, and SK4 16mm Primes.

	Units	18mm	25mm	32mm	40mm	50mm	65mm	75mm	100mm	135mm
T Stop Range		T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22
Angular Rotation of Iris Scale	Degrees	90	90	90	90	90	90	90	90	90
Minimum Marked Object Distance	mm	250	350	350	450	500	600	650	750	TBD
	Inches	14”	14”	14”	16”	20”	24”	27”	30”	TBD
Close Focus from Lens Front	mm	20	120	120	220	270	370	420	520	TBD
	Inches	1”	5”	5”	9”	11”	15”	17”	20”	TBD
Angular Rotation to MOD End Stop	Degrees	270	270	270	270	270	270	270	270	270
Maximum Diagonal Angle of View for Super 35 Format	Degrees	79.61	61.93	50.23	41.11	33.4	25.99	22.62	17.06	12.68
Length from Front of Lens to Lens Mount	mm	174	117	117	117	117	117	117	183	TBD
	Inches	6.85”	4.61”	4.61”	4.61”	4.61”	4.61”	4.61”	7.20”	TBD
Maximum Front Diameter	mm	110	110	110	110	110	110	110	110	TBD
	Inches	4.33”	4.33”	4.33”	4.33”	4.33”	4.33”	4.33”	4.33”	TBD

- Maximum Format Coverage — 30mm Diameter (Super 35mm Format).
- Focus Scales — Two opposing focus scales - metric & footage. Scales marked from infinity to MOD.
- Focus Drive Gear — 140 teeth 0.8 metric module x 5.0 wide. 102.5 mm from the image plane.
- Iris Scales — Two opposing linear T scales - whole and third stops marked.
- Iris Drive Gear — 134 teeth 0.8 metric module x 2.5 wide. 82 mm from the image plane.

Cooke 5/i Dimmable Focus Scales

Cooke 5/i Lighting Control

The new Cooke 5/i prime lenses have illuminated focus scales. You can see them in the dark. But, nothing is more distracting to a camera operator than an overly bright lens light. Camera Assistants can be equally vexed if the light illuminating their critical focus scales is too dark or too glaringly bright. The focus scales of Cooke 5/i lenses can be dimmed independently on camera left and right sides for operator and assistant comfort.

Using Cooke 5/i Lighting Control

There are several ways to do this. The easiest way to precisely control focus scale illumination is with Cooke's small, external dimmer control.

1. Plug one end into the four-pin /i connector on the lens. Plug the other end into a 9 - 35 volt DC source: ARRI 3-pin RS connector, Aaton Lemo, Sony F35 3-pin 24V DC OUT.

2. After the 5/i dimmer does a self-test, the green LED lights up. (A red LED means you have a bad connection. Check the cables.)

3. Press + or – to adjust the light level.

4. Press the ZONE button to cycle pick sides:
   a. Camera Left side ON and Right side ON
   b. Camera Left side OFF and Right scale ON
   c. Both sides OFF

Using Iris Ring for Dimming

You can adjust the level of brightness by turning the iris ring, powered by the /i contacts or externally. To adjust both sides:

1. Gently tap the iris ring to the T22 end stop, and back it off.

2. Within 3 seconds, tap the T22 end stop twice.

3. The LEDs blink. You have 2 seconds to adjust the level by rotating the iris ring.

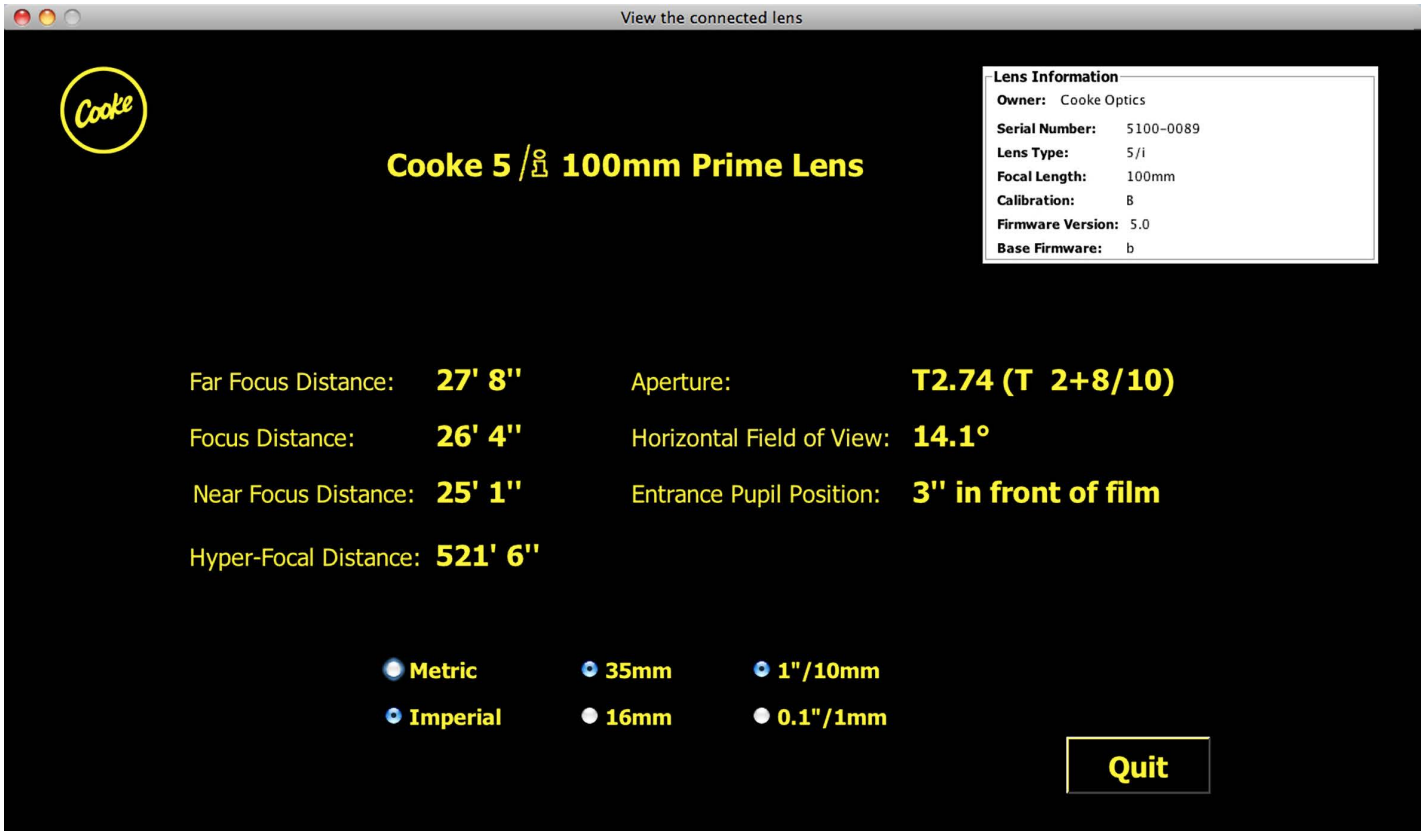
Using a Preston FI+Z Hand Unit

The Preston FI+Z Hand Unit 3 can control 5/i focus scale brightness. Press the HU3 Navigation key's right or left side.

Complete Dimming Instructions

For the full instructions, including how to reset to factory specs and how to change the brightness on just one side of the lens using the iris ring, go to: www.cookeoptics.com/dim

/i Metadata from Cooke - Apr 2011



External /i Data connector: 4-pin mini Lemo

Direct /i Data connector in PL Mount: 4 contacts at 12 o'clock position

How do we manage lens data in our increasingly complicated productions? Knowing as much as possible about each lens used for every frame of every shot—focal length, distance, field of view, entrance pupil position—helps speed production, post, effects work, match moving and 3D work.

Here's good news. The /i Viewer has been completely rewritten as a Java application, and now runs on both Windows and Mac. The /i Technology protocols and software are available to anyone online at: www.imetadata.net or www.cookeoptics.com

Using another free utility called Cooke Owner Update, users can change the owner name stored and recorded in the lens owner field (top, right). For example, you would be able to modify the owner, shown above, from Cooke Optics Ltd to Acme Cine Rentals Unlimited, or however you've named your company.

To view /i Data on your Mac or PC, you need an inexpensive cable supplied by Cooke. It's a multi pin Y cable. One branch plugs into the power source (10-35 VDC). The other branch is 4 pin mini Lemo that plugs any /i System lens. The third leg ends in a 9-pin serial connector. Use a D-9 pin serial to USB adapter to plug it into your computer.

The /i Technology system is offered by Cooke Optics to the industry. It is used or incorporated into equipment by Cooke, Angénieux, Fujinon, Aaton, Sony, Avid, RED, Preston Cinema Systems, Transvideo, Cinematography Electronics, cmotion, Service Vision, Element Technica, MRMC, The Foundry, The Pixel Farm and more.

/i®

For additional information, go to: www.cookeoptics.com or www.imetadata.com

See /i Technology, Cooke Optics and ZGC at NAB Booth C9750.

Above: First Camera Assistant Gregor Tavenner on location in wintry New York, with Cooke 5/i 32 mm, ARRI Alexa on Steadicam, Cinematography Electronics CineTape Measure, clip-on mattebox, and Preston Cinema Systems Wireless FI+Z MDR-2.

Cooke and Codex claimed the cover and cover story. We love these stills: camera, crew, cables and a jumble of accessories. Film production can be a messy process. Camera designers know that no matter how sleek and all-encompassing their devices are, camera crews will continue to pile on essential, beloved, modular accessories. Velcro, camera tape, toggle ties and wire tamers may not be what the manufacturer had in mind, but they will always rule the set.

Gregor Tavenner, First Camera Assistant on *Extremely Loud and Incredibly Close* (above) explains the configuration on this issue's cover, "The Codex is mounted on the rear of the camera, which is barely visible. It is very versatile to be able to have these different mounting options. We doubled-monitored because Chris Menges was doing a tilt and twist from the New York skyline down to eye-level, so we had positioned two monitors for optimum viewing.

"Sometimes I velcro the CineTape readout directly to the lens for perfect angle. The Cooke 5/i has a wonderful focus cam mechanism that handled the cold New York temperatures, which can gum up lots of other lenses."

In the following pages, FDTimes tries to tame the stampede of new equipment we'll encounter at IBC. As usual, it's kind of a random walk down RAI. New equipment comes first, but layout and order of pages can be more challenging than arranging who sits where at a dinner party of very picky New York socialites.

Most FDTimes readers will gravitate to Hall 11. Visit us in booth 11.F31. We are sharing the booth with Transvideo.


Cooke 5/i®
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Cooke 135 mm Panchro/i and 5/i

Cooke Optics will show their new 5/i 135 mm and prototype Panchro/i 135 mm prime lenses. Cooke's 5/i 135 mm T1.4 prime has the 5/i series' signature dimmable illuminated focus ring.

The Panchro 135 mm T2.8 is the smaller, lighter, lower-cost Cooke Look sibling that has become very popular on multiple camera setups, 2nd units, and exterior productions. As digital cameras have become more sensitive, we're seeing more Panchros on 3D shoots, dim interiors and even night exteriors.

Both 135 mm Cooke lenses are color-matched to the entire line of current Cooke lenses and have built-in /i Technology which provides cinematographers, camera operators and post houses with metadata that includes lens type, focus distance, aperture, depth of field, hyperfocal distance and focal length.

Features in production or recently shot with Cooke lenses include *Extremely Loud and Incredibly Close, The Bop Decameron, Hugo,* and *Midnight in Paris*.

Hugo is the first 3D feature production using ARRI Alexas and the first to use all three sets (times 2 because it's 3D)) of Cooke lenses: 5/i, S4/i, and Panchro/i. It is also the first major motion picture shot with 5/i lenses (closely followed by Woody Allen's *Midnight in Paris*) and the first major film to use /i Technology (metadata) and Transvideo CineMonitorHD 3DView /i monitors.

Gregor Tavenner, First Camera Assistant with Cinematographer Robert Richardson ASC on *Hugo*, said, "I was lucky to see the first sets in the US—at Clairmont Camera. They were absolutely gorgeous. They had a beautiful feeling. I ended up looking at 3 sets. What I saw was incredible consistency in those 3 sets. I shouldn't say this, but…there is such a thing as a Cooke Look. I wouldn't call it a gentleness—that would be a Speed Panchro—I don't know how to put it—what we're getting on screen and on the video monitors is not so much on or off in terms of focus. I wouldn't say more depth of field because that would be wrong—but the way the forward and backward drifts on and off is so attractive. Illuminated focus scales. Funny enough, that was such a low thing on my list when I first saw it. But, guess what. This was a perfect application for it. Two lenses inside a dark and crowded 3D rig, no way a Maglite would get in."

Hugo is expected in theaters on November 23.
trailers.apple.com/trailers/paramount/hugo/

The full range of Cooke 5/i, S4 and Panchro lenses will be on display at Cooke's IBC booth 11.D10.

		135 mm Cooke Panchro/i	135 mm Cooke 5/i
T Stop Range		T2.8 - T22	T1.4 - T22
Angular Rotation of Iris Scale	°	96	90
Minimum Marked Object Distance	mm	1000	800
	Inches	39	31
Close Focus from Lens Front	mm	790	531
	Inches	31	21
Angular Rotation to MOD End Stop	°	300	270
Max Diag Angle of View for S 35	°	14.16	12.68
Length fr Lens Front to Lens Mount	mm	157.8	219
	Inches	6.211	8.6
Maximum Front Diameter	mm	87	136
Max Format Coverage		33.54 mm diagonal — Epic S35 & Super 35 4-perf	30mm diagonal (Super 35mm Format)
Focus Scales		Two opposing focus scales - meters or feet	Two opposing focus scales - meters or feet
Focus Drive Gear		121 teeth 0.8 metric module x 5.0 mm wide. 99 mm from image plane.	180 teeth 0.8 metric module x 5.0 wide. 128 mm from image plane.
Iris Scales		2 opposing linear T-scales - whole and ⅓ stops marked	2 opposing linear T scales - whole and ⅓ stops marked
Iris Drive Gear		119 teeth 0.8 metric module x 2.5 mm wide. 84 mm from image plane.	173 teeth 0.8 metric module x 2.5 wide. 112 mm from image plane.
Screw-in Filter		Thread for screw-in filter or adapter: M82 x 0.75 pitch	Thread for screw-in filter or adapter: M131.0 x 1.0 pitch

Cooke 5/i

Cooke 5/i Primes are all T1.4, include /i Technology Lens Data and feature illuminated focus scales.

Focal lengths: 18, 25, 32, 40, 50, 65, 75, 100, and 135mm. All T1.4.

Cooke 5/i Primes are color-matched with Cooke S4/i, Panchros, CXX 15-40 mm T2 Zoom, Cooke Zooms, and SK4 16mm Primes.

		18 mm	25 mm	32 mm	40 mm	50 mm	65 mm	75 mm	100 mm	135 mm
T Stop Range		T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22	T1.4 - T22
Angular Rotation of Iris Scale	Degrees	90	90	90	90	90	90	90	90	90
Minimum Marked Object Distance	mm	350	350	350	400	500	600	650	750	800
	Inches	14	14	14	16	20	24	27	30	31
Close Focus from Lens Front	mm	125	121	121	171	271	370	421	515	531
	Inches	5	5	5	7	11	15	17	20	21
Angular Rotation to MOD End Stop	Degrees	270	270	270	270	270	270	270	270	270
Maximum Diagonal Angle of View for Super 35 Format	Degrees	79.3	61.9	50.5	41.0	33.7	26.1	22.6	17.1	12.68
Length from Front of Lens to Lens Mount	mm	175	177	177	177	177	177	177	183	219
	Inches	6.89	6.97	6.97	6.97	6.97	6.97	6.97	7.20	8.6
Maximum Front Diameter	mm	110	110	110	110	110	110	110	110	136
	Inches	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	5.35

- Maximum Format Coverage — 30mm Diameter (Super 35mm Format).
- Focus Scales — Two opposing focus scales - metric & footage. Scales marked from infinity to MOD.
- Focus Drive Gear — 140 teeth 0.8 metric module x 5.0 wide. 102.5 mm from the image plane.
- Iris Scales — Two opposing linear T scales - whole and third stops marked.
- Iris Drive Gear — 134 teeth 0.8 metric module x 2.5 wide. 82 mm from the image plane.

Cooke S4/i

Cooke S4/i Prime Lenses all open to T2.0.

They all have a front diameter of 110 mm (except the 12mm), and have /i Technology Lens Data connections.

Focal lengths: 12, 14, 16, 18, 21, 25, 27, 32, 35, 40, 50, 65, 75, 100, 135, 150, 180, 300 mm.

Cooke S4/i primes are color-matched and compatible with Cooke's 15-40 mm T2 CXX, 18-100mm T3.0 and 25-250mm T3.7 zoom lenses.

Note: the Cooke 65mm SF is a soft focus attachment for the 65mm S4/i prime.

		12 mm	14 mm	16 mm	18 mm	21 mm	25 mm	27 mm	32 mm	35 mm	40 mm
		S4/i	S4/i	S4/i	S4/i	S4/i	S4/i	S4/i	S4/i	S4/i	S4/i
T Stop Range		T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22
Rotation of Iris Scale	degrees	96	96	96	96	96	96	96	96	95	94
Miniumum Marked Object Distance	mm	225	225	225	250	250	250	250	325	350	450
	inches	9	9	9	9	9	9	10	12	14	16
Close Focus from Lens Front	mm	47	45	46	85	85	85	85	144	169	257
	inches	1.8	1.8	1.8	3.3	3.3	3.3	3.3	5.7	6.7	10.2
Angular Rotation to MOD Endstop	degrees	270	270	270	270	270	270	270	300	300	300
Max Diag Angle of View for Super 35 Format	degrees	102.7	93.8	86.2	78.9	71	60.9	57.8	49.2	45.8	40.8
Length from Front of Lens to Lens Mount	mm	126	128	128	113	113	113	113	129	129	141
	inches	5	5	5	4.5	4.5	4.5	4.5	5.1	5.1	5.5
Max Front Diameter	mm	156	110	110	110	110	110	110	110	110	110
Total Weight	kg	3	2.2	2.45	1.75	2	1.6	1.6	1.85	1.9	2
	lbs	6.5	4.8	5.4	3.85	4.4	3.5	3.55	4	4.2	4.4

		50 mm	65 mm	65 mm SF	75 mm	100 mm	135 mm	150 mm	180 mm	300 mm
		S4/i	S4/i		S4/i	S4/i	S4/i	S4/i	S4/i	S4/i
Aperture		T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2-T22	T2.8-T22
Rotation of Iris Scale	degrees	93	92	92	92	91	92	92	94	78
Miniumum Marked Object Distance	mm	550	700	700	800	950	850	1050	1300	2100
	inches	20	27	27	30	36	30	42	51	84
Close Focus from Lens Front	mm	373	523	503	623	757	614	840	1063	1846
	inches	14.7	20.6	19.8	24.5	30	24.2	33	41.9	72.7
Angular Rotation to MOD Endstop	degrees	300	300	300	300	300	340	300	300	300
Max Diag Angle of View for Super 35 Format	degrees	33.4	26	26	22.6	17	12.7	11.5	9.5	5.7
Length from Front of Lens to Lens Mount	mm	125	125	145	125	141	184	157	185	202
	inches	4.9	4.9	5.7	4.9	5.5	7.3	6.2	7.3	7.95
Max Front Diameter	mm	110	110	110	110	110	110	125	136	136
Total Weight	kg	1.5	1.6	2.25	1.75	2	2.25	3.5	4.3	4.7
	lbs	3.3	3.55	4.95	3.85	4.4	4.95	7.7	9.45	10.35

Cooke Panchro/i

Cooke Panchro/i Primes are color matched and perform like their S4/i and 5/i siblings. In fact, all three lines are currently concurrently in use on the Martin Scorcese 3D film “Hugo Cabret”, shot by Bob Richardson, ASC.

There are 6 lenses in the Panchro/i set: 18, 25, 32, 50, 75, 100mm, all T2.8-T22.

The front diameter is 87mm for all lenses. Angular rotation from infinity to minimum object distance (MOD) is 300°. Focus and iris gears on each of the S4/i, 5/i and Panchro/i series have the same pitch and are consistently located in the same position relative to the lens mount.

(cookeoptics.com)

Cooke Panchro Lens		**18 mm**	**25 mm**	**32 mm**	**50 mm**	**75 mm**	**100 mm**	**135 mm**
T-stop range		T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22	T2.8-T22
Angular Rotation of Iris Scale	degrees	77	77	77	77	77	77	96
Minimum Marked Object Distance	mm	250	250	300	500	750	900	1000
	inches	10	10	12	20	30	36	39
Close Focus from Lens Front	mm	80	93	139	311	563	711	790
	inches	3.1	3.7	5.4	12.2	22.2	28	31
Angular Rotation to MOD Endstop	degrees	300	300	300	300	300	300	300
Maximum Diagonal Angle for S53 format	degrees	80	62	50	34	22	17	14.16
Length from Front of Lens to Lens Mount	mm	120	106	109	137	137	137	157.8
	inches	4.72	4.17	4.3	5.39	5.39	5.39	6.211
Max Front Diameter	mm	110	87	87	87	87	87	87
	inches	4.3	3.43	3.43	3.43	3.43	3.43	3.43
Total Weight	kg	1.4	1.9	1.7	1.5	1.6	1.6	
	lbs	2.86	4.18	3.74	3.30	3.52	3.52	
Maximum Image Format Covered	33.54 mm diagonal — Epic S35, as well as Super 35 4-perf Format							
Focus Scales	Two opposing focus scales - meters or feet							
Focus Drive Gear	121 teeth 0.8 metric module x 5.0 mm wide x 99 mm from image plane							
Iris Scales	Two opposing linear T-scales - whole and third stops marked on both sides							
Iris Drive Gear	119 teeth 0.8 metric module x 2.5 mm wide x 84 mm from image plane							
Screw-in Filter	Internal thread for screw-in filter or filter adapter: M82.5 x 0.75 pitch (not applicable for 18mm)							

Panchro/i renamed mini S4/i

reprinted from
FDTimes Feb 2012, Issue 46

Introduction

Darius Khondji, ASC, AFC lining up a shot with a Cooke 5/i 50 mm prime on a PL finder. In Rome on Woody Allen's To Rome with Love, released in 2012. Photo by Philippe Antonello, courtesy of Massimo Proietti, General Manager of Panalight, the rental house in Rome that equipped the production, with kind permission of Woody Allen.

"Paris is always a good idea," (Audrey Hepburn in *Sabrina*).

Paris certainly was a great idea for the two best films of the year: *Midnight in Paris* and *Hugo*. *Midnight in Paris* was filmed in Paris on film. *Hugo* takes place in Paris, was shot partly in Paris, mostly at Pinewood and Shepperton, and done in digital 3D.

In *Midnight in Paris*, Gil asks Hemingway to read his novel and give an opinion. Hemingway answers, "If it's bad, I'll hate it. If it's good, then I'll be envious and hate it even more. You don't want the opinion of another writer." We happen to have the opinions of more than a dozen writers in this edition. Woody Allen and Darius Khondji talk about the style of *Midnight in Paris*. Darius discusses look, light, lenses, paintings, and photographs.

For *Hugo*, we have Bob Richardson, Rob Legato, Chris Centrella, Larry McConkey, Demetri Portelli, and Gregor Tavenner, with special appearances by Howard Preston, Jean-Marie Lavalou, and Laurent Mannoni. This section is longer only because I knew more crew on *Hugo* than *Midnight*. It's kind of a *Rashomon* approach, in which four characters told four divergent stories. Our dissection of *Hugo* has eight primary sorcerers telling the same story.

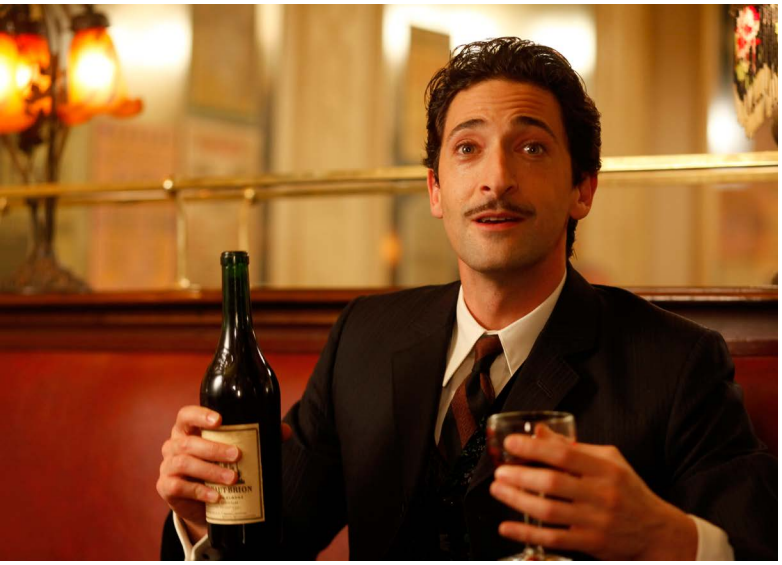
The production stills generously provided by studios and crew are gorgeous, but every reader of this FDTimes tome should hasten to watch these great films in a good theater many times.

Photo: Roger Arpajou © 2011 Mediapro, Versatil Cinema & Gravier Productions, Courtesy of Sony Pictures Classics.

The Look of *Midnight in Paris*

Woody Allen and Darius Khondji on the Japanese bridge over Monet's water lily pond at Giverny on *Midnight in Paris.*
Production photos pp 6-10 by Roger Arpajou © 2011 Mediapro, Versátil Cinema & Gravier Productions, Courtesy of Sony Pictures Classics.

Above: Alison Pill as Zelda Fitzgerald and Owen Wilson as Gil in 1920s Paris.
Right: Marion Cotillard, Alison Pill, Owen Wilson and Woody Allen.
Below: Adrien Brody as Salvador Dalí. "A very warm, flattering view of Paris..."



Midnight in Paris is Woody Allen's magnificent film about Americans in Paris, present, past, and pluperfect. Owen Wilson plays Gil Pender, a Hollywood screenwriter whose time-travel portkey to the Roaring Twenties is a sumptuous 1928 Peugeot Type 184 Landaulet.

Darius Khondji, ASC, AFC was the cinematographer. With technique and style that gracefully glide the screenplay's inspired transitions through different eras, it is a beautiful and painterly film, well written and wonderfully crafted.

Writer and director Woody Allen described the look and style of the film, saying he wanted "a very warm, flattering view of Paris—the kind that a restaurant has where they put red shades on the lights and have yellow bulbs sometimes, to make the women look very beautiful."

Shot on Kodak Vision3 200T and 500T film with Arricams in Super35 3-perf 1.85:1 format, *Midnight in Paris* offers a moveable feast of looks. Darius used Cooke Prime lenses, ancient and modern. For the modern scenes, he used one of the very first sets of Cooke

Darius Khondji on *Midnight in Paris*

John Sloan, *McSorley's Bar*. 1912. Oil on canvas, 66.04 x 81.28 cm
Detroit Institute of the Arts.

Above: Exterior - Night. 1920s. Marion Cotillard as Adriana and Owen Wilson.

Opposite: Exterior - Night. Modern. Owen Wilson and Léa Seydoux as Gabrielle.

Interior - Night. 1920s. Owen Wilson, Corey Stoll as Ernest Hemingway and Kathy Bates as Gertrude Stein. Photos: Roger Arpajou

George Bellows, *Dempsey and Firpo*. 1924. Oil on canvas, 129.5 × 160.7 cm
Whitney Museum of American Art, New York

5/i prime lenses, along with Cooke S4/i primes and Angénieux Optimo zooms. The 1920s scenes were shot with vintage Cooke Speed Panchro Series II and III lenses, whose coatings or lack of coatings contributed to the unique and classic period look.

Darius Khondji elaborated on the look, lighting, style, art, and photographic references they used:

"For the look of the Twenties, we worked with a wonderful production designer, Anne Seibel, and a great costume designer, Sonia Grande. Together with our director Woody Allen, we looked at pictures from Paris in the 1920s by Edward Steichen. We looked at Anne Seibel's research images and stock shots of Paris by Brassaï and Eugène Atget. We looked at paintings of George Bellows that I love of America in the 1920s: *Ringside Seats, Dempsey and Firpo,* and others.

"Other references were John Sloan's *Travelling Carnival, Election Night, The Haymarket*, and *McSorley's Bar*. And Everett Shinn's *Theatre Box*.

"I was looking at images from that period. They are beautiful. We looked at a lot of images of Paris in the Twenties: still pictures and also moving pictures that showed us the life of the time, the Roaring Twenties, that Woody wanted for his movie. We also researched what the light looked like at the time. We saw how there were pools of light in the city, from streetlights, cafes and restaurants. There was more light and activity in the center areas of the city. The light diminished as you traveled away from the city center, in the poorer areas. I was trying to put myself back into that feeling, that state of mind.

"It was wonderful to work like that and to be able to do a period piece this way. We looked at paintings from the period of the Surrealist movement and that also give us ideas. Not so much about lighting but about the feeling of the time: that something new was going on which was a mixed feeling of trepidation, of excitement, and at the same time very conservative in other areas. There was a strong contrast between the Surrealist movement and the conservatives.

"I was also fascinated by the idea of "the lost generation" and that there were a lot of Americans in Paris who fought in the war. Some of them were artists and intellectuals who remained for a time and were kind of lost, wandering around after the First World War, staying in Paris, some hanging out. There is a beautiful image of this in *The Last Flight* by William Dieterle.

Darius Khondji on *Midnight in Paris*, cont'd

"This was also a key for me to the movie. Even if it doesn't always show in the cinematography, it's important to have things that carry you through like this when you photograph a film.

"The script was a jewel to put into images. For the night exteriors I went warmer, adding more red and less exposure as I was treating an older period of time, using older lenses, longer focal lenses, less camera movement, and a little more diffused light in general. The image was less sharp, with more backlight. The period piece exterior nights were more low key and we lit mostly the entrances of cafes and restaurants at night letting the streets go darker. Our Senior Colorist Joe Gawler at Deluxe New York did wonderful work fine-tuning all the colors and density helping us create this world of color."

Look of the Roaring Twenties and Belle Epoque

"The scene in the 1920s where Gil first meets Hemingway in the bar was lit with warm light, top lights and using more photographic lights. I like to use still photo lights, sometimes more than film lights. I used Chimera-like lights—the type of soft boxes that are very flat, like octagons. With egg crates.

"For our lighting, the 1920s were done with warmer lights and warmer keys. I used strings of lights on panels and with dimmers. I used older lenses for the 1920s: Cooke Series II and III.

"As I said, we used less camera movement. And slightly longer lenses. We would try never to use wider than 32 mm and used more the 40 mm or a 50 mm lens. We wouldn't go with a 21 mm or 27 mm on the period pieces. We used these older Cooke lenses and used focal lengths that are a bit more classical. These slightly longer lenses just added a bit more style. I had the feeling that it was giving me something more. Whereas for the modern time, the look was a wider angle and much crisper, so I used the newest Cooke 5/i prime lenses. They are beautifully sharp and very beautiful when used close to wide open. For the modern period, with wider angles and more camera movement, we used cooler lights."

Classic Cooke Series II and III Lenses

"We found the Cooke Speed Panchro Series II and III lenses at Panavision in Paris. They were gathering dust, sitting on the shelves of the rental house. Few people use them. We had some of them redone, rehoused, had them worked on, cleaned and everything. They were beautiful. I used to use these lenses when I started as a cinematographer in France when I shot movies like *Delicatessen* or *The City Of Lost Children*.

"At the time I was using them they belonged to Technovision and Technovision was later bought by Panavision. But Technovision had them on BNCR mounts at the time. And now they are all PL mounts. Technovision's founder Henry Chroscicki was a dear friend of mine. I loved him very much. He helped me a lot at the beginning when I started. He was really passionate and a great soul for young cinematographers and filmmakers in general."

Look of the Modern Period

"For the modern period, I used Cooke 5/i lenses. But we shot *Midnight in Paris* more than a year ago. At the time, we could not get a complete 5/i set. So what I did was I took a set of S4/i to complement the set, to fill in for the missing focal lengths. I had

four 5/i lenses and the rest were all S4/i. I know they now have made more lenses to complete the sets.

"Of course, the 5/i are faster lenses (T1.4) than the S4/i (T2.0). They match at the normal speeds. But the way they are faster, they are equally or more beautiful lenses than the S4/i wide open. When you use them wide open they have very beautiful images.

"I was helped by Natasza Croscicki who helped us find all the lenses and also very good Camera Assistants Fabienne Octobre and Julien Andreetti for the research on lenses together with the techs at Panavision Paris.

"The Grand Vefour Restaurant scene was a lit through the windows with a very soft light through diffusion outside the windows. I also had a great Gaffer Thierry Baucheron and Key Grip Cyril Kuhnholtz with their crew on this film.

"For the modern lenses, I used a very light diffusion like Classic Soft, or a mix of Black Classic Soft, Pro-Mists and things like that. But very light. The old lenses had their own softer look, which I relied on more than diffusion."

For all cinematographers who yearn to time travel back to the golden age of cinema, a set of classic Cooke S2 and S3 lenses may take us there, the way *Midnight in Paris* swept us away.

For Americans in Paris visiting the AFC Micro Salon this February, we asked Darius to name one of his favorite restaurants. He recommended a restaurant called Le Chateaubriand, at 129 Avenue Parmentier, Paris 75011.

Moving *Hugo*

reprinted from Feb 2012

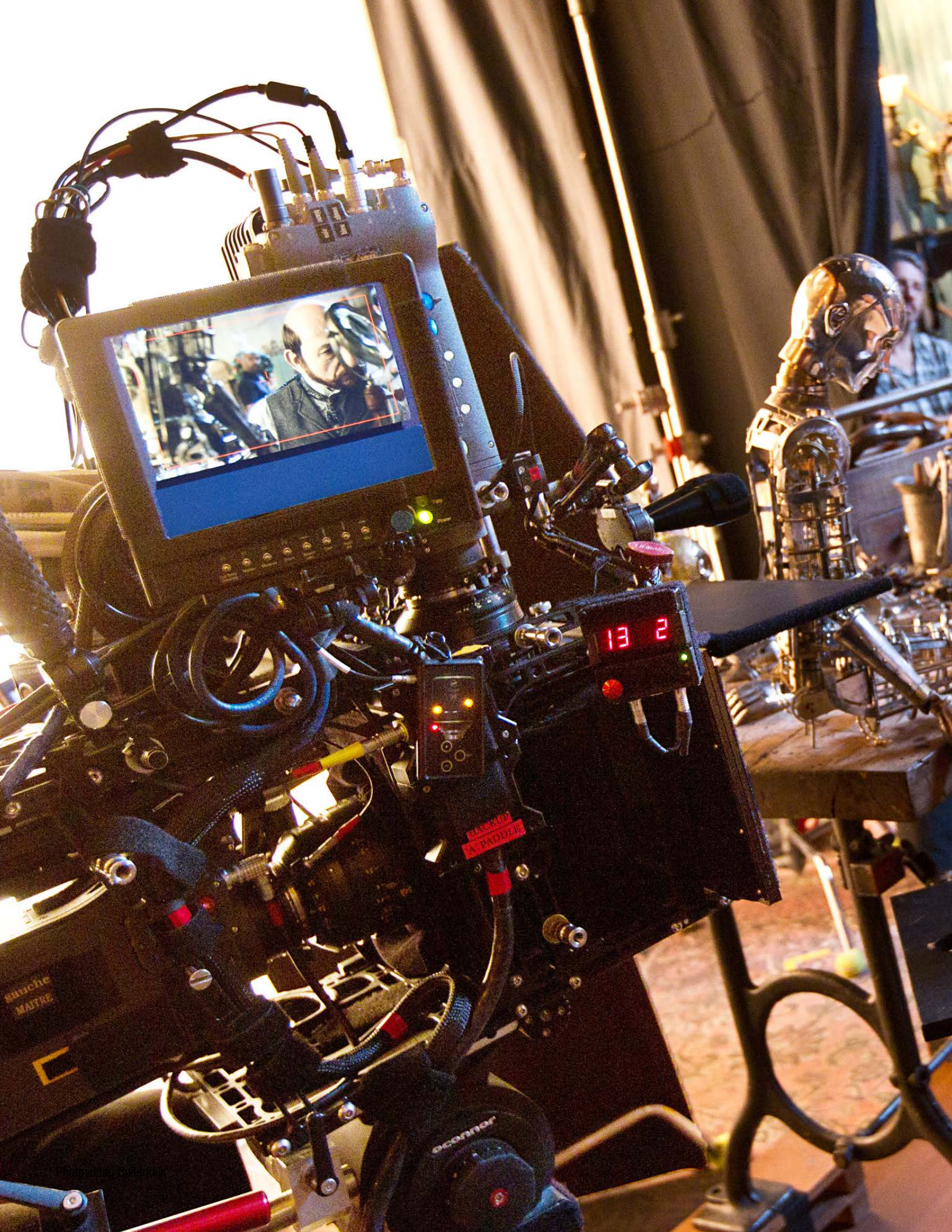
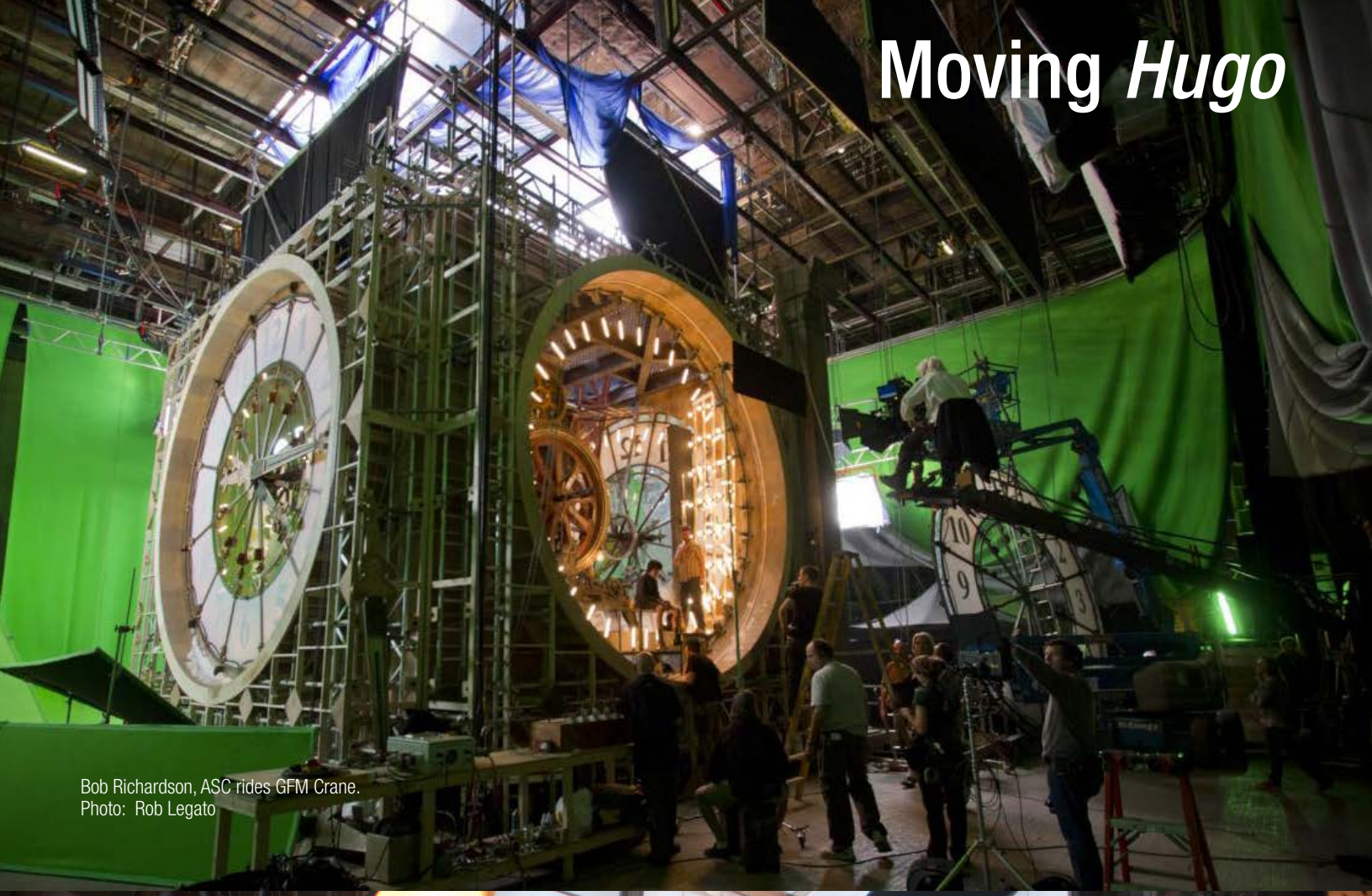


Photo: Jaap Buitendijk

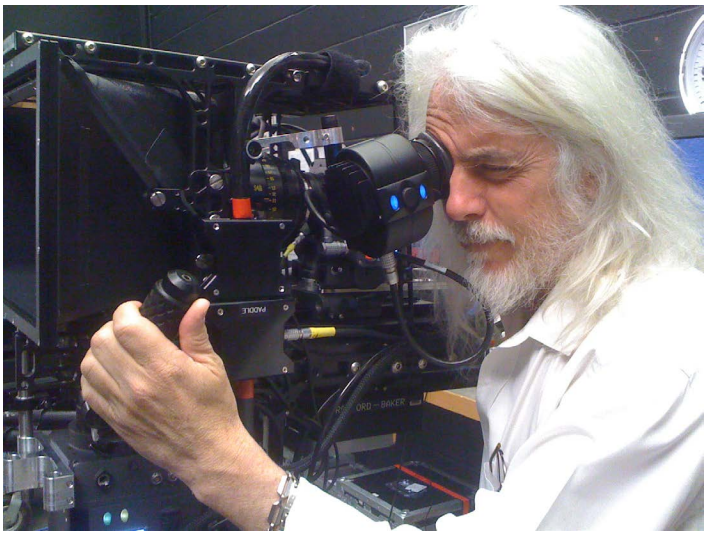
Moving *Hugo*



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

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

Richardson on the Look of *Hugo*



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

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

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

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

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

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

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

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

Weren't they stunning? It was natural light. It's a real location, the Bibliothèque Sainte-Geneviève. We were very fortunate that we had these shafts. We lit outside each window in advance, and then the real sun came streaming in. The shot you're talking about was, for both Marty and myself, an extraordinarily remarkable moment. I set up two dollies simultaneously, knowing the speed at which the sun was going to come, so we'd get a series of shots when the sun was there. And I set one closer for the medium shot and one further back for a wider shot. And then, on top of that, we had the crane on the left hand side move one, two, three, as rapidly as possible, to keep the sun in its proper place to match.

