Jon Fauer, ASC www.fdtimes.com May 2015 Special Report

FILM AND DIGITAL TIMES

All About Anamorphic

A Review of Film and Digital Times Articles since 2007 about Anamorphic Widescreen

FILM AND DIGITAL TIMES
Art, Technique and Technology

Film and Digital Times is the guide to technique and technology, tools and how-tos for Cinematographers, Photographers, Directors, Producers, Studio Executives, Camera Assistants, Camera Operators, Grips, Gaffers, Crews, Rental Houses, and Manufacturers.

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Anamorphic Ahead

Pretend for a moment that you are a Studio Mogul. It's your job to predict, eighteen months from now, the next big thing and plan accordingly. Unlike the local television weather forecaster, who gets it wrong most of the time, you will be summarily escorted off the lot for anything less than perfect prophecy.

We have two words (like Sam Goldwyn) for you. "Anamorphic."

For the past year, the two words were "3D." After the 3D Gold Rush of 2009 (two of every piece of equipment our Sponsors make, thank you very much), after *Avatar* and Sony's NAB 2010 introduction of home 3D, eighteen months from now, how will you lure audiences out of their 3D-equipped home theaters and back into popcorn-popping and snack-selling multiplexes?

Recently, you noticed that every show at a major effects company in Northern California had been shot anamorphically. This past summer, you couldn't rent anamorphic lenses in Europe—they were all out on jobs. Who you gonna call? "2.39:1." That's your kid's AIM name. The kid can explain it: he's at USC Film School.

"Dude," he says, "…er, I mean, Dad…like the anamorphic format hasn't changed much since CinemaScope, when Twentieth Century-Fox bought the rights to the technique from Henri Jacques Chrétien in 1952 to produce *The Robe*, the first feature filmed with an anamorphic lens. It was promoted as 'the modern miracle you see without glasses,' to compete with the 3D movies being made at the time—and TV. *The Today Show* premiered that year."

"Hang on a second…son, dude man" you say. "You mean they were doing 3D in 1952?"

"You're the mogul. Like, didn't you read Lipton? The Golden Era of 3-D began in 1952 with the first color stereoscopic feature, *Bwana Devil,* projected dual strip, viewed with Polaroid glasses."

"Never mind 3D. How does anamorphic work?"

"In theaters, they use a 2:1 anamorphic projector lens that unsqueezes the image. You shoot with anamorphic lenses (that squeeze the image) onto 4-perf film, or you can shoot with spherical lenses in a cropped format onto 4-perf, 3-perf or 2-perf."

"What's cheapest?"

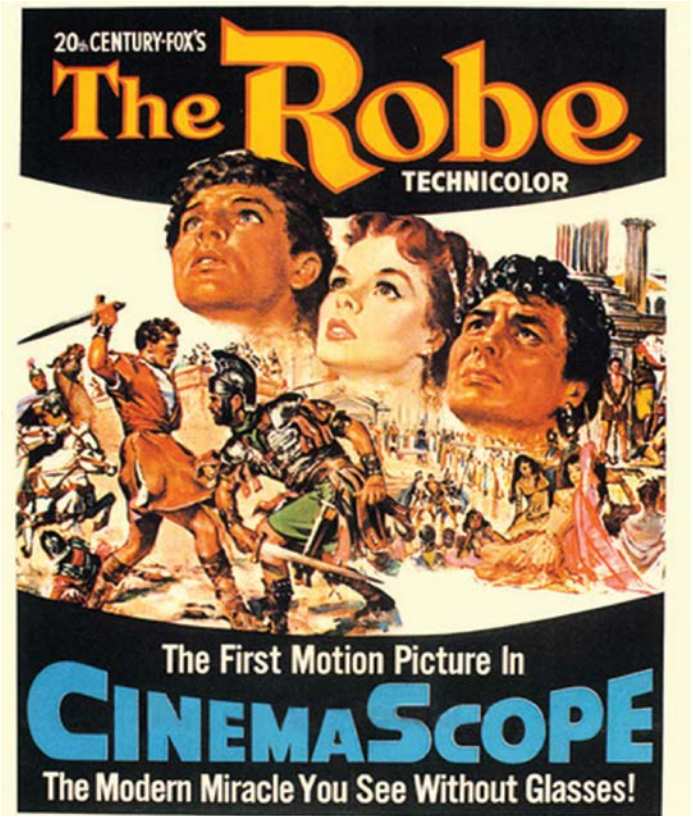
"Spoken like a true mogul. Ironically, even though anamorphic lenses are more expensive to rent, full-frame anamorphic can be cheaper because you don't need to do a Digital Intermediate like the other formats require. You can still do a DI if you want."

"Why would I want? It's all those overpriced DPs who want...from foreign countries you never heard of...and what's all this about the 'anamorphic look'—they all talk about the look?"

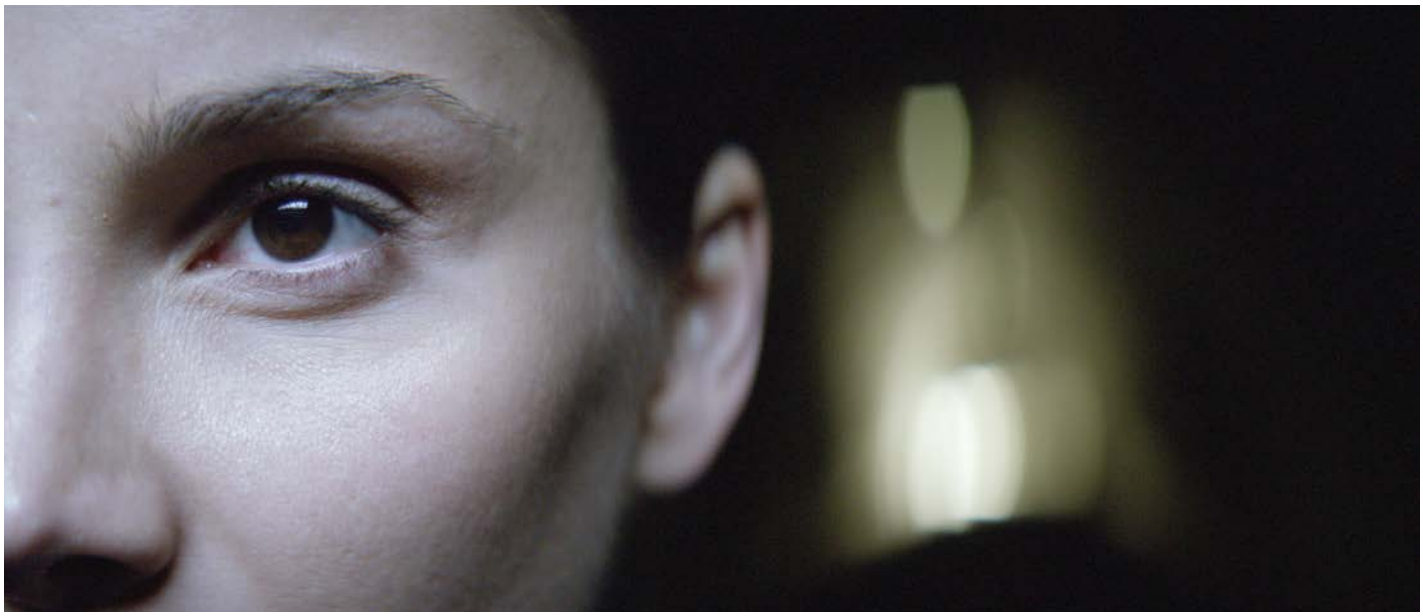
"Right on. There's something inexplicably enthralling about anamorphic lenses. It's an almost ephemeral quality akin to Cooke Look, Primo Power, Hawk Emotion, Zeiss Image, New Wave, or Film Noir, and it has nothing to do with the famous Blue Line lens flare or oval bokehs. If you're doing a big budget production, you're probably doing it anamorphic, with 4-perf, film."

"Hang on kid. Bokehs. Got it googled. Ok, why no Blue Lines?"

"Did you see Blue Lines or Oval out-of-focus highlights in the great anamorphic films *Ben Hur, The Robe,* or *The Wind and the Lion?* No. They're mostly Day Exterior Desert. No lines, no bokehs. Yet they still have an incredible, magical look. By the way, *Ben Hur* was shot in MGM Camera 65 anamorphic format, which was squeezed not 2x but 1.25x. That format became known as Ultra Panavision 70, and was used for classic films like *Mutiny on the Bounty* (1962), *How the West Was Won,* and others. The anamorphic look is equally at home in 1.25x, 1.3 and 2x squeeze ratios. Hey, that would make a great PhD thesis project. The visual psychology of the anamorphic look. Maybe anamorphic 3D. Dad, can you fund me for another four years in grad school?"



Anamorphic 2x and 1.3x



2x or 1.3x Squeeze

The most prevalent squeeze ratio has been 2x. Recently, 1.3x squeeze Hawk anamorphic lenses are being used on 3 perf and 16:9 sensors. The top image was shot with a Hawk V-Plus 65mm T3 Macro (2x squeeze ratio) at T4 on an Arriflex D-21—using its full frame, full 35mm format sensor. Notice the shallow depth of field, and the archetypal oval out-of-focus highlights (bokehs).

The lady with the chandelier in background *(bottom)* was filmed with a Hawk V-Lite 55mm at T2.2 (1.3x squeeze ratio) on an ARRICAM ST, 3 perf camera (24mm x 13.5mm gate). V-Lites have a modular anamorphic section, available in either the standard 2x squeeze or 1.3x. The oval bokehs are apparent; the big surprise is how similar they look to the out-of-focus highlights of a 2x anamorphic lens *(top)*. Images courtesy of Vantage Film.

So far, Vantage Film has designed and built 50 different anamorphic primes and 5 zooms in its Compact, V-Series, V-Plus, V-Lite and V-Lite16 Series, with about 600 lenses in use worldwide.

2.35, 2.39, or 2.40

If an anamorphic lens squeezes the image by 2:1, wouldn't you expect that after filling your 35mm Academy 1.37:1 aperture, the projected image would be double that: 2.74:1? Of course not! Anyone complaining about the many video formats that have come and gone in the past 50 years should subject themselves to an immersion in SMPTE film standards.

Initially there were no SMPTE anamorphic standards at all—prints were released in 2.55:1. SMPTE standardized the aperture in 1957 to 0.839" x 0.715" (1.17:1), which unsqueezed to 2.35:1.

1970 saw the height of the aperture shrink to make splices less noticeable: 0.838" x 0.700" (1.19:1), which projects at 2.39:1 (often called 2.40:1 in an attempt to round things out).

Finally, in August 1993, SMPTE standardized the 35mm common aperture width (0.825") for all widescreen formats, anamorphic and spherical. The anamorphic gate became 0.825" x 0.690" (1.19:1), with an unsqueezed projected ratio of 2.39:1.

Contempt

Jean-Luc Godard's 1963 *Contempt (le Mépris)* takes full advantage of the anamorphic format and Brigitte Bardot's bottom: from its opening shot, (below—that's the incomparable Raoul Coutard, AFC on camera, shooting in Franscop), and its revealing second shot (above) of a very nude Brigitte Bardot, pre-Búzios, reclining across the entire screen, through to the end shot, with cool Technicolor jumpsuits (next page).

Contempt stars Fritz Lang as himself and Jack Palance as the unforgettable producer Jeremy Prokosh, who hurls a film can like an Olympic discus.

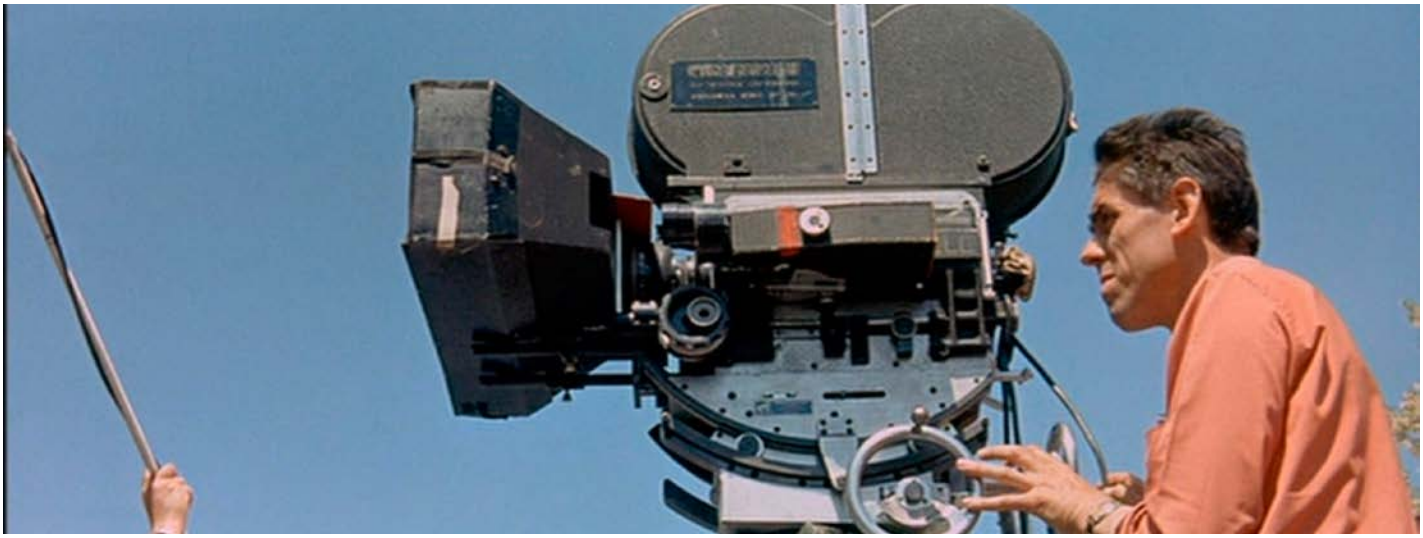
Now on DVD from Criterion, it's one of the great films about making films, shot in widescreen anamorphic splendor.

Terrence Rafferty wrote in the *New York Times:*

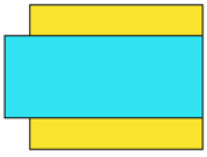
"When the picture, Mr. Godard's sixth feature, opened in France in 1963, admirers of his challenging, radically innovative previous work didn't quite know what to make of it. Based on an Alberto Moravia novel that the director dismissed (unfairly) as a 'nice, vulgar one for a train journey,' produced by Carlo Ponti and by Joseph E. Levine — two of the most powerful men in movies at that time, neither known as a patron of the arts — and starring, of all people, Brigitte Bardot, *Contempt* seemed at first a more conventional film than generally associated with Mr. Godard."

But that's not half the story. The Dartmouth Film Society religiously screened a pristine print of *Contempt* every year. Arthur Mayer had invited Joseph Levine to lecture in his film class a some years before I attended. *Contempt* was about to be released. Levine brought the film with him. Apparently Levine hated it. The students loved it. Legend has it that Levine said, "If you students like it so much, I'll give you the print if you promise to suffer through it once a year."

The other legend, as told by Arthur Mayer, upon whose 80 years of wisdom and every word we clung to, but which elicited occasional chortles from his loving wife Lillie who sat in on every class ("Oh Arthur, you know that isn't true") — was that Levine demanded that Godard shoot in widescreen anamorphic. Levine didn't like the rough cut because it didn't take advantage of (ahem) Bardot's assets. Godard, the mischief-maker, obliged with the famous second shot, as Bardot's anatomy unstretches in a lengthy anamoprhic 2x unsqueezed, almost endless take.



Contempt



Larger yellow box: Full frame, 4 perf anamorphic (squeezed) image on negative.

Blue rectangle: 3 perf, 2.39 Super-35 image (not squeezed) on negative.

The negative area of the anamorphic frame is 52% larger than Super-35. The anamorphic frame has the largest size of any 35mm format, and therefore, has the least grain.

There are a couple of ways of shooting for a widescreen 2.40 release: a traditional anamorphic negative (yellow box, below) where the camera lens squeezes the image, or Super-35 (blue blox) where speherical lenses are used.

2-Perf Aaton Penelope

1.85:1 4-perf

1. When you shoot Normal35, 4-perf Academy, 1.85:1, the picture area on the negative is 21 x 11.3mm, which is a tiny and wasteful 237mm².

1.85:1 3-perf

2. When you shoot 3-perf Super35, 1.85:1, the picture area is 24 x 13mm, which is a respectable 312mm². Note: apertures may vary by rental house.

2.35:1 2-perf Penelope for DI 4-perf release

3. 2-perf spherical centered can be used for almost any aspect ratio. Here it is with 2.35:1 for anamorphic release: 22 x 9.3mm, or 204mm²

4. After scanning 2-perf negative, we go to Digital Intermediate, 4-perf optically "squeezed" internegative and anamorphic projection release prints.

Focal Length (spherical or anamorphic)

Using 35mm format lenses on 16mm cameras, and why a 12mm lens is always a 12mm lens

Among life's many eternal truths, looming large is the lens law that explains why a 12mm PL mount lens is forever a 12mm lens. Whether it goes into an Arricam, Moviecam, Arriflex, Aaton or Panavized-PL 35mm format motion picture camera, or into a 16SR, 416 or Aaton 16mm format motion picture camera—it is always a 12mm lens.

Once upon a time, things were simpler. Bolex and Beaulieu 16mm lenses had "C" mounts, and you needed adapters to attach 35mm format lenses, most of which had Arri Standard or Bayonet mounts. Digital ⅔" cameras use a B4 mount, and ⅓" cameras use a smaller mount. But PL mounts accept both 35mm and 16mm format lenses.

Look at the lenses at right. The *top* one is a Cooke 12mm SK4 designed for 16mm format cinematography. The *next one below* is a Cooke 12mm S4/i lens designed for 35mm format cinematography. *Third from top* is a Zeiss Ultra 16 lens for 16mm format. *Bottom right* is a Zeiss Ultra Prime 8R made for 35mm format.

They all have PL lens mounts (54mm diameter, with a 52mm flange focal depth)—and fit into PL lens cavities on both 35mm and 16mm format cameras. But wait: many 16mm format lenses extend deeper or wider into the lens cavity and will scratch or break the mirror shutter—so, DO NOT ATTEMPT.

If we mount the 35mm format Cooke S4/i 12mm *(2nd from top)* on a 16mm camera, it gives us the same angle of view as the 16mm format Cooke SK4 12mm *(top)*. The angle of view stays the same on the same camera; you're just carrying around a lot more glass; the 35mm format lenses are larger; they have to cover a larger negative or imager. Of course, there are subtle design parameters.

In fact, for the longer focal lengths, Zeiss and Cooke encourage us to use their latest 35mm format lenses on Super16 cameras. From the specs at right, we can see that the manufacturers cover the wide end with specific Super16 format lenses, and leave the long end to the 35mm format lenses.

If we could mount the 16mm format lens *(top)* on a 35mm camera, what happens? It's still a 12mm lens. But you would see a round image in the center of the viewfinder because the Super16 format lenses are only designed to cover the diagonal of that format. It vignettes. It doesn't cover as big an area as 35mm. The diameter of the elements is physically smaller.

Remember, although the Cooke SK4 6mm, 9.5mm and 12mm are reported to stay clear of a 35mm camera's mirror shutter, please do this only with caution, careful testing and adult supervision at the rental house whose camera you're using. The Ultra 16 lenses, identified with a blue band, and most other 16mm format lenses do NOT clear the mirror shutter of 35mm cameras. A replacement mirror shutter costs about $22,000!

Suggestion. Make the following label for your 16mm PL mount lenses: "CAUTION: 16mm FORMAT ONLY."

Cooke SK4 12mm T2.0 Prime Lens for Super16 format

diagonal angle of view: 62°
horizontal angle of view: 55.1°
front diameter: 110mm
weight: 3.3 lbs / 1.5 kg

Set: 6mm, 9.5mm, 12mm

Cooke S4/i 12mm T2.0 Prime Lens for 35mm (Super35) format

diagonal angle of view: 103°
horizontal angle of view: 93.7°
front diameter: 156mm
weight: 6.5lbs / 3kg.

