Jon Fauer, ASC www.fdtimes.com January 2013

FILM AND DIGITAL TIMES

The Cooke Book and A Cooke Look Back

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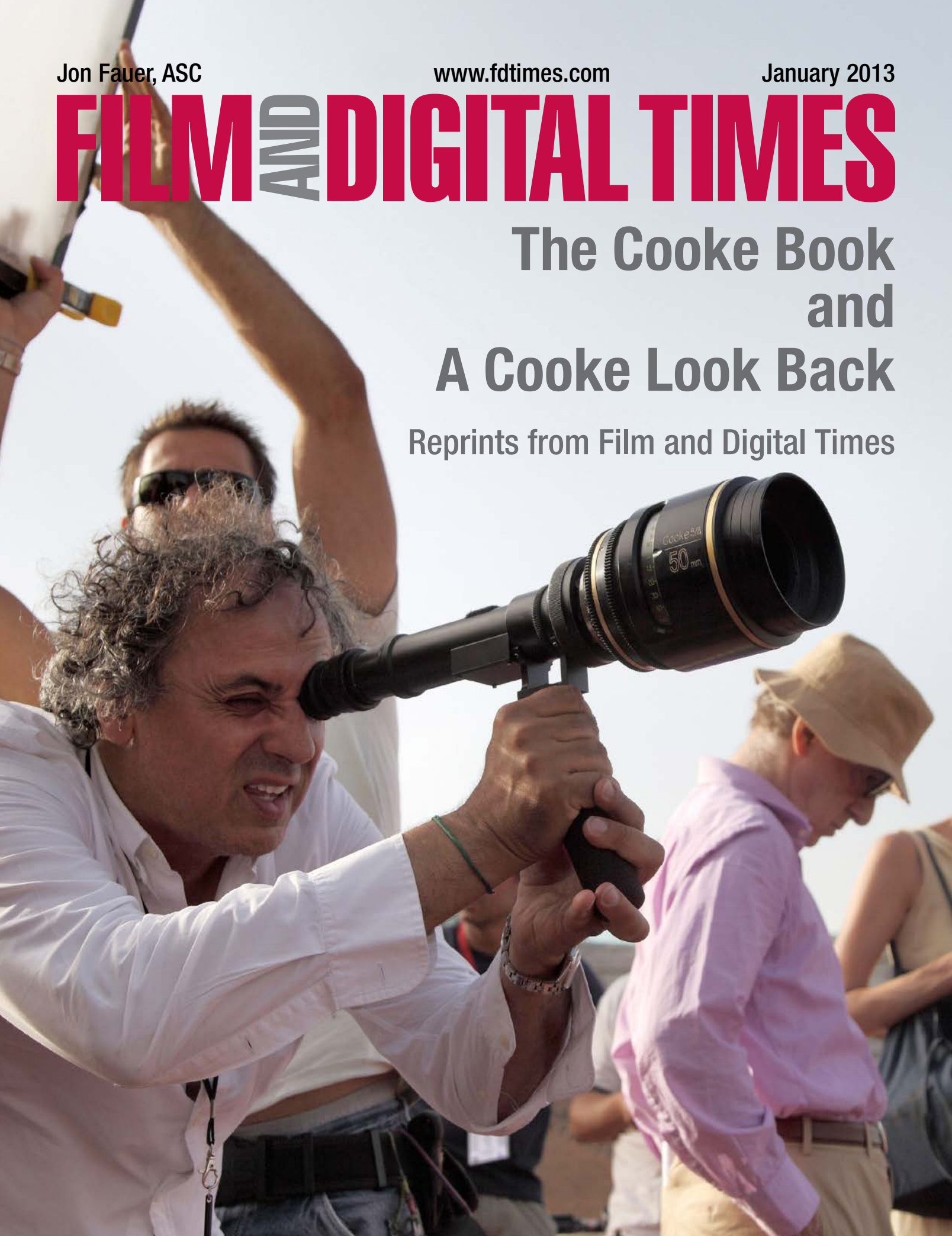

A Cooke Look Back

Timeline of Cooke Cine Lens History


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A Cooke Look Back

Timeline of Cooke Cine Lens History

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.

A Cooke Look Back...and the Original Panchros

1914-1917: Shackleton Expedition

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.