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

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

The 3D enhances that, I guess. But the 2D can't capture the weight. Well, it's two dimensions versus three dimensions. You are feeling the sides of the light source. And it's giving these—you said like pillars of light—it's giving the light beams mass. In 2D, it's just a shaft. It doesn't have mass. That's where the 3D is phenomenal, in terms of how it transforms the emotion for me.

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

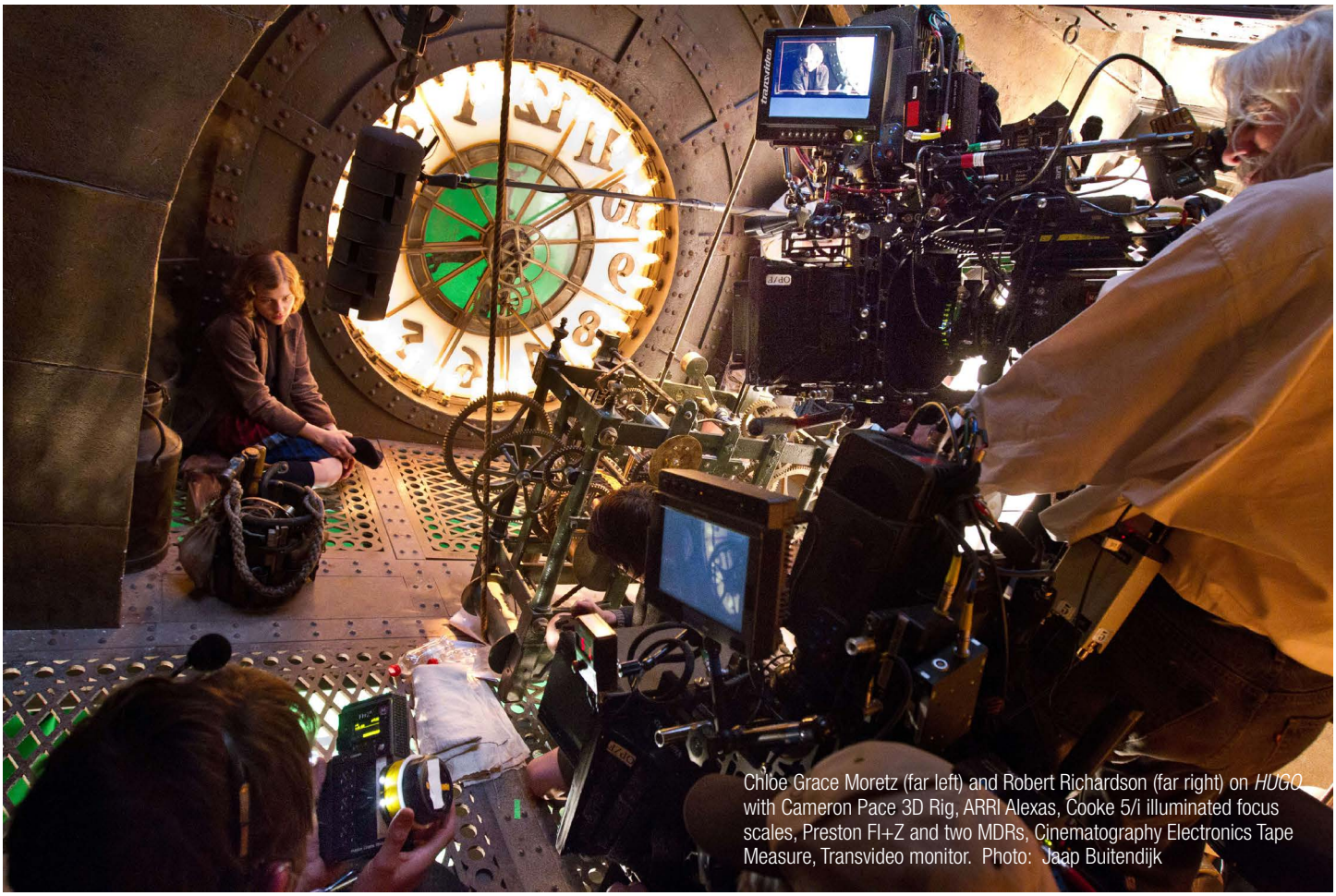
What about the look of the film and Lumière autochromes?

We began early with a series of screenings at the BFI (British Film Institute) and with Marty's selections. The Autochromes were a principal place for leaping off. But we also looked at early films that were tinted, toned and also hand-colored, including *The Great Train Robbery, Nosferatu,* and the work of Méliès. You can sense that in some of the tinting and toning in the flashbacks, with Hugo's father. Now, when Hugo was not with him, we did sort of a tint of a blue with a toning of an amber. And particularly, in night time scenes prior to the fire coming up the stairs.

(Autochrome is an early color photography process, patented in 1903 by the Lumière brothers in France. It was an additive technique and the major color photography process before subtractive color film was introduced in the mid-1930s.)

Autochrome became the basis by which we looked at that time period. A look up table was created. It's not a totally accurate mirror of Autochrome, but it is something that we felt closely resembled it, and close enough to give us the impression that we could work in degrees from it. For example, the majority of the material might be working at 50 or 60 percent of the Autochrome. But the flashbacks, where you see Méliès with his wife, those were as high as 150 percent of the Autochrome.

Richardson on *Hugo*, cont'd



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

Tell me about dailies, post and DI…

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

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

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

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

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

For Hugo's apartment in the station, there was a combination of lights. We put gels on the units to gave it the look. We used blue top light, blue beams, with white light on the bottom that was down on the dimmer about 40 percent. I would change my color temperature directly on the Alexa camera, depending upon the amount we were searching for. So you might be looking at something that was shot at 3200 or 4500 or even 2300. It would depend on which scene.

What were you using in the station, where you have a lot of big areas and really strong backlight?

Those were all Dinos or 20Ks. In most cases, that light was full intensity 100 percent, but I would gel. I might gel them ½ blue, or ½ straw, depending on what I was looking for, late afternoon, or if I wanted to use a cooler light. The colors were very different from what we've experienced in the past. With film, you would add a filter.

How did you rate the ARRI Alexa cameras?

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

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

I gravitated toward the notion of starting with the very best. We can fully remove quality later. But it's virtually impossible to add quality back once it's gone.

But, we went with Cooke 5/i primes for another reason: to use the metadata. We were pulling /i data from the lenses. It was early on, but we said we should try this because was available to us. Anything that helped the visual effects, we did.

Richardson on *Hugo*, cont'd

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

Some of the shots had a gorgeous halation. Like when Hugo is backlit, and there are glints on the hot spots…

Part of that was contributed from the digital intermediate where we put in a very light diffusion to create that, and blend it in. If you watch the outside edges of a number of those images, you'll see vignetting. In that vignetting, you'll see diffusion in various degrees. Sometimes it enhanced. Hopefully you didn't notice it. That's a good thing. But it does bring your eye in.

We would also use a small digital vignette around most images that were dark—around the whole image. It would vary between 10 percent, 20 percent.

When I blow somebody out with a strong backlight, that's a natural halation. It's going through the lens and the mirror.

You could see that not only on Hugo, but when I shot the Station Inspector from Hugo's side of the jail cell: he was lit with hard backlight and that halation is just the natural property of the lens. They're in combination.

That was a learning curve. At first, as I was learning how to shoot 3D, there were a lot of yeses and nos. Don't use backlight. Don't go above a certain lens. A strong backlight off a white surface can cause a level of pain when you try to blend two eyes.

When you can't settle them properly you find yourself using wax or something to take that sheen down, or cutting it when you see that it is too much of a problem. Sometimes it causes ghosting as well, which is pulled out in post. All 3D films have sort of that similar problem.

But, in the long run, you didn't worry about the backlight?

No. In the long run, the decision was to have 3D move to me, not me move to 3D. Certainly taking into account the limitations or the issues that everyone was bringing up, we determined what was truly an issue, rather than acting out of fear. We said, "Let's shoot this movie the way the way we want. And then, let's make a decision if we're finding that it's uncomfortable."

One excellent thing about 3D is that it does not let you miss. If it's uncomfortable, you know it's uncomfortable, and there's something bothering you. It's immediate. You'll want to react, unless you're fatigued. We sometimes missed things due to a level of fatigue. But there were enough of us watching it that someone would catch it, generally Demetri, our stereographer.

And they're watching it on what?

We all had JVC (GD-463D10 46-inch 3D LCD) HD monitors. They were all consumer monitors. We did the best we could to keep them consistent. Greg Fisher calibrated them. They were checked regularly. Sometimes, Marty would ask, "Well, why does it look like this?" Because we were now looking at an almost finished product. For a director, the quality of output in HD is superb. It isn't flickering. We've all been accustomed for a long time to flickering on video assist monitors when shooting with film. The quality of motion picture film standard definition video playback has generally been quite miserable for most people. ARRI has made strong headway with their HD video assist. And now with the Alexa or other cameras that are being used, you have extremely precise images.

Richardson on *Hugo*, cont'd

Photo: Jaap Buitendijk

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

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

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

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

Those were all done with long lenses: very tight, macro work on the gears. We ended up using 135 mm close-focus Cooke S4/i lenses. Sometimes we added a diopter on them. It took a bit of work to find the right combination. What's complicated in doing close-up shots in 3D is getting two lenses to match exactly, and coordinating the focus and everything else. So, when we had those tight shots, generally it'd be a 135 mm lens or something like a 135 with a +½ diopter or +1 at most.

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

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

When he sets focus he anticipates. You know, everyone works off of a remote focus unit now, pretty much. He marks the lenses so that when he adds a +½ diopter, for example, he already has focus discs pre-calibrated for the remote focus device. He'd just put the focus disc on for the +½ diopter. And when we went to the +1 diopter it would be a different ring. We had to experiment to see how close we wanted to go in 3D, which is sometimes just hard to do. Marty would make an alteration in the shot to accommodate the close focus.

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

If they rely too much on the monitor, they may lose their eye for distance. I worry that they may lose some of their art or skill. What happens if you shoot on film next and you don't have HD video assist? Not every show is going to be on an Alexa. Plus, the reaction time can be a little bit delayed if they're looking at a monitor, because by then it could be too late. Of course, one of the values of the monitor is that if there's a little buzz, they can see it.

What about you, looking through an electronic viewfinder?

I find that looking through an electronic viewfinder is complicated. I can't really see focus as clearly as before. But, more than that, what did take place was that I was quite worried at the very beginning, would I be able to light?

Would I be able to light through its small television eye piece? Because the electronic viewfinder is really a small eye piece that's a television. So, what I began to realize is that when I was doing initial tests for darkness and sensitivity I would have a camera with me, an Arriflex 435, a regular ARRI film camera body. And I used the same lens. I put it up next to the monitor on the dolly. And I trained myself.

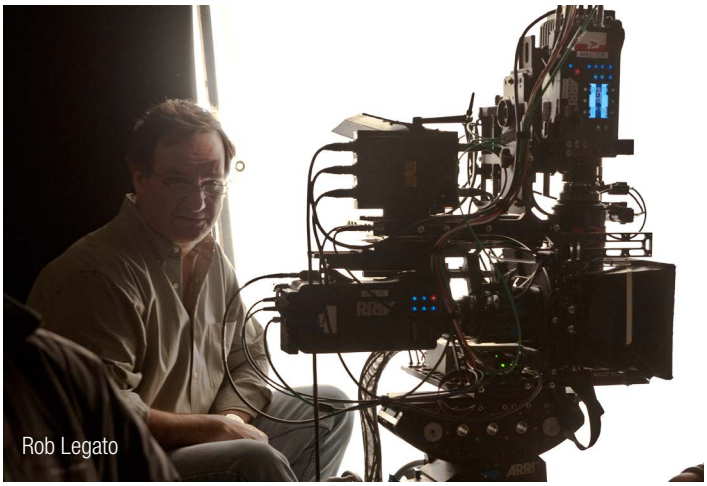
I would look to see if I were seeing the same thing through both cameras. At a certain point, I stopped. I didn't need the film camera anymore. I just worked off of the Alexa. In combination with 3D and being able to go off the monitor, I was also seeing things I had never seen before. And so, that changed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

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

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

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

Legato on Moving *Hugo*


Rob Legato

Jon Fauer: Take us through the opening shot—the clock gears becoming the streets of Paris, moving in to the station, along the platform, through a puff of smoke, into the live-action station, up to the clock face and in to a close-up on Hugo.

Rob Legato, Second Unit Director and Visual Effects Supervisor: The very first portion—with the clockworks that become the Arc de Triomphe area—was carefully selected. The subtext is that Hugo sees the world as a machine. There's something mechanical about the Arc de Triomphe area and how it matches up to a clock and the spokes of a wheel. That became a totally synthetic shot because it's an idealized version of Paris. It's not the real thing or real geography. It's our version of what you might remember.

It has a specialized color palette as well. I handed the pre-viz camera move to ILM, who then produced that portion of the shot: the clock, the Arc de Triomphe area, the Eiffel Tower. It pans and tilts in to the front of our station, which was done in CG by Pixomondo.

In the next portion of the shot, it's snowing and the camera is now pushing through to the back of the station. As we boom down to get into where the people are, the people are actually on treadmills and shot stationary on a greenscreen platform. The rotation of the treadmills becomes the rate of speed that they appear to be walking. They have the same sort of lighting that Bob Richardson developed for the movie, which is a fairly big back light, 20K back light, and passive fill pretty much throughout.

The people are in fixed positions. It's not a real camera dangerously moving past them. In fact, we shot the people in 3D from four different vantage points: in front of them, slightly to the side, further to the side, and then even more. With CG, we were able to reproject the geometry of the scene. It's manipulated to look as if we motion controlled that shot, which we didn't. In essence, we post-motion controlled the shot. The CG makes it look like we brush past the people on the platform, which is something we could not have done with live action.

That fooled me. I thought, this can't be real people, but I looked carefully and they were.

That's part of the theme. The movie itself is a magic trick. A sleight of hand. The fake is real.

And when you look at it, it's like, "Well, the part that I would have intellectually guessed is wrong is right."

The CG platform and the CG trains are added. I prefigured the whole shot to calculate from the puff of smoke where I could transition to the live-action set.

It's harder than you'd think because where that puff of smoke happens, to get that shot, we had to be outside the stage. We had to build a ramp to get the camera car up to speed to match the speed of the CG shot coming into it and then use the puff of smoke as the transition device. You actually see people walking through the puff of smoke.

I had to prefigure out with Key Grip Chris Centrella how fast we needed to go, what device would actually get us there and, once you have that device, how far can you crane up at the end, which is not very far, but enough to get me sufficient overlap that I could start picking it up with a CG camera to move into Hugo's eye.

The end of the shot, where we go to his eye was actually done with motion control and later reprojected with 3D geometry so we could control the exact speed. Then we glued it all together so that it looks like one seamless piece.

How did you do the live action part in the station?

We had to block it out with stunt people because the camera is going pretty fast. The camera car is driving through them and it looks like the camera is doing near misses. They have to be very close to the camera and then basically dart out of the way. Those were all stunt people.

Everybody after the puff of smoke is done live action from the remote head mounted on a crane armed in front of the electric camera car. At the end, the camera starts to crane up above the people's heads. Of course, we don't have a ceiling, the ceiling was put in with CG, because that's where all the lighting is coming from.

So, as soon as we go past their heads at the end, that becomes a totally computer-generated clock face as is the rest of the building. Prior to that, the CG clock has already been put in so that you never see a break and that, again, is another sleight of hand. If you see it as a jump cut, you'll see everything change at one time. You're bound to notice it. But if you see only minor portions over time changing, you have no way of knowing that it's changing. It's like a cross-dissolve that shows you everything fading out at one point and fading in at another point. But if you stagger portions of the cross-dissolve over time, it becomes very difficult to detect.

If the audience's attention is on the center of the frame, then we can

Legato on *Hugo*, cont'd

2nd part of 5-in-1 sequence: Louma 2 planes straight down, following boy on green screen platform. Photo: Rob Legato

start changing the perimeter of the frame because no one's really looking at it, just like you do in real life. Ninety percent of your vision is looking straight ahead. Your peripheral vision is weaker. But then if you say, "Okay, now you've caught my eye so I'm now going to look on the edge of frame," that's the time when we can change the center. It's kind of a magic trick, misdirecting your attention.

How did you design the complex continuous shot that takes Hugo through the Dickensian passageways inside the station? (It begins at 2 min, 38 sec.)

It's basically the idea of creating one shot that follows Hugo to really show him and his environment. The journey tells the story.

The Louma 2 was important for us because of the telescoping rig and the fact that I could encode it to have the evidence of where I moved the camera. I brought all of the computer equipment on the stage to provide a live preview. You could see what was going to go into the green screen as you moved the camera in 3D depth and motion.

I pre-visualized the shot in the computer to appear to be one long Steadicam shot—but it's actually five separate sets and five separate pieces. Break-away walls and various things allow it to be done, and then the computer would put back the walls that were taken out to accommodate the physical Louma 2 arm and the mechanism of the camera.

So, we designed this particular shot specifically for the capabilities of the Louma 2, the telescoping arm, and its ability to raise and lower and move with automatic compensation that takes the arc out of the crane. For example, if you want to do an absolutely straight move down, it does that for you—automatically telescoping in and out to adjust the geometry.

Once I knew that I had a piece of gear that could do that, then I was free to design the shot to take advantage of what it does. It still would appear to look like it's done with Steadicam operator running behind Hugo, even if that would have been physically impossible. Here are the 5 shots, which look like 1:

1. Hugo (Asa Butterfield) is looking out at the station from behind a big clock face. He runs toward camera. We are on the Louma 2 crane, telescoping in to lead Hugo. We follow Hugo all the way from the clock face to the point where he jumps to the ladder. The Louma 2 is no longer moving. All it's doing is tilting.

2. At that point, we go to another new set. We repeat the same tilt on this new set and use a pipe in between as the transition point. It's actually a different boy, too, so it goes from the real Hugo (Asa) to his stand-in at that point. I wanted to create the illusion of what I might do if I was a kid: I would put my feet up against the ladder and slide down instead of climbing down because I'm so familiar with my environment and it seems like the fun thing to do.

To do that, we built two side rails. The boy is standing on a green screen square that is basically an elevator rig. He jumps on the platform and a couple of special effects guys are yanking him down elevator style, while his feet are pressing up against the rails as if he's actually sliding down.

Later, the green screen square that he's on becomes the infinity portion of the set going down X multiple levels, so it appears as if

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

he's just sliding down the ladder. We added the ladder rungs later, because we had to leave a channel to safety him as the platform descended.

The Louma 2 has been basically booming straight down, automatically telescoping in and out to compensate for the arc. (Called planing, it's as if the Louma 2 were pressed against an imaginary sheet of glass.) Once it reaches the ground, the arm telescopes out to follow Hugo and then pans to the right as he goes to jump into the coal chute. And then, in CG, we create the whip-pan hinge as we lose him for a couple of frames.

3. We now pick Hugo's stand-in up in another separate studio shot, which is the rotating coal chute against a green screen. The rest of the set is added as CG. The part that was almost impossible to do, and was the hardest to figure out, was when he's on the coal chute and sliding down. What I came up with was using the Louma 2 again.

Basically, the boy was almost in one spot as the chute corkscrewed around him. His butt was sliding and doing a full 360° of the coal chute. All the camera had to do was boom straight down to make it appear as if it's following through his path.

Once you add and mimic the rotation of what the coal chute is doing and apply that to the set, the set appears to be rotating and spinning. It's an optical illusion. The opposite is happening. He's really staying in one place. The chute is sliding underneath him.

4. When Hugo lands on the floor, he starts running and we melt into the next Louma 2 crane move, which is basically dollying with the real Asa again as he runs through the big gear. It's a lateral camera move along a full set and he's just literally running. Then he climbs up the spiral staircase…

5. We finally pick up with the only portion that actually is a live-action Steadicam shot, as Asa and Larry McConkey run through a narrow corridor, into a larger room, past the clock mechanism, moving into a close up as he peers through the numbers onto George Méliès' shop below.

I think it was Bob Richardson who said that you used lens metadata and Cooke lens /i data.

Yes. We use any piece of information that can come out of the camera. It helps us solve problems.

For example, let's say we have a 20 mm lens. Or we're doing a zoom or changing exposure. Metadata is something that tells us what's happening. It can tell us what the curve of the focus move was and everything else. It's essentially a predictor of where we are and where we were.

If we're just looking at the visual, we can't always quite tell if the focus is perfect or in and out or that we're moving the ring of the lens and all that sort of stuff. So, any piece of data becomes helpful and useful. It's all good. It can't hurt and it can only help you.

And the further away you get from the shoot, you forget more and more what you did. On the day, you say, "I won't forget this." But four months later, you're going, "Uh-oh. I don't remember if we were at T1.4 or T2.8 and why didn't they write that down on the camera reports?"

Metadata adds a very good graph of what actually transpired

Legato on *Hugo*, cont'd

Bob Richardson, ASC and Rob Legato on *Hugo*

during the take.

It is helpful because it says, "Here's what we know the lens and camera were doing." It's very accurate and very good to give you an idea of the settings for a match move. And we used it directly. We just set it into the computer, like in the shot of Hugo going down the slide, we set all the metadata information so I could see a composite of what was happening.

Where do you store this metadata that's coming out of the lenses, the Louma 2 and everything else?

In this particular case, because we were having on-set live compositing, the metadata was stored through a program called Motion Builder and it basically became a scene file. The temps (temporary scenes and metadata) were used in editorial until we could replace them.

When Sacha Baron Cohen as the Station Inspector is chasing Hugo along the platform, Marty asked me to come up with something because it was going to be a chase scene near the train. The background was all virtual. It was something where we would have to put in the entire set.

And so I came up with the concept of the one shot, where we're traveling with the Station Inspector and the camera keeps on booming up and up to discover that Hugo is on the bridge that crossed over the tracks, and at that moment a train comes underneath him. It's essentially right after the chase scene where he runs through the café.

This was Key Grip Chris Centrella's favorite shot, as well.

That's the fun, collaborative collusion of the way we all work together. As nutty as it was, it's like, "How the hell are we going to do that?" And we're thinking how we just made up a crazy shot. But then we realize, it's like, "Yes. We can actually do it."

Chris is very bright. He's, probably the smartest and probably the best Key Grip I've ever worked with.

He figured out how big a dolly platform we would have to build. And how much track. All that stuff. And Bob was onboard with it, too, because it's kind of a cool cinema shot where the move reveals the drama that's within it and can only be done that way because that's how the camera reveals it.

It's like you don't even know why exactly you're booming up until it pays off at the very end. That was also very satisfying: to combine into one shot the 10 or 12 shots of a chase scene that would take two or three days to film, plus hundreds of thousands of dollars of CG work to add backgrounds to the whole station for all the different cuts. To do this as one piece and then to do it well—that was satisfying.

And the guys pulled off the shot. It matches almost identically the previous shot.

And then the other fun part, because it's so retro, was this: anytime you see trains, we added those trains in, except for the shot where the train seems to be dragging Sacha Baron Cohen. And the other scene at the end where Asa runs through the train to get to the other side and he throws the automaton up in the air and it lands on the track.

The only time a physical train was actually used, it actually doesn't move. It took all night to get it into the place and there's no room to move it because it goes from one end of the set to the other, so there was no driving it in or driving it out. And Sacha wanted to do this shot of being dragged by the train, so we did the old fashioned gag of you don't move the train, you move the world.

We got the art department to build about 60 feet of set and put it on sleeper dolly track wheels. Basically, the set is on wheels. The set is like a giant 60 foot dolly. And you put the camera on it.

Wherever you move the camera along with the person on the platform, the optical illusion is that the train's moving, because the people are stationary relative to the camera.

It looks like the train's moving. It's extra satisfying because it's an in-camera trick that you can't figure out because your brain just automatically says, this is what I would expect to see and I see it, so it has to be real, yet it's totally not real. It is an optical illusion and those are the most fun to do because, again, it's an in-camera gag. And it harks back to a gag that George Méliès would have done himself.

What do you think is next? 4K, high speed, 48 fps projection?

All that stuff is next. It's basically a quest. I don't know if anything will ever really quite replace what we consider movies. It may be all 3D and I think this movie proves that you can certainly shoot a drama, tastefully made, in 3D—and 3D does not distract, but enhances the mood and tone of the movie. So it's no longer something that's just for specialty films.

Centrella on Moving *Hugo*

Chris Centrella, Key Grip on *Hugo*, discussed the opening shot of the film. "What they wanted was a shot quickly moving slightly above the waist level of passengers in the train station, moving into a close-up on Hugo Cabret (Asa Butterfield)."

The live action shot begins after the virtual camera swoops in from high above the Gare Montparnasse, whizzing along the station platform between two trains, and through a puff of smoke. To accommodate the transition, they built a tunnel outside, leading into the studio as the camera had to be traveling at the matching 12 mph speed. A GFM (Grip Factory Munich) GF16 crane with remote head was mounted to a camera car. This positioned the camera 12 feet from the front of the car. The car then accelerates to about 14 mph, moving through the station past passengers who are actually stuntmen and women. The car reaches its end mark, and the remote arm rises up as the camera moves, via an indistinguishable transition to CG, into a tight close-up on Asa.

The GF16 is a big, modular, remote and rideable crane. It can be configured in many sizes, and can take a remote head and camera up to 50' or a camera operator up to 37'. Bob Richardson uses GFM cranes extensively.

The Loumasystems Louma 2 is a 33' telescopic remote camera crane, used frequently on moving *Hugo*. After a sequence establishing many of the station's characters and locations, another virtuoso "continuous" shot (composed of 5 seamless elements) leads Hugo from his high vantage point behind a clock face (1: Louma telescoping in) along another narrow corridor, down a ladder (2: Louma descending and following), and along another corridor, through a door and down a coal chute (3: Louma planing), through a Dickensian maze (4: Louma tracking) of pipes, grates, grilles, steam, giant clockwork gears, up a spiral staircase, and along another narrow, fantastically lit passage, (5: Steadicam) into another behind-the-clock vantage point overlooking George Méliès's toy shop.

The first chase sequence, eight minutes in, begins when Méliès says, "Get out of here you little thief." The Station Inspector and his trusty Doberman Maximilian set off in hot pursuit. The dog skids around obstacles and turns with four-wheel drifts, four-paw drifts around the floor. The Station Inspector leaves a trail of carnage worthy of Inspector Clouseau.

Chris explained, "In the chase sequence, the camera leads the Station Inspector from train track level—as he pushes passengers out of the way. We used about 300' of double track, with the Louma 2 mounted on an 8' x 16' platform. We needed two tracks to accommodate the Louma 2 and the grip crew operating it as it telescopes and swings around. Towards the end of the shot, the camera rises, tilts down, and continues to rise above Hugo, who is standing on a metal walkway above the tracks. This would have been a challenging shot in 2D, let alone 3D. It was a real-time shot, real in every sense, except for some greenscreen.

"The Louma 2 became a big tool on the entire movie because it enabled us to be nimble with the cameras and 3D rig, and let Bob operate the way he's used to operating. The Louma 2 also allowed us to get into tough or tight places. It enabled shots that might have physical limitations using traditional equipment, like a low angle quick tilt up where you have to keep your eye to the eyepiece. Adam Samuelson had a fluid head style control built for the Louma 2 so Bob could operate in a spontaneous style. Also, the Louma 2 can take the camera up to 31', which is very high, and it's very steady.

"To move the cameras, we also used GF8 and GF16 cranes, and a Filmotechnik Flighthead with a pan bar built by ARRI Media. This was used where we needed stabilization. The Louma 2 is very solid and worked 90% of the time, but sometimes we needed stabilization, especially on very fast moves. Of course, we used regular dollies and fluid heads much of the time. Bob and Marty told us to treat this like a 'regular movie.' And I like to say, if we can't light it, we can't shoot it."

In the scene just described, a 140' x 40' green screen backed the actors on the station platform. This green screen was back-lit by 6,000 bare light bulbs. The reason was space—front-lighting the green screens would have taken up more precious room.

Chris continued, "Although we were told that backlight was bad for 3D, Bob did it anyway.

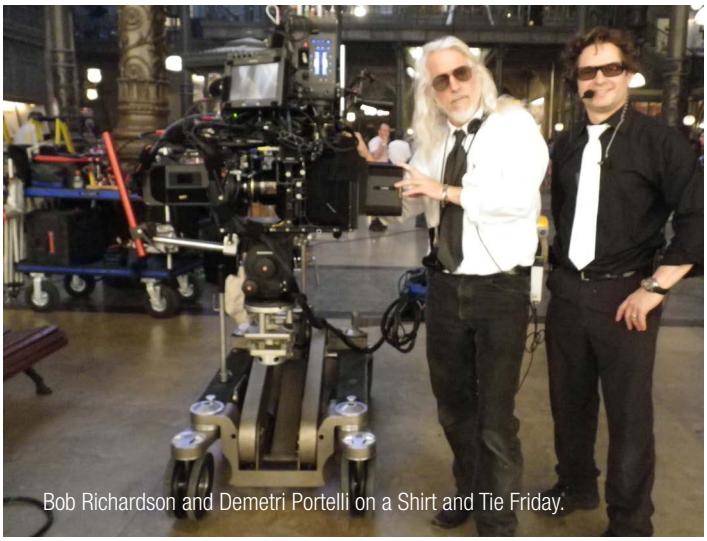
"The results are beautiful, and no headaches were induced. This is some of the best looking 3D I've seen. We used 20Ks for shafts of light and Dino Lights, often hung 10' apart for direct backlight. Diffusion came from silent Gridcloth, sometimes dyed blue or charcoal gray. We get these from Pat Caputo's 'The Rag Place.' Key light was signature Bob Richardson double-bounce: a 20K bounced off a muslin which bounced off another muslin."

Top ambient light came from gaffer Ian Kincaid's overhead light boxes. These were made up of Space lights (6 x 1K bulbs on a wagon-wheel-like frame) with diffusion underneath. Access to the grids (perms) was necessary to control all the spill from the green screens.

Night ambient light came from 40' x 40' lightboxes, weighing 7,000 lbs. These were made with 24 Space Lights, without skirts, and diffusion stretched across the bottom of the frame.

40' x 40' lightboxes.
Photo: Jaap Buitendijk

Portelli on *Hugo* 3D



Bob Richardson and Demetri Portelli on a Shirt and Tie Friday.

Jon Fauer: Talk about the role of Stereographer. Do you converge on the subject, as a focus puller stays "with the money?"

Demetri Portelli, Stereographer: In good stereography design, this is not a rule as it must be in focus. The shot depth as a whole is of far greater consideration. Sometimes one does not need a specific point of convergence at all. The job of the stereographer is frame-by-frame depth creation, depth choices, and consistent depth management throughout every frame of the shot is vital.

In the morning, I know that my coffee cup which is in my hand is round because each eye sees around that coffee cup from a different position. So my own interocular allows me to create a depth perception in my brain with which I will judge the distance of the mug as it is lifted towards my mouth.

Every shot is unique and has its own set of variables. To pull dynamically is to acknowledge that both the IO (interocular) and the convergence are interrelated and it is only through a dynamic exploration that any real finesse and control of the medium can be achieved with on set stereography duties. When building a shot, a dynamic pull must be motivated, hopefully anticipated. If improvised, it should be very well calculated from experience. From a big wide shot high in the train station I can afford a large IO and a deep convergence. As we come down to the floor and people walk close to camera, I not only need to pull down the IO, but I must find a more "acceptable" convergence point at which the subjects may cross our lens without offending our eye comfort.

I will never take my hand off the IO and convergence controls because I want to be prepared for anything. On *Hugo*, Bob Richardson was often operating on a crane. The crane was on wheels, being pushed by grips. As accurate as everyone is, it's not a perfect science where the camera and the child actors are going to land. Hence my job is much the same as it was when I was a focus puller: we live in the moment. It was my mandate to use the tools to contribute to the immersive experience and to actually allow the depth to change and evolve after each take. 3D must be like a musical soundtrack. It guides us into the train station and the world of 1930s Paris. This is where I find the work most creative as a storytelling tool. This film in particular is where I knew that I had not only to mould the space, but that I wanted our protagonist to be a real boy throughout every shot, for whom you have human recognition and sympathy.

When I start my day at a zero IO and start building depth into the shot, I refer to myself as an "investigator:" it is up to me to find the truth and realism of the depth for those moments, just as a human would recognize another human. There is something subtle, intuitive, and subconscious once you are moving around inside the depth space on your screen and you are responding just as you would on a crowded train platform to the people and objects around you. To capture physical roundness is completely different with every actor. Chloe had a completely different face than Asa's soft, boyish features. For him I would have a stronger IO to find his likeness and for her I had to be more gentle. The Station Inspector was a caricature and so we went very big.

My mandate was that no matter what the shot and no matter what the elements presented in the shot, I would find a way to make everything work in 3D. There were and always will be many discussions of 3D theory, tolerance, and previous visual preferences starting a 3D film. I must have techniques (too many to mention) to troubleshoot, design visual depth, and often to present Bob and Martin Scorcese with alternatives that "work" for 3D. For example, a can of dulling spray was kept in my ditty bag for extreme reflective hot spot moments. I sometimes used a little Vaseline on brass high-lights which caused some 3D fusion problems and distracted my eye from the action. I would run in, tap Bob on the shoulder (to cheakily ask permission), and then find and fix my problem spot. A shine on the wooden armoire (when the children reveal the hidden Méliès drawings) was polarizing (surface reflection different in each camera) something fierce, so I attacked the armoire with dulling spray to save an expensive post fix. Both on set and during dailies viewing I did not want to cause discomfort. On this film, what you saw on set was what you got.

Bob's use of top light, backlight, and side-light was a success for 3D. His bold use of contrast really centralizes the subject matter. Clarity adds definition with delicious contour and detail, while frame edges gently fall off and miraculously avoid edge conflicts. Our attention is properly framed and dimensionalized where the audience should be looking. If you are constantly looking at the edge of a wall or a chair off to the side then something much worse is wrong with the film. Breaking 3D rules was always done with careful understanding of where the audience's attention would be placed.

Bob Richardson said that he broke many rules of 3D. When he started the picture he was told not to use backlight.

When I started the picture, I was told not to tell Bob to change anything. I realized that Bob's backlighting was one of the great successes of the 3D in this movie. His lighting and the contrast really centralize the 3D subject matter and draw you in to it. Bob would continue to remind us that "he was not going to shoot a flat animated film." Once, there was a little hot spot on the shiny surface of the ear of the Automaton that floated above the ear and confounded me at first. It was actually a tiny reflection through the thickness of the mirror.

And some of the ghosting is still in the movie—but who cares? It looks great. It broke the rules and it works. The blown out highlights are beautiful. Even some of the flares and ghosting are fine. We have grown accustomed to narcissistic (ghosting) headlights in night scenes on regular 2D films, so why not?

Just as in 2D filmmaking, 3D has its own small set of unique

image constraints, but the huge opportunities here for success far outweighed the latter. For example, digital motion blur when capturing at 24 fps forced me into a gentler IO setting, but a new set of parameters may soon be possible at 48 fps when shot and projected with the upcoming *The Hobbit* film by Peter Jackson.

Hugo was a children's storybook filled with the potential to finally prove the seamless nature of a live and conceptualized 3D capture for a drama. Marty said to use the pictures in Selznick's book as a visual guide, he gave me some 3D pencil notes in his script, but ultimately, he said, it was my job not to miss a 3D opportunity.

I'm very happy how it turned out. My depth budget was dictated by the story and by a complete dedication to the style and "movement" within Hugo's world.

I think those Cooke lenses were spectacular. I know that Bob, for 25 years, had probably shot Primos. The Cookes were a great complement for him. They were warm and a little bit golden. They were magical. They have a luminescence that is different and good. The look also comes from the ARRI Alexa. Alexa is beautiful in terms of latitude and color. It has a cinematic look. I am proud that people are really responding to the images.

Some visual effects departments in the movie business may try to dictate which camera the cinematographer is going to use but I do hope they stop to consider the overall effect of the cinematic experience and the needs of the lighting cameraman. I think Bob's choice was perfect for *Hugo*. We were really supported by ARRI and Cooke. We had the first set of Cooke 5/i primes on a feature and they were making 5/i's as fast as they could and bringing them to the set. We also used the Cooke S4/i lenses. And we especially liked the S4/i 18mm primes. The pair matched very well. We had metadata with the Cameron|Pace system. Not only coming from the /i data Cooke lenses, but also the 3D rig and all the heads were calibrated as well.

What were you using to control 3D adjustments?