Set: 12, 14, 16, 18, 21, 25, 27, 32, 35, 40, 50, 65, 75, 100, 135, 150 and 180 mm

Zeiss Ultra 16 8mm T1.3 lens for Super16 format

horizontal (DIN) angle of view: 77.4°

front diameter: 95mm

weight: 2.2 lbs / 1 kg

Set: 6, 8, 9.5, 12, 14 mm

Zeiss Ultra Prime 8R T2.6 lens for 35mm (Super35) format

horizontal (DIN) angle of view: 112°

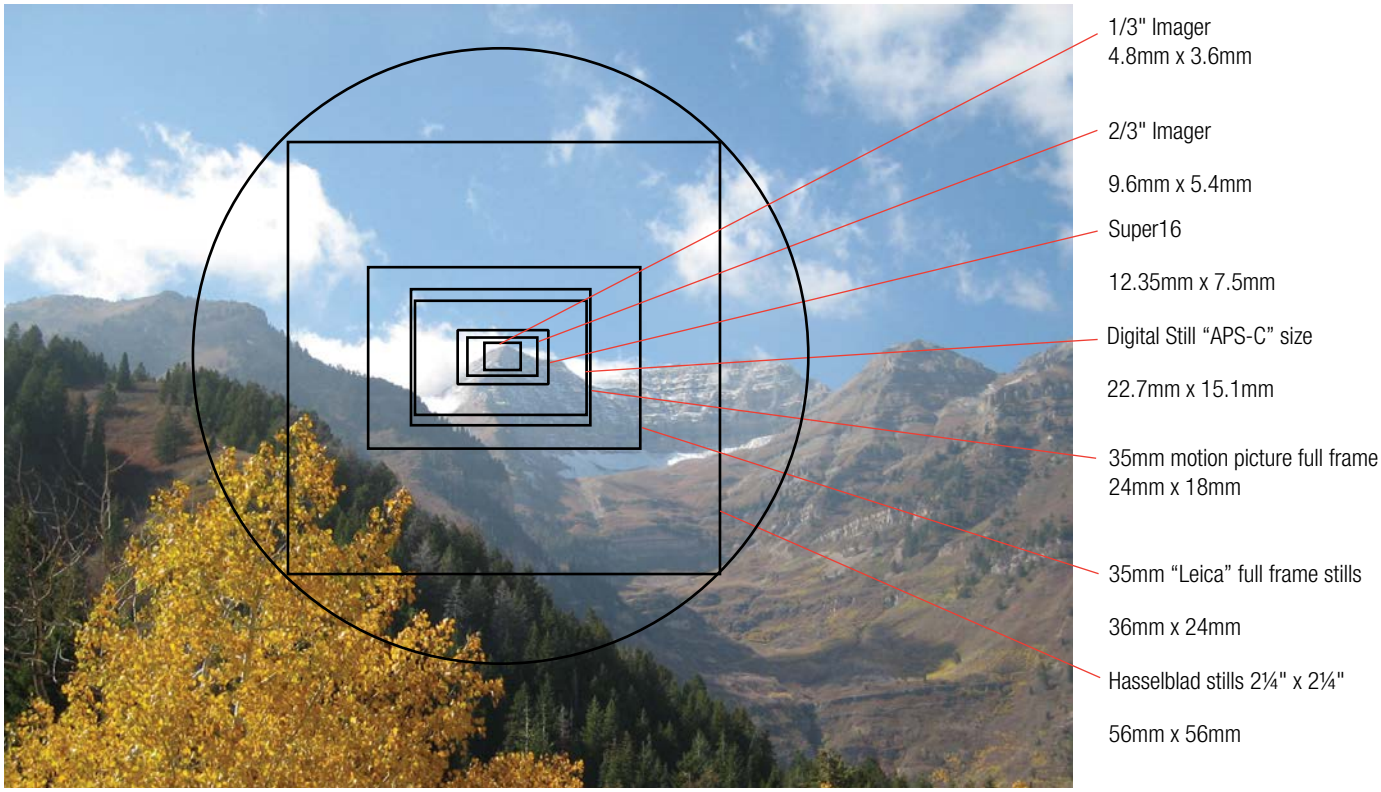
front diameter: 134mm

weight: 4.4lbs / 2kg

Set: 10, 12, 14, 16, 18, 20, 24, 28, 32, 40, 50, 65, 85, 100, 135, 180 mm

ARRI lens tool used to check whether the rear elements of a PL mounted lens will clear the mirror shutter. ARRI part number is ZMISC-PL/JIG. Very good to have. It's a simple block that slides over the back. The clear opening represents the mirror. It the lens comes through the opening, it will hit the mirror.

Photo: George Schmidt



In the photo of Mt. Timpanagos at Sundance, above, the black boxes show the actual image area for each format. The width and height of each format's film aperture or image sensor are noted to the right. If you placed the camera aperture or negative or groundglass or CCD imager on the picture, each would match the size of the box drawn for that format.

1. Lenses of the same focal length, no matter what format they were designed for, make the same size image at the film plane at the same distance from the camera.

If you measured the height of the mountain on the negative from a Hasselblad camera and found it to be ⅛" (3.2mm) tall, it would also be ⅛" tall on the 35mm Leica still camera negative, and ⅛" tall on the Super16 film negative, and ⅛" tall on the imagers and negatives of all the other formats. Where the format comes into play is that some formats are larger in physical size and some are smaller, thus "cropping" or "seeing" more or less area around the center.

2. Focal length is the distance from the optical center of the lens to the film or digital sensor when the lens is focused at infinity. That's a simplified definition.

The outer circle, above, defines the actual image that comes out of the back of a Hasselblad lens designed for the 2¼" x 2¼" film format. It's round because the lens is round. The square 2¼" x 2¼" image aperture lies within that circle. With some effort, you could build an adapter to put that same Hasselblad lens on cameras of all the other formats. A normal 80mm lens for the Hasselblad remains an 80mm lens for 35mm format and 16mm and so on. But, looking at the boxes, a smaller area of film or silicon is exposed for each successively smaller format, in turn yielding a successively narrower angle of view.

To calculate comparable angles of view, the math is:

new lens / old lens = new format diagonal / old format diagonal

So, if we're shooting with ⅔" DigiPrimes and want to calculate the comparable size in full frame 35mm, the ratio is 11/31, because the diagonal of the ⅔" CCD is 11mm and the diagonal of the full 35 film frame is 31mm.

If we're using a 40mm DigiPrime (⅔" format), and want the equivalent 35mm full frame size, the ratio is: 40/x = 11/31.

For those of us whose math is rusty, calculate this way: 11x=40*31, which is 1240/11, which is 113. So the equivalent lens of the 40mm in ⅔" format is a 113mm in 35mm format.

Shortcuts:

- to convert from ⅓" to Super35, multiply by 2.8
- from ⅓" to Super16, multiply by 2.3
- from Super16 to Super35 (full frame): multiply by 1.9

Diagonal measurements of formats

- ⅓" = 6mm diagonal
- ⅔" chip = 11mm diagonal
- 1" chip = 25mm diagonal
- Super 16 aperture =14mm diagonal
- Standard 35mm motion picture aperture = 27.05
- APS-C (digital still) = 29mm diagonal
- Full frame 35mm cine (silent aperture) = 31mm diagonal
- Full frame "Leica" 35mm still camera = 43.3 mm diagonal

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The Math of 4:3 and 16:9 Anamorphic Cinematography

Sensor size: 3392 x 2200 pixels
27.98 mm x 18.15 mm
(1.102" x 0.715")

Surround view: 3168 x 2200 pixels
26.14 mm x 18.15 mm
(1.029" x 0.715")

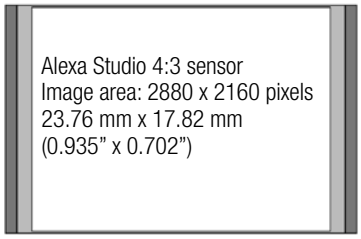
Image area: 2880 x 2160 pixels
23.76 mm x 17.82 mm
(0.935" x 0.702")

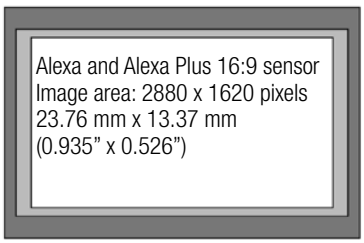
The official SMPTE anamorphic gate is 20.96 mm x 17.53 mm (0.825" x 0.690"). This is a 1.195:1 width to height ratio. (Multiply 1.195 by 2x and you get the projected width of 2.39.) To take advantage of Alexa's 17.82 mm sensor height, you could mark your groundglass with a 21.29 mm width (17.82 mm x 1.195).

4:3 2x

The news about forthcoming ZEISS anamorphic lenses calls for further comment. Currently, ARRI Alexa Studio is the only digital cine camera, besides the D-21, with a 35mm Full Aperture 4:3 sensor (4-perf format). Why is this important and why do I hear the collective clamoring for more 4:3 sensor cameras?

Most of the world's PL mount anamorphic lenses are designed with a standard 2x squeeze. Panavision, ARRI, Hawk 2x, the new ZEISS series...these anamorphic lenses all are intended for 4:3 (1.33:1) format—film or digital. They work by optically squeezing a 2.39:1 image horizontally onto the 4:3 sensor. When projected, the image is unsqueezed back to a widescreen aspect ratio of 2.39:1 (often rounded out to 2.4:1).

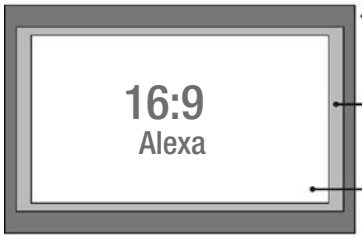




Above: Hawk V-Plus 180mm T3 2x anamorphic squeeze. Images courtesy Vantage Film.

16:9 2x

How will 16:9 sensor cameras like Sony F65, F3, FS100, Canon C300, Red Epic, Scarlet deal with 2.39:1 widescreen? Compose a 4:3 squeezed image onto the 16:9 format sensor. Your groundglass would have vertical pillars on left and right: you are using a smaller part of the sensor's image area. The picture is cropped (appears tighter) than the same image with the same lens on a 4:3 sensor camera. This has to be "blown up" more in DI or projection to fill the same size print or screen. It works—but you sacrifice resolution and familiar lens focal lengths.



Sensor size: 3392 x 2200 pixels
27.98 mm x 18.15 mm
(1.102" x 0.715")

Surround view: 3168 x 2200 pixels
26.14 mm x 14.70 mm
(1.029" x 0.579")

Image area: 2880 x 1620 pixels
23.76 mm x 13.37 mm
(0.935" x 0.526")

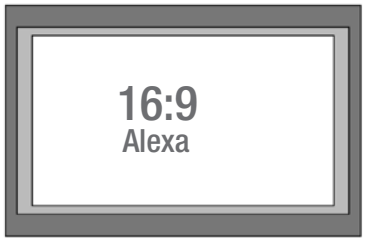
16:9 Spherical...Or you can shoot with regular lenses, but some say that isn't the hallowed "anamorphic look": an almost stereoscopic sense of depth from the combination of different horizontal and vertical focal lengths in one lens, with oval bokehs and shallow depth of field.

16:9 1.3x

Hawk 1.3x anamorphic lenses from Vantage Film offer another choice by "gently" squeezing the widescreen 2.39:1 image onto a 16:9 sensor. Bokehs and look are not exactly the same as 2x squeeze, but still very pleasing. The adventure continues.

Below: Hawk V-Lite 55mm 1.3x squeeze T2.2. Image courtesy of Vantage Film.

hanks
Ken Ro



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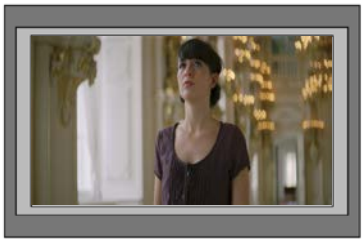


ARRI Alexa Studio and her 4:3 Sensor

This is a big deal: as we've belabored before, ARRI Alexa Studio is the only digital motion picture camera (besides the Arriflex D-21) with the equivalent of a full-frame 4-perf gate and optical finder.

ARRI Alexa Studio was shown at IBC in Amsterdam, and made her USA debut in Hollywood on October 8. Two working Alexa Studio cameras were set up in the ASC clubhouse for hands-on scrutiny. Richard Crudo, ASC opened the festivities with an introduction, followed by words from ARRI VP Bill Russell and ARRI Managing Director Franz Kraus.

Alexa Studio is the third sister in ARRI's latest family of 35mm digital motion picture cameras. This is the one with a spinning mirror shutter, optical finder and full frame 4:3 35mm sensor. Alexa Studio can accommodate 2x anamorphic widescreen as seamlessly as Arricams or Panaflexes. (16:9 sensors require either 1.3x squeeze or cropped sides.) And sure enough, one Alexa Studio had a Panavision Anamorphic G series 75mm lens with Panavision mount. The other Studio camera had a PL mount with a Hawk Anamorphic from Clairmont Camera.

Alexa Studio's spinning mirror shutter and optical viewfinder "feels" similar to an Arricam, but it's a new design. However, many existing groundglasses and eyepiece extenders will fit.

Farmous anamorphic films include *Apocalypse Now*, *Blade Runner*, *Chinatown*, the *Indiana Jones* films, *Alien*, *The Last Samurai,* and the latest *Star Trek* film.

Historically, anamorphic widescreen has followed every big wave of 3D. I think Alexa Studio will help history to be repeated again.

Above: Alexa Studio with Codex Onboard recorder at IBC.
Below: Bill Russell and Larry Parker with 75mm Panavision G Series Anamorphic.

ARRI ALEXA Studio Jumpstart

The new ALEXA Studio cameras have an adjustable mirror shutter, optical viewfinder, and 4:3 sensor.

Horizon level lock button and adjustment knob works just like the ARRIFLEX 435. In fact, the eyepiece design is similar to later generation 435 cameras

DIMMER for Frameglow brightness

Image plane, tape hook

REC Start and Stop recording button

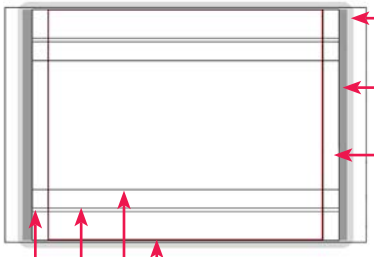
Handgrip rosette on left side of camera—and there's another one thoughtfully included on the right side as well.

VIEW: Push to start the mirror shutter spinning. Push again to stop the shutter. When you change lenses, it's a good idea to be sure the mirror has stopped to reduce chances of dust blowing onto the sensor, and to reduce chance of breaking it if you unwisely forgot that some lenses, like Optimo DP zooms, are not meant for mirror shutter cameras.

GATE: Push to clear the mirror shutter to check the gate, clean the sensor. Push again to start the mirror shutter spinning.

Both LEDs will glow when Mirror Shutter is spinning

ALEXA Studio 4:3 Sensor & Framelines



Optical Viewfinder surround view: 26.14 x 19.0 mm

Sensor surround view: 26.14 x 17.82 mm

ARRIRAW: 23.76 x 17.82 mm
4:3 (1.33:1) 2880 x 2160 pixels
Image circle Ø 29.70 mm

2.39:1 Anamorphic 2x
21.30 x 17.82 mm Ø 27.77 mm

2.39:1 Spherical (Flat)
23.76 x 9.95 mm Ø 25.76 mm

1.85:1 23.76 x 12.85 mm Ø 27.01 mm

1.78:1 23.76 x 13.37 mm Ø 27.26 mm

Groundglass

The metal frames holding ALEXA Studio groundglasses and glow masks are the same as the ones used in ARRICAM film cameras.

However, the dimensions of ALEXA's scribed frame lines are ever so slightly different than ARRICAM's. We're talking about the difference of the width of a line, so...

The good news is that 2.39:1 Anamorphic 2x squeeze framelines are the same on both cameras: 21.30 x 17.82 mm

ALEXA Groundglass	ARRICAM Groundglass
Image Area 4:3 23.76 x 17.82 mm	Camera Aperture 4:3 24.9 x 18.6 mm
	ANSI S35 projected area 1.33 (Silent) 24 x 18 mm
2.39:1 Spherical 23.76 x 9.95 mm	Clairmont 2.39:1 Spherical 24 x 10 mm
2.39:1 Anamorphic (2x) 21.30 x 17.82 mm	2.39:1 Anamorphic (2x) 21.3 x 17.82 mm
	Of course, there are these for ARRICAM as well:
	2.35:1 Anamorphic (2x) 21.3 x 18.0 mm
	2.40:1 Anamoprhic (2x) 21.30 x 17.74 mm

The Importance of Being Anamorphic

Above: Albert Dieudonné in Abel Gance's *Napoleon*

Cinematographer Denis Rouden on Place Vendôme with Alexa Studio 4:3, Codex, Hawk 80mm anamorphic—supplied by TSF. Denis' anamorphic homage glides gracefully through Paris at magic hour and night time, handheld and from the back of motorbikes, very nouvelle-vague. The short was screened at Micro Salon.

In her article "*Napoleon* Is Lost, Long Live *Napoleon!*" Manohla Dargis wrote in the New York Times on March 16, 2012:

"Soon after Abel Gance's *Napoleon* had its premiere in Paris in 1927, he wrote a letter to his audience, soliciting open eyes and hearts. 'I have made,' he wrote, 'a tangible effort toward a somewhat richer and more elevated form of cinema.' He had created a film towering in ambition, scale, cost, narrative and technical innovations, and believed that nothing less than 'the future of the cinema' was at stake. His audacity had merit. The origins of the widescreen image can be traced to *Napoleon*, which also featured hand-held camerawork, eye-blink-fast editing, gorgeous tints, densely layered superimpositions and images shot from a pendulum, a sled, a bicycle and a galloping horse.

"The film was an astonishment...specifically a process later called Polyvision that extended the visual plane into a panorama of three separate images and that required three screens to show it."

Cinema was young, and so was Gance. "He burned with ambition for both the art and his film. He wanted viewers not simply to watch *Napoleon,* but also to become participants in a revolution of his making. To that end he liberated the camera, setting it in almost constant motion. He sought a similar immersion with Polyvision, which tripled the image size. For one critic these enlarged visuals meant that the 'spectators suddenly became a crowd watching a crowd'; they also helped inspire Henri Chrétien to invent CinemaScope."

Marc Shipman-Mueller follows the trail in his excellent ARRI Alexa Anamorphic De-squeeze white paper: "Henri Chrétien saw Abel Gance's *Napoleon*, which consisted in the original of three side-by-side screens. While this technically was not (anamorphic) widescreen projection, as mostly different images were shown on the three screens, it convinced Mr. Chrétien of a bright future for widescreen cinema captured with his anamorphic lenses. He attempted to convince European and US studios of the merit of this idea, but in 1927 he was decades ahead of his time. The prototypes of his Hypergonar anamorphic lenses were forgotten for the next 25 years.

"In their search for...widescreen cinema, the studios remembered Monsieur Chrétien. Twentieth Century Fox was the first to reach him in Paris. They bought his Hypergonar prototypes, trademarked the whole process as 'CinemaScope' and proceeded to change the shooting of a sword and sandals epic, *The Robe* (1953), which was to become the first film shot in CinemaScope.

"By squeezing a widescreen image onto a standard piece of 35mm film, the anamorphic process allowed for the continued use of existing cameras, post production processes and projectors. Only the taking and projection lenses had to be changed from spherical to anamorphic. Since then, many movies have been shot using anamorphic lenses, including *Apocalypse Now* (1979), *Blade Runner* (1982), *Chinatown* (1974), *Dances with Wolves* (1990), *Indiana Jones* (1984, 1989, 2008), *Jaws* (1975), *Mission Impossible* (1996, 2000), *The Last Samurai* (2003), *Star Wars 1, 4, 5, 6* (1977 - 1999), just to name a few.

"Since patents for the anamorphic process had already run out by 1952, Twentieth Century Fox trademarked the term 'CinemaScope'. In the beginning, they were the only ones in possession of anamorphic lenses. The use of their lenses and the CinemaScope trademark, which in the public eye became synonymous with widescreen movies, was linked to licensing fees. This led to the development of other anamorphic lenses and a number of competing widescreen processes, some anamorphic and some spherical, some using 35 mm film and others using larger gauges.