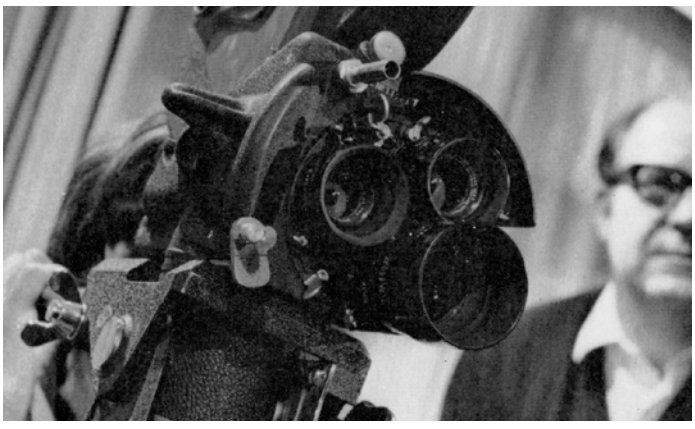
1946: 100mm, f/2.5 Cooke Deep Field Panchro

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

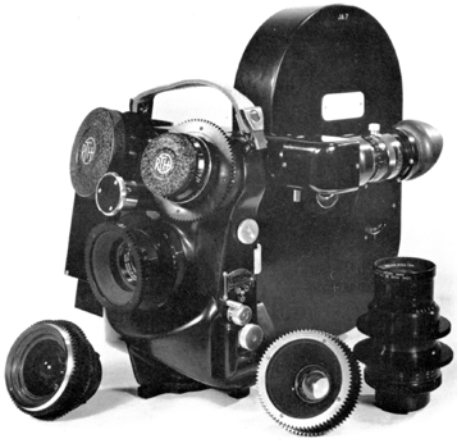
Gordon Cook worked on "anamorphotic optical systems" to squeeze the image horizontally during photography and to expand it in projection. His work on anamorphotic systems gained

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

The Cooke Look Today

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.

Cooke 5/i

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. ❐

reprinted from Sundance Issue 9 and Cinegear Issue 11

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.

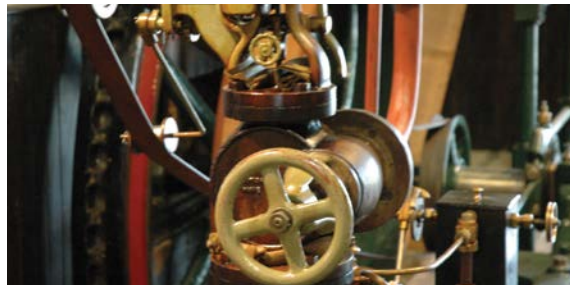
Inside the factory, there are film posters everywhere. Every square inch of available wall space is festooned with posters of major motion pictures: *Da Vinci Code, Harry Potter—Goblet of Fire, Prisoner of Azkeban, Kingdom of Heaven, Cinderella Man, Casino Royale, Brokeback Mountain, Munich, The Interpreter,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

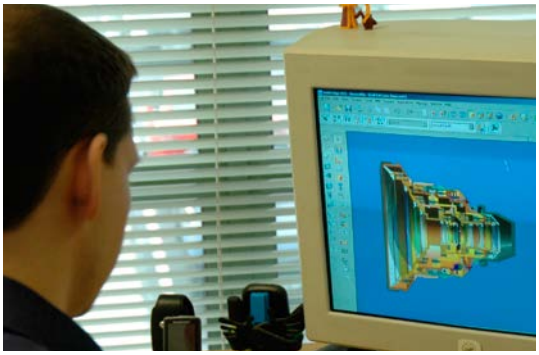
Enter Les Zellan. The Wall Street Journal wrote, "In 1998 an American wearing jeans, a bright yellow shirt and a 20-year-old red tie, with a beard and a short business plan, rescued the company."

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.