I use the Preston Wireless System. It's still the best in my books for range, reliability and accuracy. I could find Marty anywhere and quickly sit at his monitor to show him a range of creative choices. Generally, this is called convergence pulling. On *Avatar*, James Cameron locked the convergence to the focus and he called them IO pullers, as they only made IO adjustments. So Marty called me his IO puller, but our film was hardly the same environment as *Avatar*.

In an article in *The New Yorker* it was called "Hugo and IO." For convenience and speed Marty would just exclaim, "Demetri, more IO, more IO." Which would mean he wanted more depth. So I would increase the depth. But I always dynamically adjusted the exact convergence position. The convergence tool dictates our ability to fine-tune an IO. This procedure identifies the depth latitude to prepare the material for the final stereo session on the film (which is after the color DI) to make a creative "convergence pass" optimizing and enhancing the depth. The final cut, with editorial choices locked and the speed of sequencing now complete on each reel, the final mandate is to carefully tune the picture. This work was all done at Cameron|Pace Group post services in Burbank under the supervision of Vince Pace himself.

I am delighted at Marty's vision as the driving force of defining the final 3D space in *Hugo*. For Mr. Scorsese, 3D was not about looking into a window at a distant story, he wanted us to seated right on the window ledge and hopefully, once in a while, to fall in.

Take us through the end Steadicam shot. Especially when the camera moves into a close-up on Chloe's book over her shoulder.

If there was one shot I continually thought about after we wrapped, this was the one shot I was nervous about. I was delighted when I saw it on screen. It was the final shot in the movie, and it is one long take. Larry McConkey strives for perfection just like we all do. It was a challenging shot. It was a choreography between myself, Larry on Steadicam, and Gregor on focus. We were a team.

I was following the blocking with both the IO and the convergence motors. I had to make the long hallway have the correct IO and the correct depth so it looked like a hallway. But the minute we went through the door, of course, I want a larger IO to make the room feel like the parlor room that Dante Ferretti designed. The challenge for Larry and me was when doing a large pull. Here my job was really much different than focus pulling because one camera basically travels across the rig. This change in balance can be a nightmare for a Steadicam operator. Unless the rig's been manufactured with counter balance, as ours was. But it's still a very sensitive process. I didn't want to jump or perform sudden moves when Larry wasn't expecting it.

So, when Larry went through a door or around a corner, we would bury any possible jumpiness or changes in the move. I would say, in general, movement did affect how I would find depth in *Hugo*. Movement was based on the fact that it was a digital capture at 24 fps and Bob Richardson and I wanted to avoid motion blur. It really fatigues the audience if someone creates massive depth in a shot and then the camera is going to whip to the left for a fast car or a train coming through shot. Audiences need to time for their eyes to "lock in" and isolate the subject matter. There have been a lot of 3D digital films with too much streaking and it certainly flattens out the movie.

Do you coordinate with Larry and Gregor as to who goes when?

That's coordinated mostly with Larry. It is a distance thing. I also rely on the focus puller (Gregor) because I'm behind the stage wall using a 3D monitor, trying to approximate all my settings. We were on headsets in the rehearsal and the focus puller would say, "we've gone a foot closer." In terms of coordinating the mechanical pulls, Gregor and I can operate independently. I just want to tell Larry when I've got a big pull through the door frame. Or, "Larry, actually it was quite a big pull from coming into that over-the-shoulder of Chloe."

Over-the-shoulders can be tricky in 3D. You have to be very careful to protect that shoulder so it doesn't pop out of the screen and destroy the moment. I was pulling IO rapidly as we came around her shoulder and onto the book to create a realistic feeling. And then as Larry tilts back up, I increased the IO. It's like on a dolly move where you are feathering up or down, or a feathered zoom.

Hugo is a great accomplishment of a director's full commitment to shooting every shot in the film utilizing 3D tools and a 3D capture format to its finest potential. It is due to Marty's faith in 3D and in all our combined abilities to face the challenge that we did not feel the need to have a 2D camera on set.

McConkey Moving on *Hugo*

The End Steadicam Shot.
Photo: Jaap Buitendijk

Jon Fauer: When did you start on Hugo?

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

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

Tell us more about the Segway.

The crane on the electric camera car with the stabilized head at the front was a scary-looking machine. It took a lot of time to safely get a shot up to speed. I was looking for a way to move my much smaller rig quickly through the set, without running—that just wasn't going to happen with this beast. I called Chris Fawcett, a Steadicam Operator in Holland. Chris brought his Handsfree Transporter 2, a Segway modified for Steadicam use, and taught me how to ride it. We then made some modifications: a seat to allow a very low operating position, fenders to protect the 3D rig (courtesy of the extremely skillful special effects department), and mounting for video transmitter, batteries and my gyro kit. Chris now offers his own modified version of a Segway, the Steadiseg, based partly on those mods.

When it came time to do a POV of the dog racing through the station, I told Bob I could do it. Could I? This was a big movie, and the rig was very heavy and I was inexperienced with the Segway… should I really be trying this? I took a deep breath and went for it. Marty was at the other end of the stage. After several rehearsals, building up speed with each one, I did the first take, and I immediately heard yelling. "What's that?" I asked Bob, as he met me returning from the run.

"I guess it's not working out", he said, "Marty's not happy".

I was crestfallen. Then a moment later: "Just kidding—he loved it!" Marty was excited to shoot so quickly and easily. Up to then camera car shots through crowds with the 3D rigs had been an exercise in extreme patience.

What was your most challenging Steadicam shot in the movie?

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

McConkey Moving on *Hugo*, cont'd



Larry McConkey with Steadicam and Segway. Demetri Portelli, who took the still (above left) says, "Do not try this at home. Larry showed bravado to put this weight on a Segway and chase actors through the train station while fiber-optically cabled to our record decks with cable pullers, safety grips and some very cool movement through the crowds. Photos center and right by Chris Fawcett. Opposite: Larry McConkey with Steadicam. Gregor Tavenner pulling focus.

You did the Ray Liotta Copacabana shot in *Goodfellas*?

Yes. But this time the camera was much heavier and bulkier, making it harder to maneuver, and 3D brings its own unique problems as well. I was definitely feeling the pressure and the weight.

Take us through the end shot.

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

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

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

Special effects built a large dolly and attached it to the far side of the first wall so it could be flown out of my way. The second wall was an outside wall, and the estimate for the additional scaffolding and rigging was $20,000 dollars. Production strongly suggested that I find another solution. The special effects team built a very low profile dolly for the chair, with rails that were sunk into the floor. After the first wall was pulled, Chloe's chair began to slide away from the corner. I slowed my circular track but continued the pan until I had room to move around her. It had to be a perfectly smooth slide and perfectly timed for the cheat to work. I asked for a witness camera in the corner above the set for cueing and we put several hundred pounds of weight on a sled dolly 2 floors below, connected by steel cables to the sliding chair. My excellent dolly grip, Keith Mead, did that job.

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

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

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

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

Tavenner on *Hugo*

by Gregor Tavenner, First Camera Assistant on *Hugo*

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

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

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

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

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

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

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

We used Cameron|Pace 3D mirror rigs. Larry McConkey was employed early on to co-design a Steadicam rig for the Alexas. Larry helped them take it to a higher level. They've made 3 or 4 of them now, and they're going onto other shows.

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

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

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

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

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

The God of Focus Speaks

Howard Preston, President of Preston Cinema Systems (makers of the Preston FI+Z), comments on Macro Focus and Monitors:

"It is an amazing accomplishment to coordinate camera moves and focus pulls at macro distances—as Gregor Tavenner did on *Hugo*. This requires the simultaneous combining of two different skills: the focus-puller's hand-eye coordination to execute the distance estimation, and using the HD monitor to confirm and/or correct the final focus position.

"As Bob Richardson said, flawless focus is still a measure of the ability of the focus puller to accurately anticipate the camera move and focus pull. While it's true that HD monitors make it easy to see focus, once the focus is buzzed, it's too late!

"Success depends on the absolute repeatability of the focus system. The repeatability of our system allows the focus discs to be interchanged while maintaining perfect focus accuracy."

Louma 2 on *Hugo*

By Jean-Marie Lavalou and Madelyn Most

In recent years, productions such as *Avatar, Tron, Rise of the Planet of the Apes,* the TV series *Pan Am*, and in particular, Martin Scorsese's latest opus, the magnificent *Hugo*, have pushed innovative techniques to the forefront allowing a seamless blend of real and virtual CG images to be previewed on set and in real time.

Today these "hybrid" films are becoming more and more common and the new technical jargon to describe the different techniques has become cluttered with terms that are sometimes confusing: real camera, live action camera, physical camera, virtual camera, CG camera, Simulcam, real world, virtual world, CG world, Mocap, performance capture, real time previz, real actor, Mocap performer, CG character, etc.

The two worlds are so successfully interwoven that it's often difficult to distinguish what is real and what is virtual, but in fact this has been going on for quite a while, starting with films with films like *Titanic, Matrix, Harry Potter, Lord of the Rings,* and carrying on through *The Polar Express, King Kong, The Aviator,* etc.

The innovation grew out of recent developments in pre-visualization of the composited image in real time, on the set, during the take, where real sets are mixed with virtual or CG sets.

These previz techniques often originated from Motion capture techniques (Mocap). By using a grid of infrared cameras suspended above the actual set, one is able to position and orient the camera during live action shooting, while the associated software connects it to the corresponding CG set.

For *Avatar*, the system known as Simulcam used the Mocap technology provided by visual effects company, Giant Studios. The live action camera was equipped with a target made of LEDs that were tracked by a grid of infrared cameras suspended from above. The camera was treated like a special Mocap performer where fluorescent targets on the Mocap suit were replaced by the LED targets which were attached to the camera.

In other cases, a grid of visual targets is suspended from the stage ceiling with a video camera attached on top of the live action camera pointing up at these targets. This has been used recently by the visual effects company Stargate Studios on *Pan Am*.

Among other things, these techniques make it possible in real time to preview the set extensions that correspond with the green screen backings and to position the CG action characters within the live action sets.

The Louma 2, extensively used by Scorsese (and DP Robert Richardson) on the filming of *Hugo*, and by Bryan Singer (and DP Newton Thomas Sigel) on next summer's *Jack the Giant Killer*, also contributed to this real time previsualization technique with its own original technology.

For *Hugo*, Loumasystems developed a real time data stream interface that allows the VFX supervisor to position the Louma 2 camera into its combined real set—CG environment. In this way, the real world and the virtual world can be precisely interconnected into the XYZ Cartesian coordinates.

This made it possible during the actual take, to visualize the totality of the image with the numerous set extensions, such as the railway station, in relation to the green screen backings on stage. The production designer can accurately check the set extensions in the frame, the cinematographer can judge and balance different light levels, the camera operator can make fine adjustments to the composition, and the director can see the final composited image right then and there. Highly effective, cost-efficient, and timesaving because it is all there in front of you—no surprises, no corrections in post production, no re-shoots.

In one sequence, Scorsese wanted to show the young Hugo gracefully adept in getting around his strange universe of long corridors, labyrinth-like tunnels and dark narrow passageways within the Montparnasse railway station where he lived. Some are reminded of the now famous Steadicam tracking shot in *Goodfellas* where Ray Liotta and his girlfriend walk through long corridors and kitchens of the Copacabana night club shaking hands and distributing twenty dollar tips.

But it was physically impossible to do this Steadicam shot all in one, not to mention that Hugo had to travel through 5 different sets on different stages at Shepperton Studios. VFX supervisor Rob Legato (*Titanic, Harry Potter 1, Aviator, Avatar,* etc) and 2nd Unit Director on *Hugo* solved the problem by using the Louma 2 and its real set/CG set positioning features.

Initially the camera movements were created by previewing the Louma 2 inside the previz sets, and then by using the XYZ coordinates from the Louma 2 encoder data stream, Legato was able to easily and seamlessly join the 5 different sets.

The most challenging part of the sequence was to shoot Hugo sliding down a spiral coal chute (360°), but it was impossible for the big 3D camera rig to follow the action and execute such a move given the physical constraints of the set.

Legato came up with the idea of mounting the coal chute element on a Lazy Susan and to synchronize it with a straight vertical movement of the Louma 2. The manually operated Lazy Susan was equipped with an encoder that referenced it with the CG set extensions and the Louma 2—a great example of how successful the technique of meshing real world with virtual world can be.

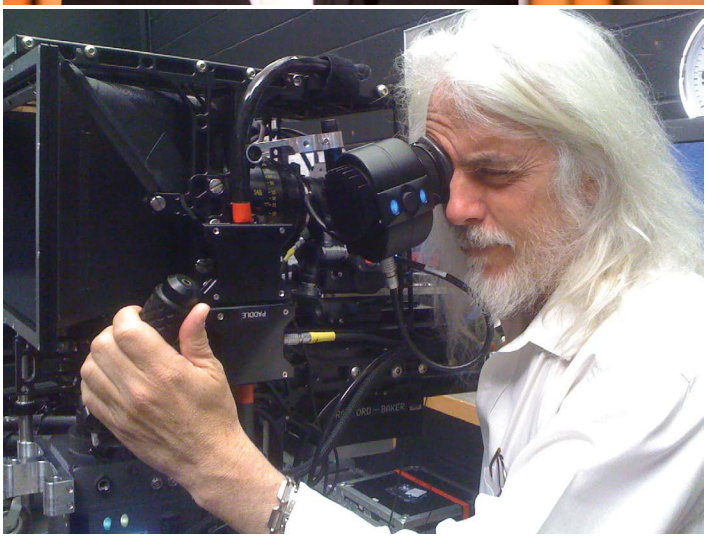
Thanks to its built-in trajectory compensation system, called "planing", the movement of the Louma 2 during the shot was a pure, true, straight movement. The Louma 2 planing is a unique feature that automatically compensates for the natural arc of the crane by extending or retracting the telescopic arm. This planing compensation system was so effective it was used in another portion of the shot where Hugo slides down a vertical ladder. Watching the magnificent imagery of *Hugo* proves how important a role these previsualization techniques will play in filmmaking's future.

NAB 2012: More Cookes


Expanded assembly facilities at Cooke Optics


Cooke Optics


Bob Richardson, ASC
photo: Michael Yada
© A.M.P.A.S.




Degreasing and cleaning

News from Leicester

Taking a line from Charles Dickens, cinematographers have been clamoring for more Cookes. "Please, sir, I want some more."

In response to the massive demand for more lenses everywhere, Cooke Optics recently updated and expanded its manufacturing facilities in Leicester, England, adding 10 additional people. The degreasing and cleaning area is now larger, with more workstations.

Degreasing is part of the Cooke assembly process (above). Each lens is assembled, tested, disassembled, calibrated, reassembled, tested again, and so on. When ready, the lens is taken completely apart again. The optical elements are thoroughly cleaned and degreased a last time. They are then reassembled under totally clean conditions as a final step, and ready to ship.

News from New Jersey

Film and Digital Times has learned that Juergen Schwinzer, formerly Vice President of the Camera Division at Arri Inc, will join ZGC beginning at NAB. Juergen will represent ZGC and Cooke products. See them at NAB in Booth C8334.

Best Cinematography: Robert B. Richardson, ASC

That's Bob Richardson, at left, accepting the Best Cinematography Oscar last month for his work on *Hugo*. *Hugo* was the first feature to use all 3 series of Cooke lenses: S4/i, 5/i, and Panchro/i.

Bob discussed look, lighting and lenses in the previous issue of FDTimes. Here are some appropriate excerpts.

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

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

Cooke Uncoated mini S4/i Primes

Cooke Mini S4/i lenses (previously called Panchro/i) are now available with uncoated front elements. They can be obtained on special order, and can be swapped with the standard coated elements by a qualified lens technician.

Uncoated front elements may help create a different, "historic" look—interesting flares, softer edges, etc.

A set of 6 Panchro lenses includes: 18, 25, 32, 50, 75, 100 mm.

Cooke lenses are distributed by ZGC in North and South America.

Reprinted from Sept 2011 FDTimes

A Cooke Look at NAB 2012

The annual, unofficial Cooke owner's club gathering at NAB was once again moderated by the inimitable Geoffrey Chappell. The discussion, fueled by friendship, fine food, and flowing beverage, offers a fine snapshot of the state of our industry. Here are excerpts. The full text, all 13 pages, can be consulted online at www.fdtimes.com

Juan Pablo Fabres, JPF Cine S.A. (Chile)

I saw a couple of very interesting things. It was very good to see ARRI announcing the acceptance of the /i system because many people are already using Cooke's /i lens metadata technology.

I still love film. Up until November, in my case, we had 50/50 film and digital. After November, 95% digital, 5% percent film. We don't have many features in our country. Cameras with the cages, with the accessories, with cables, that's our business today.

Ramish Meer, CEO, FX Factory (Mumbai)

I hope everybody knows that India is the largest producer of films. We make more than a thousand films in one year's time, which is equal to three films in one day. I'm expecting that in the next two years, 80% of the films will be made with digital technology, and 20% will be done on film. Slowly, India is picking up 3D technology. Now we have almost 800 to a thousand theatres available to project 3D systems. By the way, whether we shoot digital or film, Cooke is going to sell their lenses.

Gideon Furst, Media Film Service (South Africa)

I'm from a very interesting part of the world. Our local industry is fairly small, very active, very healthy, but for five months of the year filmmakers from around the world converge on a little town, Cape Town, and on average, between all of the rental companies, we shoot on average 30 commercials a day. A day! Which is crazy.

We saw a big change in film vs digital since the launch of the Alexa, partly due to ARRI's really good marketing campaign. Our business went from 80% film and 20% digital in a space of about two months to 93% digital, 7% film.

That was when Alexa was launched. What we found this season was film starting to come back. Janni van Wyk (CEO of Media Film Service) bought a lab. When everybody else was selling, he actually bought. People are starting to shoot on film again in South Africa. Film is not dead in our country. What has happened is we bought an old rental company that had a lot of ancient lenses, and all of a sudden the old Cooke zooms, the 25-250, 18-100, 20-60, and the Speed Panchros are always out on rental.

The cameras come and the cameras go, but at the end of the day, what our clients come back to is the glass.

Wolfgang Bäumler, Vantage Film (Weiden, Prague, Berlin, Paris)

At this NAB, I had the experience that I didn't see that much interesting or new. I just concluded, once again, that we should invest in glass, not in cameras. The Canon C300 was shown in November the first time. Now, they show a C500 model. In four months, will they show us a C700? That's not a business model I like. So, once again I felt in favor of investing in glass.

In Germany we're shooting mostly digital now: about 90% for commercials and feature films. We have a very low budget structure there in feature films. In the Czech Republic it's different. We have a lot of international features and commercials running. I would say it's 60% digital and 40 % film. I like that. Our film cameras are booked up at the moment. It's a good sign. I still love film. I hope it continues in the next years.

Sue Greenshields, LEMAC (Australia)

I am going to this small camera because it's an Australian company. Blackmagic, a marketing and digital cinema camera amazement. My own daughter actually texted me overnight to ask me about it. Now that's a worry, when the kids text you overnight and ask about what they've heard on the grapevine. She's doing digital media at University. I've already got orders for the Blackagic camera thing in sales, and nobody knows yet what's in it. It has obviously got free software packaged out with it, and the DaVinci. I think that's an interesting story, and you can't underestimate any of those companies. Look at Red. They started this.

On the rental end, trends are the same. Film, you know, is in a bit of trouble in our country. The biggest problem we have is that the film labs are shutting down. If we lose the infrastructure, film will not keep going. I'd like to say that our Aaton Penelope 35mm film cameras are still working, even though Aaton is not here at NAB. I think Aaton is still viable. We are looking forward to the Penelope Delta digital camera.

And the other trend I'm seeing is we actually got some Hawk anamorphic lenses. The anamorphic lens trend seems to be coming. And obviously the company with the blue logo—ZEISS—announced they're going back into it, too.

Danys Bruyere, TSF (Paris, Cannes, Marseille, Liege)

Last year I said we're not camera rental companies anymore. We're lens and accessory rental companies. Remember last year we had all of this talk about 3D. We have to buy rigs. We have to buy double sets of lenses. And all of this was very confusing.

This year, NAB is focusing on core business. We have companies that are perfecting their products. We're not seeing many revolutions or new directions to go into because I think what we'll move into in 2012 and 2013 will be high frame rate acquisition.

Will it be perhaps a high dynamic range? We have the tools today that can do this. I think *The Hobbit* will be the real benchmark on higher frame rate acquisitions. We've got the digital cameras that can shoot 60 frames per second. What we're seeing is building blocks being put together.

There are more cameras. And we must accept these as being ephemeral; next year these cameras will be replaced by something else. It will be the C700. It will be the F75. It will be the Alexa Magna, whatever. But the core of the business will still continue to be the craftsmanship and the lenses, of course, and bringing that craftsmanship back.

What makes the look—what makes the aesthetic? Before, it wasn't the camera; it was the film stock, and it was about the glass that was in front of it. Now we have a situation where the camera is like a film stock, but it is difficult to interchange. The vision of the world should come from the Director and the Cinematographer, not from the tools. And so the glass is what is going to find that equilibrium between what the camera manufacturers are imposing as a very structured CCD or CMOS sensor, and the potential for creativity. The glass will bring the element that the Cinematographers are looking for: changing the glass is easier than changing the camera.

Jon Fauer

Film and Digital Times has just learned that next year there will be Cooke sensors attached to the back of every Cooke lens, and all you have to do is attach one of these things to a $290 recording box. Rumor has it there may even be a Cooke Camera.

Seriously, I think this is the beginning of the year of 4K and that's reinforced by a company represented here tonight. Sony is producing the first major Hollywood F65 feature, *After Earth.* Remember last year when we heard much discussion about whether existing lenses would be good for 4K? Well guess what they are shooting *After Earth* with? They're using Angénieux zooms and Cooke primes. These are familiar lenses. They don't impose a new learning curve. An established look and feel is unchanged: film or digital.

I also think NAB 2012 is the year of mounts, accessories, and lenses. It's ironic that a lot of camera manufacturers are forgetting that we really do need to hold the cameras and we sometimes put them on our shoulder. We need a way to attach things to them, matteboxes, follow focus, monitors, and accessories. That's too often forgotten. At this NAB you see many aftermarket Mom and Pop machine shops. They must get down on their knees every morning in thanks that most of the camera manufacturers are forgetting the basics, the ergonomics. That's where we are.

Denny Clairmont, Clairmont Camera (Hollywood, Vancouver, Toronto, Albuquerque, Montreal)

I would like to talk about an experience that I had. We did some very critical tests with Leica Summilux-C lenses, Zeiss Master Primes, and Cooke 5/i. We put them on digital cameras, looked at how much resolution they had. We looked for color fringing and many things, like distortion, and so on. The lenses were all very, very close. We looked for breathing. We tested for color fringing, because that's very critical on digital cameras. They all had high MTF. We looked at what I call fall-off illumination, or shading—in other words, how bright it is in the center, how bright toward the edges. They were all very good. Some were a little bit better in one area, some in other areas. Even though the Cooke lens is just as sharp, it's not that high contrast. This "Cooke Look" is a real thing. I wanted to say that. We've always known that—at least I always felt that—many people know that the Cooke look is good.

There's something else that I want to say about these digital cameras. I just want you all to remember, when you're quoting rental rates for your shows, that these cameras are saving production a lot of money. We'll talk about the F65 and the Alexa. They work at extremely low light levels. They are almost able to see in the dark.

There's a DP we work with who just did a show with our Alexas. He was shooting night exteriors and rented a big Musco Light. He said, "I started turning off the lights one by one. I ended up with one light, and I realized that I could have done this with a cherry picker and a 2K up there." My point in telling you all that is these cameras are saving production a lot of money on lighting.

We have several shows shooting on film—but if it's a night time exterior, they will use Alexa. Because these darn things will see at very low light levels. Film's not dead yet. It's certainly decreasing in numbers. We see a big decrease in Hollywood on film for commercials. These are approximate numbers. I would think it's about 75% digital and maybe 25% film for commercials. For the big screen, in my opinion, unless you have a lot of CGI and a lot of computer effects, you are still best off with film. I think that's pretty much the popular belief. People throw a lot of numbers around, but I would think for the big screen, the percentage is 75% on film. (7 of this year's 9 Oscar best picture nominees were shot on Kodak color negative.)

The Sony F65, with its 4K and 16-bit, is going to be very important for CGI, green screen, and all of that. All of the Sony productions, Sony pictures and everything, they're going to want everything shot 4K 16-bit now. And the reason is that they want to archive on 4K because they feel that in a very few years, people are going to have 4K TV sets in their house. So they're going to shoot it now and release it in HD 1920 x 1080.

But they're going to have in the archives their 4K. And then they'll re-release these things in 4K a few years from now and get another round of sales on those. So that's pretty much it.

Geoffrey Chappell

Thank you very much indeed. It has been an exciting year for Cooke Optics. The film *Hugo*, directed by Martin Scorcese, with cinematography by Bob Richardson, ASC was the first feature to use all three sets of Cooke lenses: 5/i, S4/i, and Panchro/i.

We're passionate about what we do. We're a small company, but all of us at Cooke, as you know, are very proud of what we do. We've got that with Les Zellan, the Chairman. Robert Howard, the Managing Director, gives him amazing support at the factory to keep it all together. Although we are behind on the deliveries, and we do apologize, we are doing our best to increase that, but the demand from people worldwide for the Cooke Look is astounding.

We're now into over 70 countries worldwide, and our sales have been absolutely phenomenal, and with your support and patience and understanding—and I say that because I know you all want our product. As rental companies you've always been reactive. I've taught you the notion of being proactive, thinking ahead. I never, ever thought I'd have to tell you to think two years ahead, but that's the state of the industry now.

I'm delighted that Juergen Schwinzer has joined the group. Juergen has served 40 years with ARRI. It was an opportunity to us to invite Juergen to our team to help us build our company, give us more insight.

It's a great product. It's a great industry. Thank you for your support. I'm sure we'll look forward to welcoming you back either at IBC or Cinec or NAB next year.

Thank you again for coming. I pass you over to Les Zellan, Chairman of Cooke Optics.

Les Zellan

It's getting late and I won't keep you much longer. I just want to thank everybody for coming and to thank everybody for their support over the years. We couldn't do it without the support from all of you. Denny, you were extremely supportive over all the years, and certainly your support, Denny, has been invaluable.

But everybody in this room has supported us, and I can't say enough about it. About the people that I work with—Geoff and the rest of the team—thank you. I look forward to seeing you at any of the future shows, or next year, Wednesday night at NAB, which we do every year.

Framegrab with 5/i 100mm T1.4

How do you dim the 5/i focus scale?

In addition to a control on the lens itself, new software for Preston's FI+Z Hand Unit 3 and MDR2 support both the display of Cooke /i information and also enables wireless dimming control of the 5/i focus scale light.

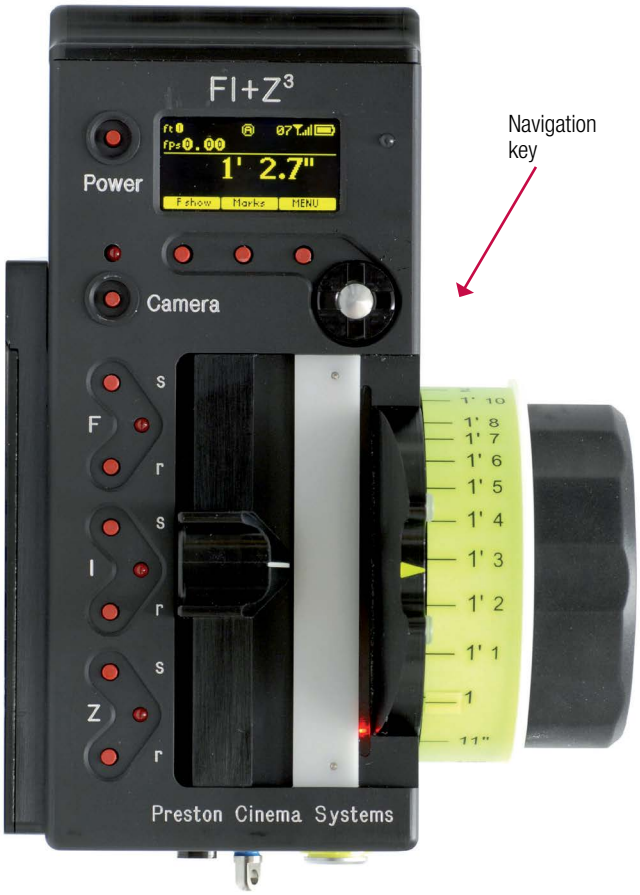
The 5/i focus scale is adjusted by pressing the Navigation key's right or left side. (The top and bottom of the Navigation key are used to brighten and dim the LED's of the Preston FI+Z.)

Preston cable #4544 connects Cooke /i lenses to the serial receptacle of the MDR2 receiver. Once the MDR2 establishes communication, the HU3 display is automatically updated with the Cooke lens data.

Transvideo's new CineMonitorHD/i supports Cooke's /i lens data system with remote control and lens information on screen.

SONY F35, RED, Pixel Farm, cmotion, and other companies are using Cooke /i data in productive ways.

Meanwhile, camera crews worldwide will be clamoring for Cooke's bright idea for wirelessly dimming lens focus scales in the dark.



Helpful notation of Entrance Pupil (E.P.) position in mm and inches from the lens mount flange.

This is the optical "pivot point" to be centered on nodal heads to eliminate image shift when panning.


Cooke 5/i
100 mm


Cooke
100 mm
Cooke 5/i®
T
1.4
2
2.8
4
120
60
40
20

Cooke 5/i


Cooke 5/i®
18mm
Cooke 5/i®
25mm
Cooke 5/i®
32mm
Cooke 5/i®
40mm
Cooke 5/i®
50mm


Cooke 5/i®
100mm

Cooke 5/i Cooke mini S4/i

A Cooke Look Back

Timeline of Cooke Cine Lens History


TAYLOR-HO
SPEED PANCHRO
HOBSON
RKING DISTANC
TAYLOR

A Cooke Look Back

Timeline of Cooke Cine Lens History

Published Sep 2012

by Barbara Lowry

The recent surge of interest in Cooke Series II and III and other classic lenses suggested the time was right for this article.

There is a short list of prolific Cooke optical designers who were responsible for major innovations that helped define the look of motion pictures for the past 118 years.

William and Thomas Smithies Taylor were mechanical and optical geniuses. They opened their first workshop while still in school. In 1885, they moved to Slate Street in Leicester, England to set up a business as "Manufacturers of Optical Instruments." In 1887, William Hobson joined them as sales manager. The firm was named Taylor, Taylor & Hobson. They built the first Cooke lens in 1894, after T. Cooke & Sons of York (makers of telescopes, but not interested in photography) offered Taylor, Taylor & Hobson the manufacturing rights to a Triplett photographic lens that solved the problem of edge softness. The 3-section lens was designed by Dennis Taylor (not a relative).

William Taylor invented, among other things, the standardized screw thread for photographic lenses (1892), the dimpled golf ball (1905), engraving machines, and many devices for making lenses at tolerances that can still compete with contemporary equipment.

William Taylor hired optical designer Arthur Warmisham 1912. Warmisham filed 70 optical patents from 1922 through the late 1930s—more than any other person or company. His designs included the Cooke Varo, a 1931 zoom lens for cinematography.

Warmisham hired Horace W. Lee as an optical designer shortly after—in 1913. Rudolf Kingslake, head of the Optical Design Department of Eastman Kodak in 1937, among other distinctions, said, "Horace Lee was one of England's foremost and most original lens designers." Lee was responsible for the first f/2.0 lens, the subsequent Cooke Speed Panchro design, and the telecentric (reverse telephoto) lens design for use on 3-strip Technicolor cameras.

In 1948, Warmisham hired Gordon Cook, who was responsible for many Cooke zoom lenses. His 1971 Cooke Varotal 20-100mm was innovative and breathtaking: it did not breathe at all. This was a first. The Varotal was also the first zoom lens for 35mm cinematography with a sealed and fixed front element. It had excellent performance and was easy to service—innovations incorporated in all Cooke zooms ever since. In 1988, the Academy honored him with the Gordon E. Sawyer Award for his lifetime contributions to the motion picture industry, the first time this award went to someone outside the United States.

In 1998, Les Zellan, then U.S. distributor of Cooke lenses, bought the Cooke lens division of Taylor-Hobson. The existing factory where Cooke lenses had been made was so run down that seagull feathers would float down through holes in the roof. Les built a new 21,000 sq. ft. factory about 4 miles away, and moved all the equipment, machines, and existing personnel, including Mark Craig Gerchman, who became chief optical designer. The Cooke brand continued under a new company name: Cooke Optics Limited.

Here's a timeline of events and inventions as Cooke lenses became a standard in the motion picture industry for most of the 20th century and into the 21st century. Note that up through the 1940s, these were uncoated lenses.

1914: Cooke Series IIa, f/3.5 Cinematograph Lenses

From a 1914 Cooke Catalog of the Taylor-Hobson Company, 1133 Broadway, New York: "Designed specially for the exacting requirements of Cinematography. . . we furnish a 2 inch f/3.5 lens at $30.00 and a 3 inch f/3.6 lens at $36.00.

1914-1917: Shackleton Expedition

A Cooke Look Back...and the Original Panchros

Ernest Shackleton sent the following letter to Taylor, Taylor & Hobson: "Dear Sirs, Now that the affairs of my late expedition to the Antarctic have all been settled…..it was largely through the excellent quality of lenses you supplied, and the care and interest taken by your firm that Capt. Hurley was able to achieve the first-class photographic records we obtained."

1920 – 1924: Cooke, Series I, f/3.1 KINIC Lenses

Cooke literature from the period says, "These lenses are of new and improved design: our object being to produce a lens with even larger aperture than previously made by us. These lenses can be readily used on Motion Picture cameras at a moderate extra charge for fitting. For motion picture film: 40mm, 51mm, 58mm, 76mm, 90mm. From $43.50 to $69.00."

1922 and 1924: Mt. Everest Expeditions

Captain John Noel, the expedition's photographer, used a Newman Sinclair camera, designed to hold 400 feet of 35mm film and a specially made 20 inch (508 mm) Cooke Series VIII f5.6 Telephoto lens to document the Mt. Everest expeditions in 1922 and 1924 and to take pictures of the climbers from a distance of two miles away.

Captain Noel donated his Newman Sinclair camera to the Science Museum in London, where it was on display without lens. When asked what happened to the missing Cooke lens, Captain Noel's daughter replied, "He donated the camera, but he wanted to keep the lens."

1924: Cooke Series O f/2.0 OPIC lens

Horace W. Lee designed the Cooke OPIC lenses (British patent 157,040) to be the first to combine an f/2.0 aperture with a fully corrected color and geometry.

In 1924, Sweet, Wallach & Company, Inc., an Eastman Kodak Company in Chicago, was sole distributor in the U.S. for the Cooke Series O, f/2.0 OPIC lens – which were sold by another Eastman Kodak company, the Robey French Company of Boston.

1925: Bell & Howell 35mm Eyemo Cameras introduced

Every Eyemo camera was supplied with Cooke lenses made in Leicester, England. Bell & Howell wanted high-end, quality lenses at a reasonable cost and Taylor, Taylor & Hobson became Bell & Howell's main supplier.

The British Journal of Photography wrote on May 28, 1926, "Taylor-Hobson Cooke lenses, fitted to Bell-Howell Eyemo cinematographic cameras, have been used with great success upon many recent expeditions to remote parts of the globe. On May 9, Lt.-Commdr. Richard E. Byrd reached the North Pole by aeroplane and Capt. Amundsen's airship 'Norge' passed over the North Pole on Wednesday, May 12. Both these aerial expeditions carried Eyemo cameras fitted with Taylor-Hobson Cooke f/2.5 lenses."

1926: Kinematograph Weekly, The Observation Window column September 9, 1926, writes, "Over a hundred Taylor-Hobson Cooke lenses of various focal lengths are used by the photographic department of the Famous Players-Lasky studios. Frank E. Carbutt, Famous' Director of Photography, adds that these lenses have, without, exception, given perfect satisfaction and that they have yet to find a poor Cooke lens."

The Famous Players-Lasky dominated the industry through its (monopoly) ownership of production, distribution, and exhibition. As owners of Paramount Pictures, they had the largest exhibition chain in the world and were releasing two features a week.

1927: *The Jazz Singer*, the first feature-length motion picture with synchronized dialogue sequences, was produced by Warner Bros. Cooke quickly adapted the design of their Series O f2.0 OPIC lenses for sound motion pictures. Sound films created a demand for faster lenses: noisy arc lamps could not be used, the lights that replaced them weren't as bright, frame rate increased from silent 16 or 18 fps to talkie 24 fps—a decrease of about 1/2 stop exposure. Studios snapped up the new Cooke f/2.0 (T2.3) lenses. The original f/2.0 OPIC design became the now-legendary uncoated Cooke Speed Panchros.

1930: Cooke Speed Panchro f/2.0 lenses

Cooke Speed Panchro f/2.0 were offered in 11 focal lengths: 24, 28, 32, 35, 40, 47, 50, 58, 75, 100 and 108 mm. The lenses were distributed in the USA by the Bell & Howell Company.

1931: Cooke Telecentric lenses for Technicolor

Horace W. Lee was the optical designer (British patent 355,452).

Technicolor's 3-strip camera used a beam-splitter between the lens and 3 separate rolls of film. This required a longer flange focal depth than before. The challenge was to provide lenses, and especially wide angle lenses (short focal lengths), with a wide relative aperture and having the long back focal distance necessary to clear the prism while maintaining high resolution.

Because Horace W. Lee's 1931 design for the inverted telephoto lens had a high degree of correction for chromatic aberration, it was very suitable for color photography and contributed to the success of the Technicolor process. "The most notable feature of these lenses is the inclusion of what might be called the inverse telephoto principle, whereby the back focal length is considerably longer than the equivalent focal length." (The Technicolor Process of Three-color Cinematography, by J.A. Ball, vice president and technical director, Technicolor Motion Picture Corp., Journal of

Motion Picture Engineers, Vol. XXV, August 1935, No. 2, pp. 127-138.)

Most Technicolor pictures were made with specially modified Cooke Speed Panchros until the early 1950s.

1932: Cooke Varo 40-120mm "Zoom" Lens

Arthur Warmisham was the optical designer (British patent 398,307).

One of the first commercially manufactured variable focal (zoom) lenses for cinematography was the Cooke Varo 40-120mm for 35mm format. The lens was made and sold by Bell & Howell. It came equipped with a special cradle that held the Varo lens and the camera together to ensure correct alignment. Focal length was changed by rotating a crank.

1935: Cooke Speed Panchros

Cooke Speed Panchros for cinematography were introduced in 8 focal lengths, all f/2.0: 24, 28, 32, 35, 40, 50, 75 and 108 mm. They covered the standard format of 0.631 x 0.868 inch. These are now known as Series I. They are uncoated. (16.03 x 22.05 mm, Standard Academy film format, 27.2 mm image circle— British Patent 377,537; U.S. Patent 1,955,591-1931.)

The Head of Metro-Goldwyn Mayer's camera department wrote, "All of our productions are made with the Taylor-Hobson Cooke Lenses and at least 50% of our productions are made with Speed Panchros. This Studio is practically 100% Cooke equipped."

A 1938 Bell & Howell brochure says, "Paramount, Metro-Goldwyn-Mayer, and Warner Bros. use Cooke Speed Panchros almost exclusively. Fox, R.K.O., United Artists, Columbia, Universal, and other studios are using them increasingly. In England, all film producers, including British Gaumont, British & Dominion, London Films, and British International Pictures, use these lenses. In other countries, Cooke Speed Panchros are used by the leading studios.