ARRI Alexa Plus 4:3

4:3 (ALEXA Plus 4:3, ALEXA M, and ALEXA Studio)

Sensor Size 3392 x 2200 Photosites (1.54: 1)
27.98 x 18.15 mm, Ø 33.352 mm

Surround View Optical Viewfinder (Studio only, 1.38:1)
26.14 x 19.0 mm, Ø 32.32 mm

Surround View EVF-1/MON OUT 3168 x 2160 Photosites (1.47:1)
26.14 x 17.82 mm, Ø 31.64 mm

ARRIRAW 2880 x 2160 Photosites (1.33:1)
23.76 x 17.82 mm
Image circle Ø 29.70 mm

16:9 (ALEXA, ALEXA Plus, ALEXA Plus 4:3, ALEXA M, and ALEXA Studio)

Sensor Size 3392 x 2200 Photosites (1.54: 1)
27.98 x 18.15 mm, Ø 33.352 mm

Surround View Optical Viewfinder (Studio only, 1.38:1)
26.14 x 19.0 mm, Ø 32.32 mm

Surround View EVF-1/MON OUT 3168 x 1782 Photosites (1.78:1)
26.14 x 14.70 mm, Ø 29.99 mm

ARRIRAW 2880 x 1620 Photosites (1.78:1)
23.76 x 13.37 mm
Image circle Ø 27.26 mm

"These competing processes were given more or less creative names like Scanoscope, SuperScope, Techniscope, Arnoldscope, Grandscope and SuperTotalscope. Technically CinemaScope is a Fox trademark rather than a description for the anamorphic process, even though they are often used interchangeably. Sometimes, simply the shortened term 'Scope' is used."

Jump cut to NAB 2012. ARRI spawns another Alexa sibling: Alexa Plus 4:3. She joins Alexa Studio and Alexa M as members of the family with 4:3 (4-perf size) sensors.

Shooting 4:3 format with 2x anamorphic lenses for 2.39:1 (aka 2.4:1 and 2.40:1) widescreen distribution squeezes the horizontal image in half. The aspect ratio on the sensor, or film, is 1.195:1. (aka 1.2:1).

Most current digital sensors are natively 16:9 or wider. Since 2x anamorphic shooting on 16:9 is like fitting a 1.2:1 almost-square box inside a 16:9 rectangle, you wind up croping the sides of the 16:9 sensor. This results in a much smaller "exposed" sensor area and a cropped, tighter angle of view.

Alexa Studio, M, and now Plus 4:3 let you shoot anamorphic in the full 4:3 aspect ratio. This is big news.

Additional news for 2012: ARRI has announced new features for the Alexas, including ProRes 4:3, ProRes 2K, DNxHD 444, vertical image mirroring for upside-down camera stabilizers, post-trigger, card-spanning and Cooke /i Technology support.

ARRI/ZEISS Master Anamorphic Primes

Focal Length	T-stop	Close Focus (2)	Magnifica-tion Ratio (3)	Length fr Lens Mount (4)	Length fr Image Plane (5)	Front Diameter (6)	Maximum Barrel Diameter	Weight (Kg) (lb)	Entrance Pupil (7) (mm)	Entrance Pupil (6) (inch)	Angle of view H - V Super 35 'Scope (8) ID = 29.26 mm (9)
35 mm	T1.9	0.75 m 2'6"	H: 1:32.3 V: 1:16.1	182 mm 7.2"	234 mm 9.2"	95 mm 3.7"	114 mm / 4.5"	~3 ~6.6	178.7	7.040	65.47° - 29.91°
40 mm	T1.9	0.75 m 2'6"	tbd	182 mm / 7.2"	234 mm 9.2"	95 mm 3.7"	114 mm / 4.5"	~3 ~6.6	tbd	tbd	58.72° - 26.31°
50 mm	T1.9	0.75 m 2'6"	H: 1:22.2 V: 1: 11.1	182 mm / 7.2"	234 mm 9.2"	95 mm 3.7"	114 mm / 4.5"	~3 ~6.6	171.5	6.75	48.46° - 21.18°
60 mm	T1.9	0.90 m 3'	tbd	182 mm / 7.2"	234 mm /9.2"	95 mm 3.7"	114 mm / 4.5"	~3 ~6.6	tbd	tbd	41.11° - 17.71°
75 mm	T1.9	0.90 m 3'	H: 1:19.6 V: 1: 9.8	182 mm / 7.2"	234 mm 9.2"	95 mm 3.7"	114 mm / 4.5"	~3 ~6.6	136.7	5.380	33.40° - 14.21°
100 mm	T1.9	1.20 m 4'	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	25.36° - 10.68°
135 mm	T1.9	1.50 m 5'	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	18.92° - 7.92°

All lenses have PL-LDS 54 mm diameter stainless steel lens mount with Lens Data System (LDS) contacts. Flange focal depth 52 mm.

All lenses have apertures of T1.9-T22.

(2) Close focus is measured from the image plane.

(3) Magnification ratio (eg: 1:32.2) is the relationship of the size of an object on the image plane (the first number, eg:1) to the size of that object in real life (second number, eg: 32.3) at the close focus setting; Horizontal (H) and Vertical (V). So in the example of 1:32.2, the horizontal image in real life is about 3 times smaller than the size of the camera's sensor or aperture.

(4) Length measured from the lens mount to the front of the lens barrel.

(5) Length measured from the image plane to the front of the lens barrel.

(6) Diameter of the lens barrel where it comes in contact with the mattebox. This is the measurement of the lens donut you will use.

(7) The distance from the entrance pupil to the image plane at infinity focus. Positive numbers indicate an entrance pupil in front, negative numbers indicate an entrance pupil behind the image plane.

The entrance pupil is the center of perspective. Panning or tilting the camera/lens system while centered around the entrance pupil prevents parallax shifts. Useful to know for special effects work.

(8) Horizontal (H) and Vertical (V) angles of view for a Super 35 'Scope camera aperture (dimensions 22.5 x 18.7 mm / 0.8858" x 0.7362")

(9) Image diameter (ID) is 29.26 mm. This is also known as the image circle.

MA Master Anamorphics 2.39:1

ARRI lens product manager Thorsten Meywald is racking up lots of frequent flyer miles lately. He called in from Beijing hours before we went to press with some eagerly-awaited and partially unexpected information on new anamorphic lenses. For the past year, Film and Digital Times has been harping on—belaboring—the rapid resurgence of anamorphic cinematography on 4:3 sensors. And suddenly they appear to be affordable.

ARRI/ZEISS anamorphic prototypes have been seen for the past three years, as Marc Shipman-Mueller, Thorsten Meywald and others grilled many of us on look, feel, myth and reality of the legendary anamorphic look. But there prevailed a sense of gloom and doom because the projected numbers of potential customers were puny while the estimated costs were prohibitive, even for the most powerful potentates of the world's rental kingdoms.

You can therefore imagine the loud crash of my telephone dropping to the floor when Thorsten announced the targeted price. More on that later. Film and Digital Times is supposed to appeal to the loftier ideals of technique, technology and damn the price. The price will be around 30,000 Euros (currently $37,500) each for most lenses. There. That's said.

Several things have changed in the past three years to make anamorphic more affordable: more 4:3 digital cameras and ARRI's announcement, at this IBC, of 4:3 ProRes anamorphic recording onto its internal SxS PRO cards.

The new ARRI/ZEISS Master Anamorphic Prime Lenses are a combined effort of the long-time design, technical and marketing partnership between Munich and Oberkochen. ARRI will handle exclusive marketing worldwide, and retains the official brand name, "ARRI Master Anamorphic," as they do with ARRI Master Prime and ARRI Ultra Prime. The lens barrels show the partnership: ARRI and ZEISS.

At IBC, both ARRI and ZEISS will have working prototypes of the new 50 mm T1.9 Anamorphic lens on ARRI Alexa Studio cameras in their booths. The new lens is smaller and lighter than the blue-barreled concept model we saw at NAB. We'll also see mockups of the new 35 mm Anamorphic.

The look of these lenses is also a nice surprise. Thorsten explained, "We designed these lenses completely from scratch. Bokehs are determined by optical design, contrast, and other factors. Sometimes the out of focus area is more important. These lenses have a pleasing anamorphic oval bokeh. The Master Anamorphic lenses do not look clinical. In addition to superb design, they have optimized anamorphic bokehs: oval highlights. To get a perfect oval, you need a lot of blades. The Master Anamorphics have irises with 15 blades. Master Primes have 11 blades."

Thorsten worked for many years at Schneider, so he's no slouch at explaining optics. "When you have an odd number of iris blades, the light rays are doubled. So a 15-bladed iris gives us 30 light rays. A 14-bladed iris will only give us 14 rays.

"With our Master Anamorphics, there are no lines or patterns inside the bokehs. These can occur when you polish aspheric elements. The MRF (Magneto Rheological Finishing) process that ZEISS uses is able to eliminate these textures.

"Designing anamorphics is like putting two different lenses into one barrel. For example, a 50 mm anamorphic will have the vertical characteristics of a 50 mm spherical lens and the horizontal characteristics of a 25 mm. When you think about designing such a lens, there are essentially two completely different focus mechanisms. Both have to be combined. A new focusing mechanism has been designed to travel different distances at the same time; it is mechanically quite advanced.

Many anamorphic lenses in the past were made from a prime lens with a cylindrical element added in front. This creates oval bokehs. Most anamorphic zoom lenses have cylindrical elements at the rear. With a rear anamorphoser, you get round bokehs and the depth of field is the same as a comparable spherical lens.

Thorsten continued, "The ARRI/ZEISS anamorphic primes are color matched with the rest of the family: Master Primes, Ultra Primes and Alura Zooms. The anamorphic squeezing is done by 'spreading' the cylindrical element around throughout the lens—not in front, not in back, but in several places. They are not based on existing lenses."

And they have streaks. BLUE STREAKS!

Thorsten provided some blue streak history. "C-series lenses provided the most classic blue streaks. G-series lenses give you a blue line, but it's sometimes reduced. These streaks come mostly from reflections off the front cylinder." You can enhance or add blue streaks with Blue-Vision filters from Vantage, Tiffen Streaks, and Optefex Blue Streak filters.

Master Anamorphics have a blue line, but because the cylinders are spread inside the lens, you can control the effect more precisely. You will be able to create a blue line evenly across the frame when a point source is aimed at a pre-determined angle. You won't get uncontrolled flares. You can also get a predominantly horizontal streak along with a reduced vertical one.

Geometric distortion will be low—around the same level as the Master Prime spherical lenses. Anamorphic distortion typically has been 6 - 12%.

Anamorphic lenses have often gone to great lengths to avoid severe image breathing and mumps. Mumps are vertical distortions. For example, when you focus from infinity to 4 feet, a person's face tends to become fat as you focus closer. These Master Anamorphics are expected to be as good as Master Primes when it comes to breathlessness and lack of mumps.

The Master Anamorphics were designed with digital cameras in mind. They are nearly telecentric (parallel rays) with minimal color fringing and shading (vignetting) at the corners.

There are rumors of work or partnerships on a zoom or zooms.

Here's the current road map. Prototypes of the 35, 50 and 75 mm Master Anamorphic lenses at NAB 2013. Delivery by Cine Gear 2013. Prototype of 100 mm around Cine Gear. Introduction of 40, 60 and 135 mm at IBC 2013. Delivery of full set by end of 2013.

The lenses will be available to purchase from ARRI and their distributors worldwide.

They will be ready to rent from the usual suspects, who, I suspect, will no longer have any reason to complain about the price. Did we mention price? ☐

Hawk Anamorphic Lenses

Wolfgang Bäumler and Peter Märtin met in a sandbox when they were five, and have been playing together ever since. In 1993, they founded Vantage Film in their hometown of Weiden, which is about 1.5 hours north of Munich. Vantage is a full service rental company for motion picture cameras and lenses, with offices in Weiden, Berlin, Prague and Paris. When they couldn't buy anamorphic lenses, they began building their own. The rest is history. Their Hawk anamorphic lenses have been major players on PL cameras for the past 17 years. Historically, after every wave of 3D there has been a surge in widescreen production. So, 2012 should be a very good year for anamorphic cinematography.

Once upon a time, before 1953, films were mostly shot in a 1.33:1 (4:3) ratio. TV arrived. To get viewers off their La-Z-Boys and back into the theatres, studios and exhibitors stretched the screens wider: 1.66:1, 1.85:1, and 2.40:1. 2.40:1 is 2.40 times wider than it is high. And yes, widescreen has also been defined in hair's breadth variations as 2.35:1, 2.39:1.

You can capture 2.40:1 widescreen images on film or digital sensors using either spherical or anamorphic lenses. With spherical lenses, the image is shaped like a Band-Aid and occupies a relatively small area on the original negative or digital sensor. A lot of the top and bottom of each frame is "wasted:" cropped or letterboxed out.

With anamorphic lenses, the width of the picture is squeezed (left and right) to fit the sensor or film aperture. This lets you use the entire image capture area, without letterboxing, and the result is a picture with less grain or less noise. This was one of the original reasons why anamorphic ("scope") was developed in the 1950s.

It turns out that anamorphic lenses have other advantages. They use cylindrical elements to squeeze the image in one axis only—the width, not the height. That means an anamorphic lens has a different focal length for the horizontal part of the image and another focal length for the vertical. The longer focal length number is the vertical. Also, the lens has two nodal points (the nodal point is where all the light beams converge inside the lens.) One nodal point is for the horizontal part of the light rays, and the other nodal point, which is in a different place, is for the vertical light rays. This recording of the image in a kind-of three-dimensional way may be part of the magic of the anamorphic look.

Peter Märtin explains, "The anamorphic look is very elegant. It is not a technical, objective lens that records everything as it is. Instead, it is subjective. It changes the scene a little bit. It gives you a wider panorama with a pleasing, shallower depth of field. You get oval bokehs (out of focus highlights). Faces have a beautiful, appealing, cosmetic look. Actors appear more separated from the background. Actors' faces are full, rounded—not flat. If you use a long (telephoto) spherical lens, normally the face gets flattened, which may not be flattering. The anamorphic lens gives you depth that's very pleasing. Many cinematographers are using anamorphic lenses mainly because they look so beautiful for faces."

For example, if you were shooting a 100 mm portrait with a spherical lens, and wanted to match the vertical angle with an anamorphic, you'd pick a 100 mm anamorphic. But the horizontal view would be equivalent to a 50 mm spherical lens—much wider.

If you want the same horizontal (left to right) field of view, you'd have to choose a 200 mm anamorphic lens to match the horizontal angle of a 100 mm spherical. But, you'd be seriously cropping the vertical axis, because the vertical angle of the anamorphic is the same as the spherical (200 mm).

It's easiest to think in terms of the vertical when choosing an anamorphic lens. If you're a focus puller calculating the depth of field, but misplaced your anamorphic depth of field chart, you can take a spherical chart, choose the named focal length, and then compensate to be on the safe side. You can count on having a bit less depth of field. The depth of field of a 50 mm anamorphic lens is between a 25 mm and 50 mm spherical.

Wolfgang Bäumler comments, "The anamorphic look, I would say, is a more cinematographic look than shooting spherical. Anamorphic 35mm or digital looks a little bit like 65mm without having all the disadvantages of using 65mm with its big, huge camera, big lenses, even less depth of field. With 35mm anamorphic, you really get the advantage of an image that has nearly the best quality you can get without using 65mm.

"And I think it's very cinematographic because you can separate the foreground from the background. You can really isolate the actor from the surroundings. You get a very nice out of focus area. A cinematographer once described it as a painting in the background. The colors are just flowing."

Wolfgang and Peter are life-long cinematographers and filmmakers. When Peter was 7, his grandfather gave him a Super 8 camera. Peter, his brothers, and Wolfgang began making feature length home movies.

Peter remembers, "When you bought one 15 meter Eastman Kodak Super 8 reversal film cassette, it would last 3.5 minutes. It came with a small yellow envelope, addressed to Kodak Laboratory Stuttgart. There was a place where you put your return address. You mailed the envelope. The postage was pre-paid. It took 2 weeks for them to open the cassette, process it, put the film onto a spool, and use the same envelope where you wrote your address to send it back. We lived in a house with a post box on the ground floor. The post box had a small window through which you could see the letters inside. Since processing took 2 weeks, during the first week I did nothing. During the second week I would always go downstairs to look through the window. If I saw orange inside, I knew the Kodak film was back and we should put it in a projector for viewing. It was a very nice experience. When we viewed those 3.5 minutes of film the first time, it seemed to take much longer than viewing it the second or third time.

"I learned about filmmaking at an early age. I continued and

wanted to understand the process completely. Once I fully understand something I like to go to the next step. Wolfgang lived in the house next door. That was convenient. He joined my brothers and me making films. We built a lot of our equipment."

Wolfgang adds, "In high school, we started doing some short films in 16mm. We had a Beaulieu R-16 with a Schneider 18-90 mm C-mount lens, and a 60 meter magazine. Since this camera was very expensive for us, we couldn't afford a tripod. So we started to make our own tripods and heads. Peter's father had an engineering company for metal work with a big machine shop, drills, lathes, and all that stuff. We worked together on weekends when the factory was empty. We built low, medium, and high tripods. We made a very simple gear head. But it worked. We made a dolly with tracks. Friends of ours helped with our short films. After a while, we got more experienced in shooting. Eventually we offered our services to local companies to do commercials. Then we bought an Arriflex 35 2-A 35mm camera. Peter directed and I did the cinematography. We did the lighting together. Editing and sound—we did that together as well. We bought a Steenbeck."

Peter says, "We built a lot of accessories in order to save money. That funny gear-head now sits in the museum of Vantage and Hawk. My father was an influence. For four generations, our family had a firm that built special machines for the glass and dry-cleaning industries. I grew up in an atmosphere where you got an order, you made plans, you bought raw materials, and you built something. That was normal for me. Every day new steel arrived at the company, and I watched how the steel was cut into pieces, shaped, fabricated, and welded. To start with something from scratch and go a long way to get the finished product is something I have seen all my childhood. The experience with film was similar. Because the film industry is relatively small, you always have to invent something when it's not there.

"I was working with a cinematographer from Latvia, Janis Milbrets, on a 35mm film production. I was the first AC and he was cameraman on the second unit for special effects filming. I told him that I liked anamorphic lenses. Over the next year we built up a friendship. Then, he introduced us to our lens designer, Dr. Ing. Anatoly B. Agourok. Wolfgang and I plan the concepts and designs. We start on paper. Next come the optical calculations. We manufacture the lenses right here in Germany. For infrastructure, we have our rental company, Vantage Film, and ship anywhere. Our local FedEx driver is very busy. We also sell the lenses worldwide.

Early on, we wanted to work with anamorphic lenses. But it was hard to get them. Nobody would rent them to us. Panavision, no chance. Technovision, Joe Dunton lenses were always busy. Even the ArriScopes were always rented out. We figured if they were that hard to get, maybe we should build our own."

The new lenses were named "Hawk." The first C series set consisted of five lenses: 35, 40, 50, 75, and 100 mm—and their first major feature was *Star Wars Episode One: Phantom Menace*.

The V-Series were introduced in 2001, the V-Plus Series in 2007, and the V-Lites in 2008. The V-Plus series of 2x anamorphics consists of 35, 40, 50, 65, 75, 85, 100, 120, 135, and 150 mm.

The V-Lites, with interchangeable 1.3x or 2x modules, come in 20, 24, 28, 35, 45, 55, 65, 80, 110, and 140 mm. Most apertures on both sets open to T2.2. Zooms include the new Hawk Front

Anamorphic Zooms V-Plus 30–60 mm T2.8, 45–90 mm T 2.8, and 80–180 mm T 2.8, all with close focus capability. The new zoom lenses are available in 1.3x and 2x squeeze.

More than 850 Hawk anamorphic lenses—120 sets—have been built. Peter elaborated, "Anyone interested in Hawks, whether to buy or rent, can be confident knowing we are their partner with worldwide repair, parts, and replacements. This is reassuring if your production needs service or you simply want to add to or subtract from the package you're shooting with. The anamorphic world is an exclusive club—and our large inventory and spares keep you confidently supported.