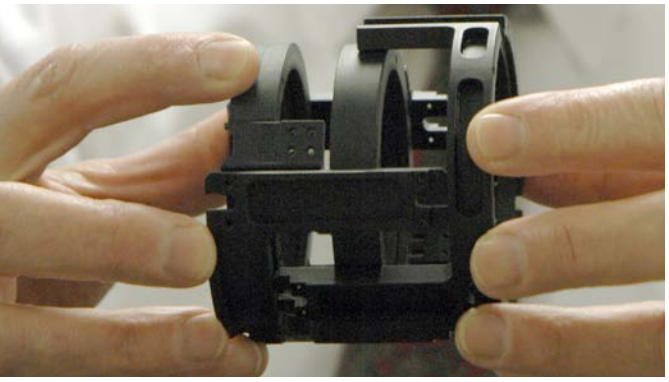
Lens design is mostly math, physics and formulas. Venerable Taylor Hobsons and Speed Panchros began as long lines of numbers pencilled into voluminous notebooks, still on display and often referred to in the Cooke design offices. Now they use computers. Paul Nettleton uses 3D CAD, middle left.

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.

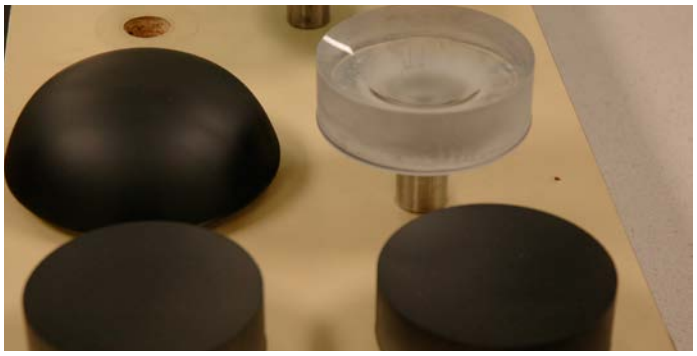
The shapes define curvature of the lenses, as defined by the mathematical formalae that have been established.

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.

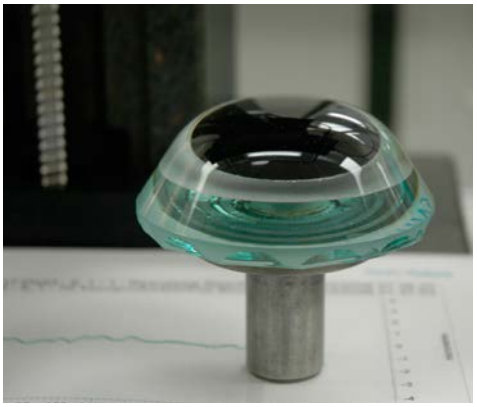
Cooke, cont'd

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.

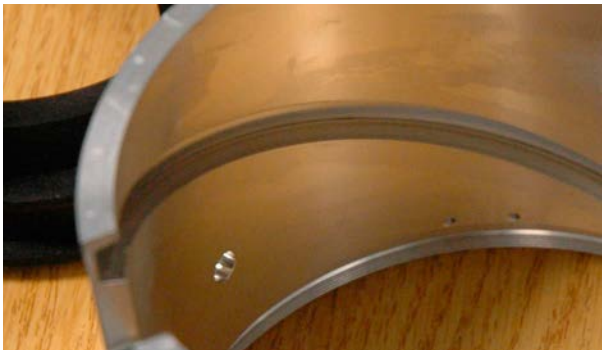
It's time to put all the pieces and parts together. Barrie Billington (left) is the assembly manager, shown here in the assembly room.

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

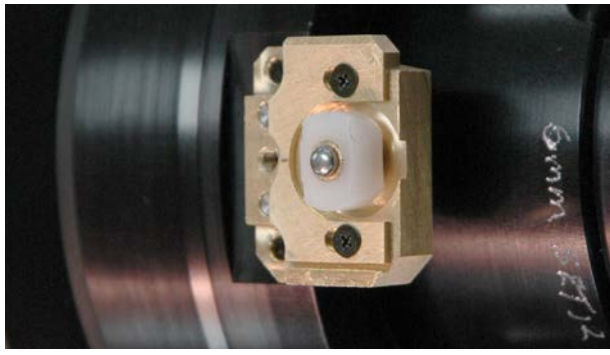
Cooke, cont'd

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

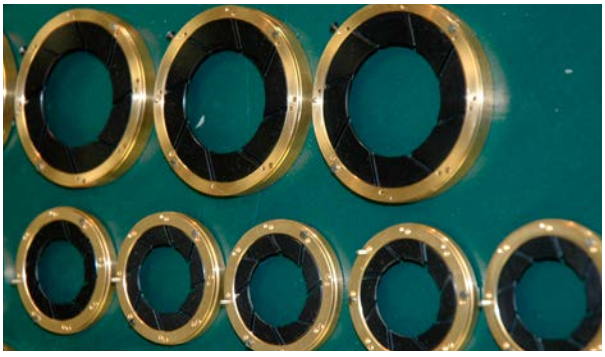
The lens barrels are machined from aluminum tubes and then anodized.