1939-1945: The Bell & Howell Eyemo, fitted with Cooke lenses, was standard issue for World War II combat cameramen.

1945: Cooke Speed Panchro Series II Lenses

Gordon Cook was the optical designer. The Cooke Series II lenses were designed to cover the 0.723 x 0.980 inch format (18.36 x 24.89 mm). They came in 6 focal lengths: 18, 25, 32, 40, 50 and 75mm.

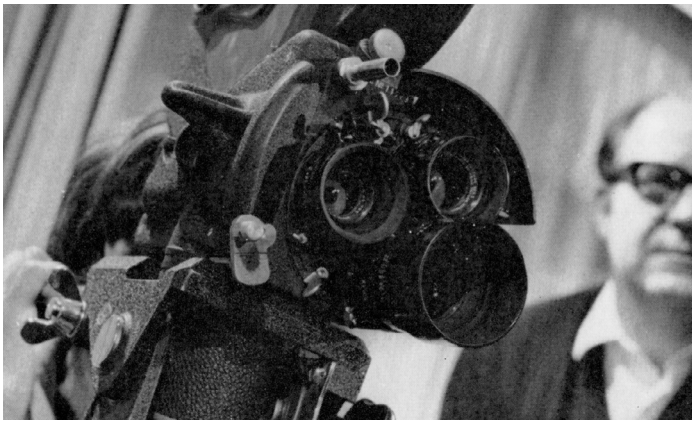
1946: 100mm, f/2.5 Cooke Deep Field Panchro

This was a six-element, four-component lens of extended Speed Panchro construction that corrected all aberrations and was used with both color and b&w film stock.

1954: Cooke Speed Panchros, Series III 18mm and 25mm

Gordon Cook was the optical designer. The 18mm f/1.7 and 25mm Cooke Speed Panchros were redesigned to address the use of larger negative areas—especially CinemaScope and VistaVision. VistaVision was 1.6 times as wide as the conventional picture.

Gordon Cook wrote, "The lenses used in motion-picture cameras are almost invariably of wide relative aperture and the sharpness of the recorded film images must permit very considerable magnification on to large viewing screens. These and other factors present a series of optical problems which are more severe than those encountered in other branches of photography. In recent times this situation has been aggravated by the demand for wider angles of view at the camera and even larger magnifications for bigger screens and wider screens. . . . [The solution had to] achieve a larger angular depth of field while balancing spherical aberration, astigmatism, coma and more." (from paper, "Modern Cine Camera Lenses," by G.H. Cook, Senior Lens Designer, TT&H, Leicester, *British Kinematography*, Vol. 27, 37-52.)



The Series III 18mm design achieved an angular field of 80 degrees, a wide relative aperture on the 18mm of f/1.7. The Series III lenses corrected for all aberrations and maintained good definition and resolution for widescreen presentation.

1953-54: Cooke Anamorphic optical systems

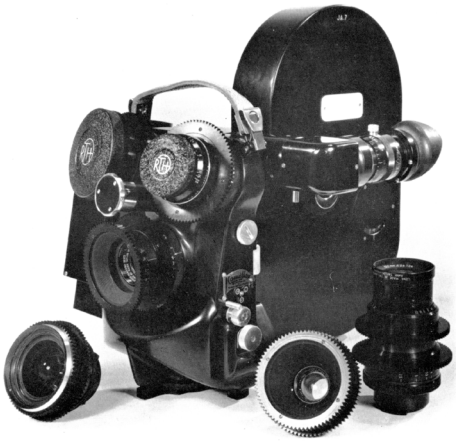
Gordon Cook worked on "anamorphotic optical systems" to squeeze the image horizontally during photography and to expand it in projection. His work on anamorphotic systems gained him the Fellowship of the British Kinematograph Society and a silver metal in Rome.

1958: Bell & Howell 8mm and 16mm cameras were sold on the amateur photography market with Cooke lenses of various names

and focal lengths.

1959: Cooke Telepanchro Lenses for 35mm Motion Pictures

Gordon Cook designed lenses to supplement the Cooke Speed Panchro range for shooting close-ups from a considerable camera distance. The Cooke Telepanchros came in focal lengths of 152mm, f/2.8; 203mm, f/4.0; 318mm, f/4.0; 406mm, f/4.0; 558mm, f/5.6. The lenses were offered unmounted or in "basic" focusing mounts for adaptation to a variety of cameras: Newall NC, Mitchell NC, Arriflex and Éclair Cameflex (CM3 picture below).



1959 – 1960: Cooke Kinetal Lenses for 16mm Production

The Kinetals (optical design by Gordon Cook) were built in response to increased demand for 16mm format documentary, industrial and scientific production. By the early 1960s, the Kinetals for 16mm professional motion picture cinematography were offered in 9 focal lengths: 9mm f/1.9; 12.5mm, f/1.8; 17.5mm, f/1.8; 25mm, f/1.8; 37.5mm, f/1.8, 50mm, f/1.8; 75mm, f/2.6; 100mm, f/2.6; 150mm, f/3.8. They were supplied in Arri Standard Mounts.

1960s. Cooke Speed Panchro lenses were supplied in a range of unmounted (neutral) optical units. Mounted versions were supplied for almost every camera used in the motion picture industry: Newall, Mitchell, Éclair Cameflex and Arriflex.

In 1960, Director of Photography Russell Metty, ASC used Cooke lenses with a Delrama anamorphic adapter to film *Spartacus* in Technirama. The 35mm negative was converted via Panavision printer lenses to a 70mm print.

1971: Cooke Varotal 20-100mm, T3.1 zoom lens

(Gordon Cook, optical designer.) This was the first high-quality zoom designed for professional motion picture production with a new design concept that remained the basis for all Cooke zooms subsequently produced. The lens had a sealed front focus unit and fixed front element that eliminated the risk of dirt and moisture being drawn into the lens, did not rotate or trombone in and out, and allowed for easy fitting of matte boxes. The lens used an anti-reflective wide-band Varomag high-performance coating. This increased shadow area definition, light transmission and durability, and reduced ghosting and flares.

1975: Cooke Varokinetal (CVK) 9-50mm
For standard 16mm format.

1978: Cooke Super Cine Varotal 25-250mm

With an aperture of f/2.8, it was attractive for special effects and was used to shoot the original *Superman* film in 1978.

1980: Cooke Super 16mm Varokinetal (CVK) 10.4-52mm

The Super16 version of the 9-50. This lens was first used by Cinematographer Curtis Clarke, ASC to film *The Draughtsman's Contract*, the first technically and commercially successful Super 16mm feature to be made. The Cooke Varopanchro helped filming under difficult lighting conditions in 16mm and Super 16mm formats.

1981: Cooke Varopanchro (CVP) 20-60mm, T3.1

Optical performance comparable to prime lenses. Jon Fauer, ASC bought one of the first models and used it to shoot the second unit of *All the Right Moves* with Tom Cruise in 1983.

1983: Cooke Varopanchro (CVP) 10-30mm, T1.6. The CVP offered advancements in filming under difficult lighting conditions in 16mm and Super 16mm formats. It began production in 1983. The Cooke 20-60mm was the 35mm equivalent of this lens.

1983: Cooke Cine Varotal 25-250mm, Mark II, T3.9

There were 2 versions of the Mk II 25-250: focus in front, and zoom in front.

1986. Cooke Wide Angle Varotal, 14-70mm, T3.1

During the development stage in the mid-1980s, customers' input prompted the company to incorporate a curved front cover glass and a noise isolator. This lens was unique in the zoom series because it included a wide angle aspheric element.

1987: Cooke Varotal 18-100mm

A Cooke Look Back, cont'd

Design was initiated at the beginning of 1987 and the lens was exhibited for the first time at Photokina in 1988. It included refinements prompted by extensive suggestions by cinematographers and camera operators, and became very popular.

1992: Cooke Cinetal 25-250mm, Mark III, T3.7

1995: Cooke S4, T2.0 Prime lens series. Discussions began between Denny Clairmont, Otto Nemenz, Paul Duclos and Cooke lens designers Mark Gerchman and James Moultrie about characteristics to include in the next series of Cooke lenses, based on the requests and needs of cinematographers. After many conversations, especially with Denny Clairmont and Paul Duclos, the new Cooke S4, T2.0 Prime lens design included a cam movement and a novel, open window with opposing focus scale design that has since become an industry standard.

Gerchman designed the Cooke S4 T2.0 lenses and was part of the team that developed the illuminated focus ring on the new Cooke 5/i T1.4 Prime lenses.

March 1998: Les Zellan entered the Bank of Scotland's main branch at Trafalgar Square, opened a carrying bag, plunked down two Cooke lenses on the desk of a bank officer, and announced he intended to buy the company. The planned 30-minute meeting lasted for more than two hours. "We were surprised that an American, or anyone overseas, had so much knowledge of Cooke," Mr Wighton, the banker involved, said. "He had a clear knowledge of the market and a clear vision of the company."

July 10,1998. 7 pm GMT: Les Zellan bought Cooke.

July 13, 1998: After purchasing Cooke, Les was in Leicester the following Monday. Work began on a new custom-designed factory, complete with clean rooms, modern CNC machines, a canteen for the staff and plenty of free parking. Lens designs were completed and production began on the Cooke S4 T2.0 lenses.

Lord Richard Attenborough, the Oscar-winning director of *Ghandi* who grew up in Leicester, presented a plaque at the opening ceremonies of the new factory. Orders flowed in for the new S4 lenses, and within two years, the company had nearly doubled its staff.

Cinematographers loved the look. Camera Assistants loved the mechanics. Cooke S4 lenses were a breakthrough because their design made focusing much easier. Most lenses focused by rotating at a constant speed on interlocking or helical threads, much the way a toothpaste cap is raised or lowered on the tube. The S4 lenses use cams that follow an elliptical track, which is smoother and doesn't become stiff at low temperatures. These were breakthroughs that became industry standards.

Cooke S4 lenses won a Cinec Award in 1998.

1999: The Academy awarded Sci-Tech plaques for "the Cooke S4 range of fixed focal length lenses for 35mm motion picture photography" to James Moultrie for the mechanical design and to Mike Salter and Mark Craig Gerchman for the optical design. In 2000, Cooke S4 lenses were awarded a Technical Emmy from the Academy of Television Arts and Sciences. By 2012, the Cooke S4 set consists of 18 or 20 lenses, depending on whether you count the two SF (Soft Focus) attachments: 12, 14, 16, 18, 21, 25, 27, 32, 35, 40, 50, 65, 65SF, 75, 75SF, 100, 135, 150, 180 mm T2 and 300mm T2.8.

2005: Cooke /i Technology

In February 2005, Cooke developed /i Technology and began incorporating this digital protocol into every Cooke S4 Prime lens made from then on. Cooke's /i "Intelligent" Technology enables both film and digital cameras to automatically record important lens and camera data (focus, iris, serial number, etc) for every film or video frame. The data can be viewed live on set, saved as metadata with the picture, and used in post-production to streamline editing, effects work, saving time and money.

2007: Cooke SK4 Prime lenses for 16mm/Super16

A Cooke Look Back, cont'd

The 6mm, 9.5mm and 12mm wide angle T2.0 lenses were designed as an adjunct to the Cooke S4 range of 35mm lenses for shooting in 16mm/Super16.

2009: Panchro/i by Cooke T2.8 Prime Lenses

Cooke S4/i

The new "Mini S4" T2.8 range of 35mm lenses were announced at NAB 2009 in Las Vegas. These prime lenses were designed to provide a smaller, lighter weight and lower cost option for professional filmmakers, while maintaining familiar optical quality and "Cooke Look." Panchros currently come in seven focal lengths, 18, 25, 32, 50, 75, 100 and 135 mm. More coming—including the new 65 mm T2.8, previewed here, to be announced at IBC 2012. All lenses are /i Technology equipped.

Cooke Panchro/i

2009: Cooke 5/i T1.4 Prime Lenses

The new Cooke 5/i T1.4 35mm format Prime lenses were introduced at IBC 2009 in Amsterdam. The 5/i lenses come in 9 focal lengths: 18, 25, 32, 40, 50, 65, 75, 100 and 135mm. More are in the works. For the 5/i, Cooke's designers developed and incorporated an illuminated and dimmable focus scale into its fastest lens designed to date (U.S. patent 8079723). All lenses are /i Technology equipped.

All Cooke lenses, for both photography and cine use, have been designed and made substantially by hand in Leicester, England since 1894.

Taylor-Hobson currently manufactures fine metrology instrumentation, while Cooke lenses are made exclusively under the company name Cooke Optics Limited in Leicester, England. □

Cooke 5/i

The Cooke Look Defined 2/2013

by Jon Maxwell

The Academy will honor Cooke Optics with a Sci-Tech Oscar statuette in February 2013 "for advanced camera lenses that have helped define the look of motion pictures over the last century…producing what is commonly referred to as the Cooke Look…"

Jonathan Maxwell, lens designer, said, "The design procedures and adjustment techniques developed by the company have led to an enviable cinematographic reputation for what has become known as the Cooke Look. This revered 'look' is a sympathetic color depth in the images, combined with an adjusted coincidence between the sharpest image and the optimum chromatic focus."

Jonathan took me on a tour of the Cooke factory in Leicester a couple of years ago. He has worked with Cooke and Taylor Hobson, taught courses for SPIE, and published two books on optical design. I fired off an email to him: "Please explain optimum chromatic focus and the Cooke Look." For a long time, many of us cinematographers have been fumbling with words to try to describe that look, and it sounded more like wine-tasting than optical aptitude. We had epithets like roundness, gentle fall-off, smooth and gentle, cosmetic silky skin tones, and so on. Here is Jon's illuminating reply.

You asked, "When discussing the Cooke Look, please explain what you mean by optimum chromatic focus?"

At Cooke we take particular precautions, and a pride, in how we correct and adjust the aberrations in our lenses, and I'll talk technically about that in a moment. But, before I do, I have to share a secret with you: the fact is that cinematographers, who obviously appreciate the Cooke Look, wax eloquent about it, but very often the language is of an artistic nature, and, frankly, we humble technicians have difficulty in really understanding that language. Having said this, our chests of course swell with pride when we read of or hear creative people in our industry talk about how they love the "look" we manage to achieve, but we think to ourselves "all we have done" to achieve that look is to follow our scientifically determined standard procedures.

So what are these procedures? A large part of it is about balancing the focusing of the three different wavelengths, red, green and blue, which don't normally fall on the same focal plane simultaneously. Appreciating the details of this situation and how we design and adjust lenses in the face of it is necessary if one is to understand where the Cooke Look comes from.

Firstly, all modern lenses are what we call "achromatic" (without colour) and occasionally "apochromatic" (completely without colour), that is, they are corrected for chromatic aberration. Nearly all lenses that the cinematographer comes across are achromatic, rather than completely apochromatic (in spite of some being called "apo-something"), and this means that there is a residual difference in focus between the red, green and blue focal planes. Except in very unusual circumstances, the distribution of these chromatic focal planes, working from the lens side of the focal region to beyond the focal region, are as follows: green focuses first, and then red and blue focus together (making magenta) a little further away from the lens.

Under normal circumstances, unless special precautions are taken (as they are at Cooke), the longitudinal distance between the green focus and the red + blue focus will be approximately one thousandth of the focal length of the lens. This separation between the green and the red + blue (magenta) focus is called the longitudinal secondary spectrum. The reason that longitudinal secondary spectrum wants to be approximately one thousandth of the focal length is mainly associated with the types of optical glass that are available, but it is also influenced by the optical construction of the lens.

So, secondary spectrum wants to vary with focal length? Yes! And this should immediately ring alarm bells for you, because we design and make ranges of prime lenses that have focal lengths that, for 35mm detectors, vary, for example, from 12 mm to 300 mm. The secondary spectrum will (unless special precautions are taken) vary from 0.012 mm to 0.300 mm, and so the images at various focal lengths will look chromatically different. This is unacceptable, and the lens designer's job is to devise suitable constructions for each focal length of lens and to use appropriate types of optical glass in those constructions to hold the secondary spectrum more or less constant for all focal lengths.

In the case of a zoom lens this issue is particularly problematic because, although the lens construction does vary with focal length change (in order to zoom the lens), the types of glass in the zoom lens do not change, so the secondary spectrum will vary from one end of the focal length range to the other. This is one of the fundamental limitations of zoom lenses for cinematography.

Next, we have to understand that for any achromatic lens, as we go through focus, there will be a subtle change in the colour fringing around the fine detail in the image. When the focus of the lens is adjusted so that the green image plane is at the detector, then the red + blue (magenta) image will be slightly out of focus, and there will be a subtle magenta fringe around the fine detail in the image. (You can see this when you go through focus on a lens projector–you see green and then magenta color fringing.) Similarly, when the lens is adjusted so that the magenta image is at the detector, there will be a subtle green fringe around the fine detail of the image. Roughly halfway between the green focus and the magenta focus there is an image plane where the two coloured fringings (green and magenta) mix to make a colourless black and white image. This plane is known as the achromatic image plane, and it is this plane that cinematographers choose when they focus the lens.

So far in this discussion, nothing that is particularly remarkable has been described. I have just been reviewing what every lens designer knows about the necessary achromatic correction of any lens, albeit with some special emphasis on particular points.

But here comes the more specific aspect of this subject that explains the Cooke Look. If the lens is suffering from spherical aberration, the sharpest image plane, that is, the focal plane where the most fine detail of the image is resolved, will not lie at the achromatic focal plane. This is the question of adjusting the design and, particularly, the final assembly of the lens, to align the best resolution focal plane with the achromatic focal plane. That is what creates the Cooke Look.

There is another stage in this procedure, which is about applying these criteria to the off-axis correction of each lens. In this case, rather than adjusting the spherical aberration to get alignment between the achromatic plane and the best resolution plane, we adjust astigmatism. ❐

The Aesthetic Role of Depth of Field in Anamorphic Cinematography

Concerning depth of field and focal lengths—which relate to the shape and the area of the bokeh

by Jon Maxwell

An important feature of anamorphic cinematography is the look of the images compared with normal spherical lenses, whether it be distortion, or colored streaks, or bokeh. But distortion, streaks and bokeh are not the only contributors to the difference between the look of a spherical lens and an anamorphic lens; depth of field also plays an interestingly subtle part in this difference of look.

In this article, I am referring to the new set of Cooke anamorphic lenses, which have cylindrical elements at the front of the lens.

For any point in the picture, the depth of field for vertical image structure is different from the depth of field for the horizontal image structure, and the lens will generate vertical elliptical bokeh.

Consider a scene shot on a ranch: the cross-bars on the gates are mostly horizontal, and the posts of the fences are mostly vertical. The depth of field for the gates will be less than the depth of field for the fences. You can guess that this must be the case when you look at the interesting and attractive elliptical bokeh that an anamorphic lens creates: The bokeh of front anamorphic lenses are elliptical because of the placement of the cylindrical elements. Furthermore, the focal length of the anamorphic lens is different in the horizontal plane compared with the vertical plane, and, the circle of confusion used to calculate the depth of field is also elliptical.

For example, a 100 mm anamorphic 2x squeeze lens has a focal length of a 100 mm in the vertical plane and a focal length of 50 mm in the horizontal plane. So, the ratio of the two focal lengths is 2x (100/50 = 2). However, the difference of the two depth of fields is 4x. Why is that?

Pull out your ASC Manual or the lens manufacturer's depth of field charts—or dust off your Guild Kelly or Samcine calculator or click on your pCam or Toland app.

You will see that for spherical lenses having a 2x difference in focal length, like our 100 mm Anamorphic lens, with its 50 mm focal length in the horizontal plane (both set at the same T/stop and focus distance), you will see approximately a 4x difference in depth of field. In other words, if the depth of field for the 100 mm is 2 inches, it will be 8 inches for the 50mm lens.

If you don't have depth of field charts for your anamorphic lenses, you will be safe to look up published depth of field data for the vertical focal length "component" of your anamorphic lens (that is 100 mm in our example), and similarly for the horizontal focal length (50 mm). But If you are in a real rush, and you are concerned to have "at least enough" depth of field you can just depend on the 100 mm focal length value, which is the lesser of the two depths of field. However, as we were going to some lengths to explain, this slightly mysterious dual nature of the depth of field is an important part of the anamorphic look. I mean, when the cowboy hero rides into the ranch yard, nobody is going to calculate the exact effects, but the anamorphic depth of field look is going to be there telling the story.

A more mathematical way to think of this is to compare the beam diameter in object space for a 100 mm spherical lens compared to a 50 mm spherical lens at the same T-stop. You'll find there is a 2x difference in beam diameters, but a 4x difference in beam area (area of a circle is πr^2).

Earlier, I mentioned the out of focus highlights (bokeh). In addition to those, the overall anamorphic look of the picture is created not only by the in-focus highlights but also by any objects in the picture. The large 4x difference in depth of field actually contributes substantially towards the overall look of the image, whether there is actual bokeh in any particular shot. This is something that cannot be reproduced with spherical optics shooting Super 35 flat or, for that matter, with the post-processing of captured images.

Jon Maxwell is an optical designer, professor of optics, Cooke Designer Emeritus, current Cooke consultant, author, reliable resource, and optical pundit to Film and Digital Times.

Below: Framegrab from "Seeing." Cooke Anamorphic 40mm at T2.3 on ARRI Alexa. Directed by Francis Luta. Cinematography by Jeremy Benning, CSC and Adam Marsden, CSC.

And the Oscar Statuette goes to Cooke Optics

Les Zellan receiving the Academy Award of Merit Oscar Statuette at the the Academy of Motion Picture Arts and Sciences' Scientific and Technical Achievement Awards on February 9, 2013, at the Beverly Hills Hotel. Photo: Darren Decker ©A.M.P.A.S.

Actor Chris Pine introduced Oscar and Les. He began, "Since the Academy initiated its awards for scientific and technical achievement back in 1930, there have been 779 awards bestowed. Only 46 of those awards were Oscar Statuettes. And tonight, it will be our pleasure to present Cooke Optics with number 47.

"Cooke introduced their first set of motion picture lenses—the Series O Panchro f/2s back in 1921. The company, originally known as Taylor, Taylor and Hobson, has been turning out optical innovations year after year, filling the creative needs of cinematographers worldwide. In fact, in the beginning days of our industry, even the legendary Lasky Famous Players owned over 100 Cooke lenses and shot all of their movies with them. In the very early 1930s, their lens designer Horace W. Lee invented the first inverse telephoto lens for the Technicolor Three-Strip Camera, thus enabling wide angle cinematography in full color. With its 1-inch beamsplitter, it required a considerably longer back focal distance than a normal lens design would avail. In the age of reflex cameras, we've come to know these as retrofocus lenses and virtually all wide angle lenses made today take advantage of this principle.

"In the 40s came the Series II set, with the 18 mm Cooke Speed Panchro. In 1956 came the Series III with redesigned 18 and 25 mm lenses in a more manageable size. In the 60s came the 100 mm f/2.8 Deep Field Panchro. And the list goes on decade after decade. In 1999 the Academy recognized members of the Cooke design team with a Scientific and Engineering Award for their S4 fixed focal length lenses for 35mm motion picture photography. A few years earlier, the Academy recognized the renowned Cooke zoom lens designer Gordon Cook, who we should mention was not related to the founder, with its highest technical achievement honor, the Gordon E. Sawyer Award."

Co-host Zoe Saldana continued, "Since their first series of motion picture lenses, Cooke Optics has continued to be prolific in creating optical innovations, producing what is commonly referred to as the 'Cooke Look' —I like that—these lenses have helped define the look of motion pictures over the last century. For their continuing innovation in the design, development and manufacture of advanced camera lenses for motion picture cinematography, it is a pleasure to now present the Academy Award of Merit to Cooke Optics Ltd. To accept on behalf of Cooke Optics, please welcome their Chairman, Les Zellan."

Upon taking the stage, Les Zellan, looking resplendent in a distinguished tuxedo, said, "It's hard to condense our 127 years of supporting this industry into a minute, but here goes.

"The piece we just saw (*referring to the short film that was shown during the previous introduction by Pine and Saldana*) explains why Cooke is being honored tonight and I would like to thank the Academy for bestowing this award upon Cooke Optics. I am indeed fortunate to be at Cooke as our contribution to the industry is being directly recognized. Our company has literally grown up with the movies. Over the last century, we have made lenses that helped 'define the look' of motion pictures. Cinematographers call this the 'Cooke Look.'

"Your award means so much to the men and women of Cooke. We have been associated with the industry from our founding, during film's earliest days. I am hard pressed to think of a company other than Cooke with a history of 127 years directly related to motion pictures. We appreciate your recognition of our ongoing contributions. I would like to honor a few of Cooke's great heroes in the motion picture industry who created the lenses that made and continue to make the movies.

"William Taylor, who along with his brother Thomas, founded the company in 1886.

"Denis Taylor, no relation to the Taylor brothers just mentioned, invented the Cooke Triplet in 1893. The Cooke triplet was a revolutionary and novel concept and ushered in the modern era of lens design.

"H.W. Lee was the designer of the legendary Cooke Speed Panchros in the 1920s.

"In the 1930s, Cooke's Arthur Warmisham invented the inverse telephoto lens design that made the Technicolor 3 strip camera possible.

"Gordon Cook, our chief optical designer from the 1950s to the 1980s — was responsible for many, many lenses, including the famous Cooke 20-100 and 25-250 zooms.

"As a testament to their innovation, the inverse telephoto design is a basic optical concept to this day, and Cooke Speed Panchros and Cooke Zooms are still sought after, and still used to make today's films.

"More recently, Mark Gerchman– chief optical designer for Cooke Optics from 1998 until his untimely death in 2010 — was principle designer of the Cooke S4, miniS4/i and 5/i lenses. These Cooke lenses have shot memorable films including *Cider House Rules, Chocolat, Chicago, Girl with the Pearl Earring, Munich, Harry Potter, Casino Royal, Da Vinci Code,* last year's Academy award winner for best cinematography — *Hugo*, and this year's *Zero Dark Thirty* — and just about every type of film in between.

"Today, Cooke relies on the efforts of many skilled people, and I rely on our management team, Robert Howard, CEO; Alan Merrills, COO; Geoffrey Chappell, Sales and Marketing Manager; my business partner of 30 years, Guy Genin; and, of course, the Cooke archivist, my lifetime partner and wife, Barbara Lowry.

"On behalf of the 90 engineers, artisans, craftsmen, technicians and administrators, as well as all those who have come before us and laid the foundation for tonight's honor, I thank you."

The Oscar Statuette was awarded "To Cooke Optics Limited for their continuing innovation in the design, development and manufacture of advanced camera lenses that have helped define the look of motion pictures over the last century. Since their first series of motion picture lenses, Cooke Optics has continued to create optical innovations decade after decade. Producing what is commonly referred to as the 'Cooke Look,' these lenses have often been the lens of choice for creative cinematographers worldwide."

Cooke Sci Tech Oscar

Les Zellan, Chairman of Cooke Optics with Oscar, above

Cooke Optics team, below left to right: Jaimie Cluer, Guy Genin, Les Zellan, Geoffrey Chappell, Paul Utting, Robert Howard

Cooke Anamorphic Prime Lenses

Prototype "Cooke Look" 2x squeeze anamorphic lens, with front cylinders, oval bokehs, /i lens metadata and 33.54" image circle are shown.

		25 mm	32 mm	40 mm	50 mm	75 mm	100 mm	135 mm
Aperture		T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22
Iris Rotation	deg	90	90	90	90	90	90	90
MOD	inches	33	33	30	33	39	44	56
	mm	838	838	762	838	991	1118	1422
Focus Rotation	deg	300	300	300	300	300	300	300
Length	inches	7.68	7.68	7.68	7.68	7.68	7.68	7.68
	mm	195	195	195	195	195	195	195
Max Front Diameter	inches	4.33	4.33	4.33	4.33	4.33	4.33	4.33
	mm	110	110	110	110	110	110	110
Total Weight	kg	2.77	2.68	2.93	2.74	2.64	2.93	2.93
	lb	6.11	5.90	6.47	6.03	5.81	6.47	6.47

Cooke Metrology Lens Projector 9/2013

Cooke Metrology Lens Projector

A hundred years ago, William and Thomas Smithies Taylor, founders of the company that became Cooke Optics, said, "If you can't measure it, you can't make it." Along the way, they built all kinds of machines to measure things, including the famous Talysurf. Cooke Metrology continues that tradition today with a new line of lens testing equipment designed by Cooke and manufactured by Pure4C.

Lens projectors are used by most of the world's best rental houses to compare, check and analyze optics. It works like a slide projector, shining an even and bright light onto a reticle. It's in reverse of the way we shoot, projecting the image through the back of the lens and onto a flat wall, which presumably has been painted studio white. It's a good way to see how the lens handles geometric distortion of straight lines, whether there is chromatic aberration, internal barrel flare, sharpness, where the edges fall off (shading), if the lens breathes, and so on.

The new Cooke Lens Projector is especially good at working accurately with lenses faster than T2, which some other projectors do not. Cooke Metrology's projector is so bright that it can be demonstrated in daylight. This makes it much easier to discern flaws and artifacts in fast lenses. The projector comes in racy British Racing Green. Price has not been finalized, but FDTimes expects it to be under US $15,000. This is the first of three pieces of optical test equipment. A T-Stop Tester and an Infinity Bench are in the works. www.cookeoptics.com

"If you can't measure it, you can't make it."

Taylor, Taylor & Hobson Talysurf, built in 1946, could measure variations of 1 millionth of an inch (.0254 microns) in apparently smooth surfaces.

Lens Projector Specs

- 200W ceramic tungsten lamp (rated at 200 hours lamp life)
- dimmable electronic ballast
- adjustable back focus
- dial gauge for analog back focus read-out
- connector for USB work light
- Lemo 2-pin connector for 12V-output
- Interchangeable Mount System with PL Mount
- optional Canon EF-Mount, Nikon Mount and more
- support for 19mm and 15mm rods
- tool for correct line-up when testing anamorphic lenses
- flange depth control without touching the sensitive reticle
- upgrade 1: wired remote control for back focus adjustment
- upgrade 2: box with large LEDs for flange depth read-out

Cooke Anamorphics

Things have been busy at Cooke this year. The shelves in the reception area are sagging under the weight of Oscar Statuette and other awards bestowed this year. The discovery of Richard III's royal remains in a Leicester parking lot did not distract, despite evidence that he was pierced by a pike, stabbed with a dagger, sliced with a sword, and hit by an arrow at Bosworth Field in 1485. Nevertheless, the Cooke Optics factory in Leicester has continued to expand and increase the size of its workforce.

At IBC, the production 75 mm and prototype 40 mm Anamorphic lenses will be ready.

Les Zellan said, "The next one out will be the 50 mm. We're still on track for March." Cooke Anamorphic Lenses will be available in 25, 32, 40, 50, 75, 100 and 135 mm. They are all T2.3 and have a 2x squeeze.

Cooke Optics is in IBC booth 11.D10

Cooke /i square

/i Technology

The new /i square Technology is Cooke Optics' next generation, patent-pending metadata system. It is more accurate than its predecessor /i. Higher resolution provides more data points. Furthermore, /i square lenses will contain components that track and measure dynamic movement: inertia, speed, and direction.

What does this mean?

Let's say you're doing a 20-second handheld shot for a composite scene. An extra walks between camera and principal actor, obscuring the carefully placed tracking points. Match-moving in post can now be expedited, because the Cooke /i square equipped lens has supplied information as to speed, direction and distance covered during the time when tracking points were lost. Tracking software has been developed by The Pixel Farm to accommodate this new information (PF Track).

Les Zellan, Chairman of Cooke Optics, explains, "/i square is our big news for IBC. We have been working on this technology for a long time, and we've embedded inertial guidance components into the lens. For example, when your smartphone loses the GPS signal it still tells you north, south, east, west, acceleration, and velocity. When we introduce this, we'll have an SDK, a Software Developers' Kit, that will allow tracking software to retrieve the information and use it as needed."

Cooke S4/i and 5/i lenses will have the new /i square hardware beginning in 2014. There will be a slight price increase for each lens (around $100) to cover the additional cost. If you buy a new S4/i or 5/i lens now, it will be at the current rate. Pre-/i square lenses can be upgraded, when available, at a Cooke service center.

Codex is building an /i square recorder. ARRI, Sony, and Canon have adopted /i technology, but each company approaches it differently and each camera manufacturer has come up with its own, usually different, way of recording /i data. Now one simple recording system will be compatible with everyone.

Cooke Optics is teaming up with Codex Digital and The Pixel Farm to develop and deliver the next generation of metadata capture for film and digital cameras.

Codex Data Logger One

Codex Data Logger One is a small, single channel serial data recorder that captures data directly from a number of devices including Cooke /i and /i square lenses, and the Preston FI+Z Wireless Lens Controller. It was designed to support the growing need for camera metadata by visual effects artists on film and television productions.

The system will record all Cooke /i square metadata with frame accuracy, consisting of critical lens and camera information. It allows monitoring and transfer of key lens data including inertial tracking information, focus, iris, zoom, depth of field, serial number, and more.

The device is a small box that mounts easily onto the camera rods. It only needs to be set up once. From then on, it will automatically capture lens and inertial metadata directly to an SD card. When used with ARRI Alexa cameras, the Codex Data Logger One will capture all data automatically on a shot by shot basis.

An open interchange format is used to move data to the Pixel Farm's PF Track. Metadata can be translated and processed directly or a shot-specific online service will be available to users who do not wish to invest in the development required to get accurate data to artists.

www.codexdigital.com

Codex Data Logger One Specs

Product name/code: Codex CDX-3650
Inputs:

- Serial
- /i and /i sqaure data
- LTC
- GPIO-Tally – Pulse and Record start/stop

Power:	DC 10 – 34V
Output:	GPIO Tally
Media:	SD Card

Compatibility:

- PF Track
- Cooke /i and /i square
- Preston

Optional: GPS and GPI Trigger (Product Code CDX-3001)

Codex Data Logger One

Trigger

Codex Data Logger One

Vintage Cooke Panchros Revived

Give them your tired, your poor, your old Cooke Series II and III Panchros, yearning to be breathing free. If you're looking for a vintage Cooke Series II and III Panchro look, here's the real deal.

P+S Technik in Munich (left) and True Lens Services in Leicester (below) showed skillfully rejuvenated vintage Cookes at NAB.

True Lens Services showed an entire set. Send them your original vintage 1950 Cookes to be rehoused with cam focus and barrels reminiscent of current S4 lenses. Below, a True Lens Services revitalized set in PL mount: 18, 25, 32, 40, 50, 75, 100 mm. True Lens Services is down the road from the mother ship Cooke factory in Leicester, with a staff that includes some of technicians who built the original Cooke Series II and III lenses. P+S Technik: pstechnik.de

True Lens Services: lensrepair.co.uk

True Lens Services

P+S Technik Rehoused S2/S3 Cooke Panchros

P+S Technik can rehouse your Classic Cooke Panchro S2 and S3 lenses — or even provide a complete set on request.

- The compact and lightweight design has a consistent 80 mm front diameter on all 6 lenses. Comes in PL Mount.
- The focus mechanism has a cam drive: the original helical thread is replaced.
- The original Cooke S2/S3 lenses are serviced like new.
- High-tech tools are used for lens polishing and the elements are re-finished with a choice of original anti-reflective coating, state-of-the-art modern multi-coating, or uncoated.
- A macro function provides close focusing capability.
- Rings for iris and focus use a standard 0.8 gear module.
- Focus rings come in imperial or metric. Exchanging the rings is easy; you can do it yourself. Each focus ring is engraved individually for each lens. Since P+S Technik keeps the data for the engraving, an extra feet or meters focus ring could be ordered at a later date. Of course, the best thing would be to order both rings with the rehousing.

P+S Technik tells us that delivery time averages 4 weeks, and they are currently doing 4-5 sets per month).

www.pstechnik.de email: sales@pstechnik.de

75 mm T2.3 50 mm T2.3 40 mm T2.3

32 mm T2.3 25 mm T2.2 18 mm T2.2

Cooke Metrology Lens Projector 2/2014

Sockets for 15 and 19 mm lens support rods

A lens projector is an essential piece of test equipment for rental houses, manufacturers, technicians and camera crews to check a lens for geometric distortion, chromatic aberration, internal barrel flare, sharpness, where the edges fall off (shading), if the lens breathes, etc.

It works like a slide projector, illuminating not a slide but a test target (reticle). The image is projected through your camera lens onto a flat wall, ideally painted bright studio white. The Cooke Lens Projector uses a 200W Ceramic Tungsten Lamp. It is extremely bright and dimmable.

The projector uses an interchangeable lens mount system: PL, Panavision, Canon, Nikon, etc.

Here's a simplified how to.

1. Examine the image to check the lens's resolution, geometry, characteristics, "look."

2. Next, check the focus marks:

3. Set your lens to a specific focus mark, say, 6 feet.

4. Hook your focus tape onto the Cooke Lens Projector's focus hook (image plane) and position the projector the same distance from the wall—in this case, 6 feet.

5. Focus of the lens. If it doesn't focus at exactly 6 feet, check a few other distances.

7. There are two possibilities for being off:

   a. Gulp—the lens manufacturer wasn't accurate and the focus marks really are off. (Chart tape and Sharpie Ultra Fine marker to the rescue.)

   b. The back focus of the lens is off.

8. To check the back focus, adjust the projector's reticle position so that both lens and projector distance match.

9. Read the flange focal depth micrometer to see by how much the lens needs to be shimmed.

Rear of Cooke Lens Projector:

- On/Off Switch
- Dimmer
- Power light
- Connector for Power Cable (90-255 VAC, 50-60 Hz.)

Connectors on front:

- DISPLAY: connector for optional wired back focus depth display
- RC: Wired remote control for back focus adjustment
- 12V: 2-pin accessory power
- 5V: USB outlet for work light or to charge your iPhone

Cooke Anamorphic Primes - Apr 2013

Approx. Actual Size

Cooke is introducing a new series of 2x anamorphic prime lenses. The initial set, announced at NAB, consist of 7 lenses: 25, 32, 40, 50, 75, 100, and 135 mm. They all have a wide-open aperture of T2.3 (except for the 135mm lens, which is T2.8).

At the AFC Micro Salon in Paris a few weeks ago, Angénieux CEO and President Pierre Andurand and Cooke Chairman Les Zellan were seen *tête à tête*. FDTimes has learned that Angénieux and Cooke technical teams worked together to share the design of their respective anamorphic lenses and check their compatibility.

Pierre Andurand said, "Les and I are pleased to announce that our anamorphic zoom lenses and Cooke's anamorphic primes will work well together, providing cinematographers with a compatible series of lenses to shoot motion pictures in anamorphic format."

Les Zellan said, "In terms of color and look, our lenses have always complemented each other and the fact that they will continue to do so, even in anamorphic, will make this exciting widescreen format available and affordable for a new generation."

The Cooke Series of Anamorphic Prime Lenses are a completely new design. Of course, the "Cooke Look" is built in. They will all be equipped with the next generation of /i lens metadata, which should be welcome news for special effects supervisors. Anamorphic oval bokehs will be visible.

At the entrance to the AFC Micro Salon in Paris last month, left to right: Pierre Andurand, Les Zellan

Cooke Anamorphic Primes, cont'd

The Cooke anamorphic lenses are each 195 mm / 7.68 inches long from PL mount flange to front, and have a front diameter of 110 mm / 4.33 inches.

And now some technical details from the eminently quotable Jon Maxwell, Optical Designer:

"The 25 to 135 mm designations refer to the focal lengths in the vertical plane. In the horizontal plane (the anamorphic plane) the effective focal lengths are divided by the anamorphic ratio, so the equivalent focal lengths in the horizontal plane, in this sense, range from 12.5 mm to 67.5 mm.