"A lot of anamorphic lenses exhibit dramatic breathing. Mostly it's in the vertical direction, which is more apparent to the audience. It's also very noticeable along the edges of the frame. What we have is a different direction of breathing. We breathe towards the horizontal edges, which are less noticeable. And we reduce the breathing, for example, on our long telephoto zoom, from the original optical calculation of 20% to 4%. We don't reduce it to 0%, because even 4% is not noticeable. If you want to reduce it completely, you have to add elements and make it more complex.

"Our iris blades make a perfect circle. The iris circle influences the way the lens photographs the out of focus areas. You can easily show this if you shoot a headlight or a flashlight and if you have a six iris blade lens, then you'll see the shape of the iris. For us it's important not only when it is in focus, but also when it is out. If you look at images, often the larger part of the image is out of focus. When you think of lens design, you should consider the out of focus characteristics. The geometry of the iris is one of the factors to consider. We use irises with 14, 15, and 18 blades. Furthermore, our irises are coated very matte black on a very reliable surface for minimum internal reflection.

"The Hawk focus scales are non-linear in order to squeeze the close focus marks and to stretch the far end toward infinity. Most of the Hawks have a cam-follower focus mechanisms. Focus scales are normally logarithmic. With an unsqueezed close-focus scale, as you get closer, you would have to turn the barrel a greater distance—which is not needed. With an unstretched far end, the numbers are too close together. On a stretched and squeezed focus scale, for example, if you pull focus from infinity to two feet, when you look at the focus element, it appears to be speeding up as you focus closer. This involves designing the focus element with cam followers. When we look back to the '80s and early '90s, lenses mostly used a threaded focus mechanism manufactured to high precision with brass barrels, but they didn't have the squeezed or stretched focus scales."

Why We Make Hawks the Way We Do

In the middle ages, the "Golden Street" was a major road between Paris and Prague, by way of Nurnberg. One of the major stops was Weiden—these days, the home of Vantage Film. That's apt, since Vantage has offices in Prague and Paris, with headquarters in Weiden—about 2 hours north of Munich, 2 hours west of Prague, 3 hours south of Berlin.

Peter Märtin (left) and Wolfgang Bäumler are the owners of Vantage, the camera rental company and manufacturer of Hawk lenses. They both began as camera assistants and cinematographers, so they know a thing or two about lenses, cameras, cases, shipping, organizing and above all, the ingredients of the anamoprhic look.

by Peter Märtin

If you want to design new lenses, you have to consider the characteristics of the format for which it will be used. You have to separate problems from the things you want to protect or enhance. For example, if you are renovating an old church, you probably don't want to do it too perfectly. Maybe you see an old stone wall or an old gate and you say, "It's not perfect—but of course, that's the beauty of it." We are very deliberate about where there is room for improvement. Perhaps speed, close focus, size of the lenses, definition at the top, bottom and the corners, matching lens sets, and so on. There is always room to improve, but we also recognize what not to touch and what to leave alone so as not to lose character.

The idea behind Hawk Anamorphic Lenses

We design and build Hawk Anamorphic Lenses. Most lenses today are really good. For us to have followed the same path of just making new lenses sharper and better was not sufficient. A sharper lens on its own is not automatically a nice, new tool for a cinematographer. Of course, sharpness is good to have, and our Hawk lenses have very good definition and sharpness.

When we started in the '90s, more than 40 years had already gone into development of anamorphic lenses. Panavision did the major part of that. But things were still lacking. Lenses did not focus close enough, they were too big, and you could see focus falling off quite easily. we wanted to improve those things. For us, it was more important to make smaller lenses than faster ones.

An anamorphic lens, with its "squeezing" cylinder, develops a "fingerprint" which is unique. We try to keep that in our designs. When we see elliptical bokehs or slightly curved geometry, we don't regard them as defects that have to be eliminated. On the contrary, we understand that those are part of the language of anamorphic.

If you photograph with spherical lenses, the image can seem flat and without surprises. So if you want to build a new spherical lens, maybe you design it to be sharper in the corners, or faster. When you put an anamorphic lens on a lens projector, you think, "Ah, we have curvature here, and look at those corners. They are softer."

There's a difference between what rental houses do and what most cinematographers do. The first thing a rental house does is to take a new anamorphic lens, put it on their lens projector and then start looking for the aberrations. But what does the image look like?

It's similar to a painter worrying more about buying the canvas or paint. In our world as a manufacturer of anamorphic lenses, we are in contact with the cinematographers, and most of them just do the tests. They rarely look at the lens on a projector. The assistants do because they want to check the focus scales and want to hand-pick some lenses. But the cinematographer wants to see the results.

Anamorphic is like a roller coaster. When watching an anamorphic film you probably would not be obsessing over line pairs in the very far corners of the screen. You are, hopefully, immersed in the story and the dazzling widescreen cinematography. You would just be embraced by the image.

Hawk Anamorphic Lenses

We have to recognize and accept that audiences love the famous anamorphic films out there. Those were all made on classic anamorphic lenses. We applaud those pleasing qualities. Maybe it's the curvature or a little bit of fall-off in the corners. As a designer, if you try to improve it, you have to be careful not to improve everything. Otherwise you risk losing the anamorphic fingerprint.

The Anamorphic Look

If I were to define the anamorphic look, it's emphasizing the in-focus part of the image because there's a bigger separation of the out-of-focus. So it automatically looks sharper and crisper. It's very appealing to the eye. The eye likes to be cued what is in-focus and what's not. If it's Super35 and shot in spherical, then the eye may start to search, looking for the area of maximum sharpness. Maybe you cannot find that area easily. It's not always a pleasant experience. But in anamorphic the in-focus area is easy to see.

The second characteristic is how the out-of-focus areas look. The bokeh is completely different. These out of focus highlights are oval; they are created by the curvatures of the anamorphic lens element. A spherical lens would be photographing everything as it is, trying to reproduce it as faithfully as possible. The anamorphic lens interprets reality. It tells us how the reality might look, but it's not recording the reality.

It's the same as if you make a sketch with a pencil. You decide what to enhance and what not to. You interpret the reality with your tools. You enhance important things and you don't show unimportant things. If you want to add dynamic shape to a sketch, for example, you might change a straight line into a curved line. Let's say you're doing a sketch of a powerful producer at his desk. You might make the desk curved to give it more dynamic shape—but in reality it was really straight.

The anamorphic lens works similarly. It's interpreting reality in a very cinematic way. Because of the mistakes, drawbacks or problems in the design of the cylindrical anamorphic lens, you wind up with "happy accidents."

Why does everybody loves this format? Because of the organic look—not because things have been corrected the way we expect them to be on spherical lenses. When we make the Hawks, we improve certain parameters which we feel are lacking. But we do not try to "improve out" some of the original characteristics like curvature.

Making Hawk Lenses

Most of our lenses focus down to two feet, which is remarkably close for anamorphics. And we have three lenses where you can focus to the front glass element: 45 macro, 65 macro, and 120 mm.

Hawk is a family of lenses. Everything is assembled in our facility in Weiden, which is about 1.5 hours north of Munich. We produce a lot of parts for our lenses. All the parts come from Germany—most from within 100 miles.

Iris and focus rings are all in the same position. We have internal focusing: cams and cam followers. There are basically two front diameters, one for the wide lenses in the V-Lite series, and one for the medium and long ones. You can easily attach clip-on matte boxes. Even if you tighten the mattebox way too hard, it will still not bind the internal elements (as it does with some other lenses).

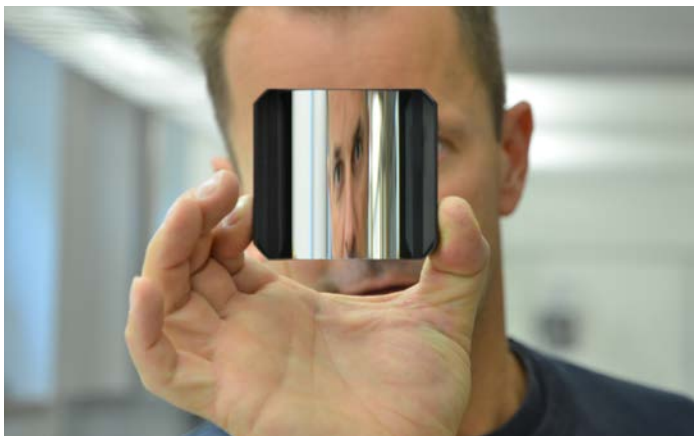
You can interchange the focus scales very rapidly, easily, and precisely. The connection of the PL mount to the lens is unique in the Hawks. We don't have any screws going into the lens body. We screw the PL mount into an L-shaped stainless steel part. It's held by a ring to the lens, so it's very solid, without mini screws like PL screws.

The Hawk design, as far as I know, is the only design that has parallax-free witness marks on both sides. The focus ring and the barrel with the witness mark is on the same plane.

We use a unique paint on the lens, which is a matte finish. It's a special industrial paint that is baked on after glass pearl blasting and anodizing. And, we apply high-contrast highly visible yellow paint into the engraved lens markings. Even the serial number is in a prominent position, because you have to always write the serial numbers on the delivery notes, so it's good to find them easily.

We have plaques on both sides showing the focal length very prominently so you quickly can identify each lens.

We tried to minimize lost time for the assistants. You can find your lens in seconds. We also design cases for our lenses—containing



Clockwise from top left: 1. Wolfgang Bäumler assembling anamoprhic cylinder. 2. Hawk lenses. 3. Parallax-free, yellow witness marks and special matte finish. 4; Plaques ready to be mounted on new Hawks.

the lenses and accessories. We have designed very small cases for location, studio and camera truck. They don't take up too much room on an assistant's cart. These cases then go into larger, tougher cases for shipping. Camera crews want small cases, but shipping requires more foam, more protection, hence larger cases. We use A&J Cases in Los Angeles. So far, they have built 3500 cases for us.

A rental house is not a laboratory. If you have to open up a lens, it should not be sealed. A lens designer should consider parameters appropriate to our business—and avoid making overly complex lenses that are difficult to service. You should not have to send it back to the factory for repair just to maintain tight tolerances. My partner Wolfgang Bäumler once completely disassembled our 150 to 450 zoom at ARRI Media in 10 minutes—right down to the focusing system and the zoom section. He had put the lens on the lens projector before starting. He then dissembled it down to the individual components, and then re- assembled it again. They put the lens back on the lens projector and were impressed. It was just as sharp. They did not have to re-shim it. The point is, we don't want to have to say, "Do not open it. Send it back to us in Weiden." That would not be a successful product. Our mechanical design ensures that maintenance is easy for rental houses even with limited possibilities.

In addition to primes, we make front anamorphic zooms. Rear anamorphic zooms (and primes) do not have oval bokehs or the classic look. Because the cylinders are at the rear, they are just stretching the image vertically, in a process similar to using a 1.4x or 2x extender—but only on one axis. The image is already made by the taking lens, it's an aerial image. You cannot influence it any more because stretching takes place after the lens. The depth of field and the bokehs have already been created. You cannot influence how the bokeh or distortions look from the back.

Matched sets

We doubled our lens-making capacity two years ago. Hawks are all the same family of lenses. They are made by one company—and one group of designers—us. That's why they match very well. Camera crews do not have to hand pick our lenses so they match each other. Problems in matching happen with sensitive designs and when lenses suffer from wear and tear. But the Hawk design is very robust. So every 50 mm lens will be the same. Every 60 mm as well. And so on.

Digital Cameras

For the next generation of digital cameras, we worked hard on the points that we felt were important: back focus, good contrast, less color fringing and relatively bright corners. But we don't touch the curvature or the bokeh. We use the classical front anamorphic design in order to get the traditional anamorphic look.

We consider cinema lenses as tools for a rental business. Lenses are constantly shipped forth and back. They have to be serviced by the rental houses. We took that into consideration and made a very robust, not over-designed, simple mechanical concept. Once the lens is manufactured and assembled, it will maintain its quality over its lifespan. We did not want our Hawks to look good on paper but give us trouble in manufacturing. We also did not want our lenses to run into problems later on, while on productions, because they could not be serviced. We were careful to prevent down-time or anything that might cause delays on a movie.

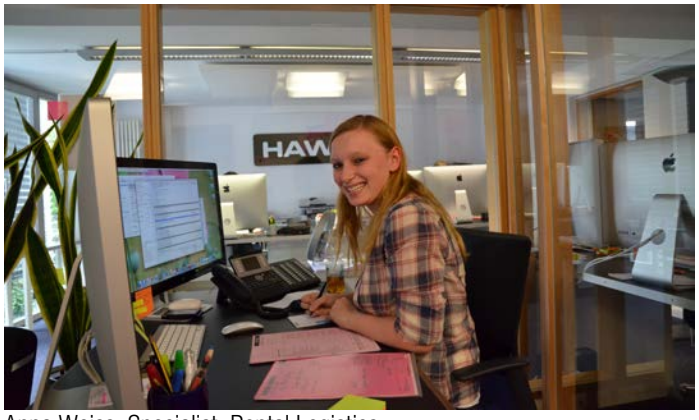
Hawk at Vantage, cont'd

Sabine Schlosser, Executive Administrative Assistant, testing ARRI Alexas

Sylvia Gössner, Executive Administrative Officer

Marion Wild, Head, Client Contacts, Rentals (left) and Barbara Weiss, Senior Consultant, Client Contacts, Rentals

Peter Märtin and Wolfgang Bäumler



Anna Weiss, Specialist, Rental Logistics

Albert Rath, Senior Specialist, Camera Operations

50 of 3500 cases holding Vantage equipment

Oana Apostol, Consultant, Client Contacts, Rentals (left) and Alexander Schwarz, Director, Digital Systems & Key Accounts

Hawk Vintage ‘74 Anamorphic Lenses

Hawk V-Lite 65 mm T2.3 Vintage ‘74
Shown approx actual size
Front diameter: 104 mm
Length: 160 mm
Weight: 2 kg
MOD: 3.25’
Squeeze: 2x and 1.3x

1974 was a good year. For anamorphic films, not Bordeaux. In 1974, John Alonzo, ASC shot *Chinatown*. Now, Hawk lenses take us back to that era.

New Hawk Vintage '74 Lenses provide the lower contrast, chromatic characteristics and flares of older, 1970s anamorphic lenses—but with precise, modern mechanics and the dependability, sharpness and consistency of all the current, modern Hawk lenses.

Cinematographers who seek the signature 1970s anamorphic look, complete with low contrast, flares, color aberrations and other “flaws,” can now achieve that look with new lenses that incorporate state-of-the-art optics and mechanics, and work seamlessly with the latest accessories.

After listening to customers, Vantage noticed the strong interest in older lenses due to their unique “defects.”

Peter Märtin explained:

“We realized that these so-called defects are tools used by cinematographers to subtly communicate a certain feeling or mood to the audience. For example, some of these older lenses, prized for beauty work, deliver a low contrast image with creamy skin tones. With today’s glossy digital formats, the right lens can add a certain authenticity or aesthetic to the image by way of these traits, which in many cases were originally limitations – flares, reflections, certain contrast and color characteristics and more – that are put to use by cinematographers as storytelling tools.”

The idea was to update these lens traits in lenses that come with all the upgrades in design and ease-of-use that camera crews have come to depend on over the last 40 years.

Vantage researched the types and methods of coatings used in these lenses from the 1970s, and undertook a series of experiments designed to recreate the effect. Modern optics meant that the “new recipe” varied from the older lenses, which often used only one or two layers of coatings. Modern coating techniques often employ as many as 14 layers. After two years of tests, Vantage arrived at a combination of coatings and lens elements that achieved the goal: a thoroughly modern lens that delivers the recognizable patina of those films we love from the 1970s. These new lenses will be thoroughly compatible with motor-driven follow focus devices, clip-on matteboxes, and other modern lens mechanics.

Hawk Vintage ‘74 Lenses will initially be ready as a set consisting of 35, 45, 55, 65, 80, 110 and 140 mm. They will be available with 1.3x and 2x squeeze, starting with 2x, and eventually cover all the Hawk focal lengths. They have clear, legible markings. They are more durable—more resistant than actual 1970s lenses to the physical punishment of today’s far-flung shipping and production realities. And, should they need repair or replacement, their up-to-date design makes it possible—which was not always the case with older, 70s-era lenses.

Hawk Vintage '74 Lenses could be the best of both worlds: the signature aesthetic of older 1970s lenses, combined with the latest and greatest in modern lens design and construction.
www.vantagefilm.com ❐

"Did I Say That?" Danys Bruyère on Anamorphic

For insight, we often look to Danys Bruyère, TSF Deputy Managing Director of Operations and Technologies, despite his famously funny disclaimer, "Did I say that?" Danys is shown, anamorphically composed, above left, with Howard Preston in the TSF Cine Boutique in Paris.

by Danys Bruyère

There has been a strong demand for anamorphic productions in France for a long time. Between TSF, Panavision and Vantage, we probably do about 25 anamorphic films a year in France. People have been extremely interested in the Alexa Studio for proper anamorphic. There is, however, a cost reality. The Alexa Studio camera costs around 60% to 80 % more than the normal Alexa. People look with starry eyes at doing anamorphic until they see the cost of the cameras and the cost of the lenses. The Hawk lenses, currently the only anamorphic lenses you can go out and buy, are also the most expense lenses in the world. So that has repercussions on the rental prices. The price of anamorphic still remains high, prohibitive for some. So you have an expensive camera with a short life cycle, expensive lenses, a Codex – and the final price tag for rental is significantly higher. Shooting anamorphic will remain an obvious choice for the top tier films that can afford it.

Alexa ProRes or DNxHD 4:3 will help lower costs. Certainly when we have competition as far as lenses go, that could help drive prices down. Hopefully anamorphic can become more widespread. Certainly the new Alexa Plus 4:3 will help.

Having been involved in anamorphic for some time, and having done a lot of tests—the optical aberrations, the way the flares happen, the way you perceive depth of field, the wrap-around feel you get on faces—the anamorphic look is unique. If you look at a face with a 100 mm spherical lens, it can feel kind of flat. When you shoot in anamorphic, it stands out. You're not concentrating on the background. There is subconscious information that the background is feeding you and you get this ovalizing of the pixel content. The actual pixels remain square, but the content is being redistributed from 2880 pixels across to 2048 pixels for 2K finish, and then de-squeezed from a 1.2:1 package to a 2.4:1 DCP "spherical" master, or put through an optical de-squeezer which will add its own set of aberrations.

Digital capture of skin tones and textures, especially with Alexa, can sometimes give you a sort of waxy feel with sphericals that you don't get with anamorphics—due to the increased resolution at acquisition, and most certainly the 12-bit Codex recording.

These are handmade lenses. They are unique. Every lens is slightly different in a nice way. When you have a 100% digital chain in a good projection room, you sometimes get the illusion that you are looking at theater, or further, that the scene is happening before you, that there is no mediation between yourself and the set, the characters. With film, you always had this veil on the screen plane, bringing grain texture and diffusion, which could also be a good thing. With digital anamorphic you're not putting diffusion in between the images and the viewer, or a layer of grain as we have with film—where you see the same layer of grain in the sky and on the actor—anamorphic gives all the elements in the scene their own sense of depth, which is not objective reality. Your eyes can see much sharper than the lens which is selective in a strange way, reacting differently to foreground and background elements, and dependent on positioning and movement in the composition. Anamorphic takes some of the hyper-reality away from digital. Grain is not necessarily a plus, but we are used to it—much the way that the texture of paint or canvas can enhance or detract from a painting's emotional charge.

The extremely rigid structure of single sensor cameras gives the images a very specific feel. Anamorphic is incredibly subjective. It gives you a warped impression of depth, instead of a linear impression as you do with spherical lenses. It changes your perception. Since you're choosing focal lengths on two different criteria, one is height and one is width, you get an image that is structured very differently than a spherical image at an equivalent angular field of view or image height.

You get a perception of depth cues from soft focus, highlights that start to glow because of the optical distortion that the anamorphic element brings in. The bokehs are oval. Even on a set where you just have 2 people talking, with little additional depth information, the obvious anamorphic depth cues aren't necessarily in your favor but you still have this sense of roundness. Lines are not perfectly straight. Instead, you have miniscule aberrations with different shapes that are different from the incredibly sharp and perfectly corrected spherical lenses that we are working with now.