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.

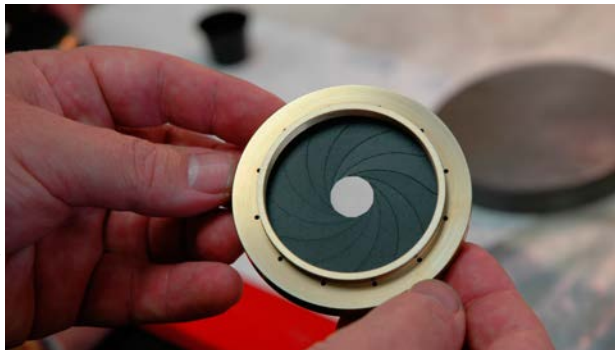


The cam and cam-follower present much less friction than threaded lens barrels. The threads require grease to provide smoothness.

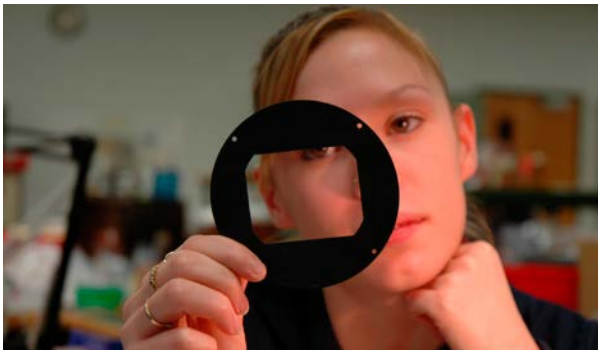


Cooke S4/i lenses work smoothly in temperatures from -25° C to 55° C.

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

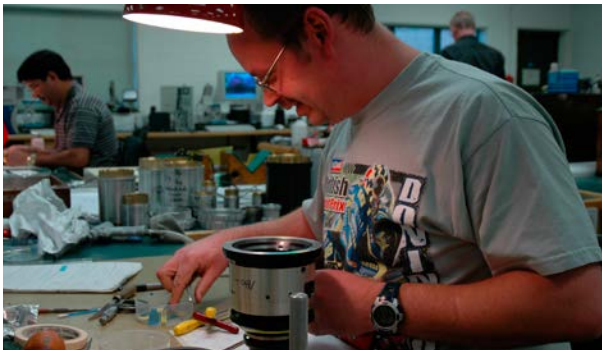


Next, add an iris, (left and right). They have 8 blades.



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.

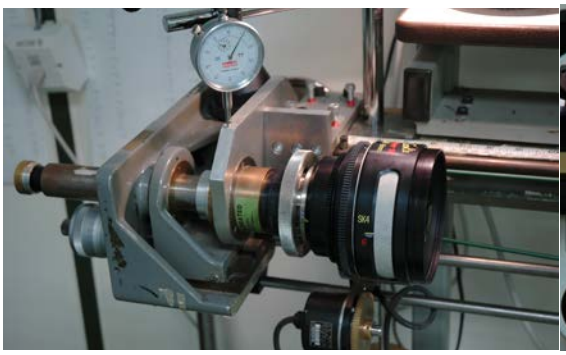
He likes acetone on a cotton ball.

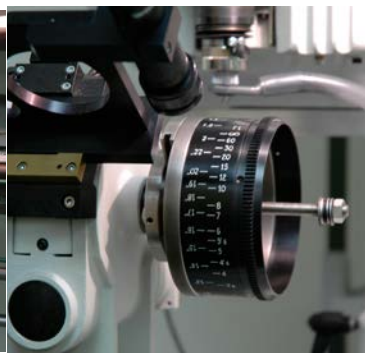
Apparently the epoxy edge blacking and the coatings are hard enough to withstand acetone. I cannot vouch for any other lenses until I check with their manufacturers.

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
Cooke
100mm
8
9
10
11
120
60
∞
T
1.4
2
2.8
4
5.6
8

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.

Midnight in Paris

Photo: Roger Arpajou © 2011 Mediapro, Versátil 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.

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

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

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.