"These are not the first anamorphic lenses that Cooke has made for the film industry. Back in the 1920s the company (then Taylor, Taylor & Hobson) made a cylindrical attachment for Bell & Howell. Then, in the 1950s the company (at that time called Rank Taylor Hobson) made a series of anamorphic lenses for the Paramount/Rank VistaVision system of widescreen cinematography.

"These new anamorphic lenses have been designed with great attention to detail for the modern demands of cinematography. They match the image quality of the 5/i, S4/i and miniS4/i Cooke prime lenses and have the Cooke 'Look.'

"The new Cooke anamorphics will not breathe horizontally or vertically. In this regard it is particularly important that the apparent 'fatness' and 'thinness' of the actors will not change with focusing. In the early days of widescreen cinema some lenses suffered particularly badly from this defect, in a way that made actors fat in the face at close focus, and this defect became known as 'mumps.' These new Cooke anamorphic lenses do not breathe, and they do not have mumps."

Delivery is projected for sometime before NAB 2014. Prices are not yet finalized, but estimates are in the ballpark of Cooke 5/i.

NAB Booths C11149 and C11150.

www.cookeoptics.com

Cooke Anamorphic Prime Lens Specs

	Units	25mm	32mm	40mm	50mm	75mm	100mm	135mm
T-stop Range		T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22
Angular Rotation of Iris Scales	deg	90	90	90	90	90	90	90
Minimum Object Distance	inches	33	33	30	33	39	44	56
	mm	838	838	762	838	991	1118	1422
Angular Rotation to MOD End Stop	deg	300	300	300	300	300	300	300
Length from Front of Lens to Lens Mount	inches	7.68	7.68	7.68	7.68	7.68	7.68	7.68
	mm	195	195	195	195	195	195	195
Max Front Diameter	inches	4.33	4.33	4.33	4.33	4.33	4.33	4.33
	mm	110	110	110	110	110	110	110
Total Weight	kg	2.77	2.68	2.93	2.74	2.64	2.93	2.93
	lb	6.11	5.90	6.47	6.03	5.81	6.47	6.47

Cooke Anamorphic Test in Paris 4/2014

Danys Bruyère, TSF Managing Director of Technology and Ops, writes from Paris:

"We were thrilled to have the opportunity to test the first pre-production prototypes of the 40, 50 and 75 mm Cooke Anamorphics. We went out on location with Les Zellan, Patrick Blossier, AFC, First Assistant Maeva Drecq and DIT Julien Bullat. We used an Alexa XT in ARRIRAW mode at 24 fps. We threw a Cooke S4 40 mm lens into the case for good measure, not really to compare, but to illustrate certain qualities we had already gotten a feel for during the day. We drove around trying to get Paris scenery until the gendarmes told us we needed shooting permits if we were to put a tripod on the sidewalk.

"With anamorphics, the oval bokeh is the obvious draw, but more importantly to me, the smoothness of the foreground elements really stand out with the new Cookes. You feel it in the comparative shot of our trainee Meriem Housni (at left, top two). Certainly, the anamorphic backgrounds stand out, but more importantly her face and skin change subtly, bringing a silky, creamy feel to skin detail, even in the cold of a winter night in Paris, with sodium lighting and a single SoftLights T5 fluorescent tube. The distortion of the pixel structure really changes the structure of the digital image.

"On the shot of 2nd AC Florent Bertholet in front of La Samaritaine (middle picture), it is really interesting to see how the horizontal and vertical planes play differently when we focus from background to foreground. These are real anamorphic qualities which go beyond the ovalization of highlights.

"On the Les Zellan interview shot (bottom), as car headlights zipped by toward the camera, we never saw any out of control flaring, but rather, very subtle diffusion around the headlights without ever altering the contrast in the dark areas, keeping the image rich in low light detail and faithful color rendition.

"Another effect of anamorphics can be seen in the way that objects enter or exit frame. When panning, you get a feel that objects entering the frame are being pulled into the center, keeping our attention focused on the key parts of the image, rather than getting lost in unnecessary details at the limit of our peripheral vision."

Cooke Anamorphic Tests from Paris, London, Toronto and New York ("Look") are online. vimeo.com/cookeoptics

“Look” Cooke Anamorphic Test in New York

Jon Fauer tested the lenses and writes from New York:

No sooner had I returned from my visit to the Cooke factory than Marc Paturet, President of Handheld Films, called to propose shooting a test in New York with the pre-production Cooke Anamorphics.

I wanted to pursue Les Zellan’s description of “anamorphic funkiness” and try to illustrate the qualities learned about the “Cooke Anamorphic Look” from the designers at the factory. Engineering Manager Stephen Pope had said, “It isn’t fair for you to be asking all the questions. Now it’s our turn. What do you think about our anamorphic look?”

I commented how, in the Paris opening shot of Les, the skin texture was cosmetically smooth. But his beard was totally sharp (opposite page, bottom). We told Les that he was a perfect lens test target. He replied, “Should I call my agent?”

Different agents in New York led Marc Paturet, a serious practitioner of Yoga, to entice three Yogini classmates to star in our test. The theme of the short film—“Look”—was a day in the life of a camera prep checkout at New York rental house Handheld Films—sort of an invasion of the Yogini Camera Assistants.

We wanted to push the lenses Les provided (32, 40, 50, 75 mm Cooke Anamorphic/i) to do all the things we’re not “supposed” to do with anamorphics: minimum focus, wide open with a wrench, major flares, and more. We shot ARRIRAW with Handheld Films’ Alexa Studio (4:3 sensor) and Codex Onboard. Timothée Arene was the terrific Camera Assistant. The camera was rated at 800 ISO.

Goldcrest Post Production did the finishing. Ricardo Madan edited. Tim Spitzer supervised and grading was on Qantel Pablo by legendary John Dowdell III.

In the framegrabs at right, top to bottom:

1. Next time the producer calls you halfway through checkout and changes the entire order from spherical to anamorphic, this is the stress-relief routine.

2. Oval bokehs. The foreground is a bare Maglight bulb held at the edge of matte-box.

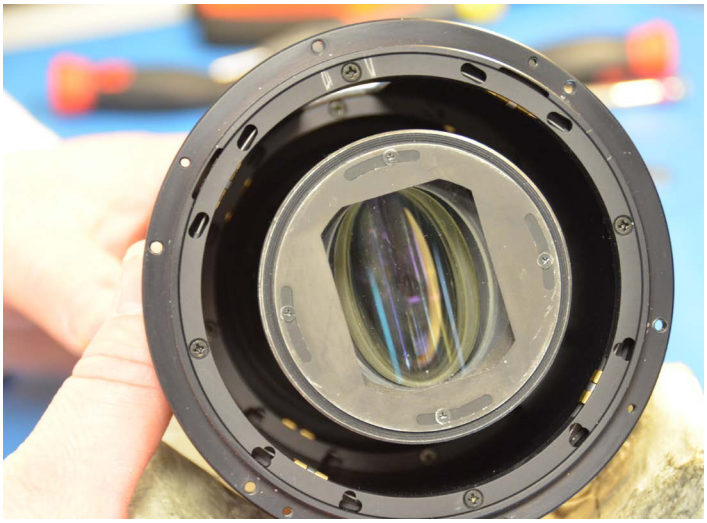
3. Cosmetically smooth skin tones, oval background bokehs from little LEDs on battery chargers.

4. Funky flares and nice contrast. There is one shot in the finished short done with a Blue Streak Filter.

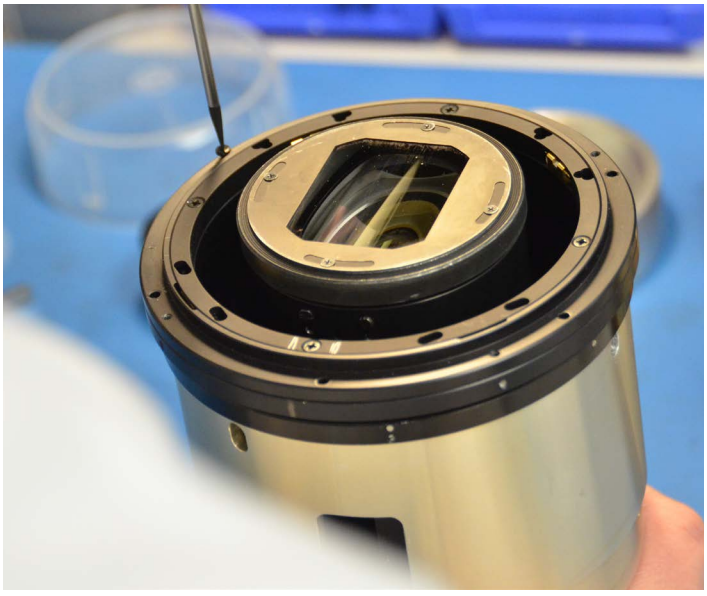
A Look at Cooke Anamorphic/i 4/2014

"Class picture" of Team, photographed with Cooke 2x Anamorphic 40mm

The "Inner" being mounted into the "Outer"



Anamorphic cylinder element mounted inside.



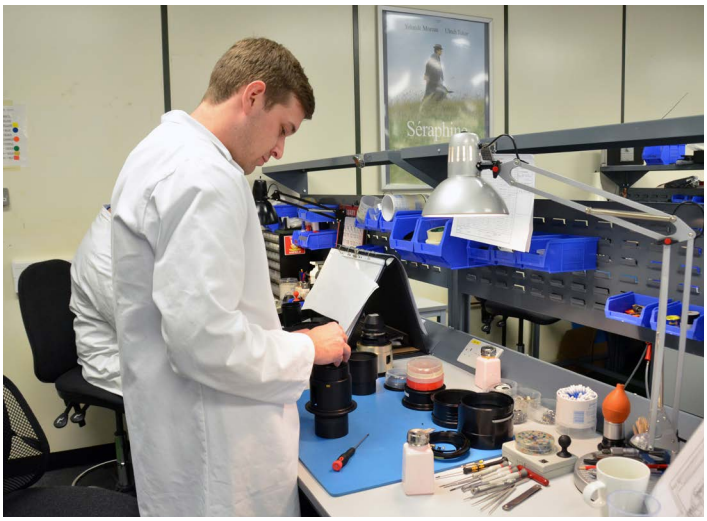
Screwing the innner and outer together

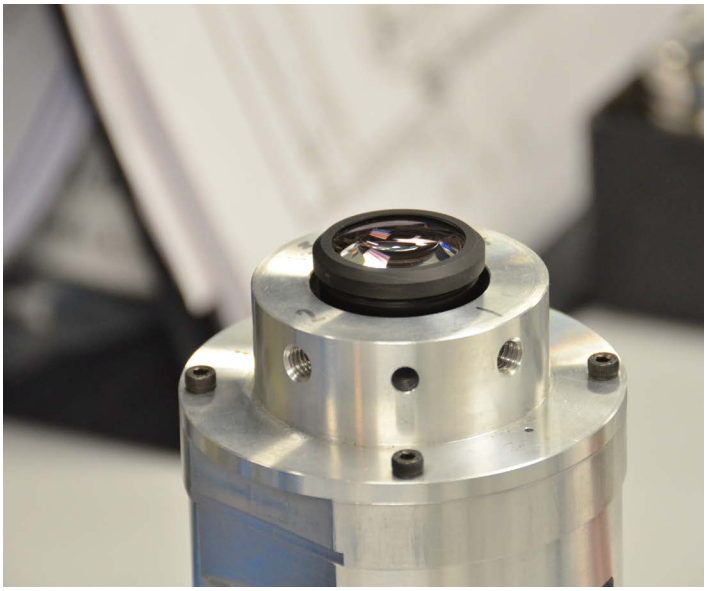
Lens cells

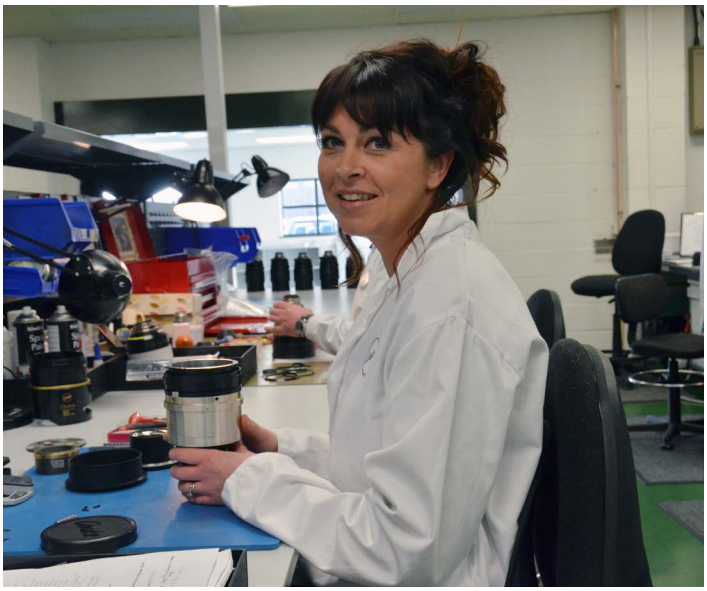
Cooke Anamorphic/i (cont'd)

The Basic Set of Cooke 2x Anamorphics: 32, 40, 50, 75, 100 mm

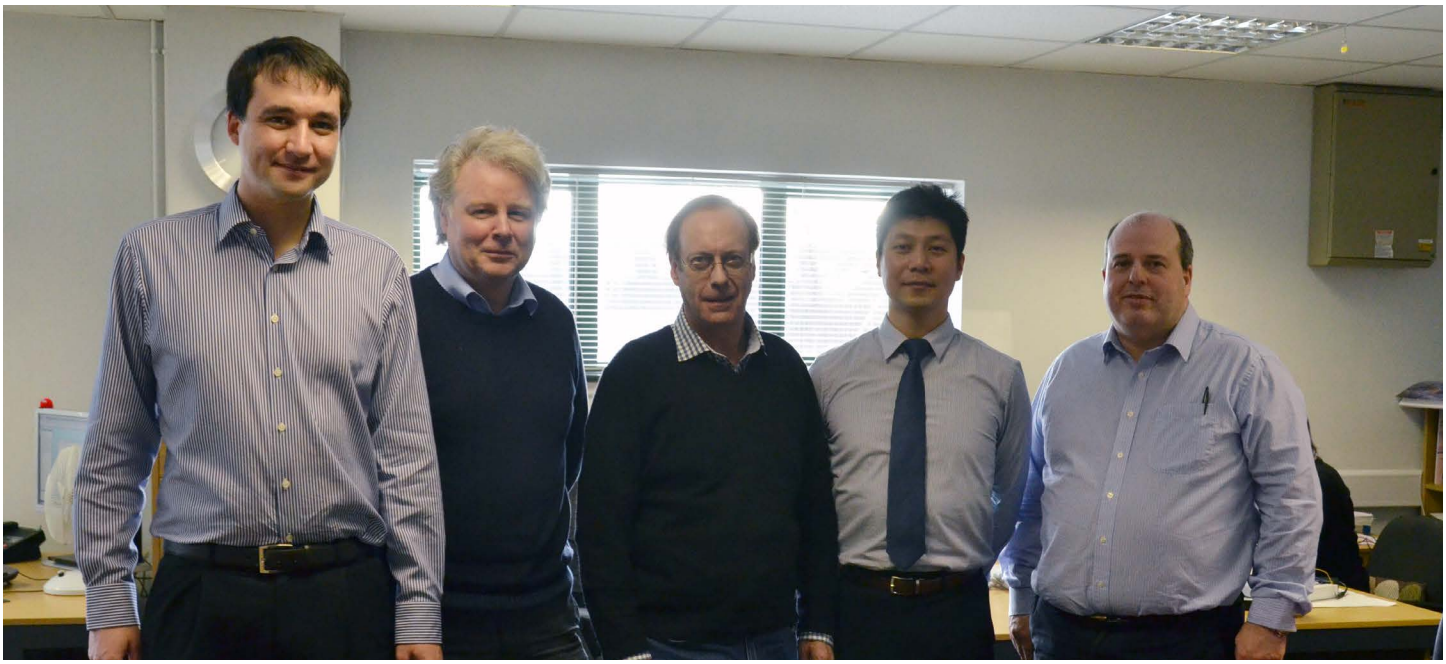

Iris assembly


Jamie Cluer


Tool to align optical elements


Fiona Cheetham started building outers for miniS4/i and is now building 5/i

Cooke Anamorphic Optical Design Team



Cooke Optical Design Team: Graham Cassely, Philip Watson, Iain Neil, Leo Chen, and Stephen Pope (Engineering Manager).

It was a cold, rainy day a couple of weeks in Leicester, about two hours north of London. I was in the second floor conference room at the Cooke Optics factory talking about the new Cooke anamorphic lenses with Les Zellan and the optical and mechanical designers. I had expected to be meeting with one designer or two…not a group large enough to comprise an entire football team. We divided the discussions into three sections: optical, mechanical, and management. The optical design team was introduced first: Graham Cassely, Philip Watson, Leo Chen, Stephen Pope (engineering manager), and…Iain Neil. Iain Neil—what was he doing here? Les Zellan is an accomplished prankster, known for surprise parties for his wife Barbara, his family, and far-flung special encounters for his staff. Now I knew why he had vigilantly shepherded me from Micro Salon in Paris directly to the Leicester factory.

JON FAUER: I see some familiar faces here.

LES ZELLAN: When we started this project, I came to the designers and asked them for a set of modern anamorphic lenses. I wanted them to have the classical anamorphic character—what I typically call "anamorphic funkiness."

The reason is that, in the "old days," five or six years ago, when we used to shoot film, there were dozens of film stocks and processing options, and there were all kinds of things that let the cinematographer achieve different looks. In today's world, as we go more and more digital, those choices have been reduced to just a handful of sensors. That gives films a certain sameness in look. As these digital sensors get better, I think we're seeing cinematographers wanting to use not only modern lenses like our Series 4, 5 and miniS4, but they also want to use vintage lenses like Cooke Speed Panchros, Baltars, Standards, Super Speeds, and other older lenses. They're trying to inject personality and character into the digital medium, which can be fairly sterile. This renaissance of anamorphic is an attempt by cinematographers to get the image they want, give it some personality, and show character.

I asked our design team for a modern set of anamorphic lenses, with reasonable speed, new /i Squared Technology, and with the Cooke look (because it's going to have our logo and name on it). I wanted to keep the anamorphic character that's interesting to cinematographers today. It would have to go beyond just having classic elliptical bokehs, which are certainly a telltale sign. When building an anamorphic lens, you're sort of combining two lenses together. You've got the "normal" lens in the vertical axis, and you have another lens in the horizontal direction that is twice as wide. These two focal lengths give you multiple depths of field, all kinds of strange and wonderful artifacts and distortions. These are the things that give anamorphic its personality.

When did you assemble this dream team?

LES ZELLAN: It took a while. This is a highly experienced team and one person who's missing today is Jon Maxwell, a designer here for a long time. Although retired, he continues to work with us as a consultant and is very influential in what we do. This is a pretty young team. We knew we needed a little guidance here—somebody with a little bit more experience, especially going into anamorphic territory, somewhere we haven't been in years. So we approached Iain Neil and luckily he was available and didn't have any other anamorphic projects. Iain Neil is the optics technology consultant to Cooke and has taken the lead on the anamorphic project. We also have a continuing and ongoing arrangement with Iain to encompass other projects.

This team works well together and the proof is we're going to be delivering the first 5 of our 7 anamorphic lenses at NAB 2014. Later this year, we will deliver an additional 2 focal lengths, 25 and 135 mm, and we'll be announcing a few more. I think the set will finish with about 10 or so prime lenses.

Describe the process of designing this new set of anamorphic lenses and what each of you do.

PHILIP WATSON: Our approach was to come up with a completely new lens and so we began by making a whole pile of notes.

GRAHAM CASSELY: I translated that pile of notes, "the specs," into a lens design by tracing rays of light through the lens on the computer, deciding on elements and glass types, and tolerancing.

When I was here last, there was a gentleman who was dropping S4 lenses on the floor to test their durability.

GRAHAM CASSELY: That was Dave Nettleton. He has since retired. You'll be talking to his son Paul later—the mechanical de-

signer. But I don't know if they'll be dropping any of these anamorphics today. Anyway, we came up with the optical designs and then we handed them over to the mechanical designers and they worked out how it all fit together, how it all moved.

PHILIP WATSON: As an optical designer. I was mainly involved in 5/i designs. Now I'm now keeping an eye on the anamorphics.

LEO CHEN: My major responsibility on the project is actually doing tolerancing analysis—how the system is being designed within the team. We evaluate whether the designs these guys create are buildable. We look at ways to bring down the cost and whether we can actually improve the design. My post-graduate work was in lens and optical design. The tolerancing skill was acquired at my previous and current job.

STEPHEN POPE: I've been doing this for 25 years. Background in military optics. Also worked in telecoms and high volume optics. Now it's come back full circle. It's about traditional optics really.

I'm the engineering manager on this project, which involves knowing what's going on in the optical design and translating that over to the mechanical design team and making sure all that work happens. I look at what tooling we're going to need on the shop floor to put the lenses together. All the components have to be manufacturable. All parts have to be within our manufacturing tolerance limits. I identify any new processes that we need. There's quite a lot going on in this "little" project of ours.

LES ZELLAN: In addition to requesting an anamorphic lens with character, we wanted this to be a Cooke lens in the S4 tradition, meaning the Cooke Look, of course, as well as S4 ergonomics, sharp focus and good shadow detail. Camera assistants had a big influence on the design of the ergonomics with all our lenses beginning with the S4—particularly with the gears and the windowed scaling. The rental houses were also very involved by demanding a lens that was serviceable.

Like all Cooke lenses, there are different levels of complexity, but they're also serviceable by competent technicians. We didn't want a lens so complex that it's unserviceable. When you talk to the mechanical team, you may well come to the same conclusion as mine. The optical team runs numbers through their computers. It's the mechanical team that has the harder job of making the lenses work at all temperatures and maintain the air gaps and the spacing and make it focus.

The entire design was not a trivial exercise. But there always was a balance. The goal was to come up with a series of lenses that deliver what cinematographers are looking for and that we can assemble relatively easily to keep the costs from spiraling out of control, and that could be easily serviced at rental houses and repair facilities. I think we've come up with the right balance.

GRAHAM CASSELY: This balance is a tricky thing. We look at the possibilities, and sometimes come up with a different approach, and it's very much a trade-off among all the different departments—glass, mechanical, manufacturing, assembly. So it is a give and take.

Who cracks the whip and sets the deadlines? With NAB looming, who decides when something should be ready and who says when to make compromises to enable it to be ready? Because building lenses, not just anamorphics, often seems like a turtle race. It seems like a race to see who's going get there, not first, but eventually.

IAIN NEIL: The approach used here, I believe, is probably different from anything done before. We used new methods to figure out how to tolerance the optics and the optical designs in such a way that they suited the manufacturing techniques.

Because anamorphic lenses have cylinders, which we call non-symmetrical components, they once were extremely difficult to manufacture, to align, and to calibrate. It was very tedious, involving a lot of tapping of elements with little hammers and that kind of thing. That was in the old days—involving a lot of fine adjustments. The approach taken here was to minimize all these little, almost random, adjustments. And reduce it to something that's more scientific or…

GRAHAM CASSELY: Logical.

PHILIP WATSON: Systematic.

IAIN NEIL: It means that you can build anamorphic lenses in a very similar way to spherical lenses. And that's very important. Because if you don't do that, it can be, as you said, like a turtle race trying to get the product finished.

That was one of the fundamental things at the beginning of the project: to say this is how we want to do it. It had quite a bit of influence on the optical design. If you don't include those thoughts, you end up with a design whose tolerances can't be maintained and you can't build it.

When Leo mentioned the tolerancing, we actually used different software to do different kinds of analysis to make sure that what we were talking about technically was going to happen in practice. And then Stepheen would let us know whether it would work or not with the tooling and the test fixtures. All these things had to come together. I would amplify what Les said: it's very important that the optical design at the beginning starts with all this in mind.

Iain, please take us through the design process.

IAIN NEIL: The mandate was a new set of anamorphic lenses, with anamorphic imaging character, with the Cooke look—the anamorphic Cooke look. That was important because it would follow the Cooke spherical lenses: the S4/i, 5/i, the miniS4/i.

In terms of the optical design, we looked at the history of anamorphic lenses. They were used extensively shooting movies beginning in the 1950s. There were several different lens systems available. Anamorphic lenses came out as part of the studios' fear that television was going to take over and so they were looking for new, larger formats. People often think of 65mm film. But what's interesting about anamorphic was it didn't depend on a big piece of film, so it was a very cost-effective way of shooting in terms of film using standard cameras, for capturing the image, for processing. It was 35mm, 4-perf and it used the same film as a spherical production—and the same camera. The key point is that the camera system could stay the same. The only part that really changed was the camera lens, the taking lens.

Another important thing was using the entire negative area, as opposed to a cropped or letterboxed image. So the anamorphic image was less grainy and looked sharper.

IAIN NEIL: That's correct. So we're now in the second decade of the 21st century, almost 50 or 60 years later. You could say we've reached a point now where something's changing again in the entertainment business. This also harks back to the "old days" when cinematographers were looking for new ways to capture an image, to produce a different look.

So the anamorphic look comes back into play, because it's the same situation again. You keep the camera, but if it's not film in the camera, now it's a chip in the camera. You can keep the camera basically the same. And what you do is change the lens.

About our anamorphic lenses and the optical design. There were a couple of very important factors at the beginning. One was that we did not want to go technically crazy and push the cost of the lens through the roof. Anamorphic lenses have always been considered to be expensive, whether you bought them or rented them.

You're democratizing the anamorphic process.

IAIN NEIL: Yes. We wanted to carefully consider what people wanted from the lens, but also to be careful with the cost. There was definitely a cost constraint.

Anamorphic has been the object of desire for many directors and cinematographers, and, rightly or wrongly, an object of budgetary dyspepsia for producers.

IAIN NEIL: That was the opportunity, but only if the cost of the lenses could be controlled. Our team looked at what might be possible in terms of a new kind of optical design, with the anamorphic Cooke look, with character, at a reasonable cost, with the main features that the market was asking for. It was really important to listen to the end users. We're not just talking about rental houses. What is it they see or what are they looking at? Is it the out-of-focus highlights, the bokehs? Everyone hears about the bokehs. But that's just one part. It's also skin tones and color temperature and textures.

Can you define the anamorphic look that a spherical lens cannot provide? Specifically in your design.

IAIN NEIL: There are quite a few characteristics. One of these is the treatment of aberrations. Should we correct this aberration or leave that one alone? We heard many different cinematographers talking about aberrations they liked or didn't like. And we discussed producing or reducing some of these effects. Again, it's very easy to go crazy with the optical design and end up with many lens elements doing all sorts of things. So we reduced it to what we think are the key things.

If you take the anamorphic bokehs, which seem to be a big topic when people think of anamorphic pictures, there's more to it than is normally discussed. Some people might agree or disagree. First of all, to create what I would call the true anamorphic bokeh or character, you've got to really produce a two-to-one ratio.

There are different ways to describe the bokehs. You can call them elliptical or oval in shape. And the shape can even vary a little bit, depending on certain lighting situations, the focus distance setting of the lens, and the distance of the out of focus objects.

But having elliptical or the expected bokehs are very important not just because of how the shape looks, but because there are two or three other things that go on over the whole picture, related to the bokeh. The first one is not just the bright point source that's out of focus and shows up as a bokeh, but everything else out of focus in the picture. I would call it the out-of-focus highlights overall. You end up with that certain look when you have all the anamorphic optics, the cylindrical optics, in front of the iris.

And the out-of-focus background is going to look different with a front cylindrical lens as opposed to rear?

IAIN NEIL: Yes. In the past, you've seen rear anamorphic zoom lenses. They have a different look. But, yes, let's call the traditional approach with anamorphic lenses as having some sort of anamorphic cylindrical lens module in front of a spherical lens module. And the spherical lens module would normally have the iris inside, so it's just a taking lens.

The key point I'm making is that the anamorphic optics are basically between the object and the iris. That's where they sit. And that's what gives you the classic, elliptical out of focus look as well as the bright streaks across the picture.

GRAHAM CASSELY: Which is created by the two focal lengths and a combined depth of field.

IAIN NEIL: Graham makes a very good point concerning depth of field and focal lengths—which is also related to the shape and area of the bokeh. If you have a 100 mm anamorphic lens, it's about 100 mm in the vertical direction, and it's about half of that, 50 mm in the horizontal direction. For any point in the picture, the depth of field is different vertically and horizontally. For example, a 100 mm anamorphic 2x squeeze lens has a vertical focal length of a 100 mm spherical and a horizontal focal length of 50 mm spherical lens. So, the difference of the two focal lengths is 2x (100/50 = 2). However, the difference of the two depth of fields is 4x. Why is that?

Pull out your *ASC Manual* or lens manufacturer's depth of field charts—dust off your *Guild Kelly* or *Samcine* calculator—or click on your *pCam* or *Toland app*. For spherical lenses having a 2x difference in focal length, like our 100 mm and 50 mm example, with both lenses set at the same T/stop and focus distance, you will see approximately a 4x difference in depth of field. In other words, if the depth of field on the 100 mm is 2 inches, it will be 8 inches with the 50 mm lens.

So, if you don't have depth of field charts specifically for anamorphic lenses, you would be safe looking up published depth of field data for the vertical focal length "component" of your anamorphic lens, easily covering the horizontal focal length depth of field.

A more mathematical way to think of this is to compare the beam diameter in object space for a 100 mm spherical lens compared to a 50 mm spherical lens at the same T-stop. You'll find there is a 2x difference in beam diameters, but a 4x difference in beam area (area of a circle is πr^2).

Earlier, I mentioned the out of focus highlights (bokehs). In addition to those, the overall anamorphic look of the picture is also created not only by the in-focus highlights but also any objects in the picture. The large 4x difference in depth of field actually contributes substantially towards the overall look of the image, with and without bokehs. This is something that is not easily reproduced with spherical optics shooting Super 35 flat, or even with post processing of captured images.

STEPHEN POPE: You can see whether the cylinders are in front of the iris or behind by looking down the front of the lens. If the cylinders are in front, then you'll see an elliptical shape when you look at the iris. If the cylinders are behind the iris, when you look through the front, it'll be a circular shape.

IAIN NEIL: Bokehs from a front cylinder anamorphic lens are much larger vertically than from a spherical lens. In other words,

if you take out 100 mm spherical and 100 mm anamorphic lens, the anamorphic bokeh is much larger in size vertically. The width should be about the same, but the height is much larger.

What do you see on the Panavision C series?

IAIN NEIL: That's what I believe you will see. People generally like to see a very clean, smooth, homogenous look to the bokeh. In other words, you don't want to see a bright center and a very bright edge. You like to see it evenly illuminated. One of the things we did not want to do was to introduce optical surfaces other than are spherical and cylindrical ones. The cylindrical surfaces we need to achieve the two-time squeeze. But we did not want to use aspheres, because aspheres can show machining artifacts that look like lines and squiggles and little circles and ellipses, and other effects that may look like the rings of a tree. They are caused by thee grinding, polishing, and various other techniques involved.

What else went into the design?

IAIN NEIL: We wanted same size diameter and similar weight for the base series. We weren't looking for a super lightweight nor a monster lens. The base series is 32, 40, 50, 75 and 100 mm. The optical design approach we're using employs all the anamorphic cylindrical optics in front of the iris. It's a novel approach, because we're using cylindrical optics but some of the cylinders go in one direction and some go in another direction. They're not all cylinders going in the same direction. And there's actually a patent pending.

And what's the advantage of that?

IAIN NEIL: The advantage of that is gaining more degrees of freedom to tweak or optimize the performance to get as much of an anamorphic look as possible.

GRAHAM CASSELY: I think traditionally most anamorphs previously built had all the cylinders in the same plane or there was just one cylinder.

IAIN NEIL: In the Cooke anamorphic lenses it should be noted that the front element is actually not anamorphic, it's a spherical element. All the anamorphic optics, all the cylinders are between the front element and the iris. This is a novel, new concept.

There were certain aberrations we made a point of correcting that are worth mentioning, which directly relate to digital sensors. We tried to reduce the chromatic aberration. Because that can be difficult to post process. We tried to keep a near telecentric output, which improves the efficiency of light collection at the sensor. We've eliminated shading by achieving high illumination at the corners of the picture.

What's the image diagonal?

IAIN NEIL: We're optimizing for greater than the Alexa anamorphic 2.39:1 format dimensions 2x squeezed on the 4:3 sensor.

Alexa Studio and Alexa 4:3 sensor in anamorphic mode occupies an area of approx. 21.20 wide x 17.74 mm high (27.64 mm diagonal), occupying 2570 x 2150 photosites, with a ratio of 1.195:1. Unsqueezed, 1.195 x 2 = anamorphic widescreen 2.39:1 ratio.

You said optimize for digital. Will this lens look equally good on film cameras?

IAIN NEIL: They are optimized for maximimum performance with digital. But they work equally well with film.

Here are some points that could be controversial. As I see it, there are three ways to evaluate the imaging performance of anamorphic lenses. One is the computer, looking at numbers on the computer screen. The second way is to look at them in projection. And the third way is to actually use the lens, shoot something.

The rule of thumb with anamorphic lenses is that perhaps the worst way to look at the lens is on the projector. I think it's very important not to look at the textbook and get too caught up with MTF and test charts. As we noted, the depth of field on anamorphic lenses is 4x less in the vertical azimuth than the horizontal azimuth. So, if you project the lens slightly out of focus, the vertical test target line pairs will be 4 times more out of focus than the horizontal line pairs. But the projector can't go away, because you need the projector to build them. So to me the projector is part of the manufacturing process. It's building, assembly, alignment, testing, calibration, etc. But in terms of overall evaluation I think projection is limited and can even be misleading.

What I really want to say to rental houses is don't go bananas with projection. Anamorphic is more than what Les calls "funkiness" and more than just the bokehs. The anamorphic look involves artifacts and compression and curvature—which are difficult to evaluate projected on a flat wall. They are best evaluated in real-world situations. One other point. We keep the image performance good throughout the entire focus range.

Stephen, how do you take all these design parameters into account and how do you then manufacture this?

STEPHEN POPE: All those specifications have been distilled down and refined at the start of the project. It's also tied with the "trivial" things that we think about: length, diameter, weight, and all those good things that fit in with the cost. We take the optical designs from the computer in our first phase, put it into the CAD system, and try to wrap some metal work around it and say, "Yes, we have something here that looks promising to go forward."

We get an initial optical design and then Leo churns away doing all sorts of modeling in the background. He comes back and says that he has a question about an optical design parameter. We get those figures back and say, "Oh, that one's a bit tight."

Next, we might say to the team, "What resolution do we need to move that?" And they say, "Half a micron would be good." And then we might say that we're not too keen on half a micron, no. But if they come back and say 10 microns, we'll say, "Great!" That's the kind of iteration that goes on.

We went out and tried new techniques on this project as well. We had to develop some new tools to do the centering of the lenses. Most of our strategy was to avoid doing iterative adjustments. We prefer to do it by making many measurements. We try to reduce the time it's taking to build by making measurements and calculations. These lenses are very well measured.

GRAHAM CASSELY: I would use one big word here. It's not random assembly. It's predictable.

Who does the sourcing? And who says we need to get this element from such and such a company or another.

STEPHEN POPE: Alan Merrills is in charge of that and I do a little work on that as well. If the guys in the glass shop don't like a certain glass type because it stains or something like that, they say, "We don't like that one, can we have a different one?" You go around the loop and then you come back and say, "No, sorry, we must have this one because of such and such a reason." These are the sort of debates during the design process. It's a two-way collaboration. Every time we come back and say it might be easier one way, someone says we really have got to have this, and then we'll go find a certain material. These are the decisions we get into.

Earth. The Four Elements: Earth. A Fruit and Vegetable Market with the Flight into Egypt in the Background. Joachim Beuckelaer.
1569. Oil on canvas 157.3 x 214.2 cm.
NG6585. © National Gallery, London / Art Resource NY

Water. The Four Elements: Water. A Fish Market with the Miraculous Draught of Fishes in the Background. Joachim Beuckelaer.
1569. Oil on canvas. 158.5 x 215 cm.
NG6586. © National Gallery, London / Art Resource NY

I should say that an essential part of the process is the entire team in the optical, mechanical and assembly departments building the lenses. They also contribute valuable ideas during the design phase that continues during manufacturing: Keith Wykes, Jaimie Cluer, Paul Prendergast, Raj Mistry, Mick Maher—in fact, every one of the people you just photographed with our Cooke Anamorphic 40 mm lens in front of the factory today.

GRAHAM CASSELY: As a designer you work to a particular specification until you've actually built the lens and it's out there and people are actually using it. Until then, you don't know whether or not you've really got that specification right.

LES ZELLAN: That's exactly it. The anamorphic is even more subjective than the spherical lenses we're making. One person's awful artifact is another cinematographers, "Oh, I love that look."

Is there a Cooke Look in your computer program?

IAIN NEIL: The Cooke Look is in the computer. It's absolutely clicked in like an equation.

Can we go around the room and have each one of you designers explain to me how you interpret the Cooke Look. We cinematographers talk about it like fine wine. Oh, it's rounded or it's smooth or thin...

STEPHEN POPE: As scientists and engineers we are usually accustomed to nice specifications that are clear. Whereas here, it's great, we can say we want an MTF of this much here, and certain colors, and we get the challenge to think artistically as well.

LES ZELLAN: We at Cooke spent a lot of time in the early days (15 years ago) of really understanding what the Cooke Look is. We had all talked about it and we knew it when we saw it. But we hadn't necessarily codified it in engineering terms. Mark Gerchman, Jon Maxwell and Mike Salter spent a lot of time understanding it at a fairly deep level. We now have a very deep understanding of what it is and why it works so well.

But we're not going to tell you. It's like your asking Coca-Cola for their recipe.

GRAHAM CASSELY: But you can see what it looks like.

LES ZELLAN: Exactly. And that's what you cinematographers do.

If I were to describe the Cooke Look I would say it's smooth face tones, with a gentle fall-off in depth of field. You see sharp eyelashes and yet you have silky facial tones. The background falls off gently. It's slightly warm. That's how I would describe your ineffable Cooke look.

IAIN NEIL: I can think of two aspects. It takes away the harshness of an image and gives it a certain texture—for example, a person's face. The second thing is it makes skin tones look better, in that they have a slightly warm appearance. They have a pleasing look.

LES ZELLAN: It's not the same as using a filter. Other companies may go for contrast over resolution. But we clamp down a bit on the contrast. In return, we get resolution and more detail in the shadow areas where cinematographers love to have stuff hiding. It doesn't make one of us wrong or right. It's just gives you as the cinematographer a different brush to use.

When you designed the Cooke anamorphics, did you have in mind the S4 and your other Cooke lenses in terms of matching and characteristics?

GRAHAM CASSELY: Yes, we wanted to get the Cooke Look in there. I think they are pretty good matches. In the Paris test there's a shot with an S4 and another one with the anamorphic, and I would say in terms of the look there are similarities, other than the bokehs and anamorphic qualities, what Les would call anamorphic funkiness.

PHILIP WATSON: There's something more about color balancing. It's like lighting. When you say warm, what kind of warm? When you say bright, how bright? And what kind of white are we talking about? So color balancing is very important to the look.

IAIN NEIL: We can measure it. We see it as numbers or graphs.

GRAHAM CASSELY: I'll say we've been doing it for a long time. We have quite a good understanding of what's going to work and what doesn't.

In terms of the design, it's not like taking a 100 mm S4 and a 50 mm S4 and simply combining those two? It's a totally new science, right?

IAIN NEIL: Really, it acts in a completely different way.