With anamorphics, you compose differently. As a cinematographer, you are more aware of the edges, because that's where more aberrations occur, especially spherical ones, but also chromatic. For example if you have a high frequency leafy image at the edges—you tend to center things a little and let the sides fall off and look a little more natural, as opposed to TV, where you really want to use all of the viewer's real estate. The anamorphic cinema experience is more immersive, where part of the screen can be out of your critical viewing area of focus so it falls off naturally the way your eyes would.

This is speculation about why anamorphic looks so good, especially in digital. You don't have any of the legacy film unsteadiness aberrations, no grain coming into play, etc. Shot in digital, everything seems more transparent. It turns a new page in the book.

We've had some spherical requests for Studios from cinematographers who are really insistent on optical finders. The optical viewfinder pleases a lot of the more established DPs who are used to composing and judging contrast, whether anamorphic or spherical. They're thrilled to get the optical finder, even if there's a drawback of having the mirror spinning all the time if you want video village to see it on the monitor while you're rehearsing. That's a necessary evil, in a way, because then of course the director wants to have a good video image on his big 25" monitor while the DP is working in the finder—and I think the DP would prefer to see it without flicker like on a film camera. Today the possibility of turning off the video, the way you used to be able to turn off the video tap on a film camera, may no longer be possible.

You go from either really good video to no video at all, there's nothing in the middle. Which was interesting with the D-21; you could put a video assist on it—you could put an IVS on it with a beam splitter, so you could park your mirror and still have a video image.

With the Alexa you can't. I'm not saying that's a good idea, because it's adding another piece of glass in the light path, which may not be good for low light. At 1200 ASA, 30% is an awful lot of light loss—but we were pleasantly surprised how bright the optical viewfinder on Alexa is – it's really nice, because it doesn't have the beamsplitter we were used to on Arricams and 435s and 235s. We gain almost a stop of light, and its incredibly bright. We have the high brightness groundglasses. Looking at the equivalent of ISO 1600, you can still judge colors and focus and it has a lot of information. And the color rendition is really accurate—the red dress on an actress really is the same color red in the finder. ❐

Pierre Andurand, CEO of Thales Angénieux

Pierre Andurand is CEO and President of Thales Angénieux. Jon Fauer talked with him in Hollywood following the ASC Awards.

JON FAUER: Please tell us about your background.

PIERRE ANDURAND: My background is engineering. I studied engineering, business management and economics at the Ecole Polytechnique in France. Many CEOs and Presidents of French companies studied there. I started my career in aerospace, security and high technology. I worked with Aerospatiale and Société Européenne de Propulsion, involved in space launch programs like Ariane 5.

I have been working in the Thales group for 7 years. This has been fascinating for me, because of the company's diverse activities in communications, transportation, satellites, air traffic control, banking transactions, defense, and more. Thales is a worldwide group with 67,000 employees in 56 countries.

I think my predecessor Philip Parain did a very good job. He really restored confidence and capabilities within the company. When I arrived, it was reassuring for me to see that the industry was continuing to demand very high performance optics.

This is where Angénieux has always excelled, not only because we have the people to design very high performance optics, but also because of our history and our long term relationships with the cinema industry. I think we provide a good combination of high performance optical designs along with integration of certain human touches and sensibilities. Each product is designed keeping this in mind. The aesthetics of the image are as important as the pure optical resolution and technical characteristics. This is something that really struck me when I arrived at Angénieux, a company already famous and with a lot of very expert people.

Since early childhood I have been a fan of cinema. It was literally a dream for me to be appointed CEO and President of Angénieux. When I arrived at Angénieux I got a warm welcome from the entire cinema community. It was a little surprising for me because this is not so natural in other businesses.

JON FAUER: I think that's because people in the motion picture business like to know the person in charge of a company.

This really helped me to realize how connected Angénieux was with the community. It was clear that my welcome would have been less warm had Angénieux not, for years and years, been very close to all the people working in the cinema industry. This proximity to all the users has been very important for us. It's clearly part of the success of Angénieux, to be very close to its customers and try to better understand their needs.

How many people work at Angénieux?

We are now about 400 people. The company has been increasing its staff for the last 3 years. We want to remain a mid-size company to retain our spirit of innovation. To keep a friendly relationship among our employees, at a size that is still a human level.

Where are you going to take the company?

We see that there is a strong demand for higher resolution. The latest cameras on the market have larger or higher resolution sensors. This suggests that we will be facing the need for even better optics than what we have today.

We will have to include new optical designs and components. We anticipate a big evolution in the way we will design future optics. But it is also necessary to keep in mind that ultimately the final resolution is not the only criterion, the feeling of the spectator in front of the screen also has to be taken into account. I consider that we have at Angénieux a very good mix because we have very strong optical designers having an important background and also experience of putting humanity into the product.

I realized when I arrived at Angénieux that there will be major technical breakthroughs in terms of technology. Probably not for all products, because today's products are already very good and fit many users' requirements. However, we can foresee the demand in the next years, and so we decided to reinforce our R&D Department. The Angénieux R&D Department in Saint-Héand has more than 50 people now. Electronic engineers, optical engineers, high-precision mechanical engineers. Could you imagine 50 people out of a company of 400 are engaged in R&D? That is very important.

That's about 12.5% of the company.

This is consistent with the level of 10% of R&D investment we are planning for this year. We will spend several million Euros to develop new products and new technologies. Smart optics will be one of the areas. I see an enormous potential in that domain. What we will face in coming years is a revolution that could be equivalent to the one provided by Pierre Angénieux when he developed his first zoom.

Do you have something revolutionary to announce for NAB?

At NAB we will announce a full family of anamorphic zooms. We see "Scope" widescreen as the important format for the future. Angénieux has always been keen to find the best way to help cinematographers and users. The basis for this product, and this is something that does not exist today, is a line of compact anamorphic zooms. Since we already have a family of compact Optimo spherical zooms, this is the logical progression. We will develop a full range. We will start with a 56-152 mm anamorphic zoom.

In addition to the 56-152 mm anamorphic zoom, what other focal lengths will you offer?

It's kind of easy to guess. Basically we have today a complete spherical compact Optimo line with 15-40 mm, 28-76 mm and 45-120 mm compact zooms. We also intend to have a complete compact "anamorphic" line including a 30-80 mm, the 56-152 mm and a 90-240 mm. Each one of those lenses will be completely new lenses, and not just existing lenses with adapters.

Depending on demand, we might do a 50-500 mm anamorphic zoom. But today we are focusing first on these compact zooms, because we think that this is the best way to help cinematographers and camera operators work in Scope. They will be about as lightweight as the compact zoom family, and optically they will perform as well. We will first introduce anamorphic zooms with 2x squeeze ratio. We also intend to develop 1.3x squeeze anamorphic zooms. What we hope at Angénieux is that this new family of zooms will really help to democratize Scope, which I consider to be, from all points of view, the quintessence of cinema.

When will you deliver the first anamorphic zooms?

The first prototypes will be shown at NAB 2013. We plan to deliver the first products in early 2014 so they can be used as quickly as possible on productions. As with the entire Optimo family, our zooms have been designed to match the colorimetry of many popular prime lenses. We were satisfied to see that our spherical Optimos are very close to the colorimetry of Cooke and Leica primes. Because our idea was to provide the market with a global and homogeneous solution to facilitate the DP's job, we have decided to share part of our design specifications with Cooke Optics Ltd to ensure that Angénieux anamorphic zooms will match with future Cooke anamorphic primes and can be used together.

The colorimetry is part of the DNA of Angénieux products. I am also convinced that because of the big improvements in the new digital cameras with their large, sensitive sensors, it is now possible to make a full movie only with zooms. I'm not sure that cinematographers are ready to accept that immediately. But, when you look at the quality of the zooms, I really think it is possible now, unless you are in a situation with very low light. Our three anamorphic zooms will cover from 30 mm to 240 mm.

And you mentioned something like 50-500 mm in the future…

This will probably be a completely new design. It will not be a compact zoom, but rather a studio zoom. We still want to discuss the need for such a product with users. In reality, many Scope movies are already using Angénieux 25-250 or 24-290 mm zooms with an anamorphic adapter and the resolution is quite good. We would like feedback from cinematographers and users before making the decision to develop a 50-500 mm anamorphic zoom.

You said that Scope was very important to the future. Why?

This is something I discovered after I arrived at Angénieux. I really think that it adds something special to the image. There is an almost magical, aesthetic quality with this format in comparison to our standard formats of 4:3 and 16:9. You have much more latitude. I think this is a great help to creativity and the art of cinematography. Watching several anamorphic films recently, I was convinced that a larger screen can really help in displaying a more beautiful image and expressing stories in a different manner. You don't have to shift or cut from one face to the other for dialog. You can have two or three people in the same scene.

When you ask people what is the difference between anamorphic and spherical, many say it's the bokehs or the blue streaks. And when you question the more technically-minded, it's something not easy for them to describe. When I look at a movie in this format I really appreciate it. This is just my personal opinion. Until now, shooting in Scope was quite expensive. You needed expensive equipment. You needed expensive lenses and they were often in limited quantities. However, I'm sure that a lot of younger Directors and Cinematographers dream of being able to shoot in such a format. I really hope that with these new Angénieux products we will help them to realize their dream.

Some say that the anamorphic look is not necessarily about oval bokehs, and maybe only 10 people in the audience will notice and they'll be DPs. It's more an identification of anamorphic. It is a signature of some anamorphic images. But considering the new technology and the way people are shooting, this is not the most important aspect of anamorphic. It almost gives you a 3D quality about the image. It gives you more depth.

You said that Angénieux is putting humanity into the product. What do you mean by that?

The fact that Angénieux has been working in the cinema industry for years and years becomes very important. An optical designer comes with years of optical design experience. But the job is not only pure optical calculations. It also involves polishing and specific chemical surface treatments. The designers at Angénieux are not systematically targeting purely theoretical parameters. They are also trying to take into account the look and aesthetics. They have simulating tools that help them rapidly check how the final result will look on the screen and to ensure a natural look. All this is what I call the "DNA" of Angénieux products.

Angénieux has always been working like that. Originally we had in our books, and now we have in our computers, more than 2,000 particular combinations. These serve as the basis for new technical designs. We are fortunate to have a cinema studio next to the company, which helps us make direct image assessments with the latest professional cameras.

We can very rapidly produce new prototypes and do practical shooting in a real studio, under real-life conditions, and then see the results. This feedback between what the optical designers envision and what we see is very important.

This year there seems to be a move towards maybe not so perfect lenses because either the digital cameras are unforgiving or, as some have said, they are all looking pretty much the same. So it's up to the lens to help provide the unique look cinematographers are searching for.

You are absolutely right and it is a question of compromise. All lens designs are ultimately a compromise of look, resolution, cost, size, weight, speed. Pushing for maximum resolution may not always be the best way. At Angénieux, we have chosen to maintain a superb level of resolution while keeping what we call humanity in the image. We also take into account something important for the customer: a friendly, usable, compact and lightweight product. All this is a compromise. You can have the perfect optical design, but it will be a very expensive, very heavy product. And in the end, the result may not be very good for the spectator. ❐

Angénieux Optimo Anamorphic 56-152 mm

Angénieux Optimo Anamorphic 56-152 mm T4 2S Series Zoom

Zoom ratio:	2.7x
Horizontal focal length:	56-152 mm
Aperture:	T4
MOD:	2'1" / 0.63 m
Weight (approx):	4.8 lb / 2. 2 kg
Focus:	320˚ rotation, 50 marks, interchangeable feet or meters
Length:	210 mm / 8.3 " (actual size is the width of this page)
Front diameter:	114 mm / 4.5"
Image coverage:	28.8 mm diagonal (18.6 x 22 mm)
Anamorphic squeeze:	2x horizontal squeeze
Format:	35mm "4 perf." scope
Mounts:	PL mount, PV mount available on request

Angle of View

for 35mm "4 perf." format (18.6 x 22 mm)

Focal length	56 mm	152 mm
Horizontal angle of view	42˚50'	16˚24'
Vertical angle of view	18˚41'	7˚05'

Angénieux Optimo Anamorphic 2S Series

Angénieux debuts the first in the 2S Series of lightweight, compact 2x anamorphic zoom lenses at NAB 2013.

The 56-152 mm T4 Optimo Anamorphic zoom has a focus barrel with 50 marks. It rotates 320 degrees and focus scales can be easily changed from feet to meters. There is no ramping (change of exposure) throughout the zoom range, and there is no breathing (shift of image when focusing).

The Angénieux 2S Series will consist of the 56-152 mm and two additional compact anamorphic zooms that together will cover a range of 30 to 240 mm. The first zoom (56-152) will be available early 2014. The two others will be available Q2 2014 and Q4 2014.

The 2S anamorphic series will be completely new lenses, not existing Optimo zooms with adapters. They will share popular characteristics of the Optimo Series: light and compact for handheld or Steadicam work. The designers tell us they render a cinematic, dimensional quality to the image with superb optical performance and low distortion. The anamorphic "module" is at the rear of the lens, and a 1.3x squeeze anamorphic version of these zooms was discussed.

Angénieux will be an Official Partner and Technical Partner of the 66th Cannes Film Festival in May 2013.

Angénieux NAB Booth: C6020. www.angenieux.com

A Quick Anamorphic 2x Review with Angénieux's Angels

To take full advantage of 2x anamorphic squeeze, a 4-perf film camera or 4:3 digital sensor camera fills the frame.

Right: your optical or electronic finder shows the full 2.4:1 (actually 2.39:1) de-squeezed image.

Below: this is what the 1.2:1 squeezed image looks like on your 18.6 x 22 mm negative or file. (2.4 final ratio divided by 2x squeeze is 1.2:1.)

Below, right: Your final unsqueezed 2.4:1 images.

The Angénieux Angels will be featured in an ad campaign that was photographed by Diego Zitelli for Angénieux.

Cooke Anamorphic Primes

Approx. Actual Size

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

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

Pierre Andurand said, "Les and I are pleased to announce that our anamorphic zoom lenses and Cooke's anamorphic primes will work well together, providing cinematographers with a compatible series of lenses to shoot motion pictures in anamorphic format."

Les Zellan said, "In terms of color and look, our lenses have always complemented each other and the fact that they will continue to do so, even in anamorphic, will make this exciting widescreen format available and affordable for a new generation."

The Cooke Series of Anamorphic Prime Lenses are a completely new design. Of course, the "Cooke Look" is built in. They will all be equipped with the next generation of /i lens metadata, which should be welcome news for special effects supervisors. Anamorphic oval bokehs will be visible.

At the entrance to the AFC Micro Salon in Paris last month, left to right: Pierre Andurand, Les Zellan

Cooke Anamorphic Primes, cont'd

The Cooke anamorphic lenses are each 195 mm / 7.68 inches long from PL mount flange to front, and have a front diameter of 110 mm / 4.33 inches.

And now some technical details from the eminently quotable Jon Maxwell, Optical Designer:

"The 25 to 135 mm designations refer to the focal lengths in the vertical plane. In the horizontal plane (the anamorphic plane) the effective focal lengths are divided by the anamorphic ratio, so the equivalent focal lengths in the horizontal plane, in this sense, range from 12.5 mm to 67.5 mm.

"These are not the first anamorphic lenses that Cooke has made for the film industry. Back in the 1920s the company (then Taylor, Taylor & Hobson) made a cylindrical attachment for Bell & Howell. Then, in the 1950s the company (at that time called Rank Taylor Hobson) made a series of anamorphic lenses for the Paramount/Rank VistaVision system of widescreen cinematography.

"These new anamorphic lenses have been designed with great attention to detail for the modern demands of cinematography. They match the image quality of the 5/i, S4/i and miniS4/i Cooke prime lenses and have the Cooke 'Look.'

"The new Cooke anamorphics will not breathe horizontally or vertically. In this regard it is particularly important that the apparent 'fatness' and 'thinness' of the actors will not change with focusing. In the early days of widescreen cinema some lenses suffered particularly badly from this defect, in a way that made actors fat in the face at close focus, and this defect became known as 'mumps.' These new Cooke anamorphic lenses do not breathe, and they do not have mumps."

Delivery is projected for sometime before NAB 2014. Prices are not yet finalized, but estimates are in the ballpark of Cooke 5/i.

NAB Booths C11149 and C11150.

www.cookeoptics.com

Cooke Anamorphic Prime Lens Specs

	Units	25mm	32mm	40mm	50mm	75mm	100mm	135mm
T-stop Range		T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22	T2.3-T22
Angular Rotation of Iris Scales	deg	90	90	90	90	90	90	90
Minimum Object Distance	inches	33	33	30	33	39	44	56
	mm	838	838	762	838	991	1118	1422
Angular Rotation to MOD End Stop	deg	300	300	300	300	300	300	300
Length from Front of Lens to Lens Mount	inches	7.68	7.68	7.68	7.68	7.68	7.68	7.68
	mm	195	195	195	195	195	195	195
Max Front Diameter	inches	4.33	4.33	4.33	4.33	4.33	4.33	4.33
	mm	110	110	110	110	110	110	110
Total Weight	kg	2.77	2.68	2.93	2.74	2.64	2.93	2.93
	lb	6.11	5.90	6.47	6.03	5.81	6.47	6.47

Scorpiolens 2x Anamorphic

Servicevision will show their new 100 mm Scorpiolens 2x Anamorphic Prime Lens at NAB 2013. This will be the first time the 100 mm will be exhibited in the United States. A prototype was first seen at Cinec in Munich last September.

Andres Valles and Alfredo Valles, Managing Directors of Servicevision said, "Servicevision is working to complete production of the lenses. The 100 mm is finished, the 35 and 75 mm are finished and waiting to be assembled, and now our engineers are working on the 50, 135, 40 and 60 mm lenses—in that order."

Pedro Povill, Sales Manager, said, "The next step will be to show the finished 35 and 75 mm lenses, and start preparing the rest. We are planning to be able to start delivery the complete set (35, 40, 50, 60, 75, 100, and 135) by the beginning of 2014."

Servicevision's engineers just completed a 20 mm T2.8 Anamorphic as part of the set. This extremely wide lens will be unique in the world of 2x Anamorphic. The cost of Scorpiolens Anamorphics is estimated to be similar to high-end spherical lenses.

NAB booth C10845. www.servicevisionusa.com

Scorpiolens 2x Anamorphic Specs

Focal length	Aperture	Close focus (From image plane)		Front diameter		Length (Front to PL mount)	
20 mm	T 2.8	0.40 m	1 1/4 feet	95 mm	3.7 in	190 mm	7.5 in
25 mm	T 2	0.45 m	1 1/2 feet	95 mm	3.7 in	190 mm	7.5 in
30 mm	T 2	0.45 m	1 1/2 feet	95 mm	3.7 in	190 mm	7.5 in
35 mm	T 2	0.45 m	1 1/2 feet	95 mm	3.7 in	160 mm	6.3 in
40 mm	T 2	0.5 m	1 3/4 feet	95 mm	3.7 in	160 mm	6.3 in
50 mm	T 2	0.55 m	1 3/4 feet	95 mm	3.7 in	160 mm	6.3 in
60 mm	T 2	0.65 m	2 1/4 feet	95 mm	3.7 in	160 mm	6.3 in
75 mm	T 2	0.75 m	2 1/2 feet	95 mm	3.7 in	160 mm	6.3 in
100 mm	T 2	1.0 m	3 1/4 feet	95 mm	3.7 in	160 mm	6.3 in
135 mm	T 2.8	1.3 m	4 1/4 feet	95 mm	3.7 in	160 mm	6.3 in
150 mm	T 2.8	1.5 m	5 feet	95 mm	3.7 in	190 mm	7.5 in
200 mm	T 2.8	1.8 m	6 feet	95 mm	3.7 in	190 mm	7.5 in
250 mm	T 2.8	2.0 m	6 1/2 feet	95 mm	3.7 in	220 mm	8.7 in
300 mm	T 2.8	2.5 m	8 1/4 feet	95 mm	3.7 in	220 mm	8.7 in

- Small size and weight
- Almost no distortion or breathing
- No anamorphic mumps
- 31.14 mm image circle
- 95 mm front diameter for all
- Feet and meter scales can be changed
- Internal focus
- PL mount
- Telecentric design
- Floating elements
- Multi-aspheric design
- Consistent optical performance over the entire focus range

ARRI/ZEISS Master Anamorphic Primes

Approx.
Actual Size

At NAB, ARRI will have 4:3 Alexa cameras equipped with 35, 50 and 75 mm ARRI/ZEISS Master Anamorphic prime lenses. Deliveries of the 35, 50 and 75 are expected in May 2013, the 100 mm in August, 40 mm in October, 60 mm in November, and the 135 mm in February 2014. The 35, 40, 50, 60 and 75 mm have a list price of 29,000 euros. The 100 mm will be 31,900, and the 135 mm will be 34,900 euros.