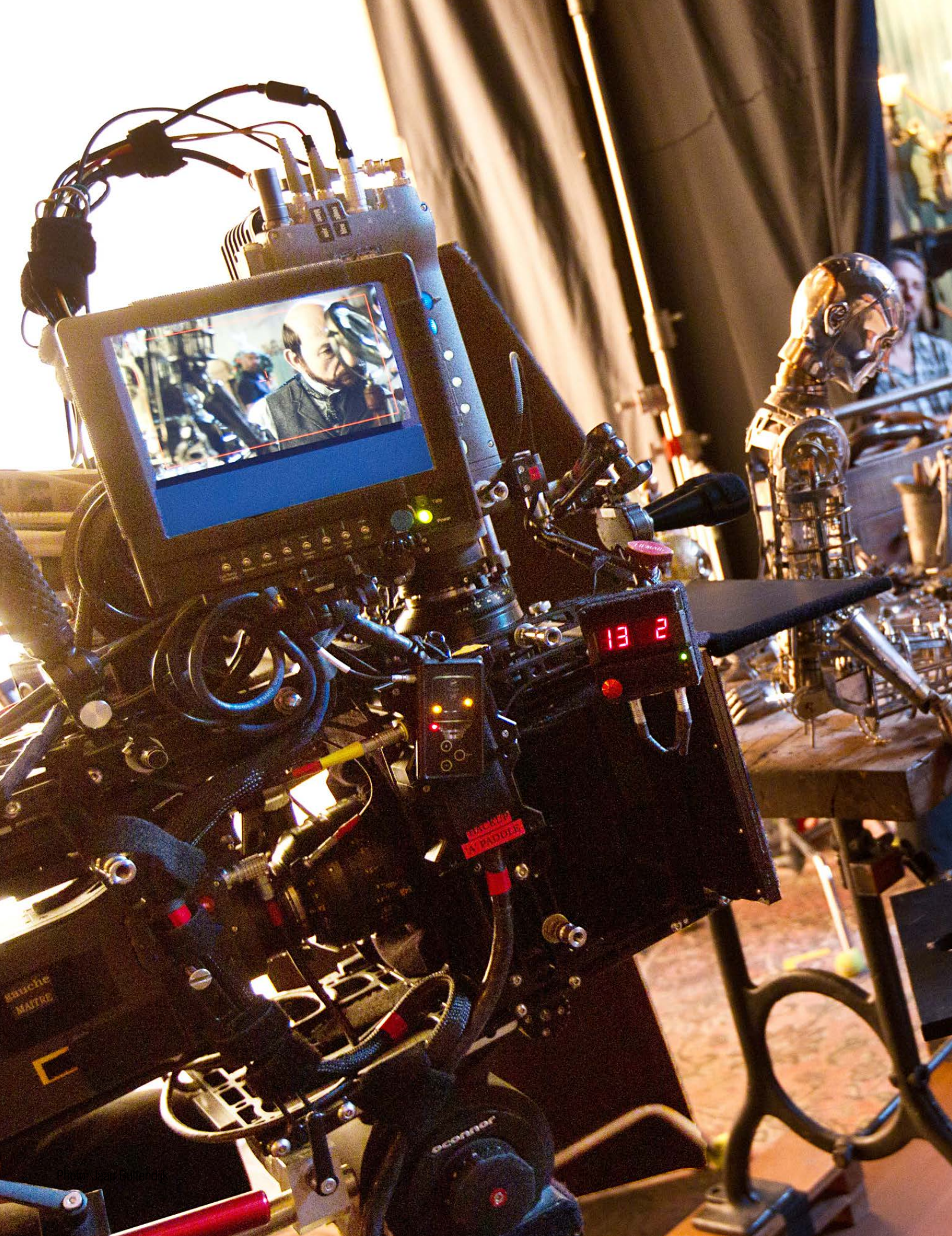
"For the modern lenses, I used a very light diffusion like Classic Soft, or a mix of Black Classic Soft, Pro-Mists and things like that. But very light. The old lenses had their own softer look, which I relied on more than diffusion."