Air. The Four Elements: Air. A Poultry Market with the Prodigal Son in the Background. Joachim Beuckelaer.
1570. Oil on canvas. 157.7 x 215.5 cm.
NG6587. © National Gallery, London / Art Resource NY

Fire. The Four Elements: Fire. A Kitchen Scene with Christ in the House of Martha and Mary in the Background. Joachim Beuckelaer.
1570. Oil on canvas. 157.5 x 215.5 cm.
NG6588. © National Gallery, London / Art Resource NY

LEO CHEN: I think designing a lens is not a leap of faith. We actually get numbers from the software or the computer, and then we see if it's going to be okay. The software predicts our figures. Much of what has been built in the past is considered. We have the belief in our particular sets of figures. We match the design with the specifications and we actually reproduce what has been discussed about the Cooke Look. It's all related.

Using this "stethoscope" approach will save a lot of time as well. We actualize with the prototypes and compare projection, distance, and, of course, we all worry about uncertainties regarding how the cinematographers will feel about our work. That's actually what makes the whole design more challenging. We talk a lot about "look." But one person might like it, and another person may not like it.

I actually saw 4 paintings in the National Gallery. The title is "The Four Elements," and it is a series of four paintings, "Earth," "Wind," "Fire" and "Water" by Joachim Beuckelaer. The painter actually had to point out the names in the titles, because each viewer might call it something else.

Our discussion today of out-of-focus bokehs and the design processes reminded me of these four paintings. Even objects far away or close up, sometimes out-of-focus, can be used to tell a story.

I think the artist, Joachim Beuckelaer, intended that we focus on the physical (the four elements) while aspects of the spiritual world are seen in the background, far away and out of focus, and by their very uncertain nature, are hard to grasp. For example, each painting has a subtitle, in case you, the viewer, missed it. "Earth" has the subtitle "A Fruit and Vegetable Market with the Flight into Egypt in the Background."

It's a similar thing in lens design. We can try to correct the aberrations or leave them in. It's like the "Four Elements." If you look inside, there are more things to consider than just the background and out of focus areas.

Just as we can see references to biblical parables in Beuckelaer's paintings, there is much embedded information in the backgrounds of anamorphic lenses that actually makes the filming more interesting.

"Just as we can see references in Beuckelaer's paintings, there is much embedded information in the backgrounds of anamorphic lenses that actually makes the filming more interesting."

Hamlet to Horatio: "There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

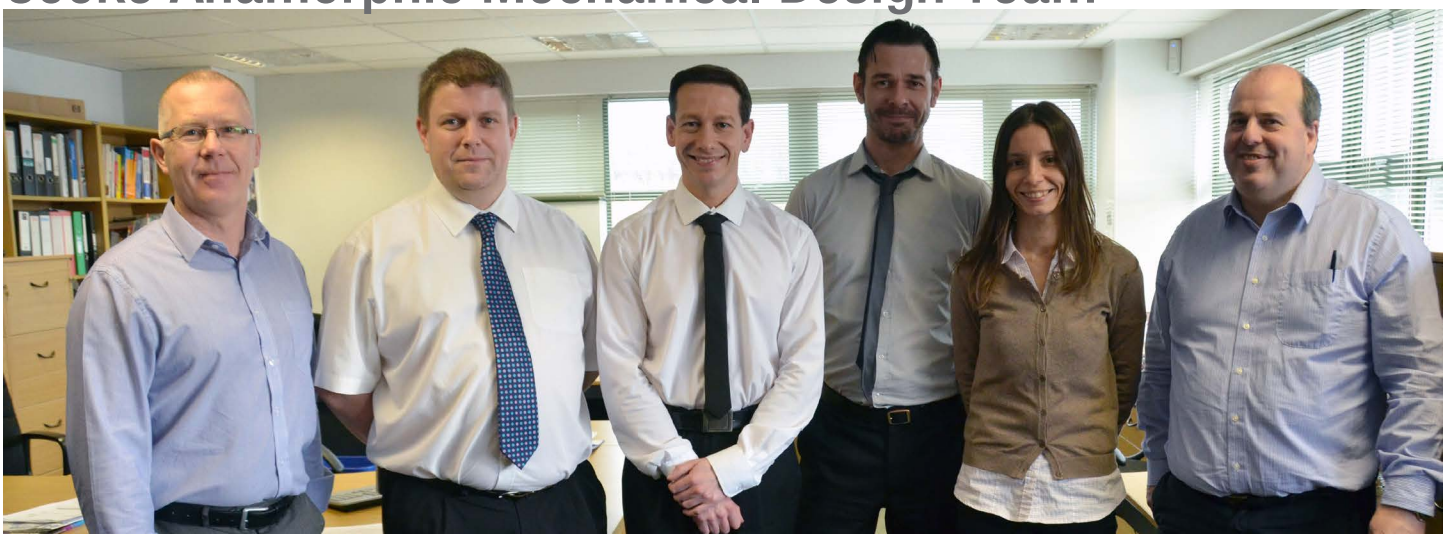
LEO CHEN: That is what makes the design process very rewarding and very interesting to carry through. Sometimes we have a debate. Should we be testing this way? It is a learning process so we can understand a bit more.

At what point do you then say, okay, now I am safe to order the barrels and cams and the mechanical stuff?

STEPHEN POPE: When we get to the point where we say that we are we happy with the optical design coming from the team, we like to call it a "freeze." But I think a better phrase than "freeze" would be "chill." So when we're good to go, essentially we're getting a prescription which says use this radius, this thickness, this glass type, and this distance behind it. And we have to take that and work out the mounting techniques to hold all those elements in there. In addition, we have to maintain an external diameter and a length that constrains us. And then we'll have a chat with the mechanical guys.

LES ZELLAN: I have to say that over 16 years that I've been here, the confidence in our computer tools has grown exponentially. We can move much more rapidly into pre-production. Because of the experience we have with the tools, when we see these numbers and translate them, we know we're getting what we expect and what we want to see on screen. That's the point. We have engineers translating specifications and numbers into what gives that look.

Cooke Anamorphic Mechanical Design Team



Cooke Mechanical Design Team: Kevin Warren, David Payne, Paul Nettleton, Kurtis Brooks, Catia Mao De Ferro, Stephen Pope.

I had kept the optical design team long enough, and I didn't want to be accused of delaying the imminent NAB introduction of the Cooke Anamorphic lenses. After a short break, the mechanical design team entered the conference room. The cast of characters included: Kevin Warren, mechanical design engineer; David Payne, mechanical design engineer; Paul Nettleton, senior mechanical design engineer; Kurtis Brooks, mechanical design engineer; Catia Mao De Ferro, mechanical design engineer, Stephen Pope, and Les Zellan.

You told the optical design team that this group, the mechanical designers, actually have the harder job. Why?

LES ZELLAN: The mechanical team has the harder job. This team has to take all the optical team's numbers and hold them precisely. The lenses have to move. And they have to keep that precision whether it's minus 20 or plus 110 degrees. The other thing they have to be looking at are ways to manufacture the lenses in such a way that we can make them, put them together, and service them easily. The optical team works very closely with the mechanical team. There's a lot of back and forth during the design process. Paul is the lead mechanical designer on the anamorphs. Kurtis has been doing the iris. And everybody else supports this effort.

The one thing that impressed me is how many designers you have working on this project. I thought at most there would be one or two people. I had no idea you had so many. I don't think I have interviewed so many optical and mechanical designers in one place at one time. You have enough people to start a football team.

PAUL NETTLETON: We have a football team. The Alpha Bokehs.

Alpha Bokeh! So, is it a chicken or an egg situation? What comes first, the optical or the mechanical design?

PAUL NETTLETON: They came together simultaneously on this project. I was working on the principles of the mechanical design while the optical team was working on the start of the optical side. We discussed a size that were going to try and stick to. It was just a space envelope on the inside. I didn't see an optical design for a number of months while we were doing the space envelope.

LES ZELLAN: It was driven by the main spec that you've got a diameter and length to meet. And then you try to estimate what the other focal lengths are going to look like, and can they all fit?

What are the dimensions?

PAUL NETTLETON: As small as possible, if you ask Les.

LES ZELLAN: We wanted everything to stay within 110 mm diameter, like the S4, and roughly an S4 shape. Which I think is sort of a good shape to sit in the hand. It's a manageable size.

KURTIS BROOKS: The length is mostly around 202 mm from the flange to the front.

Were these specs flexible? Did you come up with a design and then say, oh, but if we could make it slightly bigger or smaller, we could save $10,000.

LES ZELLAN: If you look at the original spec that we published a year ago, all the lenses were actually the same size. Now you'll see that the 25 has a wider front diameter and 135 is longer. It's flexible until the fat lady sings.

Take me through the design process as specs come in from the optical team, the mechanical team, and others.

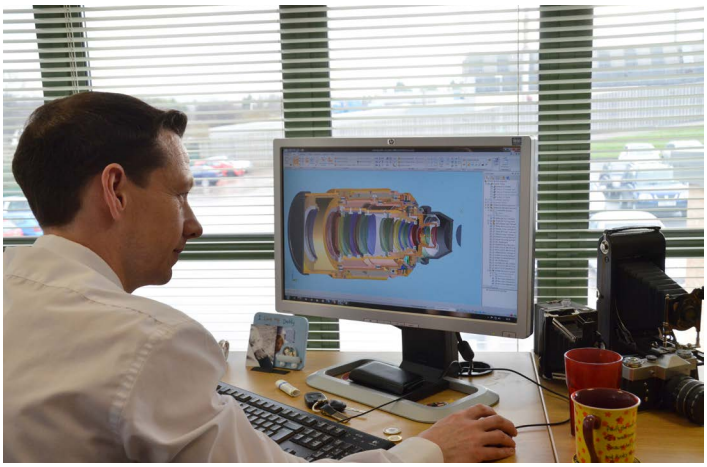
PAUL NETTLETON: When it first started, the brief was basically to try and make the mechanics as S4ish as we could. It's easier to build similar things. So I'll try and use as many standard parts from the S4 or 5 series. Some worked, some didn't, and I've got a lot of different design concepts that didn't work, or just hit a brick wall and stopped. This was the outer barrel, the parts that you're going to see and people are going to touch. It had nothing to do with the mounting of any of the elements, because that was a completely different ballgame. The idea was to use as many familiar parts as we could, because people are used to using Cooke lenses and how they look and how they work. There's a certain kind of classical physical look to them.

KEVIN WARREN: And this is all before Kurtis and Dave Payne and I were brought in, because Paul did quite a lot of the front end work, loading in the designs and so on.

KURTIS BROOKS: Then it was a question of the keeping different focal lengths consistent, one after the other. Paul would be doing one focal length. Dave would be working on another one. And then they would oscillate between the two.

DAVID PAYNE: Paul got to see all the initial designs and then they sort of filtered down to me. I would trace it forwards. And start running it through the process.

PAUL NETTLETON: Once we got a fixed idea of how we were going to design it, we followed the principles to make it quite easy for anyone to build and also to service. So the scales on one focal length are pretty much the same scales on all the focal lengths. If



Above, left: Paul Nettleton working on Cooke Anamorphic mechanical design. Above, right: Dave Nettleton drop-testing Cooke S4 in 2006. Paul is at the same desk, same place--older computer.

you know what you're doing with one of the lenses, you should be able to strip down or rebuild another one. It was me doing it, so I tried to make it as simple as possible. Because, that's the Cooke philosophy, keep things elegantly simple. Almost always a simple design is harder to do than a complicated one. But this extra effort at simplicity pays off in many ways.

KEVIN WARREN: The next step was completing the "outer" – which is the housing, the part that's got the cam, and the iris gear. The "outer" is the front cover, the focus, anything that you see from the outside.

KEVIN WARREN: It's like a shell, you have the mono body which is the main structure of the lens. Then you have the inners, which are the parts of the optical design that go inside. You have an outer and an inner and put them together.

And how are the elements held together?

PAUL NETTLETON: That was the hardest thing that we got to come across. Normally we put in spacers, clamp onto radiuses. It's perfect. So we had to come up with a new idea. We talked about potting. Gluing in position. We talked about spinning them in place. Using the old Panchro style, which is you get the position, and then you roll metal to get into the right position. In the end we decided to use a design of putting profiles in. And then putting clamps, proper spacers between these funny shapes. So basically we're going bigger and making our own full diameters to contact on.

How does that work?

PAUL NETTLETON: Imagine you've got a Pringle shape (representing a cylindrical element) that you can't clamp. We have to make the diameter bigger, make it round, cut out a full circle, and then clamp straight onto that. That way, we control the angles, and have the ability to make a few tweaks to make sure they're perfect.

STEPHEN POPE: Because you're working with cylindrical lenses, it's not rotationally symmetrical. So whenever you look at a 2D drawing in your head you'd rotate it around to see what it looks like. But it doesn't work because you're taking an X section and a Y section on this one. You have to go between the two. It's a very different way of working in the mechanical design because your brain is sort of hard wired when it looks at drawings. A number of times I would focus and the lens wasn't there. And then you look at the other section and it is there.

PAUL NETTLETON: On a normal design, we'll just work on a section. And we'll revolve it, and it'll be fine. Like Steve just said, you can look in one section and it's all making perfect sense. And then you go over to the other section and it looks like everything's in mid air. But it's not, it's just located 90 degrees round. So doing the glass drawings was interesting.

Shall we talk about the iris?

STEPHEN POPE: The iris is important because it affects the shape of the bokeh and what the bokeh looks like. We have a very round 11 bladed iris, which means that the bokeh look pretty smooth at the edges, at any T stop. The nice smooth shape is not just a matter of the number of iris leaves. Of course, the more leaves you have sometimes the better. But it can become excessive. It's having a suitable number of leaves, well designed, that's very important for the bokeh. What you might get away with for a spherical lens is probably less so with an anamorphic lens, because you want those smooth bokehs. If you don't have that it sort of takes away part of the anamorphic look. It's an interesting mechanical challenge and Kurtis has been looking at the iris.

KURTIS BROOKS: I've worked on the 5/i iris, which is spring loaded and has 7 blades. For the anamorphics, we wanted a very round iris, so I was going for as many blades as I could physically fit in. Which ended up being 11, still a tight squeeze. The S4 iris is round, and has 9 blades.

When did you start working on the mechanical design of these lenses?

KEVIN WARREN: It was, July 2012. The optical design had started earlier. And by Christmas we were doing glass drawings for manufacturing to show the first prototypes at NAB 2013 last year.And then we were talking about hitting the date for NAB 2014.

DAVID PAYNE: Then Catia came in. And helped us get as many drawings out.

KURTIS BROOKS: After the mechanical design, we did the tooling design to trim that timescale down. Which has been a useful feature on this.

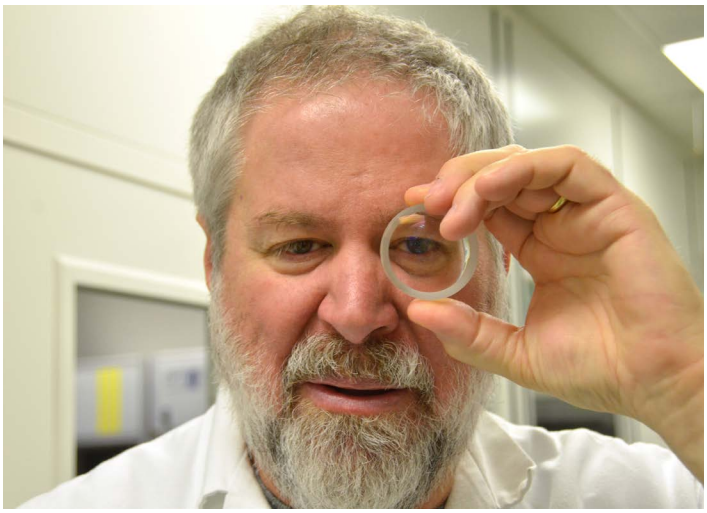
Has this been a faster development time?

PAUL NETTLETON: The miniS4/i and the 5i's took about 16 - 18 months. This has been faster, about 14 – 15 months.

And your deadline is NAB of this year, right?

PAUL NETTLETON: Yes. A short set of 5 Cooke Anamorphic lenses. And I was going to say it's a credit to the entire team that we are in this position now.

Above the Line at Cooke



Les Zellan, Chairman

Robert Howard, Managing Director

Having met the optical and mechanical designers, there remained one more team: the executives— the "Above the Line" group. Les Zellan is Chairman of Cooke Optics. Robert Howard is the Managing Director. Alan Merrills is the COO.

Alan, please take us through a day in the life of what you do at COO of Cooke Optics.

ALAN MERRILLS: Basically, I manage the factory. This job varies every day. No two days are the same ever, and I think that's what makes it enjoyable. Every day brings different problems and different opportunities. The factory normally opens up around 6:00 in the morning. The night shift has finished, the day shift takes over in polishing, assembly starts up and it's just a matter of pushing things through, staying on top of it.

Tell me about the three different shifts.

ALAN MERRILLS: We run three shifts in a polishing department. It starts at 7:30 on Monday morning, and we don't stop polishing glass until 3:00 on Friday afternoon. In assembly, some people will start at 6:00, and normally we have people in there until between 5:00 and 5:30 at night. We don't run two shifts in assembly. That's an opportunity yet to be taken.

What's going to happen when you get 300 orders or 500 orders for sets of these new anamorphics?

ALAN MERRILLS: Well, we're currently cross-training people to build anamorphics. We've taken some people off S4/i line, we've taken some people off the miniS4/i section and we've taken one person off the 5/i group, and we've put together a group of people specifically trained to build the anamorphic lenses. Because with the introduction of anamorphic lenses, we want to change the way we build the lenses at Cooke.

Which is how?

ALAN MERRILLS: We want to take more of a sub-assembly approach, where we can build the lens in its various sections and then bring those sections together to build the final lens. Previously, we tended to assemble just one lens at a time. With the new way of building, we hope to get more productivity.

That's very un-Japanese. Isn't the Japanese style called "cell production," where one person builds one lens?

ALAN MERRILLS: Perhaps. But we want to have a whole bunch of sub-assemblies on the shelf and say, give me a 40 mm. Well, I'll take that bit and that bit, put it all together and, presto, there's a lens. I hope it's as easy as that.

LES ZELLAN: We're trying to surprise the industry by not being the Cooke of the past, where we introduced the 5/i to great fanfare and great demand, but we couldn't deliver, and that really cost us dearly in some sales. We were fortunate when we delivered the S4 lenses in that we were alone in the market. There were no competitive lenses for almost three years, and then we learned a lot with the Minis.

You should be aware that while this is the main project, obviously it's not the only the project we're working on. We have been working on future lens designs while the majority of the team has been working on the anamorphic project. But we'll save those discussions for another day.

We're trying to make these anamorphic lenses more manufacturable and more deliverable and we're trying to apply the knowledge that we gained to the anamorphs, because we already have a long waiting list of people who have put refundable deposits down. We hope to surprise them by delivering much faster than the 20 years they're probably thinking it's going to take us. *(laugh)*

Why did it take so long to do the 5/i lenses?

LES ZELLAN: That goes back to the overall management structure that we have changed. It was just the ingrained thinking here and nobody wanted to think out of the box, rattle the cage a little bit.

ALAN MERRILLS: Nobody was shaking the culture, but now the culture has changed at Cooke, although it didn't change overnight.

What do you mean by culture?

ALAN MERRILLS: The way in which we do things, the way we approach them, developing a little bit more aggressiveness and hunger for sales, for making lenses.

How did you change that culture?

ALAN MERRILLS: Day by day. It was a matter of introducing things differently, convincing our teams that there were better ways to work. Losing some of the culture of the old parent company, Taylor Hobson, but keeping the best of it. We still have a lot of Taylor Hobson people here. There are good things about Taylor Hobson, but there wasn't the hunger in the Taylor Hobson days. Now, it's about introducing a drive.

Robert, at NAB last year, you joked that your worst fear, as CEO of Cooke, was having to build as many anamorphics as people has ordered.

ROBERT HOWARD: Did I say that? *(laugh)*

Alan Merrills, COO

Les with Cooke's "library" of one of about 4,000 glass gauges

Do you feel confident that you'll be able to meet the demand? I think the demand is huge.

ROBERT HOWARD: Yes. I'm confident we can meet the demand, but you've got to put that into perspective in the sense that when you launch a new set of lenses, you get a massive increase in orders.

That bubble is there for a while, and until we eat into it, we won't be able to deliver everybody's lenses at the time they want them, because they all would like them now. And they all would like to be first. Unfortunately, there's only one set to be delivered be first. That's the way of it. Some people will have to wait and--but we've geared ourselves up to be able to produce a reasonable quantity of these lenses and we don't anticipate anything like the sort of waiting times that we've had with some of the other lenses, particularly the 5/i.

From what I saw today and talking to all the engineers and the people in assembly, it looks to me like it's a design that is practical to build.

ROBERT HOWARD: Absolutely right. There's no point producing lens designs that look wonderful on paper but nobody can build.

We have to have designs that we can build and build relatively easily without requiring 15 engineers to build each of the lenses. We just can't do that. We have to be able to build not only a product that people want, but also that we can deliver, and that's what we've got with these anamorphs.

It was interesting to see the synergy of your mechanical, optical and assembly team—with everybody all in one facility and able to talk to each other. You don't have one person in one country and another trying to deal with it on the phone.

ROBERT HOWARD: Both Alan and I have tried to make sure that the lens design is both optically and mechanically buildable.

LES ZELLAN: Achieving the vision that we had, I think they really came through.

What was it that convinced you that it was time to do build anamorphics?

LES ZELLAN: Digital. The anamorphic market was prestigious, but it was basically Hollywood, London, New York, Paris, and India, except India wanted anamorphic lenses for nothing. Panavision more or less owned that business, and then Hawk gained a lot of market share, and the rest of the field was using older or modified designs.

But predominantly, if you were going do a major film, you were going to use Panavision or Hawk.

If you're really want to make money doing anamorphic work, you've got to get the Panavision type big budget features, and so you can't do that with one set of lenses. You can't do that with two. You're going to need at least 3 to 5 sets of lenses--and probably at least 5--to take on a large 9-figure movie. So before you start buying anamorphic viewfinders for your film cameras, we assumed that an anamorphic S4 would cost twice as much as a regular S4, so around $35,000.

And let's you have 6 lenses in a set, that's around a quarter of a million dollars for one set. Multiply that by 5 sets, it's over a million dollars in glass, and you haven't even started to buy anamorphic finders or groundglasses for your cameras yet. You still want to play? And I lost people pretty much right there.

Then digital happened. And digital anamorphic became much easier to do. You just flipped the switch of the Electronic Viewfinder, and you're unsqueezing anamorphic. That was a big plus.

And then, going back to my usual mantra that when digital was born, it became almost immediately obvious that digital looked inherently boring, and people immediately started looking for the old speed Panchros and other vintage lenses, as you've heard me say too many times before.

So all of a sudden, from a worldwide market of 200 or 300 Rental Houses where maybe only a dozen of them were serious about anamorphics in the film days, we've now gone to 10s of thousands of new digital cameras and users who are hungry for digital personality. So the market has gone from maybe tens of sets to hundreds of sets. And maybe even more.

Are more companies building 4:3 sensor cameras?

LES ZELLAN: We certainly hope that other manufacturers will embrace a 4:3 aspect ratio or larger sensors. We're talking to any camera manufacturer who will listen that they should jump on board with 4: sensors instead of 16:9. But I think the driving force is still to get interesting images. The real driving force is character and personality.

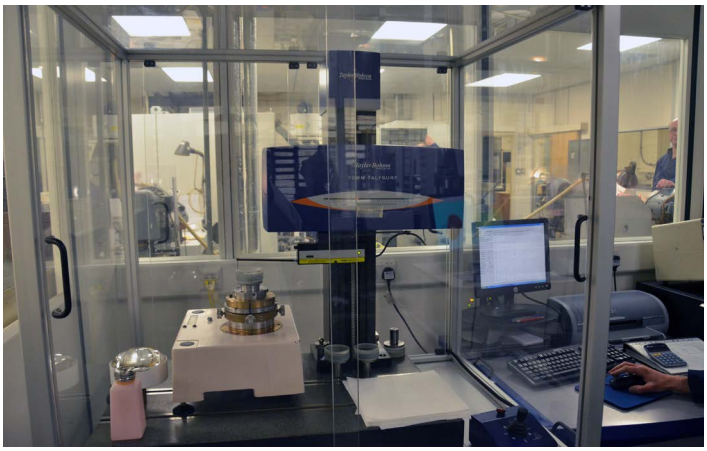
Last time I was here, we took an S4 lens and did the drop test from 3 feet directly onto the carpet. Can we do that again?

LES ZELLAN: Only if you want to buy that one.

www.cookeoptics.com NAB Booth C6143

Cooke Optics Ltd Factory Tour

Erin Samuel cleaning glass elements



Talysurf machine

Philip Mathew inspecting glass elements

Glassing up the inner is done in a clean room

Chris Norton inspects the form of a glass element on a Zygo interferometer

Grinding

Aspheric polishing

CNC polishing

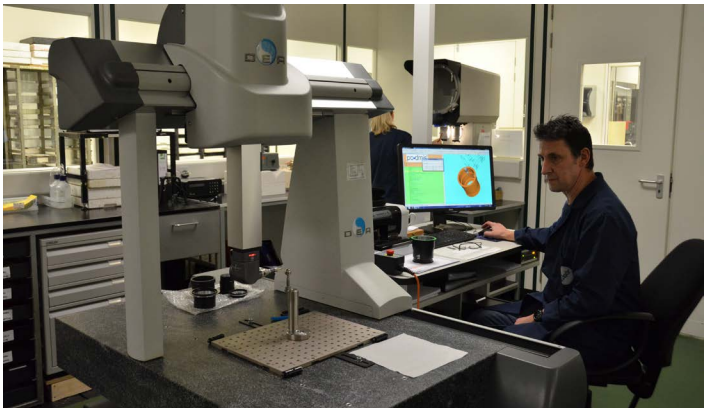
Cooke Tour, cont'd

Balzers coating plant

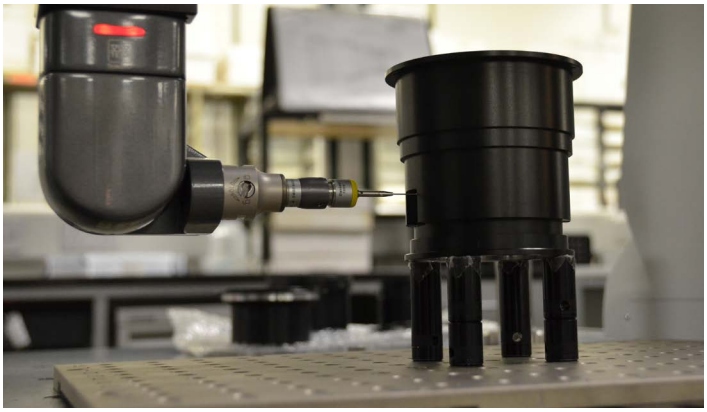
Catia Mao De Ferro, mechanical design engineer

Chris Norton, glass polisher and Les Zellan, Chairman

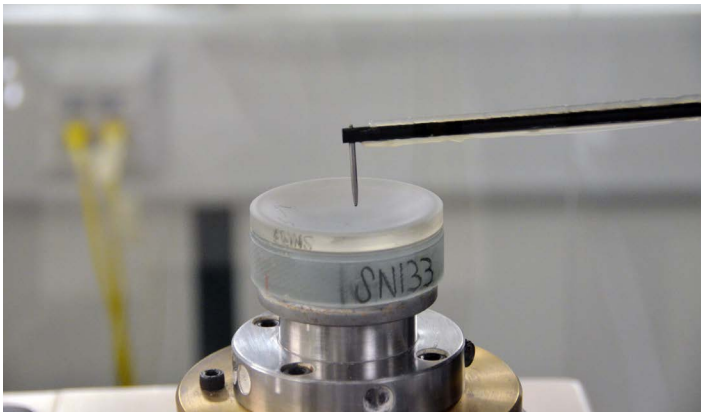
Iain Neil, optical designer, and Les Zellan in assembly area



Steve Newitt, CMM programmer



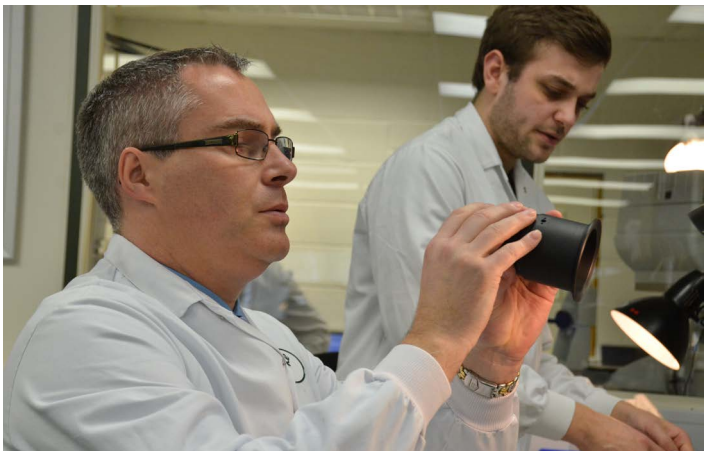
Coordinate measuring machine checking metal components



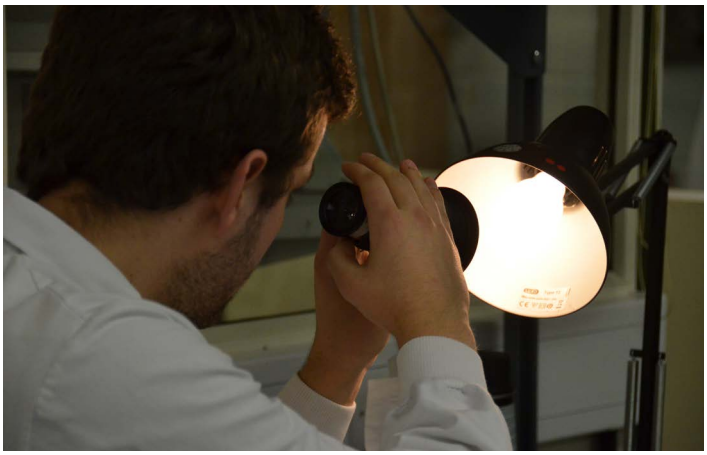
Measurement probe tracing the form of the glass

Optotech profiler, built especially for Cooke

Lens Assembly



Keith Wykes , Jaimie Cluer



Checking optical elements for dust and defects

Paul Prendergast, Optical Glass Shop

Hui Yen, Cooke /i Technology software designer

Calibrating the iris

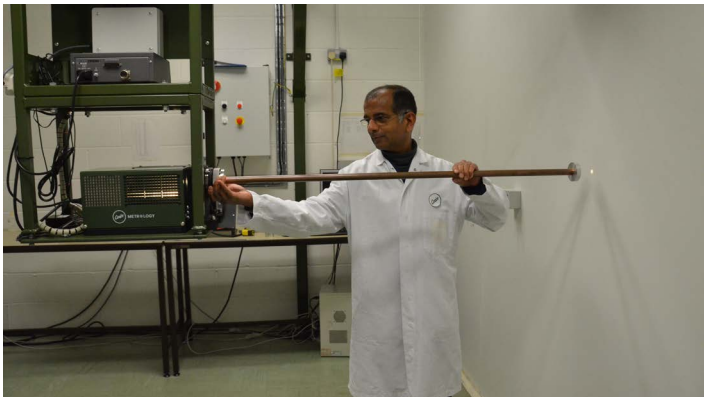
Dee Roden using a shadowgraph

Checking Focus

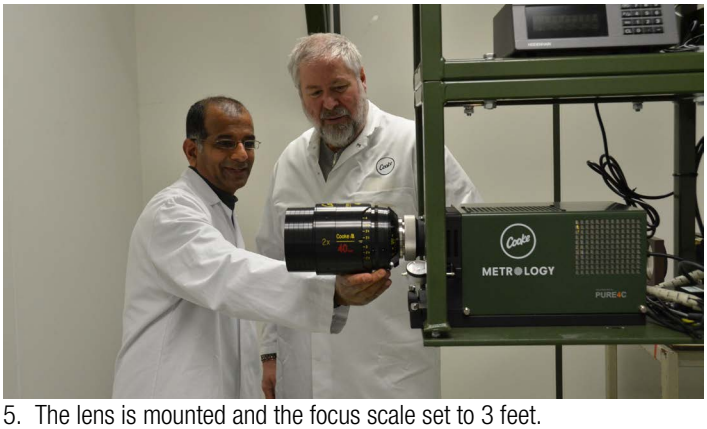
1. In the lens assembly area, Raj Mistry calibrates the focus scale individually for each lens.

2. The lens barrel is then engraved and checked again. Next, Raj takes the lens into the projection room.

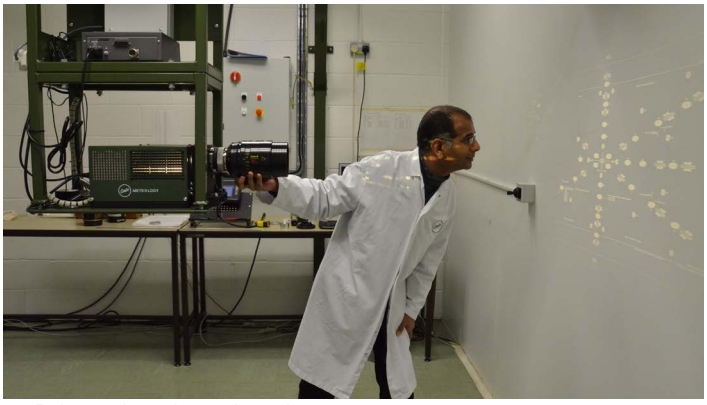
3. On the projector, made by Cooke Metrology, of course, the flange focal depth is checked to be sure it is exactly 52mm.



4. Raj uses a metal rod to begin calibrating at exactly 3 feet. The rod is much more accurate than a sagging tape measure.



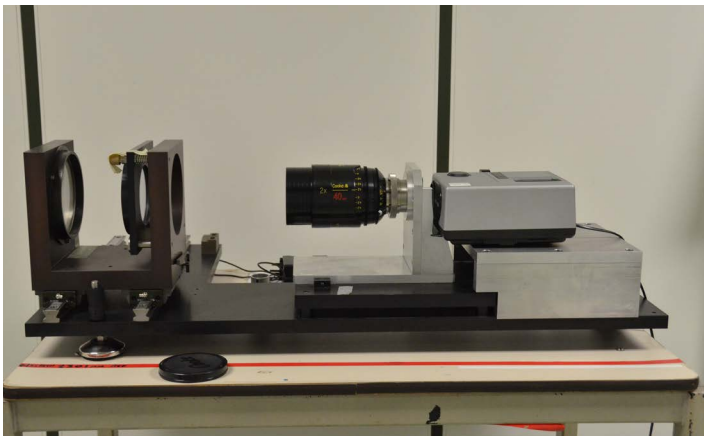
5. The lens is mounted and the focus scale set to 3 feet.



6. Raj examines the projected test pattern

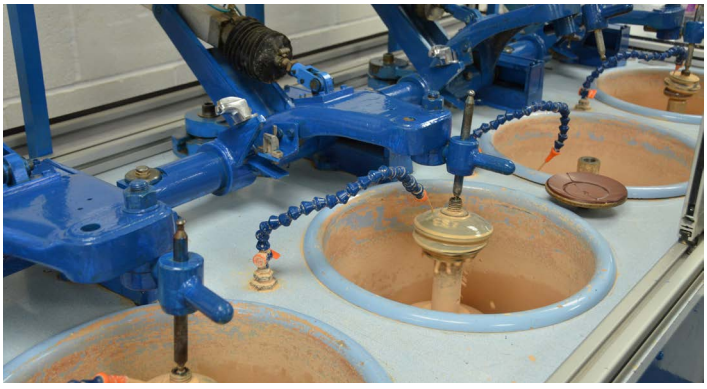
7. Below: Each lens is checked at each focus mark distance.

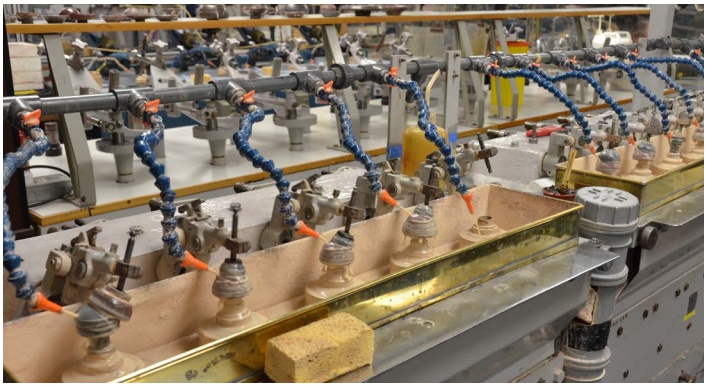
8. Below: infinity is checked separately by projecting through an additional element.



Mick Maher on Traditional Polishing

"My name's Mick Maher, and I've been working for Cooke for approximately 15 years. I've been in the industry for 35 years now. I started out in the early days when it was Rank Taylor Hobson in 1979. This process is a traditional process using serium oxide as a polishing compound. It's actually a mixture of Swedish pitch, beeswax, resin, wood flower, and red oxide polishing compound which gives it the pink colors. The tool is cast iron. The difference between using this traditional method and the CNC machines is that we often use these machines to finalize the polish, to get a good cosmetic, to get the radius to within plus or minus 3 rings. Then we hand paint it black, put it in the freezer to separate the glass from the pitch, clean the lenses, and then go to the QA department to be checked. Traditional polishing is often more suited to certain lenses. The CNC is used possibly more for smaller diameters and shallow curves. The steep curves and more difficult large diameters, we do over here."



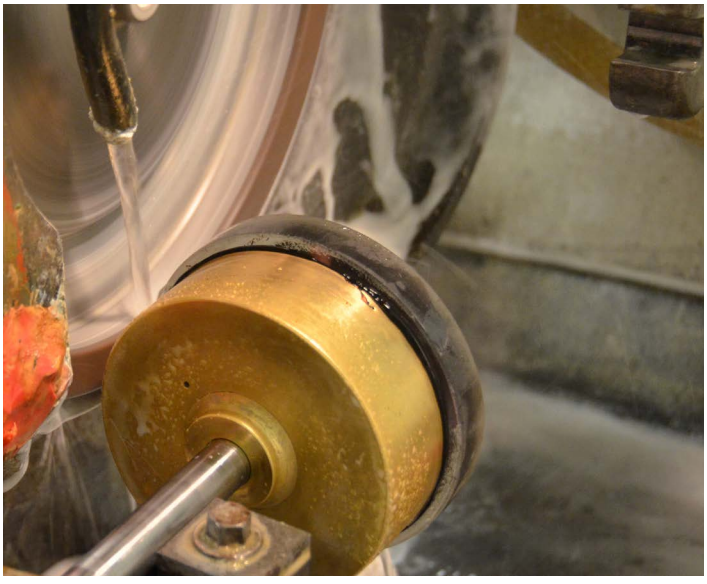


Paul Utting on Traditional Edging

"My name is Paul Utting. I recently was made supervisor in this room, the edging department. What I'm about to do now is stick an optical element onto a brass choke and center the lens. To attach it, we apply pitch and some heat.

"To center the element, we have a collimator. When we look through it, we can see a green line, and then it's a matter of manipulating the lens very, very slowly until it appears perfectly stationary on both axes.

"Next, we put the lens on the edging machine, where we get the diameter accurate to within 5 to 10 Microns, and very smooth. These traditional machines do a wonderful job, often smoother than the modern CNC machines.