Barring any surprises, these appear to be the first of the new anamorphic lenses coming to market. FDTimes caught up with ARRI's peripatetic Product Manager for lenses Thorsten Meywald between long-haul flights.

Thorsten explained, "There are several main design parameters involved with these anamorphic lenses. They have a very cinematic look. This includes the out-of-focus highlights, the bokehs. Oval out-of-focus highlights are part of the design. The out-of-focus part of the image is silky, creamy, smooth. We have a telecentric design, and 15 aperture blades.

"Very often we get the question whether this is a front, rear, or middle anamorphic. It's a completely new concept, and normally an anamorphic image is based on cylindrical optics, and the cylindrical optical elements are spread all over the lens. This is not an existing prime lens with a front or a rear anamorphic element added. This is a totally new design. To overcome all the problems with distortion, breathing and anamorphic mumps, we decided to design an anamorphic lens completely from scratch.

"When you look at the optical performance of our anamorphics, you'll see very little distortion, minimal breathing, no mumps. It's also a very specific optical design. Normally we look at the image that is in focus for highest resolution, lowest distortion, and the fewest aberrations. We decided to provide a larger area of interest. That means the area on screen the audience is watching. For example, when it comes to the Master Prime, we have 3 image areas of interest. There is one area in the center where we have the highest optical performance. Then we have the so-called field area with slightly different optical performance. And then we have the edge area. With the anamorphic, we have a very large image area of interest because of the wide aspect ratio of 2.4:1. We have very uniform optical performance all the way across and all the way out to the edges. Another reason these anamorphics are so different is that there are no others out in the market with such a clean image, free of optical aberrations. This is the philosophy of ARRI with cameras and also with lenses.

"We would like to give our clients the best tool, without any gimmicks. These anamorphics will be in the market for many years to come. It's a long term investment and we would like to secure the investment of our clients with the best possible anamorphic.

"If somebody wants to have a lot of flares, there are filters available. Imagine a rental house needing to buy an anamorphic for blue streaks, an anamorphic for normal streaks, a clean anamorphic, a flare anamorphic— and every set costs a lot of money. Our philosophy at ARRI is to make a clean anamorphic, not clinical, with very good skin tones.

"There are many filters in the market—Tiffen, Schneider, Formatt and others have hundreds of filters. They can make customized filters if you like. And there are many possibilities in post to add additional flares and effects. But on the other hand, if you have a lens with a lot of optical defects, to get rid of all those defects in post, although you might be able to do that, would cost a lot of time and money."

ARRI NAB Booth C4337. www.arri.com

ARRI/ZEISS Master Anamorphic Prime Lens Chart

Lens Focal Length	Aperture	Close Focus (2)	Magnification Ratio (3)	Length Mount to Front (4)	Front Diameter (5)	Maximum Housing Diameter	Weight (kg)	Weight (lb)	Entrance Pupil (6) (mm)	Entrance Pupil (6) (inch)	Angle of View H - V ID = 29.26 mm (7)
(mm)											Super 35 Scope (8)
35	T1.9 - T22	0.75 m / 2'6"	H: 1:32.3 V: 1: 16.1	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7	178.7	7.040	65.47° - 29.91°
40	T1.9 - T22	0.70 m / 2'4"	H: 1:25.6 V: 1: 12.8	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.7	6	176.9	6.929	58.72° - 26.31°
50	T1.9 - T22	0.75 m / 2'6"	H: 1:22.2 V: 1: 11.1	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7	171.5	6.750	48.46° - 21.18°
60	T1.9 - T22	0.90 m / 3'	H: 1:24.3 V: 1: 12.2	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.7	6	152.2	5.984	41.11° - 17.71°
75	T1.9 - T22	0.90 m / 3'	H: 1:19.6 V: 1: 9.8	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7	136.7	5.380	33.40° - 14.21°
100	T1.9 - T22	0.95 m / 3'1''	H: 1:14.7 V: 1: 7.4	210 mm / 8.3''	95 mm / 3.7"	114 mm / 4.5"	3.1	6.8	145.9	5.709	25.36° - 10.68°
135	T1.9 - T22	1.50 m / 5'	tbd	tbd	tbd	tbd	tbd	tbd	tbd	tbd	18.92° - 7.92°

All lenses have PL (Positive Locking) 54 mm stainless steel lens mount with Lens Data System (LDS) contacts.

(1) Image circle is 29.26 mm.
(2) Close focus is measured from the film/sensor plane.
(3) Magnification ratio is the relationship of the size of an object on the film/sensor plane (first number) to the size of that object in real life (second number) at the close focus setting; Horizontal (H) and vertical (V).
(4) Length is measured from the lens mount to the front of the lens housing.
(5) Diameter of the lens/matte box interface.
(6) Entrance Pupil: the distance from the entrance pupil to the film/sensor plane at focus = infinity. Positive numbers indicated an entrance pupil in front, negative numbers indicated an entrance pupil behind the film/sensor plane. The entrance pupil (often called "nodal point") is the center of perspective; moving the camera/lens system around the center of the entrance pupil prevents parallax errors. This measurement is important for special effects work.
(7) The image diameter (ID) is the diameter of the image circle needed for the respective format. These lenses are designed for the largest ID given here.
(8) Horizontal (H) and vertical (V) angles of view for a Super 35 Cinemascope camera aperture (dimensions 22.5 mm x 18.7 mm / 0.8858" x 0.7362").

Hawk Lens Designer Anatoly Agourok

Hawk Anamorphic Lenses and Vantage Spherical Lenses come from Vantage Film, headquartered in Weiden, Germany. I had heard of their brilliant lens designer, Dr. Anatoly B. Agourok. We finally met this February in Paris. After a busy day at Micro Salon, we sat down on the second floor of the fashionable Hôtel de Vendôme, overlooking rue du Faubourg Saint Honoré, sipping champagne and nibbling macarons. Peter Martin, Executive Director of Vantage Film and Hawk Lenses, and his wife Elina Martin joined us. Elina translated effortlessly between English and Russian.

JON FAUER: Can you please tells us about the process of designing the Vantage One T1 lenses?

ANATOLY AGOUROK: Vantage One prime lenses are our latest work. The first idea came from Peter Martin and Wolfgang Baumler, the owners of Vantage Film, for lenses that do not exist on the market. There are a lot of different lenses out there, but no other lens system has such a wide (T1.0) aperture. It was a very interesting task. The big and successful companies doing sets of lenses—ZEISS, Panavision, Cooke, Leica—they are the pioneers. It is very interesting to be in competition with these companies and to make this line of lenses.

Recently we saw digital cameras with new demands on optics. That's why we made this new set of lenses: to be very fast and also to be interesting on the digital side, which was very important. This set of lenses is a totally new design. We didn't modify or improve an exisiting design. Every Vantage One is based on a new optical concept with original calculations.

Lens	Stop	MOD
17.5 mm	T 1	10"
21 mm	T 1	10"
25 mm	T 1	10"
32 mm	T 1	10"
40 mm	T 1	1'2"
50 mm	T 1	1'2"
65 mm	T 1	1'2"
90 mm	T 1	1'8"
120 mm	T 1	2'6"

Vantage One
Spherical T1 Primes

We heard today from many colleagues that the digital cameras are getting better, but they still mostly look the same. Each DP wants a different and unique look—to stand out, to be different from each other, despite these digital cameras looking the same. Which means lenses.

Yes, especially these lenses. The concept was that they shouldn't be ultra sharp when wide open at T1.0. This creaminess was very interesting. A lot of DPs appreciate the idea. And the sharpness changes as you stop down, so you have an almost infinite amount of control over sharpness as you go from T1 to 1.4 to 2.0. I tried to pay attention to this point. From creamy to sharp, it's gradual.

So, the cinematographer can have a possibility of choices. This line of lenses is made in response to the wishes of many DPs. This set of lenses is original. I don't think anyone else has done something like this before.

Today I was talking with a lot of Cinematographers at the Micro Salon. No matter how much experience I have had, the last word is always with the DPs. How will they react when they see a new lens? Do they like it? How do they feel about it? After all the calculations, design and construction, it's just half of the work. The second part is what the DPs make of the lens and how they like it.

When they are happy with our lenses and say nice words to me, then I always reply, "Your work is so important because you are the artists who transform into images what we have put into the optical calculations." The Cinematographer and the lens are like a piece of theater: everybody knows the roles, what to say, how to act. But immediately after the first premiere, you know whether people love it or not. And it is the same with lenses.

I always wait to hear the reaction from cinematographers. I worry because we may have created a very nice lens, and it may look beautiful on paper. But if somebody shoots and says, "Oh, it's not interesting," or, "It's too sharp..." So I always wait, very concerned, how will it be accepted?

But, if the DP says it's a wonderful lens, then I can breathe a sigh of relief.

Everybody is sure that we will make a wonderful lens and it will do a wonderful job. It seems I'm the only one with doubts. So far, my lenses have always been successful. But I still worry. In my job, just like shooting a film, there still lurks the possibility that something may go wrong, something is not 100 percent perfect.

How did you become a lens designer?

I finished my studies at the Institute for Fine Mechanics and Optics in St. Petersburg and did my dissertation work at the Government Optical Institute. I started working as an optical designer for cinema lenses and have been working with optics all my life. I began at Kino Operatura in the 1970s. It was a big company, manufacturing motion picture camera systems, lenses, processing equipment, sound and everything needed for cinema. I was in the optical department. Optical design work always centered in St. Petersburg.

How did you meet Peter, Wolfgang and the gang from Vantage? How did this all begin?

I often attended exhibitions in foreign countries. I was in Prague for Intercamera '89 and '91, at Photokina '94 in Cologne. I was

showing the work of my company, and also representing the country. We had contacts in the Baltic states. And there was a DP. His name is Janis Milbrets. He's Elina's father.

Elina, I know you are an artist—of course your father is a DP.

ANATOLY AGOUROK: Yes, he is. Janis Milbrets was working together with Peter Martin and Wolfgang Baumler. And we knew Janis Milbrets very well because he was always interested in technique, in what was new, and was constructing innovative equipment. We always were in contact with him. And that's how I met Peter and Wolfgang—through Janis Milbrets in 1994. In 1995 I was invited to meet Peter and Wolfgang for the first time, and that's when our professional relationship began.

PETER MARTIN: Because Janis Milbrets was a DP, I worked as his camera assistant on a film in 1991. I met Elina in 1995. We married in 2001.

ELINA MARTIN: Peter knew my father before he met me.

JON FAUER: So Peter heard that Janis Milbrets had a beautiful daughter, and the rest is history?

PETER MARTIN: Yes. That's the story.

JON FAUER: A romance out of the movies and a business relationship in the movies. What was the first lens project?

PETER MARTIN: I think it was a 30 mm anamorphic lens.

ANATOLY AGOUROK: Around this time, in 1994, '95, Peter and Wolfgang had started a new company called Vantage Film.

Do you have a philosophy of lens design? Is there an overall theme, pattern, or path that you try to follow in all of this?

We begin with ideas from Peter and Wolfgang on which lenses they would like to see. We have always discussed the possibilities and the challenges. We did the designs together, and the lenses were produced in Germany. The ideas followed requests from the market. Peter, Wolfgang and I tried to follow what was needed in the world of cinema.

Does it start with a mathematical idea or an artistic idea?

The beginning is always an artistic idea. First of all, the ideas are coming from Peter and Wolfgang because they know what the DPs' wishes are, what is important at the moment. And from my side come the answers, how far we can go, what is possible. How I imagine it. How it should look.

Do you see a lot of movies? Does that influence your designs?

Yes. I want to see how DPs are "building" the movie. What is the process. And I try to use this in my optical calculations.

Sometimes we describe lenses the way people describe wine. How would you describe Hawk lenses to cinematographers?

Most of my work has been with anamorphic systems. The latest ones are very much tied in with the look of cinema. There are some qualities which you can recognize, especially if you are shooting an anamorphic movie.

Calculation of lenses is always a very difficult job because there are many things you have to consider. When you are ready with the calculation, it's something on paper or on the computer screen with a lot of numbers and nothing more. You have to pay attention to many other things and keep the quality very high.

Peter likes to say that we mix a classical design approach with a modern approach. It begins with a concept from Peter and Wolfgang: what lens do they wish to have?

It's always important to pay attention that the lens design is not too complicated. It shouldn't be "fussy" or over-engineered. Sometimes you have an idea that looks very nice on paper, but it turns out to be impractical in production. The actual working lens should be as good as the design concept. It's important that all the calculations are practical when it comes to construction, that all the barrels and scales are in the right places. The lens has to be very comfortable for the camera operator and it must fit comfortably on the camera. And it must be simple for lens technicians to service. Of course, I always speak about these things with Peter and Wolfgang, and they take part in the design.

The design calculations include many other details. How big will the lens be? How heavy? How fast? I would say that a Hawk lens is made up of the optimal optical and mechanical decisions, making the best choices among all available parameters. I would call Hawk "optimal decision lenses." Because the lens shouldn't be very complicated, it must be very durable, have very high quality, be practical in terms of construction, have a very good, modern design, and be easy to use.

So, the look of the Hawk lens is the result of all our efforts.

And it sounds like your experience in both optics and mechanics influences the whole system.

Yes. I do not build the lens, and I'm not the final mechanical designer. But I take these things into consideration. I know that in order to get a good lens, with good design and good construction, the calculation lays the groundwork. After all the numbers and calculations, it is the quality of the image that is most important. The image moves off the paper and starts to live. If the calculation doesn't take care of all things, then it will be just paper without life. This is perhaps the most important thing about lens design as I understand it.

I like the slogan that Vantage has: "For you it's an art, for us it's a science." That is exactly what the lens is. We are scientists, we are making the lens. The film crews, the cinematographers, assistants, directors work together to make the movie. And art only comes when we all work together.

Just like teamwork on a film, these lenses can only be made as the result of the most important thing. And that's great teamwork.

Hawk V-Lite Vintage '74 Anamorphic Primes

Apocalypse Now, Blade Runner, Close Encounters of the Third Kind, Bridge on the River Kwai, Evita — if you were enthralled by the look of these classic 'Scope films, you may be considering anamorphic lenses for your next production. Angénieux, ARRI/ZEISS, Cooke, and Scorpio showed prototypes of new anamorphic lenses at NAB, some expected to be ready later this year, others next year. If you need your anamorphics right away, Hawk primes and zooms have been made by Vantage for the PL world in Weiden, Germany since 1995. Panavision has covered the PV world since the late 1960s. Lists of anamorphic lenses to purchase or rent, ready now or in the future, begin on page 12 Hawks are mostly rented; a few are sold. Panavision only rents. But first a few words about anamorphic.

In December 2009, I wrote, "Pretend for a moment that you are a Studio Mogul. It's your job to predict the next big thing and plan accordingly. Unlike the local television weather forecaster, who gets it wrong most of the time, you will be summarily escorted off the lot for anything less than perfect prophecy.

"After the 3D Gold Rush of 2009, how will you lure audiences out of their HD, 3D, and soon 4K-equipped home theaters—and propel them into popcorn-popping and snack-selling multiplexes? In two words, as Sam Goldwyn might have said, 'Anamorphic.'"

Twentieth Century Fox bought the rights to the technique from Henri Jacques Chrétien in 1952 to produce *The Robe*, the first feature filmed with an anamorphic lens. It was promoted as "'the modern miracle you see without glasses," to compete with the 3D movies being made at the time—and TV. (The *Today Show* also premiered that year.) Sound familiar?

Once upon a time, films were mostly shot in a 1.33:1 ratio. This evolved over time to wider 1.66:1, 1.85:1, and eventually 2.40:1 widescreen ratios. The 2.40:1 aspect ratio means the picture is 2.40 times wider than it is high. You can use either spherical or anamorphic lenses. The ratio is the same. The process differs.

With spherical ("normal") lenses, the 2.40:1 aspect ratio "wastes" a lot of unused space on the sensor or film negative. The top and bottom of each frame is cropped, or letterboxed, out.

With anamorphic lenses, the width of the picture is squeezed (usually by a factor of 2x) to fit the sensor or aperture. This lets you use the entire image capture area, without letterboxing, and the result is a picture with more pixels, more resolution, and less noise . This was one of the original reasons why anamorphic ('Scope) was developed in the first place in the 1950s—to use more film negative area, with less grain and more resolution.

Peter Martin of Vantage Film, makers of Hawk Anamorphic lenses, explains, "Anamorphic lenses use cylindrical elements to squeeze the image in one axis only—the width, not the height. That means an anamorphic lens has different focal lengths: the horizontal part of the image is the wider focal length and the vertical is the longer focal length. Also, the lens has two nodal points. (The nodal point is where all light beams converge when going through the lens.) One nodal point is for the horizontal part of the light rays, and the other one is for the vertical. Essentially, the lens records the image in a sort of three-dimensional way.

"It's similar to looking at a landscape with one eye closed. If you hold up your hand and move it closer to you, your hand will covering more of the background. Move side to side, and you reveal different perspectives behind your hand. You get information about the three-dimensionality of the room. Anamorphic lenses do something similar: providing the two dimensional sensor a part of the three-dimensional information. It's almost 3D, perhaps 2.5D."

There's something inexplicably appealing about anamorphic lenses, and it's not inextricably tied to blue line streaks or oval bokehs.

Peter continues, "The anamorphic look is very elegant. The lens is not a neutral technical observer. Instead, it is subjective. It changes the scene slightly, adding out of focus areas, providing depth to a sequence. It's very appealing for faces, good for beauty. It gives actors a beautifully cosmetic, elegant, interesting, different look. With a long spherical lens, the face might look flattened, which is not always flattering. The anamorphic lens gives you depth and is pleasing. A lot of cinematographers are using anamorphic lenses mainly because they look so beautiful for faces."

A good way to select the appropriate anamorphic lens for a specific scene is to think in terms of the vertical focal length. Use the same numbers as you would for spherical. A 100 mm anamorphic lens gives you the same headroom as a 100 mm spherical lens. Of course, the 100 mm anamorphic will be twice as wide as the spherical 100 mm — equivalent to a 50 mm spherical in its horizontal field of view.

If you were thinking in terms of a 100 mm spherical lens and wanted the same horizontal field of view in anamorphic, you'd choose a 200 mm anamorphic lens. Of course, the vertical axis would be "tighter" because the vertical angle of the anamorphic is the same as the spherical.

The out of focus look of a 200 mm anamorphic lens is different from the spherical 100 mm. You get less depth of field. An actor would appear more separated from the background. Anamorphic lenses whose cylinders are in front will provide oval shaped bokehs. The out-of-focus hot spots in the background will be egg shaped. The more out of focus they are, the more squeezed they will appear to be. Rear anamorphics don't have oval bokehs, and the rear anamorphoser results in a stop of light loss. Some of the new anamorphic lenses on the next pages are hybrids, with cylinders spread among several elements throughout the lens.

Anamorphic Math

The lines were long at NAB to get on waiting-lists for new anamorphics. But there's a catch. Although film cameras are mostly 4:3, only one line of contemporary digital cameras takes full advantage of this 2x anamorphic 4:3 format: ARRI Alexa. I hope ARRI will not wince when I exhort the other camera manufacturers to remember their history lessons. The math that made Panavision, Technovision, JDC and others famous somehow seems neglected recently.

Here are diagrams and numbers explaining how the anamorphic 2.39:1 format benefits more from a larger sensor than spherical 2.39:1, and why 4:3 sensors are better than 16:9 for anamorphic.