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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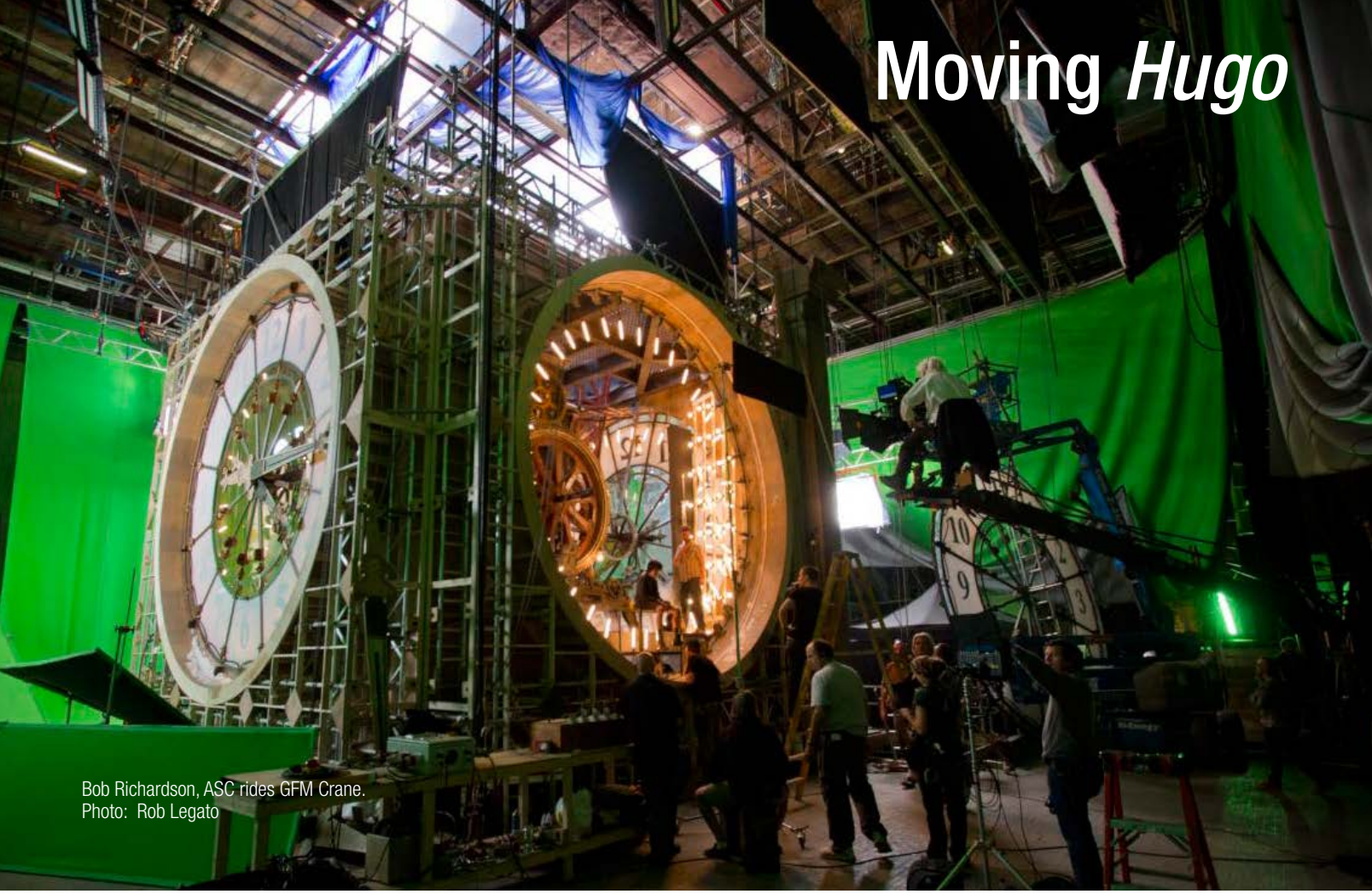
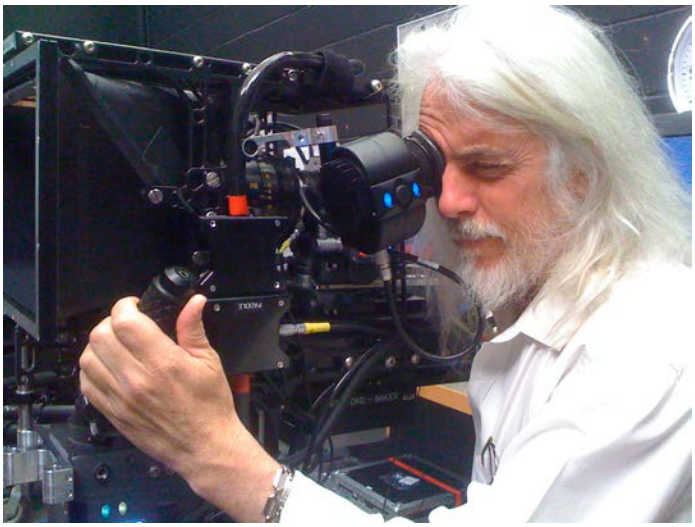
Moving *Hugo*



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.