How to Desqueeze Anamorphic June 2014

How do we get from what the camera captures (left) to the wide screen (below)?

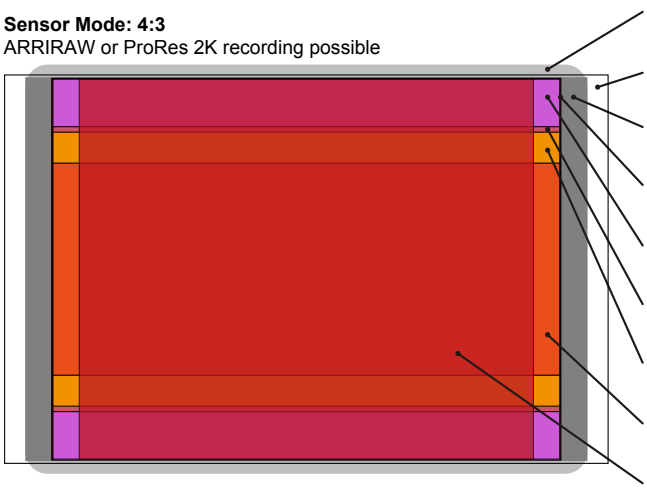
Shooting with anamorphic lenses, ARRI's Alexa 4:3 cameras capture ARRIRAW at 2880 x 2160 (23.76 x 17.82 mm sensor area = 1.33:1 aspect ratio). Inside this 1.33:1 frame, the anamorphic frameline is 2570 x 2150 (21.20 x 17.74 mm = 1.2:1 aspect ratio). So there is extra picture information to the left and right of the framelines.

In post, this extra information needs to be cropped, and we have to desqueeze the image from its native 1.2:1 aspect ratio to widescreen 2.40:1. (I know, I know, it should be 1.195:1 and 2.39:1, but the 2.40:1 math is easier and close enough.)

Goldcrest handled our recent Cooke anamorphic tests. Here are some recommendations. Desqueeze with DaVinci Resolve before editing. (Desqueezing in FCP or Avid is tedious and picture quality suffers.)

Above: Squeezed ARRI Alexa image with frameline. Cooke 40 mm Anamorphic at T2.3. Below: Unsqueezed image.

ARRI Alexa Framelines and Photosites



Sensor Mode: 4:3
ARRIRAW or ProRes 2K recording possible

Surround View Optical Viewfinder (Studio only, 1.38:1)
26.14 x 19.0 mm / 1.029 x 0.748", ø: 32.32 mm / 1.272"

Sensor Size 3414 x 2198 Photosites (1.55:1)
28.17 x 18.13 mm / 1.109 x 0.714", ø: 33.50 mm / 1.319"

Surround View EVF-1/MON OUT 3168 x 2160 Photosites (1.47:1)
26.14 x 17.82 mm / 1.029 x 0.702", ø: 31.64 mm / 1.246"

ARRIRAW 2880 x 2160 Photosites (1.33:1)
23.76 x 17.82 mm / 0.935 x 0.702", ø: 29.70 mm / 1.169"

ProRes 2K, Frameline ARRI 1.33 2868 x 2150 Photosites (1.33:1)
23.66 x 17.74 mm / 0.931 x 0.698", ø: 29.57 mm / 1.164"

Frameline ARRI 1.78 2868 x 1612 Photosites (1.78:1)
23.66 x 13.30 mm / 0.931 x 0.524", ø: 27.14 mm / 1.069"

Frameline ARRI 1.85 2868 x 1550 Photosites (1.85:1)
23.66 x 12.79 mm / 0.931 x 0.504", ø: 26.90 mm / 1.059"

Frameline ARRI 2.39 Flat 2868 x 1200 Photosites (2.39:1)
23.66 x 9.90 mm / 0.931 x 0.390", ø: 25.65 mm / 1.009"

Frameline ARRI 2.39 Scope 2x 2570 x 2150 Photosites (1.195:1)
21.20 x 17.74 mm / 0.835 x 0.698", ø: 27.64 mm / 1.088"

Alexa diagram and dimensions courtesy of ARRI

Anamorphic Desqueeze with DaVinci

1. Open DaVinci Resolve 10 Lite (free download).

2. Create New Project (click on the "+" bottom left of Project Manager screen) and give it a name.

3. In the main **MEDIA** window, click the gear at lower left for **PROJECT SETTINGS**. In **Master Project Setting**s Set your **Timeline Resolution** to **Custom Pixel Size** and enter 1920 x 804 (1:2.39 for HD). In **Image Scaling** set **Input Scaling Preset** to "Scale full frame with crop."

4. In **Output Scaling Preset,** uncheck "Match timeline settings" and set the **Output resolution** to HD. Set **Mismatched resolution files** to "Center crop with no resizing." This will fit 2578x2160 pixels of the original ARRIRAW file into HD letterboxed.

5. Time to import our Codex RAW clips. In the LIBRARY window, top left—find the folder with roll number, and drill down two more levels to the folders labeled by individual take. (If you see 2880x2160 and xml folders, you've gone too far.)

6. In the FILE NAME window (to the right of LIBRARY) select all the takes (they are folders). Drag them down to the MASTER window.

7. Most important step: Select all the clips (represented by thumbnails) in the MASTER window. (You can drag to select or Command-a.) Right click one of the clips. This opens a big pop up window. Select CLIP ATTRIBUTES.

8. This is the key to successful de-squeeze. In the CLIP ATTRIBUTES pop-up, select VIDEO, and go to the Pixel Aspect Ratio drop-down box. Be sure to select CinemaScope. Click OK.

9. Your thumbnails will desqueeze in a matter of time, but no need to wait here. Select the EDIT tool at the bottom of the screen.

10. DaVinci 10 changed the way things followed from here. So, click the "+" sign at lower left of the TIMELINE window, top left.

- In the **New Timeline Properties** pop-up, uncheck "Empty Timeline."
- Give your timeline a name -- like "Cooke Test De-squeeze Timeline." And click **Create New Timeline**.

11. While we're at it, go to the MASTER window, select all and right click one of the clips. We applied the 3D LUT - ARRI - Alexa LogC to Rec709.

12. Time to Deliver. Click DELIVER at bottom of screen.

13. In the OUTPUT window, top right, be sure **Render timeline as:** is set to **Individual source clips.** Otherwise you'll wind up with one long clip instead of individual takes.

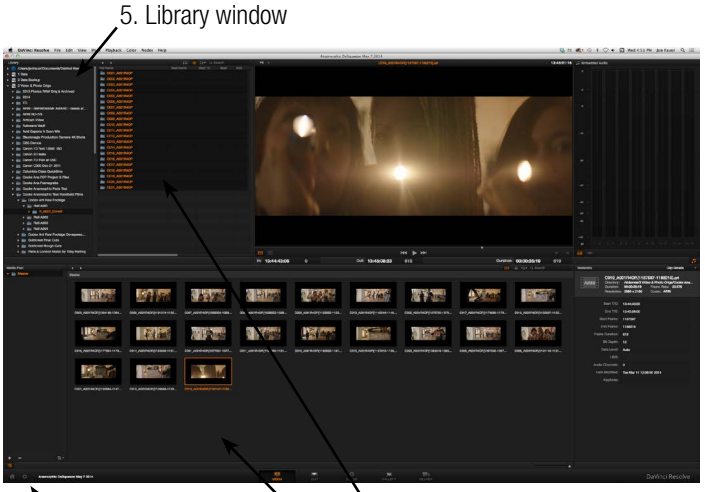
13. To render for editing, we selected Quicktime ProRes 422 (HQ), 1920x1080, 23.976 frame rate, and —very important — set our destination folder. To set the destination, first create a folder on your computer. We called ours "Codex Arri Raw Footage De-squeezed via Resolve." In the Output window, click **Browse**, navigate to that folder, and click OK.

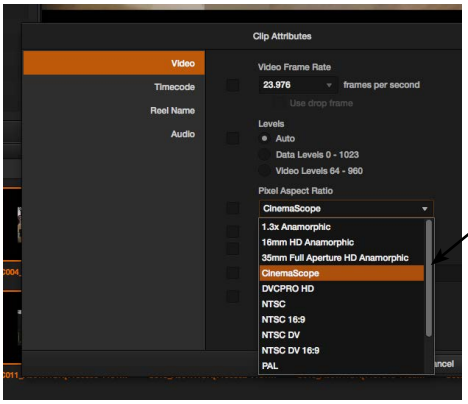
14. Select all your takes. Click the **Select All icon** on the right side of the timeline, next to the magnifying glass.

15. **Click Add Job to Render Queue** below Output Options window.

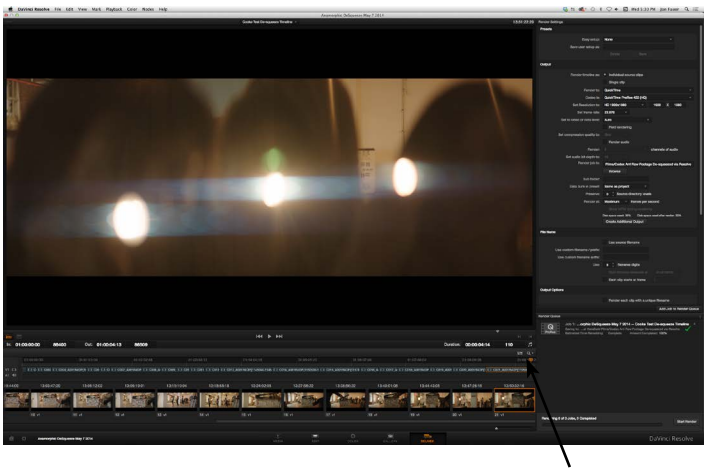
16. Finally, click the **Start Render** button at lower right.

On a new Mac Pro, rendering occurs roughly in real time. Our 20 minutes of footage rendered to .MOV unsqueezed in 19 minutes, ready for offline editing.



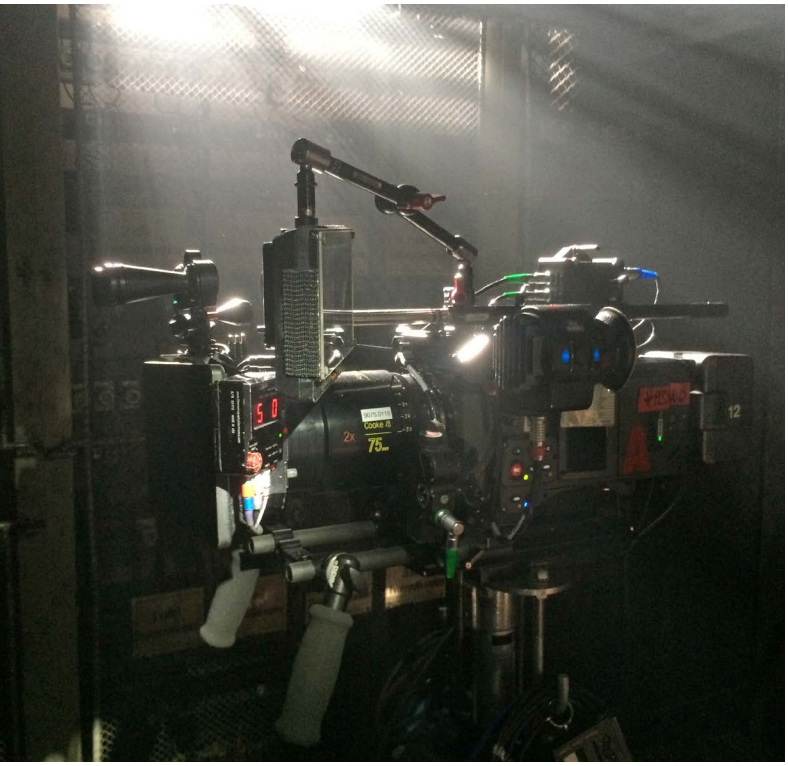


8. The key to successful anamorphic desqueeze: Clip Attibutes - Video - Pixel Aspect Ratio - CinemaScope



Credits: Cooke Anamorphic Test produced by Handheld Films. Director/Cameraman: Jon Fauer. Producer: Marc Paturet. Camera Assistant: Timothée Arene. Editor: Ricardo Madan. Grading and finishing: John Dowdell. Post: Goldcrest. Postproduction Supervisor: Tim Spitzer. Thanks to Tim Spitzer, Ricardo Madan, Marc Shipman-Mueller, Florian (Utsi) Martin, Lead Digital Colorist at ARRI, and Blackmagic Tech Support for help on this article.

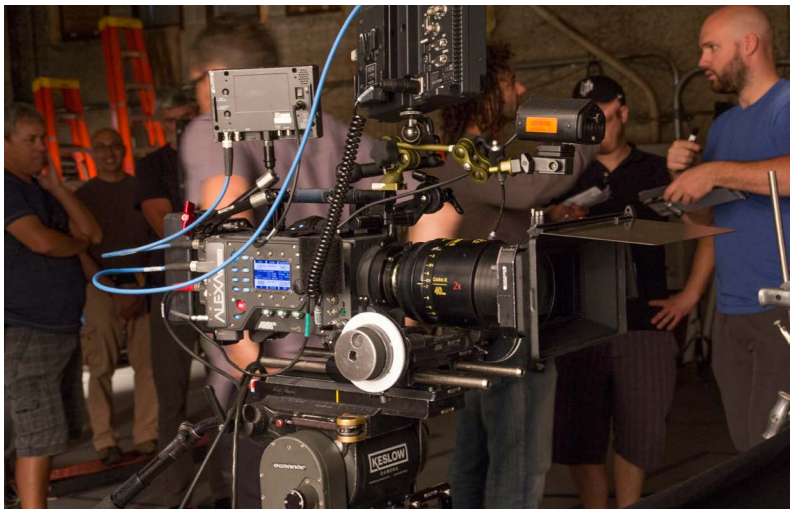
What's Cooking in Anamorphic? 9/2014



The first sets of Cooke Anamorphics were delivered to TSF and Movietech, and then Clairmont, Keslow, Camtec, Cineverse, Camera House, and ARRI Rentals.

Above Left: Clairmont Camera's Cooke Anamorphic product shot by Jon Johnson, General Manager of Clairmont Camera Vancouver.

Above Right: Andy Kierans with Cooke Anamorphic 32mm at Clairmont Camera Vancouver. Photo by Jon Johnson.



Above left: Cooke Anamorphic 75 mm on location near Budapest on *Lazarus*. Equipment from ARRI Rentals. In addition to a set of Cooke Anamorphics, Bojan Bazelli, ASC is also using a set of Arri/Zeiss Master Anamorphics. Director: Nic Mathieu. Camera Assistant: John Holmes.

Above: Amy Vincent, ASC is using Cooke Anamorphic Primes from Keslow Camera on her latest feature film, *Sinister 2*. Photo by Danny Saldana, Keslow Camera.

Left: Matthew Libatique, ASC is using Cooke Anamorphics from CamTec on "Straight Outta Compton." Matty said, "The Cooke anamorphics are a welcome addition to the world of anamorphic lenses providing sharp yet subtle imaging. They blend well with older lenses when aberration is too severe." Kavon Elhami added, "I really like how these lenses react to light coming at them from an angle. They exhibit some of the characteristics of our vintage lenses, but with more sharpness and less distortion in the corners. Matty was looking for a strong interesting look especially in some of the smaller interiors where he's working."

Also Cooking at TSF

Antoine Roch, AFC, DP Mathieu De Montgrand, 1st AC on "Un homme idéal" with Cooke 50mm Anamoprhic and ALEXA supplied by TSF

Danys Bruyère, Deputy Managing Director of TSF, writes: "This was the first feature to be shot entirely on Cooke Anamorphic lenses. Start date was May 22, 2014. *Un homme idéal* was directed by Yann Gozlan, produced by 24/25 Films, cinematography by Antoine Roch, AFC."

Antoine Roch discussed the Cooke Anamorphics with Danys. He said, "I really liked the velvety feel of the anamorphics; they have everything we like about the S4 Cookes. Like vintage anamorphics, we get fine anamorphic distortions all around the image, pulling us into the center. The Cookes are very easy to focus by eye, you really feel it when it all comes together.

"The 40mm was our favorite lens of the film, without any noticeable distortion on the outer edges. We would actually look for flares, and I would work the lenses to get them to flare when we wanted them to, yet everything remained predictable. We love to shoot anamorphic, as much for its qualities as its flaws. It really helps bring out the best of the digital cameras.

"The Cookes were not as 'dry' as other lenses I've used before; they have a wonderful round feel to them. What I really missed on this thriller with a lot of inserts was a nice extreme close focus lens, between 50 mm and 75 mm. Maybe a 65 mm could fill that gap beautifully. We really put the lens set through its paces, using them in a multitude of shooting situations, day, night, interior, exterior, rain, sun, even into a splash bag—and the lenses performed beautifully all the time, with nice oval bokehs."

John Morisson, Steadicam Operator. Photos by Haruyo Yakoto

Thierry Arbogast, AFC with F65 on Luc Besson's *Lucy*

Thierry Arbogast, AFC (above) is an award–winning French cinematographer. His work with director Luc Besson began in 1989 with La Femme Nikita. *Their most recent collaboration,* Lucy, *starring Scarlett Johansson, opened this summer. Luc Besson's parents were Club Med scuba instructors. His first big success was* The Big Blue *(1988) about free diving. He founded EuropaCorp in 2000, built the Cité du Cinema stages and post facilities in Saint-Denis, and worked on more than 50 films as writer, director and producer.*

JON FAUER: What cameras were you using on *Lucy?*

THIERRY ARBOGAST: We shot most of the film with two Sony F65 cameras, from the rental house Next Shot. We chose them after doing many tests with all the major brands. After screening the results in a theater, our favorite camera for the look of this film was the F65—especially for its color space.

Did you shoot it in 4K?

Yes, we shot in 4K. I think there will be selected screenings in 4K. But probably 90% of the film release will be projected in 2K.

Tell me about the lenses that you used on the show.

We shot with the Cooke S4/i primes. The Cooke S4 is my favorite prime lens. We had the complete set (12, 14, 16, 18, 21, 25, 27, 32, 35, 40, 50, 65, 75, 100, 135, 150, 180 mm). And we had two zooms. The 18-80 ARRI/Fujinon and an Angenieux Optimo 24-290. I like this Optimo zoom; I think it is one of the best. The 18-80 is a very good zoom for Luc because he likes to operate the camera with a short lens but he sometimes wants to zoom during the shot. The 24-290 was for long lens shots, but we didn't use it that much. Just sometimes.

Were you shooting with both F65 cameras at the same time?

No, we never used them simultaneously. We had two cameras because Luc likes to have the second camera ready to go any time. The main camera, operated by Luc, usually had the 18-80 zoom. But the second camera was always on the side ready to go with a Cooke S4. For example, we might be shooting with the "A" camera and then Luc would ask for a Steadicam shot. But, of course, he'd supervise the Steadicam shot.

Isn't the F65 heavy for Steadicam?

Not really. The F65 looks a little bigger than other cameras—especially bigger than the RED, which is very small. But if we compare weights, the F65 is not very heavy. (11 lb / 5 kg.) The Sony's body is made of something lightweight (magnesium). It looks big, but it's completely lightweight. Unfortunately, the F65 looks like a cheap camera. If we compared the styling of the F65 to other cameras, the others look much better. But in our tests, we and our colorists found that the images on the F65 had the best picture, the best color space for this film.

What was the look or the style for this film?

We spoke about the style of the movie during pre-production. Luc told me he wanted something like "Inception." He told me he wanted something close to that look and we decided with the assistance of some reference photos with the art department. Especially in Taipei, the look was very colorful, very shiny.

Did you soften the image with filters or shoot clean?

Just clean. Luc always works with a clean picture. Always. No diffusion, no filters.

You and he are not afraid of 4K for faces?

No, we always try to find something sharp, with high definition, and we are not afraid of 4K.

What about anamorphic?

I love anamorphic lenses, but Luc has not wanted to work with anamorphic lenses for quite some time. When we did "Fifth Element," Digital Domain asked for it to be shot in spherical, Super 35mm. Since then, Luc has worked with spherical lenses. He came back to anamorphic lenses only for *Malavita* (*The Family*) with Robert De Niro and Michelle Pfeiffer. He was thinking it would probably be the last movie that he was going to make using motion picture film. He asked me if I agreed to shoot in anamorphic. And I said, "Wonderful, I love anamorphic lenses." We used the Panavision anamorphic G-Series lenses, Primo Close Focus, and some anamorphic zooms.

But for this movie, "Lucy," he preferred to shoot in spherical because it would be easier with effects, and also there would be a lot of close focus. Also with the F65, it would be bad to shoot in anamorphic because the sensor is not tall enough.

Because it's 16x9 and the sensor height is less than 18 mm?

Yes, it will crop. So we tested spherical lenses with the F65. We liked the Cooke S4 set. They are very good lenses, very sharp, very beautiful. But they are not too "crispy," you know? I think it's good for digital to be not too sharp…not too hard or harsh.

How did you light your lead actress, Scarlett Johansson?

She's a beautiful woman. We used ring lights on the camera all the time. Because I wanted to have very good highlights in the eyes. I wanted her to be as beautiful as possible. I used the ring light a lot of times, with a dimmer. The dimmer was controlled wirelessly. When the camera moved, I could dial the brightness of the ring light up and down.

Is it wireless? Do you do it by remote control?

Yes, exactly. For example, if I do a travelling shot with Scarlett, and if at some point we go in front of a mirror or glass, I can go

down or turn if off if there is a reflection of the ring light in the glass. Also, if the actress comes close to the lens, I can go down or I can go up if she goes a little further away. The ring light was attached to the zoom lens. And also on the Steadicam with the Cooke S4 lens.

Really? You had a ring light on the Steadicam?

Exactly, but we built a special ring light for the Steadicam. The ring light was in daylight, but we had some filters that we put in front to go warmer and to go to tungsten. I asked my gaffer to make one with different LEDs. Warm and tungsten and daylight. But it was not possible to do it so quickly. So we only had one in daylight and we used gels to warm it. But next time if I have to do a movie with a ring light again, I'm going to try to build one with two different LED colors: tungsten and daylight so we can mix them together and chose the perfect color that we want.

Let's talk about the lighting in general.

On this movie we used all the latest technology in lighting, LED, and so on. In Taipei, I used some ARRI LED units that can go red, yellow, blue, every color. You can turn the button and it goes to any color you want. I used that for the Taipei shots with Scarlett in a taxi.

When we had a close-up of her at night in the taxi, or in the street, there were a lot of different color signs outside. Taipei has many huge color signs everywhere in the street. So we put some LEDs near the lens and I changed the color to red, blue, green. It was very nice. We also used these lights in the nightclub scene. It's a flashback. The look of the movie is quite colorful.

What key lights did you use for your big setups?

I used big 18K lights in the stage. We had a lot of sets on stage and I recreated daylight for the hotel scene. We had a lot of scenes in the big hotel and we created a lot of daylight—big sources of light from outside. We used a lot of blue screen also. Actually, the majority of the movie was shot on the stage. After shooting the real locations, we matched them on the stage. In Taipei, we shot in some real locations—including some bad restaurants and some crappy locations—but they are very beautiful in the movie.

For exteriors, did you use HMI lights?

Not so much. We used a lot of natural light. We had a chase sequence in Paris that was very sunny, with very natural light. Afterwards, we matched it with the car and the actors on stage. So the big chase was in the real location, with the car moving; but inside the car, we matched everything on the stage with the actors because we didn't want to have the actors doing this chase in the streets of Paris.

What lights did you use on the stage to match?

HMI to recreate daylight. We put a circular track around the car and used an HMI—probably 12K—to recreate the sun. This HMI sun was on the track so we could move it around the car to have the feeling that the car was turning.

Where did you do post production and grading?

At the Digital Factory (www.digitalfactory.fr) in the Cité du Cinema. On Lustre. Luc always wants to do the grading in France. Since his very first movie, he has done the grading in France.

When you were shooting, did you have a DIT to set the looks?

Yes, I have a DIT on the set all the time to check the exposure and to be sure that there are no technical problems. And also I have a Data Manager to take care of the back end.

Do you operate the camera or one of the cameras?

Luc does the camera operating himself. Always. From the beginning, from his first movie, he was always behind the camera himself. Luc usually works with only one camera. If there are some action scenes, sometimes he uses the second camera for something very special, but not usually. If there is a second camera, I take it. But because we had the Steadicam 75% of the time, it was standing by, ready to go, already configured.

You used an ALEXA and an Epic for some shots?

Yes. For the car chase in Paris, as background plates. We needed to match the chase with the actors later in the studio. We shot the chase during the middle of August. Paris is completely empty during August. It's the best time to do a chase. But the chase was supposed to be with the actors and the actress and they were not available at this time. Scarlett came to Taipei in September. So we filmed the chase elements without the actors. We mounted six RED cameras on a camera car: one in front, one behind, two on the sides, one tight, one wide. At every point, we needed to match the actors. We had this camera car do the chase along the rue du Rivoli in Paris. At the time, it was very difficult to find six F65s in Paris. It was easier to find six RED cameras in Paris. That's the reason why we shot with the RED in 4K, which was very comfortable.

If the RED cameras were for the car chase, then what were the ALEXAs for?

ALEXA was also used from time to time because it was easier to find for occasional extra camera shots. I love the ALEXA too. We also did some shots with the Canon 5D. We used the 5D for some very small, very quick shots. But when you have an action scene, quickly cut, it's not a big deal to match everything together. There are some shots that are just two seconds long.

Do you have any comments on what improvements you'd like for the next camera?

If I have some suggestions for the F65, it would be a bigger 4:3 sensor for anamorphic lenses (18 x 24 mm). Not a 16:9 sensor. The bigger the sensor, the happier I am. At minimum, an anamorphic lens should cover it (without cropping).

On this show, what aspect ratio was it? 2.35:1?

Yes. We shot 2.35:1, spherical, Super 35mm. But for the next movie, if I want to use anamorphic lenses, I would be happy to have the quality of the F65 with a bigger sensor that captures the full 4:3 anamorphic squeezed frame (23.76 x 17.82 mm).

What do you think is the mystique of anamorphic?

Because of the style of anamorphic, because of the depth of field anamorphic lens, and especially the quality. We don't always need to be so realistic and anamorphic offers something that may be a little more poetic in style. A lot of us love anamorphic lenses, especially in digital because it blocks the digital style. I choose ARRI ALEXA for anamorphic because it's the only camera that has a digital sensor that covers the full anamorphic lens. The new RED DRAGON camera has a sensor that is bigger—it crops a little less – but it still crops. But the F65 crops too much when we use anamorphic lenses.

How would you describe the color space of the F65?

I made tests—almost ten different shots, two shots outside, three shots in stage, two shots in the real location. We tested three different cameras and then we worked on the grading. First we graded the images to make the cameras' picture as similar as possible in the DI. When we adjusted the three cameras almost all the same, Luc came to the screening and said that he liked the F65 best for the color and look of the film we were about to make. For the look of "Lucy," we felt the F65 was the best for the skin tones and for the colors of the film. Also, the person doing the grading told me that with the F65 it's very easy to find the natural color.

Was this the first digital film for Luc Besson?

Yes. It was the first digital film for him. The first one that he directed. But not the first one that he produced.

Whose idea was it to shoot *Lucy* in digital as opposed to film?

It was an evolution. A while ago I asked Luc if he wanted to shoot in digital and he said, "No, I want to shoot in 35mm." But we did some tests back then with the F35 and the Panavision Genesis. Also at night, in the Place de la Concorde. I used the two cameras together, F35 and Genesis for a few shots. Because he didn't want to use cherry pickers with HMI lights at night. He wanted to catch the natural light from the street lights in the Place de la Concorde. So we started in digital with Luc on this movie. On *Malavita*, we did some night scenes with ALEXA. And for *Lucy* he said, "OK, I agree to shoot in digital." When he saw the test, he approved the Sony F65. It's nice because digital is getting technically better and better. I am not sure—but maybe Luc will go back to film for his next movie. It's not impossible, you know? But for this movie, he agreed to shoot in digital.

It's interesting that you chose the F65. I know a couple of rental houses in Paris bought F65s and they really couldn't rent them for a while. And then all of the sudden you started using them and now everybody wants to shoot F65.

I know the F65 was not very popular a few years ago. The F65 came out 3 years ago, but this camera was not very popular until now. Two years ago, nobody wanted to use it. From the beginning, Sony said why not use the F65, make some tests, try it. Few people knew about it before.

I think also in the beginning people were afraid of 4K and maybe now it's more accepted in France?

I don't think so. The RED was already in 4K, you know? The RED was very popular. So I don't think that's the reason. I think the reason that the camera was not popular is it's a little ugly. It looks a little cheap. And it's a little too big. So people stayed away from a big camera. It's a big camera. Much bigger than the others.

The film business is almost like the fashion business. If the camera's not stylish, they're not going to use it. It's like fashion.

Yes, exactly. Not fashionable. Sony has to think about that. The Genesis was very ugly too. The ALEXA and the RED have the best designs at the moment for sure. The ARRI D-21 was not very pretty.

On the set, you're watching the same monitor as the DIT and then you say make it darker, lighter and so on?

Yes. I have a Sony OLED monitor that I like very much. I advise the DIT on the exposure because sometimes I want it to be much darker or sometimes I don't care to be overexposed in some part of the picture. I might say, "No, no, you can go up in the picture" or "You can go down." I love digital cameras now because you have the complete picture on the set. You don't have to wait for the lab to process the film and screen the film dailies the next day. It's very comfortable to have the picture on the set and to know is exactly where you go.

No more scary telephone calls in the middle of the night from the lab. And the F65 is definitely as good as film?

Maybe better. Especially now that we're screening in 4K. The F65 has an 8K sensor.

How did you get started in film? Did you go to film school?

No, I never went to film school. When I was a child, I wanted to make movies and be a DP. When I was about 12, I had a Super 8mm camera and I would make films by myself. And at one point, when I was 17 years old, I began working with a DP as a First Assistant on some very small, cheap movies in 16mm. I worked my way up. After eight years as an assistant, I began working as a DP.

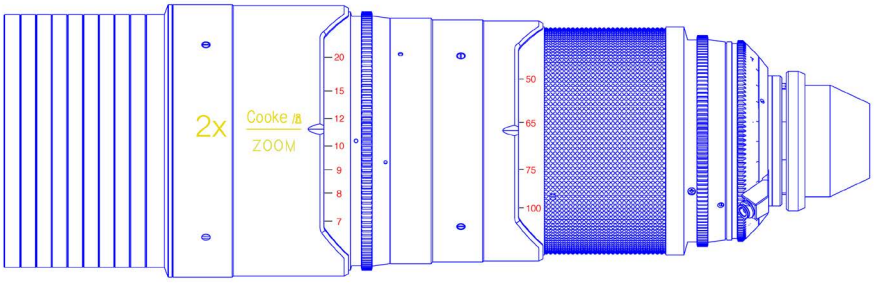
Is there anything else you would like to add about "Lucy?"

I think we made a very nice movie with Luc. I think the picture looks good in the trailer And I am sure it's going to be a good film. I have a feeling that the movie is going to be a big success. It's just my feeling.

Also, I just want to say that Luc's films are always very beautiful. Because it's Luc's style. It's something that we work on together. He helped me a lot to make this picture so good. It's a collaboration. Luc has a very good style.

Our first film together was L*a Femme Nikita*. In 1990. It's a long time ago. And we have worked together ever since. I have shot all his films since *Nikita*. *The Professional, The Fifth Element*… I'm very happy to work with him all the time.

Cooke Anamorphic Primes...and now Zooms April 2015



Cooke is expected to begin shipping their 25 and 135 mm Anamorphic /i lenses around NAB 2015 with the 180 and 300mm to follow later this year. There may also be a few other surprises.

And here is one of those surprises. A Cooke Front Anamorphic Zoom is in the works. Like the Cooke Anamorphic Primes, it is a true front anamorphic lens with 2x squeeze. The focal length has not been divulged.

Cooke Chairman Les Zellan said, "In the storied tradition of Cooke 5:1 and 10:1 zooms, this is the first in a series of front anamorphic zoom lenses that will complement Cooke's set of anamorphic /i series anamorphic primes lenses."

The photos above are renderings that arrived just as we were about to go to press. We hear that another surprise lens may be coming for Cine Gear in June.

Cooke Optics will be at NAB booth C8643. cookeoptics.com

Cooke NAB 2015 Users Discussion


L-R: Geoffrey Chappell and Cooke Chairman Les Zellan

Getting a coveted seat at the annual Cooke NAB users group meeting and dinner requires connections worthy of entry to a restaurant like Rao's in New York. It also helps to be the owner of a substantial number of Cooke lenses, spherical or anamorphic. In an undisclosed location at a distinguished Las Vegas restaurant, more than 80 prominent rental house owners, staff and cinematographers convened to discuss the latest topics and trends and to meet new colleagues. Later in the evening, fueled by a dinner of Jurassic-sized steaks and a workflow of wine, speeches were made on the state of the industry. Here are the highlights.

LES ZELLAN: This dinner achieves what we hoped for: the exchange of information and opinions that are highly valued in the industry. There are certain things we want to know about and I think you want to know about too, such as camera formats. It seems like there's a new one every week and it certainly affects rental houses and it affects us because we have to make the lenses to go on those cameras. It's hard to know where this market is going with an infinite number of formats coming out, so that'll be something we want to discuss.

Obviously, we'd love to hear how well or how poorly our anamorphic lenses are doing, but I'll assume they're doing pretty well. If you stay to the bitter end we may discuss some surprises. I'll tell you one of them right now. At Cine Gear, we plan to announce another anamorphic prime lens. As opposed to the zoom lens that we announced here at the show which should be ready toward the end of the year, or early next year, this is a lens that we'll start delivering shortly after Cine Gear, if everything goes smoothly. It's going to be a great addition to the anamorphic primes.

[This prime lens has now been revealed. Cooke's new 65 mm Macro Anamorphic /i 2x Prime is discussed earlier in this edition.]

GEOFFREY CHAPPELL: Ladies and Gentleman, on this stage from around the world, we are pleased to announce this evening we've got guests from over 46 countries. I've got a Magnificent Seven this evening to say a few words. I thought we'd start on home territory and I'd like to call upon Dennis McDonald from Keslow Camera to stand up and be questioned gently by Jon Fauer.

JON FAUER: We're going to ask pretty much the same questions to everybody. Dennis, tell us a little about your market. Is it mostly features, commercials, and how does it break down?

DENNIS McDONALD: We have a healthy balance of feature films, episodic television, and commercials, so I think we do well in all three markets. The percentage of anamorphic to spherical has changed. A few years ago I would have a different answer. Spherical was by far the leader, but as of late, anamorphic is exploding. Just last week we did a dishwashing liquid commercial on anamorphic lenses and it's absolutely huge. Every set of anamorphic lenses we own are currently working as of today.

JON FAUER: RED's introduction of a VistaVision size sensor drew a lot of attention at NAB. It wasn't totally VistaVision; it was roughly 20 mm high by 40 mm wide. That's close to our familiar Full Frame Still 24 x 36 format. So two questions: do we think other camera manufacturers are going to follow? And what does that mean for the lens business?

DENNIS McDONALD: Great question. I think other camera manufacturers will follow. I think PL mounted lenses are here to stay for a while, at least until our Cooke anamorphics are paid for. I think that what we have in our inventory is here to stay for at least a while. It's going to take a little time for larger format to take over. I'd like to thank Les and his team for a phenomenal evening. I think I can speak for everyone here that this event is without a doubt the highlight of NAB.

GEOFFREY CHAPPELL: One of our most celebrated and distinguished guests, Denny Clairmont, couldn't make it tonight. But we're pleased, in Denny's absence, to welcome Alan Albert, of Clairmont Camera.

ALAN ALBERT: I think the large RED sensor is interesting. I certainly have some questions about how big the sensors are going to be getting and that, of course, goes to the image circle of the lenses that we're all dealing with. It's wonderful, I think, to be able to have the higher resolution. But at some point in time it's going to get to a point where we're going to actually have lenses that we can't use. And that, from a rental standpoint, is very concerning and also from an aesthetic standpoint of what the directors of photography and directors are used to working with. So higher resolution is a wonderful thing, but I don't know that it's a be-all and end-all to our industry.

JON FAUER: May I just jump in with an observation about that? I think RED introduced this larger sensor not so much for higher resolution, but to accommodate more formats. Their Dragon sensor is 15mm high by 30 mm wide, so it crops 18×22 anamorphic on top. Everybody in this room probably has at least one set of Cooke anamorphic lenses, and many have, dare I say, ARRI/ZEISS Master Anamorphics, Vantage Hawks, Kowas, and others. These are all optimized for 18 millimeter high. So if you're RED and want to introduce the next camera, do you design it with an 18 x 24 mm sensor? No, you jump to the next larger size, the next multiple of 15×30, which is 20×40. You put a PL mount on it and everyone in this anamorphic room is happy. The 18×22 mm windowed area is more than 4K, inside of this 20×40 mm 8K sensor. Equally happy are all the fashion photographer/cinematographers who shoot both stills and video on RED cameras. So the big deal is compatibility with the 35mm cine 4:3 18×24 Silent Aperture, which up to now, only ARRI Alexa provided.

ALAN ALBERT: I agree with you. When we're talking about anamorphics it makes all the sense in the world. For VistaVision spherical, that's where I have my doubts.

JON FAUER: Alan, tell us a little bit about your market ratio of commercials to features and what jobs have been interesting?

ALAN ALBERT: Like Keslow Camera, our market is pretty much the same as far as episodic television, theatrical, commercials, and high-end music videos. Clearly, our major market is the episodic television work, with commercials being second, and I think with features being a close third. We're actually doing more anamorphic work for commercials at the moment. In our Canadian offices anamorphics have been very popular, Cookes in particular, but we're probably doing more anamorphic work with commercials than we are with features at the moment.

JON FAUER: Which is what Denny predicted last year because he said it was an optimum place to put the subtitles, like "Professional drivers on a closed course, do not attempt."

ALAN ALBERT: Also with the unique depth of field of the anamorphic lenses compared to spherical lenses. Directors and directors of photography are looking for a signature in their work and I think anamorphic helps them to create that unique signature.

GEOFFREY CHAPPELL: Now we go to Argentina and Jonas Pagazaurtundua from Camaras y Luces.

JONAS PAGAZAURTUNDUA: It's a pleasure for me to be here. Two great things happened to my life in the past few months. My first child was born. He's here tonight and I think he's the first baby to attend a Cooke dinner. And the second good thing is that I received my first set of Cooke anamorphic lenses.

Thank you very much, Les, for the lenses. About the market in Argentina, well, it's South America. Right now, as you may have read in the newspapers, it's a bumpy road, but we're doing quite well. It's mainly anamorphics for long feature films and not that much in commercials, but we had a very first good experience with Cooke lenses last year and we're very happy with that.

Cooke S4 lenses have always been very popular. So anamorphics were a very sure investment for us, and we're doing very well with them. Our busiest cameras are the Alexa XT. The RED 8K was a very interesting camera, I think it will give us many options in the future. The Alexa Mini is a great camera. It's something that we needed. I think it will really fit our market. The ARRI brand is very strong in Argentina.

Last year we supported the Argentina locations on "Focus," with Will Smith. It was released in the US a couple of weeks ago, and was a very nice project. I saw the picture of the Cooke anamorphic zoom lens so I hope to have it in my hands to try. About the new project, the new surprise at Cine Gear, I'm not going to be in Cine Gear, so maybe Les can tell me something?

GEOFFREY CHAPPELL: But Jonas, you waited 9 months for your beautiful son. It's similar with Cooke lenses. Good things in life take time. Please be patient. Now, let's get on a flight and fly across the Atlantic to the wonderful, historic city of Amsterdam, in the Netherlands. Can I call upon Philippe Vie of Camalot?