Figure 1 shows an image area of 234 sq mm² for Super 35 spherical widescreen 2.39:1 — the same area on both 4:3 and 16:9 sensors. The top and bottom are "thrown away"—letterboxed.

Figure 2 shows an image area of 376 mm² for anamorphic 2.39:1 format on a 4:3 sensor. Much bigger.

Figure 3 shows how 16:9 sensor cameras crop the image by a factor of 1.8x and have much less resolution than 4:3 sensors shooting anamorphic 2x squeeze format.

FDTimes has discussed and will continue to examine the different aesthetics of Hawk 1.3x anamorphics on 16:9 sensors. Meanwhile, the prevalence of 2x anamorphic lenses available from all companies today, with more planned this year, make a compelling argument for additional 4:3 sensor cameras.

4:3 Sensor with 2x squeezed image

16:9 Sensor with same lens and same 2x squeezed image: the smaller sensor size crops image by a factor of 1.8x and Linda gets a haircut

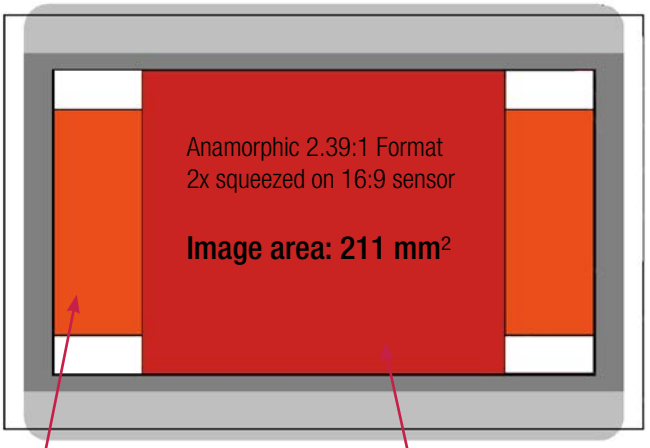
Fig 1. Spherical 2.39:1 on 4:3 Alexa Sensor

Fig 2. Anamorphic 2.39:1 on 4:3 Alexa Sensor

2.39:1 Spherical (Flat) Super35
2868 x 1200 Photosites
23.66 x 9.90 mm (Width x Height)
Ø 25.65 mm

2.39:1 Anamorphic
2x squeeze (1.195:1)
2570 x 2150 Photosites
21.20 x 17.74 mm (W x H)
Ø 27.64 mm

Fig 3. Anamorphic 2.39:1 on 16:9 Alexa Sensor



2.39:1 Spherical (Flat) Super35
Image area: 234 mm²
2868 x 1200 Photosites
23.66 x 9.90 mm (W x H)
Ø 25.65 mm

2.39:1 Anamorphic
2x squeeze (1.195:1)
1926 x 1612 Photosites
15.89 x 13.30 mm (W x H)
Ø 20.72 mm

Hawk Anamorphic Lenses

Hawk Anamorphic lenses come in a PL mount and are available to rent or purchase.

Hawk V-Lite Anamorphic Primes

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min. Filter
V-Lite 28	28 mm	T2.2-16	0.8	2'7"	2.1	4.6	120 mm	137 mm	4x5.65"
V-Lite 35	35 mm	T2.2-16	1.0	3'3"	2.9	6.4	120 mm	170 mm	4x5.65"
V-Lite 45	45 mm	T2.2-16	1.0	3'3"	1.9	4.2	104 mm	154 mm	4x5.65"
V-Lite 55	55 mm	T2.2-16	1.0	3'3"	2.0	4.4	104 mm	156 mm	4x5.65"
V-Lite 65	65 mm	T2.2-16	1.0	3'3"	2.0	4.4	104 mm	160 mm	4x5.65"
V-Lite 80	80 mm	T2.2-16	1.0	3'3"	2.3	5.0	104 mm	185 mm	4x5.65"
V-Lite 110	110 mm	T3-16	1.0	3'3"	2.6	5.7	104 mm	200 mm	4x5.65"
V-Lite 140	140 mm	T3.5-22	1.0	3'3"	2.7	5.9	104 mm	220 mm	4x5.65"

Introduced in 2008, V-Lites are, I believe, the lightest and smallest high performance front anamorphic lenses currently on the market. Smaller cylinders and less space between optical elements keeps them lighter and smaller than many spherical prime lenses. V-Lites have increased definition and contrast compared to the V-Plus series. Telecentric design. Parallax-free focus scale. Easy to service.

Hawk V-Plus Anamorphic Primes

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min. Filter
V-Plus 35	35 mm	T2.2-16	0.75	2'6"	5.3	11.7	156 mm	187 mm	6.6x6.6"
V-Plus 40	40 mm	T2.2-16	0.75	2'6"	5.5	12.1	156 mm	202 mm	6.6x6.6"
V-Plus 50	50 mm	T2.2-16	0.6	2'	3.7	8.1	125 mm	202 mm	6.6x6.6"
V-Plus 65	65 mm	T3-22	0.35	1'2"	4.3	9.5	125 mm	252 mm	40.5 mm (rear)
V-Plus 75	75 mm	T2.2-16	0.6	2'	4.3	9.5	125 mm	238 mm	6.6x6.6"
V-Plus 85	85 mm	T2.2-16	0.6	2'	4.4	9.7	125 mm	250 mm	6.6x6.6"
V-Plus 100	100 mm	T2.2-16	1.0	3'3"	5.6	12.3	125 mm	325 mm	6.6x6.6"
V-Plus 120	120 mm	T3.5-32	0.42	1'5"	5.6	12.3	125 mm	333 mm	40.5 mm (rear)
V-Plus 135	135 mm	T3-22	1.0	3'3"	5.4	11.9	125 mm	325 mm	6.6x6.6"
V-Plus 150	150 mm	T3-22	1.0	3'3"	5.3	11.7	125 mm	323 mm	6.6x6.6"

Introduced in 2006, Hawk V-Plus lenses were successors to the V-Series. Telecentric design. Parallax-free focus scales easily exchange from feet to meters. Closer focusing than V-Lites (65 and 120 mm lenses focus to front element). Internal masks reduce internal flares and increase contrast.

Hawk V-Plus Front Anamorphic Zooms

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min. Filter
V-Plus 45-90	45-90 mm	T2.8-16	0.75	2'6"	5.3	11.7	125 mm	280 mm	6.6x6.6"
V-Plus 80-180	80-180 mm	T2.8-16	1.0	3'3"	6.6	14.5	125 mm	430 mm	6.6x6.6"

Right: Hawk Anamorphic V-Lite and V-Plus Primes

Left: anamorphic cylinder

Hawk V-Lite Vintage '74 Anamorphic Primes

Introduced in 2012, Hawk V-Lite Vintage Anamorphic Primes have the same specifications as V-Lites, but maximum aperture is T2.3 instead of T2.2. They are distinguished by their distinctive white barrels.

These thoroughly modern lenses, with the classic look of anamorphic films from the 1970s, have lower contrast but use modern mechanics and work with all the latest accessories. The look includes chromatic and flare characteristics of older, 1970s lenses, color aberrations and other "flaws," in lenses.

Hawk C-Series Anamorphic Primes

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min Filter
C 40	40 mm	T2.2-16	1.0	3'6"	2.2	4.8	110 mm	143 mm	4x5.65"
C 50	50 mm	T2.2-16	1.0	3'6"	2.1	4.6	110 mm	161 mm	4x5.65"
C 60	60 mm	T2.2-16	1.0	3'6"	2.1	4.6	110 mm	180 mm	4x5.65"
C 75	75 mm	T2.2-16	1.0	3'6"	2.4	5.2	110 mm	188 mm	4x5.65"
C 100	100 mm	T3-22	1.0	3'6"	2.7	5.9	110 mm	218 mm	4x5.65"

Hawk's original Anamorphic Series, introduced in 1995. Smaller and more compact than the V-Series. Useful for Steadicam and handheld. Forgiving, natural look and feel. Used on *Star Wars Phantom Menace - Episode 1.* (Filming began in 1997.)

Hawk C-Series Anamorphic Zoom

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min Filter
C 55-165	55-165 mm	T4-22 1	1.1	3'6"	2.2	4.8	110 mm	192 mm	4x5.65"

Hawk V-Series Anamorphic Primes

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min Filter
V 25	25 mm	T2.2-16	1.0	3'6"	2.8	6.2	142 mm	135 mm	6.6x6.6"
V 30	30 mm	T2.2-16	0.8	2'8"	5.2	11.5	156 mm	188 mm	6.6x6.6"
V 35	35 mm	T2.2-16	0.75	2'6"	5.6	12.3	156 mm	187 mm	6.6x6.6"
V 40	40 mm	T2.2-16	0.75	2'6"	6.2	13.6	156 mm	202 mm	6.6x6.6"
V 50	50 mm	T2.2-16	0.6	2'	3.7	8.1	125 mm	202 mm	6.6x6.6"
V 60	60 mm	T2.2-16	0.6	2'	4.0	8.8	125 mm	213 mm	6.6x6.6"
V 75	75 mm	T2.2-16	0.6	2'	4.6	10.1	125 mm	238 mm	6.6x6.6"
V 100	100 mm	T2.2-16	1.0	3'6"	6.6	14.5	125 mm	325 mm	6.6x6.6"
V 135	135 mm	T3- 22	1.0	3'6"	6.3	13.8	125 mm	325 mm	6.6x6.6"
V 180	180 mm	T3-22	2.0	6'6"	7.5	16.5	142 mm	407 mm	6.6x6.6"
V 250	250 mm	T3-22	2.0	6'6"	7.8	17.2	142 mm	461 mm	6.6x6.6"
V 350	350 mm	T4.2-32	2.0	6'6"	8.4	18.5	142 mm	486 mm	6.6x6.6"

The second Hawk Anamorphic Series, introduced in 2001. Close focusing. Good in strong backlight. No flares, ghosting or halos around actors against hot backgrounds in interior or exterior locations.

Hawk V-Series Rear Anamorphic Zooms

Lens	Foc Lng	Aperture	MOD m	MOD ft	kg	lb	Front Dia	Length	Min Filter
V 46-230	46-230 mm	T 4-32	0.4	1'6"	7.4	16.3	150 mm	377 mm	6.6x6.6"
V 300-900	300-900 mm	T 4-32	3.0	9'9"	15.8	34.8	156 mm	672 mm	48 mm

Panavision C Series Anamorphic Primes

	C30	C35	C40	C50	C60	C75	C100	C150	C180
Focal Length	30	35	40	50	60	75	100	150	180
T-Stop	3	2.3	2.8	2.3	2.8	2.5	2.8	3.5	2.8
Close Focus (in)	48	33	30	30	20	54	54	60	84
Close Focus (cm)	121.9	83.8	76.2	76.2	50	137.2	137.2	152.4	213.4
Weight (lb)	4.8	5.4	3.7	5.4	4.0	3.6	4.6	6.8	8.0
Weight (kg)	2.2	2.4	1.7	2.4	1.8	1.6	2.1	3.1	3.6
Length (in)	5.3	6.0	4.6	5.8	6.13	5.6	7.8	10.1	12.4
Length (cm)	13.3	15.2	11.7	14.6	15.57	14.1	19.8	25.7	31.4
Front Dia (in)	4.5	4.375	4.0	4.125	3.69	3.31	3.75	3.75	3.75
Front Dia (mm)	112.8	112.8	95.3	95.3	95.3	73.7	73.7	95.3	95.3

Panavision lenses come in a PV (Panavision) mount and are available to rent.

Panavision's C series were introduced in the late 1960s. Compact and lightweight, they have a pronounced blue streak anamorphic flare. The 1960s anti-reflective coatings on these lenses are partly responsible for these streaks.

The C series lenses are compact and lightweight, good for handheld and Steadicam.

Many C series lenses have been retrofitted with later generation primes and adjusted to enhance optical performance. The upgraded set matches the E series, Primo AL series, and G series lenses. There are several custom versions with enhanced flare and close focus.

Panavision E Series Anamorphic Primes

	E28	E35	E40	E50	E75	E85	E100	E135	E180
Focal Length	28	35	40	50	75	85	100	135	180
T-Stop	2.3	2	2	2	2	2	2.3	2.8	2.8
Close Focus (in)	48	42	48	48	48	60	60	45	54
Close Focus (cm)	121.9	106.7	121.9	121.9	121.9	152.4	152.4	114.3	137.2
Weight (lb)	10	8.3	7.0	7.6	5.3	5.5	6.0	7.1	8.6
Weight (kg)	4.5	3.8	3.2	3.4	2.4	2.5	2.7	3.2	3.9
Length (in)	7.1	7.4	6.8	7.3	8.1	7.5	8.4	10.6	11.4
Length (cm)	18.1	18.7	17.3	18.6	20.5	19.1	21.4	27.0	28.9
Front Dia (in)	6.875	5.625	4.938	4.95	4.438	4.375	4.438	4.625	4.938
Front Dia (mm)	174.6	142.9	125.4	125.8	112.7	95.3	112.7	112.8	112.8

Panavision E series Anamorphic Primes were introduced in the 1980s. They were designed with higher optical quality than their predecessors, the C series. The E series have more sophisticated anti-reflection coatings, and fewer aberrations.

The E series lenses do not produce blue streak anamorphic flares as readily as the C Series. E series lenses show little fall off at the edges of the frame and the center to edge resolution is good. They show familiar anamorphic artifacts such as disproportional vertical focus breathing, mild barrel distortion (with wide angle lenses), without an excess of flare.

The E series lenses are larger and heavier than the C or G series lenses

Panavision Primo Anamorphic Primes

	AL35	AL40	AL50	AL75	AL100
Focal Length	35	40	50	75	100
T-Stop	2	2	2	2	2
Close Focus (in)	42	42	42	54	54
Close Focus (cm)	106.7	106.7	106.7	137.2	137.2
Weight (lb)	13.6	14.6	15.3	10.4	12.1
Weight (kg)	6.2	6.6	6.9	4.7	5.5
Length (in)	11.5	11.6	13.1	9.5	10.5
Length (cm)	29.2	29.5	33.3	24.1	26.7
Front Dia (in/mm)	5.938 / 150.8	5.938 / 150.8	5.938 / 150.8	4.968 / 126.2	4.968 / 126.2

Primo Anamorphics were matched to a modified version of the E series. They have high contrast and resolution, even field illumination, and negligible ghosting and distortion. They provide the signature blue anamorphic streak without unwanted veiling glare.

The earliest set had a close focusing distance of 2'6" to 4'6".

The more recent close focusing Primo anamorphic lenses have an MOD from 2'6" to 2'9".

Primo anamorphic primes are larger and heavier than other series of Panavision anamorphic lenses.

Panavision G Series Anamorphic Primes

	G25	G30	G35	G40	G50	G60	G75	G100
Focal Length	25	30	35	40	50	60	75	100
T-Stop	2.6	2.6	2.6	2.6	2.6	2.6	2.6	3.0
Close Focus (in)	30.0	30.0	36.0	36.0	36.0	36.0	36.0	36.0
Close Focus (cm)	76.2	76.2	91.4	91.4	91.4	91.4	91.4	91.4
Weight (lb)	4.6	4.6	4.4	4.2	4.4	3.9	3.8	4.5
Weight (kg)	2.1	2.1	2.0	1.9	2.0	1.8	1.7	2.0
Length (in)	5.4	5.4	6.0	5.2	6.1	6.2	6.3	7.8
Length (cm)	13.7	13.7	15.2	13.2	15.5	15.7	16	19.8
Front Dia (in)	4.94	4.94	4.44	4.44	4.44	4.44	4.44	4.44
Front Dia (mm)	125.4	125.4	112.8	112.8	112.8	112.8	112.8	112.8

The G series were introduced in 2007, with the convenience of the C series and the optical technology of the Primo AL series in mind. The G series use recent advanced anti-reflection coatings. The barrels are consistent: they all have front diameters of 125.4 or 112.8 mm, and are lightweight.

Optically, the G series lenses have high contrast, high resolution, well balanced aberration control, excellent flare control, and minimal breathing.

Performance and size make these lenses comparable to Panavision E series anamorphic primes, but in a lightweight, compact size similar to the C series.

Panavision Anamorphic Zooms

	AWZ2	ATZ	ALZ11	ALZ3
Anamorphic Elements	Front	Front	Rear	Rear
Zoom Focal Lengths	40-80	70-200	48-550	270-840
T-Stop	2.8	3.5	4.5	4.5
Close Focus (in)	39.0	69.0	49.0	103.0
Close Focus (cm)	99.1	175.3	124.5	261.6
Weight (lb)	10.4	12.8	20.0	25.1
Weight (kg)	4.7	5.8	9.1	11.4
Length (in)	10.5	15.4	14.75	19.88
Length (cm)	26.7	39.1	37.46	50.5
Front Dia (in)	4.87 x 4.08	4.87 x 4.08	5.94	6.75
Front Dia (mm)	123.7 x 103.6	123.7 x 103.6	150.8	171.5

Panavision's front anamorphic zooms - AWZ2 and ATZ have high contrast and resolution, good field illumination, low veiling glare, and minimal aberrations, ghosting, distortion and breathing. Performance is comparable to E Series primes.

The AWZ2 Anamorphic wide-angle zoom was introduced in 2004. It is Panavision's first zoom lens to use anamorphic elements at the front of the lens. It is also known as the "Bailey Zoom," in honor of John Bailey, ASC, who asked Panavision to develop a wide-angle front anamorphic zoom.

The ATZ Anamorphic Telephoto Zoom was introduced in 2007. It is Panavision's second zoom lens with front anamorphic elements.

The rear Anamorphic 11:1 Primo Anamorphic Zoom – ALZ11 – is a 24-275mm Primo with a high-performance rear anamorphoser, making it a 48-550 zoom.

The rear Anamorphic 3:1 Primo Anamorphic Zoom – ALZ3 – is a 135-420 mm Primo with a rear-mounted anamorphoser, making it a 270-840mm, T4.5 zoom.

Panavision High Speed and Close Focus Anamorphic Primes

	Super High Speed Anamophics					Close Focus / Macro Panatar				
	HS35	**HS50**	**HS55**	**HS75**	**HS100**	**AR90-SF**	**MAP55**	**MAP150**	**MAP200**	**MAP250**
Focal Length	35	50	55	75	100	90	55	150	200	250
T-Stop	1.4	1.1	1.4	1.8	1.8	4.3	2.5	3.2	3.2	3.2
Close Focus (in)	54.0	48.0	48.0	54.0	54.0	17.0	10.0	17.0	18.0	29.0
Close Focus (cm)	137.2	121.9	121.9	137.2	137.2	43.2	25.4	43.2	45.7	73.7
Weight (lb)	5.8	5.8	5.4	7.7	9.3	3.0	6.0	6.1	5.7	6.0
Weight (kg)	2.6	2.6	2.4	3.5	4.2	1.4	2.7	2.8	2.6	2.7
Length (in)	6.3	6.3	5.5	9.9	11.8	4.3	6.1	7.4	7.4	7.4
Length (cm)	15.9	15.9	14.0	25.1	29.8	10.8	15.6	18.7	18.7	18.7
Front Dia (in)	4.5	4.125	4.125	4.25	4.5	4.25	3.69	4.375	4.375	4.375
Front Dia (mm)	114.3	104.8	104.8	108.0	114.3	108.0	93.7	111.1	111.1	111.1

AWZ2

G-Series

Panavision Telephoto Anamorphic Primes

	Telephoto Anamorphic Lenses					
	C360	**AN400**	**CN400**	**AN600**	**CN600**	**C800**
Focal Length	360	400	400	600	600	800
T-Stop	3.8	3.5	3	4	4.5	5.6
Close Focus (in)	66	108	96	156	324	180
Close Focus (cm)	167.64	274.32	243.84	396.24	822.96	457.2
Weight (lb)	6.0	6.0	6.5		15.8	
Weight (kg)	2.7	2.7	2.9		7.1	
Length (in)	8.56	8.86	8.02		13.28	
Length (cm)	21.74	22.5	20.36		33.73	
Front Dia (in)	4.95	4.98	4.83		6.89	
Front Dia (mm)	125.8	126.6	122.6		175	

Panavision has a large inventory of specialty anamorphic lenses: high speed, flare, portrait, macro, and telephoto lenses.