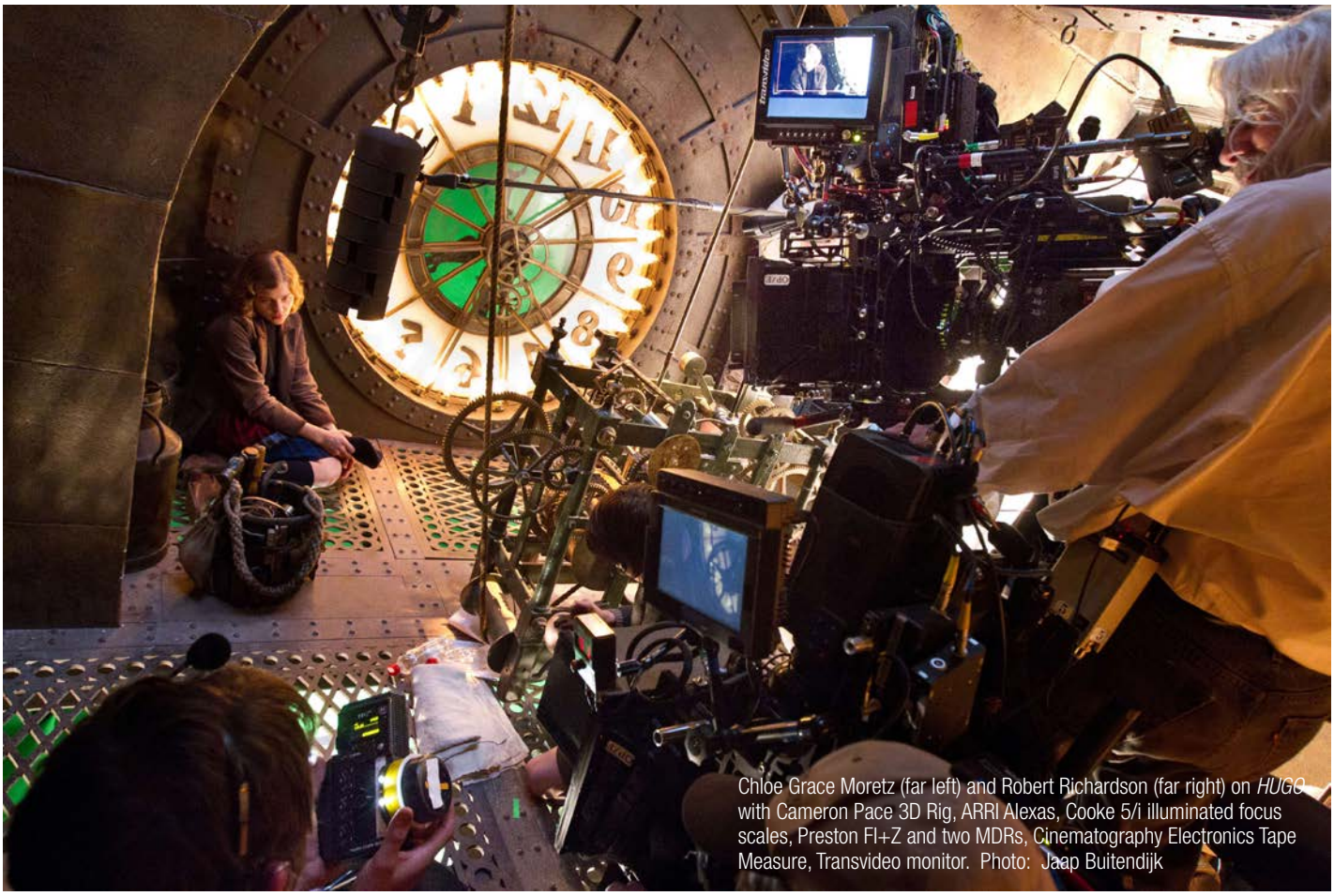
What about the look of the film and Lumière autochromes?