PHILIPPE VIE: Business is picking up again. It is nice to sit here, once a year, and again at IBC in Amsterdam, to notice that whether it's Australia or South Africa or Japan or China, we all have the same problems. We all have the same issues with DPs, operators and assistants buying their own gear. Actually Berndt, my business partner who is present, and I decided two years ago our pension is in glass: lenses. There are more and more cameras that come on the market. I was sitting next to Geoff Boyle talking about it. Are there any bad sensors at this moment coming out? No, not really. So it's more and more about, luckily, the guys behind the camera and the glass in front of the camera. To me, the camera is becoming less and less important.

JON FAUER: It has been called a "mere" box on which you put good glass. Is there more of an interest in anamorphics now?

PHILIPPE VIE: Definitely, yes. We actually own this funny set of Russian lenses called "Elite." And the funny thing with all the new anamorphics coming out, now suddenly people want to go back to that look or the vintage looks, but as long as you can offer the different ones that are in the market I think it's getting better and better. I think Denny Clairmont said four years ago here, "Anamorphics, anamorphics, anamorphics." It's a niche, but unfortunately in our market, you probably all have the same, we don't decide what it's going to be. It's the directors of photography that decide it and it's a niche. 3-D is going away, luckily, and now it's anamorphics and hopefully for a very long time.

JON FAUER: And what's your reaction to RED's introduction of a larger VistaVision format today?

PHILIPPE VIE: I think it's RED's answer to the Alexa 65. VistaVision is interesting, but I'm not sure. It's more like the bigger the sensor, it's the promise they put out. It's the factories that decide what we are going to buy. And actually, I'm still very much an advocate for what Sue Greenshields from Lemac said a while ago. If we put our heads together it should be possible that we tell the factories what we want instead of them deciding what we need to buy. The lens factories actually listen to us, but the electronics factories, they don't. It's like 4K, 6K today, tomorrow it's 8K, then it's 12K. But for now, anamorphic is a good way to go now.

GEOFFREY CHAPPELL: Next, we go to Japan and the city of Tokyo, and we call upon Masa Yasumoto of Sanwa.

MASA YASUMOTO: Thank you Les and your team for the wonderful evening. I come to NAB only for the Cooke dinner, so I can go home tomorrow. Yes, we're a rental company in Japan. What may come as a surprise to some of you is that we still rent film cameras. I see a couple of film cameras everyday going out on jobs. Some customers know that they can shoot cheaper on film than with digital cameras. They don't waste any film. They know exactly what they can get from film, so we're very pleased with that. And the anamorphic lenses–yes, we use them mostly on commercials, let's say 70%, and then 20% feature films, and the rest 10% T.V. Dramas, music videos, whatever.

JON FAUER: How many film labs are left in Tokyo right now?

MASA YASUMOTO: I think there are still four.

JON FAUER: That's more than any city in the world. Amazing.

MASA YASUMOTO: Okay, so if you're stuck processing film, come to Japan. We've been supplying anamorphic lenses, but we don't have enough. You know that we are also the Panavision agent in Japan. But nowadays, maybe because of trends or because of availability of more anamorphic lenses, we get more and more requests for anamorphic lenses. And they are used on

commercials, of course, as well as feature films. So we need more lenses, Les. Thank you very much. We have Cooke anamorphic lenses and before I left Japan a week ago, they're fully booked a month ahead. People start booking and some people don't bother to book because they know these lenses are not available so they just shoot with sphericals. But it's the DPs who decide what equipment to use.

JON FAUER: In reaction to what you just said about the DPs driving the equipment choice, and since you're probably in touch with Panasonic, Canon, and Sony, I was expecting them to come out with a large format sensor cine camera as well. My impression is that RED did it at the request of many of their customers. Many are still photographers who shoot stills by extracting frames from the high resolution video. They have their Canon or Nikon lenses. Looking into our crystal ball I wonder what Sony, Canon, Nikon and Panasonic are going to do now that RED has fired the starting gun of the Full Format race. Are they saying, "We have these sensors already in our 5D, A7, D810. We can do a cine-camera as well in this larger format. We don't have 18 x 24 anamorphic-friendly cameras, so let's just jump to the next size, and it's one we are very familiar with." By the end of the year, are we're going to see more cameras in 24×36 FF size?

MASA YASUMOTO: Yes, I agree with you, Jon. I always wonder which direction the camera could go. So there's only one direction, to a larger format. I don't think they will go beyond VistaVision size; that's too much. But I think they will do full frame still camera 24 x 36 mm size. That is already on the market and some companies have cameras, lenses, so all they need is a decision to do it. What I want to see, and I know Cooke is busy with anamorphics and the S5 and so on, but I want to see a new series of lenses that can cover at least 24 x 36 mm. I think it is the future and something to be considered.

JON FAUER: That is interesting. And it wouldn't have to be PL mount, it could be a shorter flange focal depth, because there's no more spinning mirror, which could make the lenses smaller?

MASA YASUMOTO: That's true. We've been renting PL mount lenses, but nowadays we see more and more demand for lenses in the EF mount. They're smaller, lighter, probably cheaper for them to ship, but mechanically, optically, not as good as, of course, Cooke, but the Producers can save some money.

JON FAUER: With the Tokyo Olympics coming in 2020 and the announcement of 8K, is where are we heading?

MASA YASUMOTO: 8K is maybe only NHK, the TV stations and the companies supported by governments. But on the production side, I don't think we can go in that direction too fast. We need to solve the lens issues, post-production, workflow, there are many things we have to solve before we can work with 8K.

GEOFFREY CHAPPELL: Keeping in Asia, I'd like to jump back on my plane and head towards the wonderful country of India. I'd like to call on Tarun Kumar from Anand Cine Services; it's the largest rental company in India.

JON FAUER: India was originally all anamorphic but now I hear not so much. Why is that?

TARUN KUMAR: The digital sensor cameras were responsible for that. But interest has be rekindled and we see some sort of revival of anamorphic though much slower than expected. Probably our cinematographers are waiting for the full range of lenses to be available, as they've been pampered with the spherical lenses.

JON FAUER: India, I understand, is the land of Total RAW. Why so much?

TARUN KUMAR: Yes, yes. Totally RAW. In fact, we shoot no ProRes at all. That is because in India all our equipment is sent out with our people, so the camera guys carry the gear, they set it up, they upload the camera, and the cinematographers just has to do the creative part of it. The lighting crew has his own team to do the creative part, but all the operational part is handled by our crew, which, again, is picked by the cameraman. We do the operation, we do the data handling, the data wrangling, the data management, we create the proxies and give it to the editors, and we also have a big post facility so it comes back to us for post. And so we make it easy for them all the way through, from end to end. So there's no difficulty, the learning curve is not so steep, and in post they find it easy to do the grading and they're delighted to work in RAW.

JON FAUER: Do you think we're going to larger format sensors?

TARUN KUMAR: That's the way the world is heading. It's inevitable.

JON FAUER: How many features are done in India each year?

TARUN KUMAR: Oh, more than a thousand. I think 1,200 movies a year. There are a lot of productions, independent owners making movies just because they have access to a camera, but I don't think they'll ever see the light of day, but still the 1,000 figure doesn't come down. At our company, we handle about 200 to 250 features every year. Full length features, each about 2-1/2 hours long.

JON FAUER: Wow. How many cameras do you have?

TARUN KUMAR: We have about 50 cameras and a balance between Alexa and RED. ARRI Alexa is very strong in India, but RED is not keeping quiet.

GEOFFREY CHAPPELL: Now, we're going to call upon our last speaker of the magnificent seven and no Cooke dinner would be complete without the ever-loquacious Danys Bruyere, of TSF Paris. I'd just like to say before Danys speaks, we do have to be out of here before morning.

JON FAUER: Like the Academy Awards, the music will come up after a certain amount of time. Danys, tell about production in your neighborhood.

DANYS BRUYERE: At TSF, 95% of the work that we do is long form. It's 50% feature films and 45% long form TV drama. An interesting twist this year has been the reduction in quantity of features that are being shot in France while we've seen an incredible increase in the quality of the TV dramas. TV dramas went from regional interest melodrama—stories of the local preacher saving someone, getting the cat out of the tree, to really trying to compete in an international market.

This escalation in quality has resulted in our biggest camera job ever: a TV drama just finishing, that used four cameras constantly throughout the entire film, over 120 days of shooting. They've got two sets of Cooke anamorphics, and we sub-rented a set. They also did some scenes with 1.3x squeeze Super 16 anamorphic. They've done everything you can dream of. The market is changing, it's evolving. People are looking for new looks, for new ways to tell the stories, and the stories are more compelling, trying to be more exotic. It's evolving in a really interesting way.

JON FAUER: They're shooting T.V. drama with anamorphics? And they're cropping/pillaring to 16:9?

DANYS BRUYERE: In France it will be presented through Canal+ in 2.35:1 aspect ratio. One of the co-producers, Sky, will be showing it in 2:1. They managed to get out of 1.78, so they're shooting double format. We'll see what happens with international sales and whether they do a 16:9 version.

JON FAUER: What are the average budgets these days in France for overall production?

DANYS BRUYERE: Feature budgets are going down and TV drama budgets are going up. France does about 200 features a year. The average budget is just a little under 3,000,000 Euros. About 20% of the films are above 10 Million Euros and 80% of the films are under 3 Million.

JON FAUER: Is there still financing in France from the CNC?

DANYS BRUYERE: Yes, there is assistance to productions in tax credits. The tax shelters aren't very competitive on an international level, so we get very few international productions. Unless you need to shoot the Eifel Tower or the famous monuments. Unlike England, Bulgaria or the Czech Republic, we don't get foreign productions that just come to shoot in France for the tax shelter. Labor laws are too complex and labor costs are too expensive, even with the tax credit. Our cost of labor is high.

JON FAUER: And your reaction to the large format introduction today?

DANYS BRUYERE: I think it's great, but I don't think it will replace our sacrosanct to 18×24 mm format. If you set up a bunch of photographs on the wall, the ones shot with large format still cameras, for example 6×7, will stand out. You'll notice them from 10 feet away and they will appear special. I think that going towards large format in the high end is attractive.

It won't replace the standards that we have today because we have so many excellent PL mount Super35 format lenses. But some people will want to distinguish their look. Some of them will be anxious to work in 65mm. There's a reason for that. It shows on the screen. There is a difference. The image is just not the same.

With digital large format cameras, we now have the technical and financial possibilities that didn't exist before. It doesn't really cost a lot more, as it did in the days of celluloid. But it doesn't mean that large format will be used for TV content, news, and sports. You can't do that on large format. There will be a continued need for smaller sensor 4K cameras where you mount a 100x zoom.

But higher end productions, for example like "Lawrence of Arabia" 50 years ago, will move to a bigger format because it just differentiates the look from everything else.

There exists a large selection of Full Frame still photo lenses that have been converted for cinema. So I think that this evolution is in the right direction. Also, it's important that the new RED sensor, with its 20 mm height, can accept all our 1.2:1 2x squeeze anamorphic lenses with their 18mm height. And spherical wide screen on the new RED sensor will be 36 to 40 mm wide, VistaVision format, with its shallow depth of field. We have so much image content today, we need to evolve what we're looking at to have more diversity and to give it personality.

JON FAUER: Danys, you remind me of the film "Birdman," made to appear as if it were a single long take. You appeared to have said all of that in a single breath. It's like a single take. You are the Proust of Production.

GEOFFREY CHAPPELL: I'd just like to pick up on one thing. Danys was saying that he shot a feature film and he wanted a second set of lenses and he subrented them from another rental company. Just because you've only got one set at the moment should not limit their use on a big production. Look around this room and you'll see a combined ownership of many sets of lenses. Just phone the people you know who stock Cooke anamorphic lenses and perhaps you can do some cross or sub rentals to help you grow your business in the feature film market until we catch up and start supplying the second, third, and fourth sets of lenses to each of you. We hopefully will be able to start supplying our second sets this year.

So there's no need to turn down or lose a production because you haven't got two or three sets. On a recent production, one set came from Chile, and the other sets came from Australia. That's what business is. It's across borders now. It's a global business and the idea of these meetings here is to meet other people from around the world who work together.

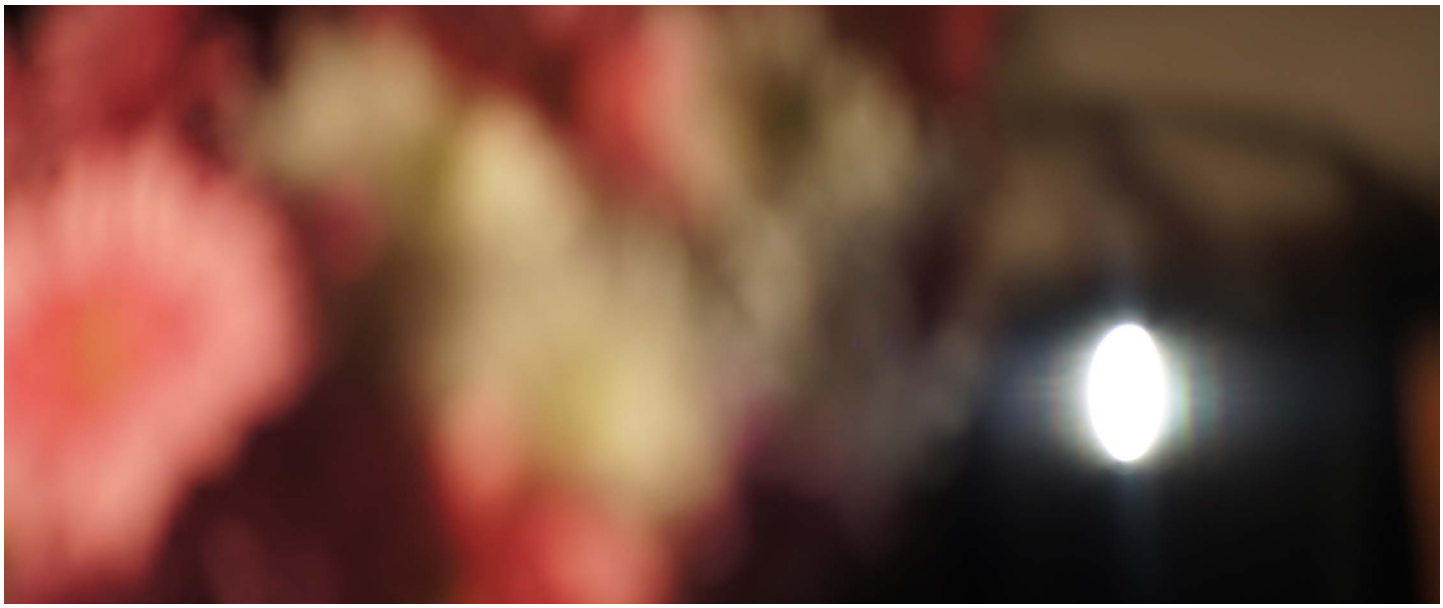
Production is global and sometimes you have a crew stranded in Australia, Chile, Uruguay or wherever in the world, and you've got a partner there, somebody who'd be able to help you. I think, with your support and the amazing first few days at NAB, we certainly stirred up a lot of attention with the announcement of our anamorphic zooms. So I'd like to thank Jon very much indeed, and the magnificent seven.

LES ZELLAN: Now is the moment you've been waiting for. Those of you anticipating the 25 mm anamorphic, we can start shipping that hopefully within days. We have several prototypes here and that lens should be coming off the production line very shortly. I hope that we'll be delivering the 135mm by Cine Gear so that when we get to Cine Gear we can have the new lens to add to the Anamorphic prime lens family that I referred to earlier. I'm quite excited about it.

The 180 mm anamorphic we'll see by the end of this year, and the 300 mm anamorphic probably either the end of this year or early next. The zoom that we announced, we hope to be showing it around the end of the year and hopefully delivering it sometime early next year. As I said at the beginning, we're doing it in the tradition of the 5:1 and the 10:1 Cooke products, the famous Cooke 20-100 and the 25-250. They're true anamorphics with the funky anamorphic artifacts that give it personality. It is roughly the size of the 20-100 or 18-100. A new front anamorphic primes lens will also be announced at Cine Gear. It will match the characteristics that you like about the Cooke anamorphics.

I'd like to thank everybody for coming and thanks for the comments. We listen to everything that's said here. We take it back and we try to come up with the products that you will need tomorrow. Thank you.

Cooke Macro Anamorphic. Pictures worth more than words. Sept 2015



Cooke 65 mm Macro Anamorphic /i 2x Prime

Cooke is showing their new 65 mm Macro Anamorphic /i 2x Prime lens at IBC. The 65mm Macro has a close-up magnification ratio of 4.1:1. That's an area of 92 x 38 mm in real life—shown in actual size above.

Cooke 65 mm Macro Anamorphic /i Specs

- T-stop range: T2.6 - T22
- Min marked object distance: 450 mm (18 inches)
- MOD: 420 mm (16.5 inches)
- Light loss at MOD: 1/3 stop
- Close focus from lens front: 140 mm (5.5 inches)
- Front diameter: 136 mm
- Magnification: 4.1:1

Max. angle of view (H/V) 36.9°/15.6°
Angular rotation of iris scale: 90°
Angular rotation of focus to MOD end stop: 300°
Length from front of lens to mount: 258 mm (10.1")

Cooke 135 mm Anamorphic /i 2x Prime

The long-awaited Cooke 135 Anamorphic Prime is at IBC. Like the rest of the "S6" set, it's a front anamorphic (oval bokehs). The current Cooke 2x Anamorphic set is: 25, 32, 40, 50, 65 Macro, 75, 100 and 135 mm.

Cooke 135 mm Anamorphic /i Specs

Aperture: T2.3-22
Iris Rotation: 90 degrees
MOD: 56 inches 1422 mm
Focus Rotation: 300 degress
Length:7.68 inches 195 mm
Max Front Diam: 110 mm
Total Weight : 2.93 kg 6.47 lb
Image diagonal: 33.54 mm

$$x'=x(1+K_1r^2+K_2r^4+\cdots)+[P_1(r^2+2x^2)+2P_2xy][1+P_3r^2+\cdots]$$
$$y'=y(1+K_1r^2+K_2r^4+\cdots)+[2P_1xy+P_2(r^2+2y^2)][1+P_3r^2+\cdots]$$

The formula above is part of Cooke's new Enhanced /i² project. Luckily you don't have to do the math. That's done automatically by Cooke inside the lens.

What it really means is that you don't have to spend a day shooting lens distortion test charts each time you're checking out a lens for a VFX job. The lens distortion map is part of the metadata.

Cooke Enhanced /i² is introduced at IBC. Cooke Chairman Les Zellan explained, "We're adding this at the request of many in the VFX community and it is our fervent hope that this pushes lens metadata across the finish line."

Enhanced /i² also includes inertial data, keeping track of the camera's movement. It's like the inertial data in your iPhone that tells you how many steps you took. As part of the lens, the data speeds up VFX tasks like match-moving and interpolating parts of a scene where tracking markers might have been obscured.

Cooke Optics IBC Booth 11.D10 ww.cookeoptics.com

Matias Boucard on "The Odyssey" Feb 2016

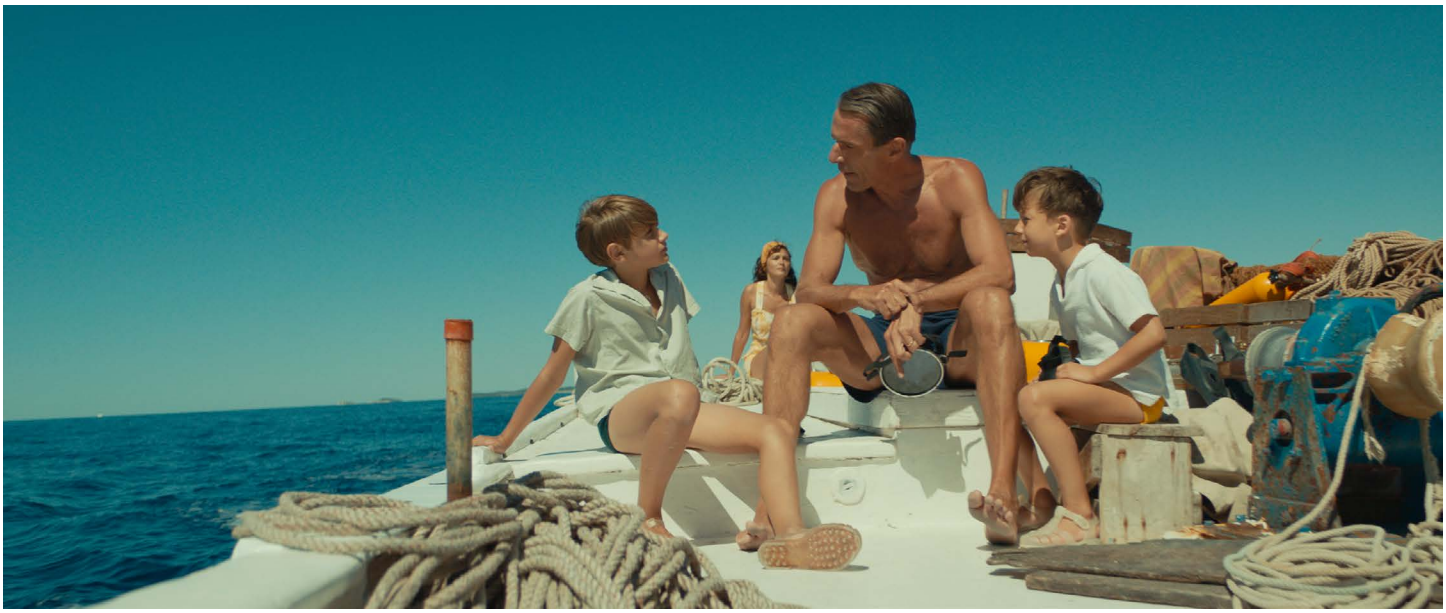
Matias Boucard with the very first Cooke 135mm Anamorphic lens from TSF, filming in Capetown. Photos © Fidélité - Pan-Européenne

Matias Boucard is the cinematographer on "L'odyssée" ("The Odyssey"), a film about Jacques-Yves Cousteau. It was the biggest budget French language film of 2015. Still in production, the 2016 release will coincide with the 60th anniversary of Cousteau's famous documentary "The Silent World" (1956).

The film is directed by Jérôme Salle, with Audrey Tautou, Pierre Niney, and Lambert Wilson. It spans many decades, beginning in 1946 in the South of France and ending in the 1970s. The distributor (wildbunch.biz) writes, "With his aqualung invention, his recently acquired vessel the Calypso, and a crew of free-spirited adventurers, Cousteau is ready to cross the world's oceans. Ten years later, back from the boarding school to which he was sent with his brother Jean-Michel, Philippe finds his father greatly altered – an international celebrity with megalomaniac dreams. Despite their mutual love and admiration, conflict between these two passionate men is inevitable. But on their greatest adventure together aboard the Calypso, in Antarctica, they will find each other."

Locations were Croatia, France, South Africa, Antarctica, Bahamas. They started July 28, 2015, and will wrap on February 4, 2016.

Matias Boucard was born in France, grew up in Marseille and at age 12 moved with his family to Les Saintes, a small island in the Caribbean. Back in Saint-Quentin, France to continue his studies, he received a Technicien Certificate in Cinematography. After that he worked as an AC, Electrician, and Gaffer before becoming a Camera Operator and Cinematographer on commercials, music videos and features. On "The Odyssey," Matias was not only DP, but also camera operator, underwater operator, and Aerial operator.



JON FAUER: What is the style of the movie?

MATIAS BOUCARD: I was always a huge fan of Cousteau. The style of the film is colorful, sensual, rounded, where you feel the sea and the sky. It's poetic..and anamorphic. I was not searching for something perfect and cold. I tried to achieve a vintage look with digital tool. I wanted to shoot anamorphic, not spherical—because everyone has seen the Cousteau documentaries and they used spherical lenses.

What lenses did you use?

Cooke Anamorphics, ARRI/ZEISS Master Anamorphics, ARRI Anamorphic Ultra Wide Zoom, Kowa Anamorphics.

Basically I used Cookes for daylight scenes—about 80 percent of the film. I used Master Anamorphic for some interiors of the boat when I was working at full wide-open aperture, some night scenes, and underwater. The Kowas, being very lightweight and small, were used for specific configurations on the MoVi Freefly and drones.

The choice of Cooke gave me the opportunity to get a classic anamorphic look. I wanted to work with these new lenses that have a pleasing, classic distortion but with nice skin tones and a maximum of color contrast.

Is the distortion of the Cookes different?

I was happy that the distortion is different and unfamiliar. How many period movies have I seen that were shot with C-series? We wanted to find something special. We didn't want blue flares. We used to have many film stocks—Kodak, Fujifilm, 50, 100, 200, 250, 500 ASA—and different labs—and they gave us many different looks. No more. Now we all have the same cameras. So lenses help us define the style.

Before this movie, I had often worked with Master Anamorphics, which are wonderful lenses. But because of a lot of the exteriors on the boat *Calypso* had interesting backgrounds, we wanted to see those details behind the actors. Therefore I didn't want to shoot wide aperture and have everything behind the actors go soft. I was shooting at T8 to 11 to see behind. Master Anamorphics stopped down seemed "cleaner" and maybe too perfect.

For the interiors, I used the Cookes because I was interested by their distortion. On the boat, I also wanted to shoot from low

angles to make the actors look heroic, and using a wide angle lens let me see some details in the background and not just blue sky.

Sometimes I used Master Anamorphics on the boat, for example when we wanted to put actors on edge of the frame. The Master Anamorphics have less distortion. Sometimes that’s helpful when there’s a geometric shape at the edge like the vertical of a window frame and you don’t want it to appear bending.

But other times on interiors you want to feel the edge of that window frame. It’s like a glass between the reality and the movie to create a different perception. We have this lens between the viewer and the story, so in a poetic way, it was like looking through something onto the story. Most of the time, the Cooke 32mm had a pleasing distortion that gave us the opportunity to have a little more poetry in the shot.

I did not mix manufacturers’ lens sets within the same sequence.

In general, I used the Cookes 80% of the time, usually at apertures above T4, where I wanted a bit more depth of field. I used the Master Anamorphics from wide open T1.9 to 2.8 for a more shallow depth of field.

I found I liked the performance of the Cookes with a bit more depth of field to carry sharpness to the edges of the frame, and I liked the Master Anamorphics wide open.

Did you change your style for the different periods of the story?

There are three time periods: 1940s, 1960s and 1970s. We started wider and as the story progresses, the lenses get tighter. We start with 30, 40, 50 mm and toward end we are at 65, 75, 100 mm.

The Cooke Anamorphics were perfect for that. We were searching for the special distortions that the Cookes have.

What about Antarctica?

I think this is the first dramatic feature film shot in Antarctica. If I didn’t have the 25mm Cooke Anamorphic in Antarctica, it would have been impossible to show its vastness. The first thing you feel is how big the place is. When I used the 32mm I didn’t have same feeling. I didn’t want a fisheye lens. The 25mm felt perfect. It was good to compose with it. You don’t see distortions in the landscapes because you don’t have straight verticals on the edges.

Lighting and locations?

We wanted to reveal the color of the deep intense blue ocean. I tested the lenses and found we could achieve a good balance of color and contrast. I tried to work with the colors that you see on the Cousteau documentaries. When people watched them, they were encouraged to discover the world. We wanted to have the similar feeling and look.

I used LEDs for lighting on the boat. But mostly it was available

L-R: Matias Boucard, Jérôme Salle

light with 4x4 or 8x8 bounce to fill in. We would shoot at good times of day. For some scenes, I used Airstar Gaffairs and HMIs. The ship's interior has white walls. Cousteau did the art direction for 30 years—he painted the walls white. They changed hue every hour of the day. It was magical.

Cameras?

I used Alexa XT Plus cameras recording Arriraw internally onto Codex Capture Drives. Our Alexa Minis recorded ProRes. I operated a Freefly MoVi 15 Rig with RED Epic. In Antarctica, Guillaume Marion of Pole Images was the drone pilot using a RED Epic with ZEISS 16 and 50mm Standards and 50mm Kowa anamorphic. South Africa aerials used a Cineflex with Alexa and 30-300 Canon zoom. For the opening, we did helicopter aerials with ACS's Shotover K1 and RED Epic with the ARRI 19-36mm T4.2 anamorphic zoom. We had an Angénieux 24-290 for long shots. I never mixed anamorphics and sphericals in the same sequence.

The entire movie is composed in 2.66:1 format. This is pretty much the native desqueezed ratio of ARRI Alexa if you don't crop the sides. It's wider than the standard 2.39:1 widescreen format.

Data, Editing and Grading?

Alexa internal Arriraw—I work as if I'm shooting film. I have a waveform monitor on the camera. I expose at 800 ISO, 1600 maximum. No LUTs—I viewed in Rec. 709. Stan Collet, the editor, was on set giving us feedback on our shooting. The day after, he and Jérôme were doing a first cut on the sequence.

The lab was Technicolor in Paris and Searle Street Post in Cape Town. We had a DIT who managed data and dailies were graded. I was a gaffer before becoming a camera operator, so I like to be sure all the lights on set are the correct color. When I go into final grading, it is nice to approach it with new eyes. But 80% of the look is already there.

Your way of working?

I try to prep a lot before I arrive on set. I like to be there with an idea. The Cookes gave me that. It was like looking through a medium format camera. If something was a little soft at the edges, we would go a little wider. It helps your framing in the end. Negative things can give you positive results. Unexpected things can give you something extra. If its too easy, you can be lost. It's like driving down a road, and liking where you are going. The Cookes were interesting and challenging and something good was always happening. I never had to tell director we couldn't do something.

Underwater?

The underwater housing was an Alexa Hydroflex shooting Arriraw with Master Anamorphics and Ultra Primes. We had Hydroflex PAR 1200w and underwater Litepanel 1x1 lights. The underwater operators were Roberto Rinaldi, Pete Zuccharini, and me.

In conclusion?

The equipment came from TSF Paris. Thanks to Danys Bruyere. He was wonderful. He got us the first Cooke 135mm anamorphic. He introduced me to Pete Romano at Hydroflex who was a great help. Equipment for Antarctica came from Camaras y Luces, Argentina. I had worked with them when I was doing a commercial.

This is an adventure story about men on a boat and on location in the Red Sea, Antarctica, South of France in the '40s. The locations were important and the lenses helped tell the story.

Camaras y Luces Antarctic Sequences.

Jonas Pagazaurtundua of Camaras y Luces added, "TSF's Danys Bruyere contacted us for the Antarctic work because Matias shot some commercials last year in Buenos Aires. Apparently he had a good experience with us, and gave the production company, Fidelite, our name. We coordinated with TSF before the crew's arrival to avoid any technical inconveniences. We provided complete camera support: two RED Epics, two Alexa XT cameras, lenses, accessories, some lighting and grip equipment. They brought a set of Cooke anamorphic lenses from TSF because ours were out on another feature film. "Francois Vigon and Melodie Preel were here for a week checking out and prepping everything for the extreme weather conditions. They were two great professionals. We finished the week with a great asado (argentine barbecue) at the company. We also had the opportunity to meet Julie Belthoise from Fidelite and Florence Riviere from Cinematrans."

Cooke Anamorphic/i Series

April 2016

		25 mm	32 mm	40 mm	50 mm	65 Macro	75 mm	100 mm	135 mm	180 mm	300 mm	35-140 mm
Aperture		T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.3-22	T2.8-22	T3.5-22	T3.1-22
Iris Rotation	deg	90	90	90	90	90	90	90	90	90	90	90
MOD	inches	33	33	30	33	18	39	44	56	78	120	47
	mm	838	838	762	838	450	991	1118	1422	2000	3000	1200
Focus Rotation	deg	300	300	300	300	300	300	300	300	300	300	300
Length	inches	7.68	7.68	7.68	7.68	10.1	7.68	7.68	7.68	11.65	14.88	17
	mm	195	195	195	195	258	195	195	195	296	378	430
Front Diameter	mm	110	110	110	110	136	110	110	110	110	136	136
Total Weight	kg	2.77	2.68	2.93	2.74	5.2	2.64	2.93	2.93	5.5	8.8	10.3
	lb	6.11	5.90	6.47	6.03	11.5	5.81	6.47	6.47	12	19.4	22.6

The Cooke Series of Anamorphic /i lenses continues to grow. 11 models will be on display at Cooke's NAB Booth C8344, ranging from 25 to 300 mm primes and the new 35-140 zoom.

A brief history: Les Zellan announced Cooke anamorphic primes at Cinec 2012 in Munich. The first sets of 5 Anamorphic lenses were delivered in April 2014: 32, 40, 50, 75 and 100 mm. The 25 and 135 mm followed in 2015. The Macro Anamorphic 65 mm was announced at Cine Gear 2015, and deliveries began in November 2015. Anamorphic 180 and 300 mm primes will be shown at NAB 2016. But the most anticipated lens is the new 35-140 mm T3.1 front anamorphic zoom.

It was exactly a year ago when FDTimes rather breathlessly wrote, "A Cooke Front Anamorphic Zoom is in the works. Like the Cooke Anamorphic Primes, it is a true front anamorphic lens with 2x squeeze. The focal length has not been divulged."

Cooke Chairman Les Zellan commented, "In the storied tradition of Cooke 5:1 and 10:1 zooms, this is the first in a series of front anamorphic zoom lenses that will complement Cooke's set of anamorphic /i series anamorphic primes lenses."

More details were revealed at Cooke's annual NAB Dinner. The new Cooke zoom would be 35-140 mm 2x squeeze anamorphic and was expected to be unveiled precisely at NAB 2016. It would be a front anamorphic design, with familiar oval bokehs and familiar Cooke Look to match the rest of the Cooke Anamorphic/i family. And here it is, at NAB, and expected to ship this summer.

www.cookeoptics.com NAB Booth C8344

Photos by Richard West, ZGC Inc.

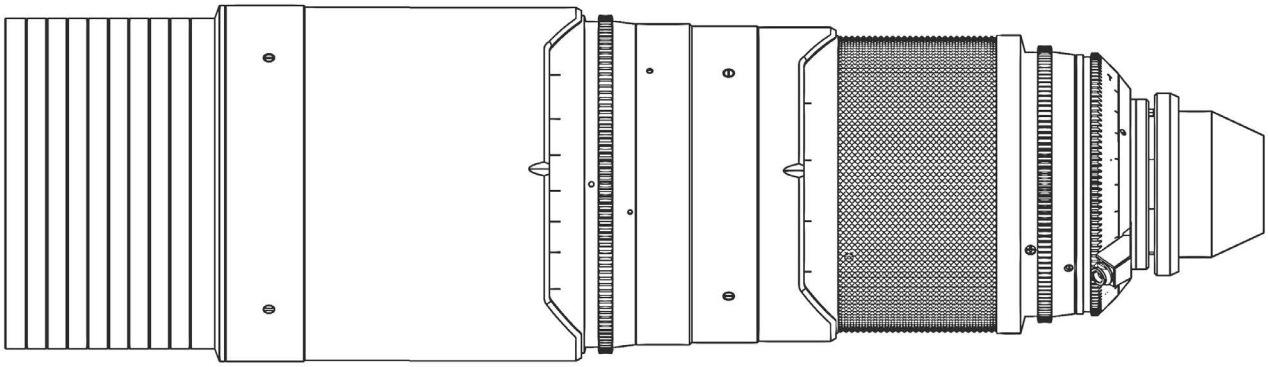
Cooke 35-140 Anamorphic/i Zoom

Cooke 35-140 Anamorphic/i Zoom Specs

- Cooke 35-140 Anamorphic/i Zoom
- Zoom ratio: 4x
- Anamorphic Squeeze: 2x
- Horizontal Focal Length: 35-140 mm
- Aperture: T3.1–22
- MOD: Minimum Marked Object Distance: 3’ 11” / 1.2 m (47” / 1200 mm)
- Close Focus from Front of Lens: 2’ 4” / 0.72 m
- Image diagonal: 33.54 mm
- Weight (approx): 22.6 lb / 10.3 kg
- Length from Front of Lens to Lens Mount: 17” / 430 mm
- Front diameter: 136 mm / 5.35”
- Mount: PL

Rotation of Iris Scale: 90°
Rotation of Focus Scale, inf to MOD: 300°
Focus Scales: Two opposing focus scales – imperial or metric
Scales marked from infinity to MOD
Focus Barrel: 172 teeth 0.8 metric module x 6.0 mm wide x 283 mm from the image plane
Zoom Scales: Two opposing zoom scales
Zoom Barrel: 140 teeth 0.8 metric module x 6.0 mm wide x 102 mm from the image plane
Iris Scales: Two opposing linear T scales – marked in whole and third stops
Iris Barrel: 134 teeth 0.8 metric module x 4.0 mm wide x 82 mm from the image plane

Cooke 45-405 T4.5 Anamorphic/i Zoom



At the famous Cooke NAB Dinner in 2015, after swearing the entire conclave to secrecy, Les Zellan had a second surprise. "The 35-140 Anamorphic/i lens will be the first of two zooms in the Cooke Front Anamorphic series. A second zoom—a long, front anamorphic—should be revealed in 2016."

True to form, exactly one year later, the next Cooke Front Anamorphic/i zoom lens will be announced at NAB. It will be a 45-405 T4.5. Since Cooke appears to be more punctual lately, the 45-405 Anamorphic/i zoom might be ready to review at our next NAB gathering in 2017.

Les described the next lens: "The long zoom will match all the models in our front anamorphic lens set. It is a true front anamorphic zoom. The pleasing oval bokehs that are currently consistent throughout our entire range of Cooke anamorphic zooms and primes will continue to be a feature of the new 45-405 Anamorphic/i zoom."

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FDTimes' sketches and renderings of possible look of Cooke 45-405 2x Anamorphic/i.

45-405 Prelimary Specs

These preliminary specifications are subject to change.

- 9x zoom front anamorphic like all
- T4.5-22
- 2x anamorphic squeeze
- MOD from image plane: 5'10"
- Close focus measured from front of lens: 3'11"
- 6.1:1 magnification at close focus
- Color and contrast will match rest of Cooke Anamorphic series
- Weight: 25-26 lb / 11.3-11.7 kg
- Length 21.2" / 537 mm
- Internal front anamorphic group of optical elements is 5.7" long. Since the cylinders are in front, that is why this lens is longer.
- Front diameter: 136 mm — same as 35-140 zoom
- Elliptical bokeh throughout the entire zoom range
- Bokeh match all other Cooke anamorphic primes and zoom
- Depth of Field (DOF) is the same as the Cooke anamorphic primes. Since these are front anamorphics, the Vertical DOF is approximately half the horizontal values. Horizontal is wider, hence more depth.
- In the Depth of Field Tables, the listings are for Vertical DOF, which are more critical.
- -20 to +50 C / -4 to +122 F operational temperature range without change in focus. Because of long length, special materials were used in critical areas to counteract the effects of expansion and contraction from heat and cold.
- Lens will have /i metadata protocol

Woody Allen and Vittorio Storaro, ASC, AIC on "Cafe Society." Photo: Sabrina Lantos © Gravier Productions, Inc.

"Cafe Society" opens at the Cannes Film Festival on May 11.

Jon Fauer asked, "What lenses did you use?"

Vittorio replied, "I used the lenses that I always have loved, the Cookes. We organized the cameras and lenses and tested at Panavision New York. We used Cooke S4 lenses because they are built for cinema. I need the best lenses to record the plastic movement of light on every kind of image, from maximum brightness to maximum darkness, particularly into the penumbra, as Leonardo da Vinci called it. I really wanted the style of the film to underline the different sections of the story, each one in a very specific way, and to maintain an overall cinematography style: mine."

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