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.

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

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

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

portion of the set going down X multiple levels, so it appears as if 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?"

Legato on *Hugo*, cont'd

Bob Richardson, ASC and Rob Legato on *Hugo*

Metadata adds a very good graph of what actually transpired 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?

Portelli on *Hugo* 3D, cont'd

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

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.

least one sort of signature long Steadicam shot.

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.

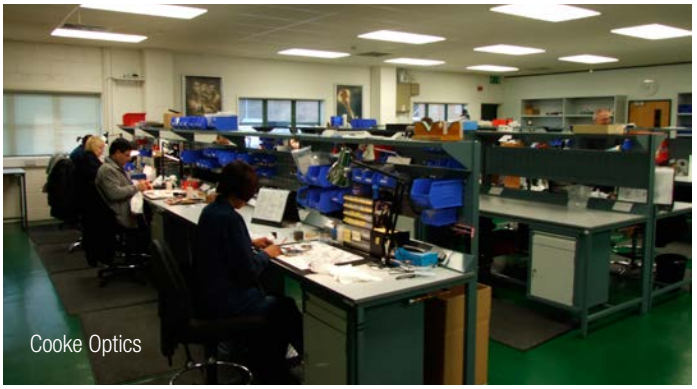
The most challenging part of the sequence was to shoot Hugo sliding down a spiral coal chute (360°), but it was impossible for the big 3D camera rig to follow the action and execute such a move given the physical constraints of the set.

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.

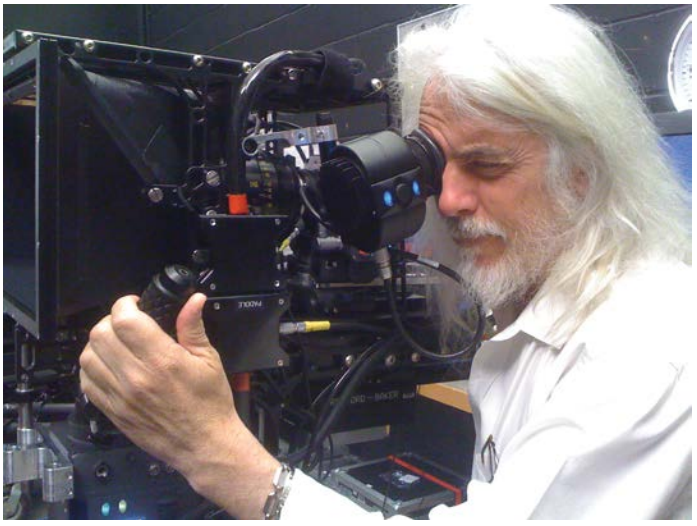
Thanks to its built-in trajectory compensation system, called "planing", the movement of the Louma 2 during the shot was a pure, true, straight movement. The Louma 2 planing is a unique feature that automatically compensates for the natural arc of the crane by extending or retracting the telescopic arm. 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 de-greased 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

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.

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®
100 mm


t
∞
120
60
40
20
15
13
11
10
9
8
T
1.4
2
2.8
4

Framegrab with 5/i 100mm T1.4

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
2'6
100 mm


Cooke 5/i ®
100 mm
Cooke
Cooke
100 mm
15
20
40
60
120
5.6
4
2.8
2
1.4
T

Cooke 5/i


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


Cooke 5/i®
100 mm

Cooke 5/i and...Cooke Panchro/i

First Look: Cooke Panchros in 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 Panchro/i series—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 at NAB 2009

NAB 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 Panchro/i shown at IBC 2009

Cooke Panchro/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 Panchro/i

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.

For specs and more information about the Panchro/i and 5/i lenses, go to: www.fdtimes or www.cookeoptics.com.


Cooke
PANCHRO/i
100mm T2.8
120
60
40
30
20
Cooke


Cooke
PANCHRO/i
50mm T2.8
Cooke
PANCHRO/i
75mm T2.8
Cooke
PANCHRO/i
100mm T2.8
Cooke
PANCHRO/i
135mm T2.8
Cooke
PANCHRO/i
18mm T2.8
Cooke
PANCHRO/i
25mm T2.8
Cooke
PANCHRO/i
32mm T2.8

Framegrab with Panchro/i 100mm T2.8

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