Anamorphic flare lenses retain their coatings and therefore maintain overall contrast and suppress veiling glare. They are modified to produce an enhanced anamorphic cylindrical flare, also called "blue streak".

Portrait lenses come in 40 mm and 100 mm. Both are T2.8. The 40 mm has a close focusing distance of 3 feet 3 inches and the 100 mm has a close focusing distance of 4 feet. These lenses have a soft focus look around the edges of the frame, leaving the center of the frame sharp.

Angénieux Optimo Anamorphic 56-152 mm Zoom

A prototype of the Angénieux Optimo Anamorphic 56-152 mm T4 2S Series Zoom had its worldwide premiere at NAB. It is the first in the 2S Series of Angénieux lightweight, compact 2x anamorphic zoom lenses. Two additional compact anamorphic zooms are planned. Together they will cover a range of 30 to 240 mm. Looking at the current line of lightweight Optimos (15-40 and 45-120 mm), that suggests additional 30-80 and 90-240 mm anamorphic zooms—unless there's greater demand for a studio version 48-580 or 50-500.

The first zoom (56-152) should be available early 2014. The two others are expected Q2 2014 and Q4 2014. This is a new design. The anamorphic cylinders are at the rear of the lens—keeping it small and light.

Focal length:	56-152 mm
Aperture:	T4
MOD:	2'1" / 0.63 m
Weight (approx):	4.8 lb / 2. 2 kg
Focus:	320˚ rotation, 50 marks, interchangeable feet or meters
Length:	210 mm / 8.3 "
Front diameter:	114 mm / 4.5"
Image coverage:	28.8 mm diagonal (18.6 x 22 mm)
Anamorphic squeeze:	2x horizontal squeeze
Format:	35mm "4 perf." scope
Mounts:	PL mount, PV mount available on request

Cooke Anamorphic Prime Lenses

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

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

ARRI/ZEISS Master Anamorphic Primes

ARRI/ZEISS 2x Anamorphic lens working prototypes in PL mounts were shown at NAB. The 35, 50, and 75 mm lenses are expected this month. They have Lens Data System (LDS) contacts and are a completely new anamorphic optical design. Image circle is 29.26 mm.

Focal Length	Aperture	Close Focus	Length of Mount to Front	Front Diameter	Max Housing Diameter	kg	lb
35 mm	T1.9-22	0.75 m / 2'6"	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7
40 mm	T1.9-22	0.70 m / 2'4"	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.7	6.0
50 mm	T1.9-22	0.75 m / 2'6"	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7
60 mm	T1.9-22	0.90 m / 3'	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.7	6.0
75 mm	T1.9-22	0.90 m / 3'	183 mm / 7.2"	95 mm / 3.7"	114 mm / 4.5"	2.6	5.7
100 mm	T1.9-22	0.95 m / 3'1''	210 mm / 8.3''	95 mm / 3.7"	114 mm / 4.5"	3.1	6.8
135 mm	T1.9-22	1.50 m / 5'	tbd	tbd	tbd	tbd	tbd

Scorpiolens 2x Anamorphic Primes

Lens	Aperture	MOD	Front Dia	Length
20 mm	T2.8	0.40 m / 1.25 ft	95 mm / 3.7 in	190 mm / 7.5 in
25 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	190 mm / 7.5 in
30 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	190 mm / 7.5 in
35 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	160 mm / 6.3 in
40 mm	T2	0.5 m / 1.75 ft	95 mm / 3.7 in	160 mm / 6.3 in
50 mm	T2	0.55 m / 1.75 ft	95 mm / 3.7 in	160 mm / 6.3 in
60 mm	T2	0.65 m / 2.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
75 mm	T2	0.75 m / 2.5 ft	95 mm / 3.7 in	160 mm / 6.3 in
100 mm	T2	1.0 m / 3.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
135 mm	T2.8	1.3 m / 4.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
150 mm	T2.8	1.5 m / 5 ft	95 mm / 3.7 in	190 mm / 7.5 in
200 mm	T2.8	1.8 m / 6 ft	95 mm / 3.7 in	190 mm / 7.5 in
250 mm	T2.8	2.0 m / 6.5 ft	95 mm / 3.7 in	220 mm / 8.7 in
300 mm	T2.8	2.5 m / 8.25 ft	95 mm / 3.7 in	220 mm / 8.7 in

Scorpiolens 2x Anamorphics from Servicevision were announced at NAB last year. A 100 mm prototype was shown at Cinec 2012. They are small and lightweight, with a 31.14 mm image circle, internal focus, almost no breathing, PL mount, and focus scales that can be changed from feet to meters. As I understand it, the lenses have a multi-aspheric design and the anamorphic cylinders are located in the center and rear of the lens. Bokehs have an interesting and unique shape. servicevision.es

ARRRI/ZEISS Master Anamorphics

The Magnificent Seven (1960) was a 35mm anamorphic film directed by John Sturges. A remake of Akira Kurosawa's *The Seven Samurai*, it starred Yul Brynner, Eli Wallach, Steve McQueen, Charles Bronson, James Coburn, and a young John A. Alonzo, before he became a cinematographer (John A. Alonzo, ASC).

There are seven magnificent new ARRI/Zeiss Master Anamorphic prime lenses for 35mm format digital and film cameras.

They are compact, lightweight, and high speed (T1.9). They exhibit minimal distortion: straight lines remain straight, even at close focus. The iris consists of 15 blades, so bokehs are smooth and anamorphically oval. Focus barrels can be ordered in feet or meters.

The 35, 50, and 75 mm Master Anamorphics should be ready by IBC, September 2013. See them at IBC booths 11.F21 and 11.F58.

ARRRI/ZEISS Master Anamorphic Prime Lenses

Focal Length	**35 mm**	**40 mm**	**50 mm**	**60 mm**	**75 mm**	**100 mm**	**135 mm**
Aperture	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22	T1.9 - T22
Lens Mount (1)	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS	PL LDS
Close Focus (fr. image plane)	0.75 m / 2'6"	0.70 m / 2'4"	0.75 m / 2'6"	0.90 m / 3'	0.90 m / 3'	0.95 m / 3'1''	1.20 m / 3'11''
Length (from lens flange)	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	183 mm / 7.2"	210 mm / 8.1''	237 mm / 9.3''
Length (from image plane)	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	235 mm / 9.3"	262 mm / 10.2''	289 mm / 11.4''
Front Diameter	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"	95 mm / 3.7"
Widest Barrel Diameter	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"	114 mm / 4.5"
Weight	2.6 kg / 5.7 lb	2.7 kg / 6 lb	2.6 kg / 5.7 lb	2.7 kg / 6 lb	2.6 kg / 5.7 lb	3.1 kg / 6.8 lb	3.7 kg / 8.2 lb
Image circle	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm	29.26 mm
Entrance Pupil (mm) (2)	178.7	176.9	171.5	152.2	136.7	145.9	129.3
Entrance Pupil (inches) (2)	7.040	6.929	6.75	5.984	5.380	5.709	5.091
Angle of view H - V Super 35 'Scope format (3)	65.47° - 29.91°	58.72° - 26.31°	48.46° - 21.18°	41.11° - 17.71°	33.40° - 14.21°	25.36° - 10.68°	18.92° - 7.92°

(1) PL Mount is 54 mm diameter, stainless steel, with Lens Data System (LDS) contacts.

(2) The distance from the entrance pupil relative to the film/sensor plane at infinity focus.

(3) Horizontal (H) and vertical (V) angles of view for a Super 35 Cinemascope format camera aperture (22.5 mm x 18.7 mm / 0.8858" x 0.7362").

Servicevision Scorpiolens 2x Anamorphics

Servicevision Scorpiolens 2x Anamorphics, cont'd

Prototype 75 mm Scorpiolens Anamorphic on a Camalot Alexa Camera at IBC 2013 in Amsterdam.

Lens	Aperture	MOD	Front Dia	Length
20 mm	T2.8	0.40 m / 1.25 ft	95 mm / 3.7 in	190 mm / 7.5 in
25 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	190 mm / 7.5 in
30 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	190 mm / 7.5 in
35 mm	T2	0.45 m / 1.5 ft	95 mm / 3.7 in	160 mm / 6.3 in
40 mm	T2	0.5 m / 1.75 ft	95 mm / 3.7 in	160 mm / 6.3 in
50 mm	T2	0.55 m / 1.75 ft	95 mm / 3.7 in	160 mm / 6.3 in
60 mm	T2	0.65 m / 2.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
75 mm	T2	0.75 m / 2.5 ft	95 mm / 3.7 in	160 mm / 6.3 in
100 mm	T2	1.0 m / 3.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
135 mm	T2.8	1.3 m / 4.25 ft	95 mm / 3.7 in	160 mm / 6.3 in
150 mm	T2.8	1.5 m / 5 ft	95 mm / 3.7 in	190 mm / 7.5 in
200 mm	T2.8	1.8 m / 6 ft	95 mm / 3.7 in	190 mm / 7.5 in
250 mm	T2.8	2.0 m / 6.5 ft	95 mm / 3.7 in	220 mm / 8.7 in
300 mm	T3.2	2.5 m / 8.25 ft	95 mm / 3.7 in	220 mm / 8.7 in

Framegrabs of Scorpiolens 2x Anamorphic 100 mm Prototype

Tour of Servicevision

Above L-R: Pedro Povill Garcia, who translated our discussons, Alfredo Valles, Andres Valles.

Opposite: Images from PL-mounted Canon 5D Mk III, desqueezed 2.39:1.

Below: Servicevision's first lenses: Servilens Nikon Macros, with unique combination Mitchell, PL, and bayonet mount. Also unique: they focus in the "correct" direction.

The History of Servicevision

Once upon a time there were two brothers living in Barcelona. Around 1977, Alfredo Valles was working as an electronic engineer. Andres Valles was a mechanical engineer, but what he really enjoyed was cinema. He started working in film studios, just to learn. He quickly advanced to become a cinematographer. Because he worked on a lot of foreign productions, he noticed how the Spanish film industry at the time was quite antiquated.

At that point, Alfredo started working in a television studio. He was involved in maintenance and repair of the equipment. He also worked as a video cameraman.

One day, Andres said to Alfredo, "Why don't we start a small company to make accessories for the film industry, especially for commercials?" Their first idea was to make macro lenses for commercials. They continued in their regular jobs, but all their free time was spent working on these projects.

Next they hired a machinist. They bought a small milling machine and parts. And they developed three macro lenses.

A unique feature of their Macros was the 3-in-1 combination Mitchell, PL and Arriflex bayonet mount. The macros were successful and sold around the world.

Soon after, Alfredo realized there was an opportunity in building cranes and remote heads because, at that time, they didn't exist in Spain. At that point, they had to be rented from outside Spain. So they began work on a small tubular aluminum crane to carry a remote head.

Although Andres was concentrating more on the lenses, they both saw the potential of greater business if they could start renting their cranes in Spain. That's when Servicevision was born as a rental company—around 1980, more than 30 years ago. They started by renting just a few items: the lenses they made, the cranes, and a Panther dolly that they bought from Panther in

Germany. They also went to England and bought a classic two-axis Powerpod.

When they finished building the cranes, they said, "Now we need to build our own remote head." They hired more mechanical and electronics engineers because they understood the necessity of providing a third axis. At that time, only two-axis heads existed.

Their three-axis head became the Scorpio Classic. Then they made a lens control system to be used with the camera on the head. From the beginning, Alfredo insisted on the heads being digital and modular for efficient service. Because they were in the rental business, they were thinking like a rental house. Down time had to be minimized and repairs had to be simple. This was the fundamental concept of all Servicevision equipment to follow. Modular, easy to work with, and easy to fix if something happensed during a production. And durable, because rental equipment works outside, in the rain, the desert, or in the mountains.

Soon after, with the revenue from the rental and service of the cranes and heads, they started buying Arriflex cameras and lenses to build up a camera rental department. The first camera Servicevision bought was an Arriflex 2C. It's still being used today—to test Scorpio focus motors. The first lenses were secondhand Cooke Panchro S2 primes. Those lenses are still working today. Alfred Chrosziel changed the mount and the housing. Andres said, "He now lives not too far away from here, in Formentera. Growing grapes and very fine wine. He's a great friend. Like Geoffrey Chappell, a good friend from the beginning."

Geoffrey Chappell recalled, "Alfred Chrosziel phoned me to say that he just had a visit from Servicevision, was very impressed with the quality, and suggested that I should meet them. Our very first meeting was in the board room of Optex, Andres not speaking a word of English and me not speaking a word of Spanish. Once we had projected the lenses, both George Hill (Optex Technical Director) and I turned to each other and smiled. We looked at Andres who was grinning and kissing his fingers, as only a chef would do, or so I thought, and we then shook hands. I am pleased to say that 35 years later Andres still has that wicked grin, and is still kissing his fingers. Film is truly a universal language. The SVS Nikon macro lenses not only came with a triple mount, but also, unlike other Nikon lenses that were being converted in those days, the SVS lenses focused in the same direction as other film lenses. Like the triple mount, this was also a first. Great images were obtained, and were popular. Optex purchased a number of sets which were very successful in rentals."

Their second set of lenses were Zeiss Standards (T2.1), followed by Arriflex 35-3 and 35BL cameras. All rental income was invested back into the company. "We didn't have any money for ourselves. Our families helped us out with food and lodging," Andres said. "In the beginning, I was living in my father-in-law's apartment and eventually bought an apartment close to Alfredo. We were always together. The big problem in Spain at that point was that when we went to the banks to borrow money to be able to buy cameras, the interest rate was about 20 percent."

The rentals were successful and they continued re-investing by buying more equipment. Alfredo was in charge of development, mechanics, and electronics. Andres took care of the rental department.

"We had stopped shooting," Andres said. "Too many hours working in the company. In the beginning we were making less money working here than working as DPs. But we were sure that this was the future. We were convinced that Servicevision could be a successful company."

After the Classic came the Mini Scorpio. The Mini Scorpio head was even more successful than the Classic. Then they spent 6 years developing a stabilized remote head.

Most other rental companies don't get into manufacturing big things like cranes. I asked why they decided to be different. Andres answered, "It's very simple. From the beginning of the 1900s to before the Spanish Civil War in 1936, our grandfather had a big engineering and manufacturing company in Barcelona. One of the things they made were kitchen carts for the army. Like movie catering, but for the soldiers. So we come from a family of manufacturers. But there was a problem. Our grandfather made kitchen carts for the Republican side, and he lost the entire company when the Republican side lost in the civil war against Franco.

At that time, our grandfather had a company with more than 1,000 people working there. The company was named after him, Juan Valles. They also did construction. The ceiling of the Barcelona Estació de França train station was done by his company. Building things is in our DNA—to create new things, to develop.

Alfredo chimed in, "The rental division is like a very expensive test facility where we can see what people need. We are in contact every day with the users of the equipment that we develop."

Along the way, they became one of the biggest rental houses in Spain. The conversation that followed could be part of a screenplay:

ALFREDO
Another very important thing about Servicevision is that it's very easy to make decisions.

ANDRES
It's two people. If we need to make a decision, we sit down, meet for half an hour, discuss and then come to a decision.

JON
I guess you usually don't argue much?

ALFREDO
Oh yes, we argue.

ANDRES
We argue all the time. But they are intelligent arguments. We never mix personal things with business. We know that we will be working together forever. Sometimes I'll win one, sometimes my brother will win, but we reach an agreement and we go ahead.

We dove into a topic on many minds: the rental business and the future, cameras changing faster than ever. In the old days, an Arriflex 35BL would last 10-20 years. Now a camera is good for a few years, some slightly longer…

Andres said, "Most companies, like Clairmont, Nemenz, Servicevision, and other companies around the world, are doing more business than before. Why? Of course they have to invest in the new digital cameras, but all these new cameras can use the same lenses and accessories that might not have been used for years. All those vintage lenses sitting on shelves were paid off long ago. Now they are being used again, and often.

"But there are many new companies starting up in rental. They start buying cameras. But they also have to invest in lenses and accessories. So there are more rental companies than before. For example, in New York there are now more rental companies than ever. For us, as a manufacturing company, it's very good because now there are more clients for us.

"About the future of the rental company, the question that you asked. I think that the future for rentals will be a few big worldwide companies and a lot of small companies. But just a few big rental houses worldwide."

Alfredo was shaking his head. He didn't agree.

Alfredo said, "Everybody is working in audio-visual. People make videos for weddings, for corporations, events, and everything else. Everybody works in the same market right now. Why are the big rental houses still working? Because like Andres says, they have a lot of old lenses and accessories.

"So for the big rental houses, it's relatively inexpensive for them to buy new digital cameras. The small companies have to buy not only cameras but also have to buy lenses (and the lenses are still expensive). So the small companies cannot grow up as quickly because they have to spend so much money on lenses.

"But the big companies that supply the big productions are also facing a problem. The big productions now shoot with multiple cameras simultaneously, and that requires lots of additional equipment. Only a few companies are able to provide this quantity of equipment for one production. But now, even a very small company can supply a movie with five or six cameras because they subrent from other small companies.

"I think that the big companies need to provide something completely new and different that nobody else has. Otherwise the big rental houses are going to disappear against the small companies. That is why I think the small companies can be more successful. It's easier to be successful in a small company because they have fewer expenses. They can make many connections and the decisions in a small company can be made very quickly. And that is why Servicevision is unique as a manufacturer and rental house."

Andres said, "Servicevision, as a big rental house, can continue to be very successful because we invest a lot from our manufacturing earnings into the camera department, which would be impossible if we only rented.

"For example, we have Arricams that we still need to pay off to the bank. We are still paying but they haven't worked for three years. You want to know how we paid for the Arricams? With REDs. In the beginning here in Spain, everybody bought RED cameras, the DPs, everybody. But they didn't invest money in lenses. And, of course, they wanted to use good lenses. Then we bought our own REDs and then Alexas."

Lenses

Our discussion shifted to lenses. I was impressed by the very high level of technology at Servicevision. And I wondered when the idea first hatched to build anamorphic lenses.

Andres said, "For more than 25 years, I've been working on lenses and I gained a lot of knowledge about optics, how to develop new lenses and what the market needs. We have a team of good designers, good mechanical and optical engineers, so it's easy for us to develop something new.

"The idea to do anamorphic lenses was born more than ten years ago. We were never shooting in anamorphic. Everybody here was shooting in Super 35. Whenever we went to the theater to see movies, it was mostly in Super 35; the look wasn't good like anamorphic. It was like something had died, without life, you know, flat, not as interesting. The magic of anamorphic and the anamorphic look is that it is almost like 3D in real life. When normal people go to the cinema, they don't know if it was shot in anamorphic because they don't know about the technical details. But if you ask them, you hear that they feel connected, integrated in the movie.

"That's when I decided that I wanted to do something in anamorphic. But I wanted to go further, and remove those qualities that I didn't like about the anamorphic process, but keep the good parts. I didn't like the distortion. I wanted the 3D quality of the anamorphic spirit, but not the geometric and linear aberrations, which don't look real.

"I also didn't like the breathing, where the image seemed to zoom when you focused. The American and French cinematographers, who were the best at shooting in anamorphic, were able to hide the breathing by burying the focus shift in a pan.

"Another thing to consider was the blue line that some people like, but a lot of people don't like. At Servicevision, we wanted to let cinematographers have the option to avoid the line. If you want it, you can add a blue streak filter. A lot of DPs told us that they agree with this."

Alfredo said, "Another point that we were thinking about was the physical size, weight, length and diameter of the lens. Because Andres was a camera operator, he was thinking like the people who were going to use the lens. We knew they needed a lens that was as light as possible, smaller, compact and capable of using the same accessories as the other lenses. Otherwise, for the camera operator and assistant, it's crazy.

Andres continued, "So we decided to make them small and all with the same front diameter. The look is warm, with a lot of definition, but not hard-edge or sterile, with smooth, silky skin tones. We started working on the design 4 years ago.

"And the engineers told us that it was impossible to make lenses in the small physical size we wanted. They said it's impossible. These were the opinions of the engineers.

"But we know how to deal with engineers because we are engineers. Engineers are special people. The first thing they always say is 'No.' "After the first "No' we can start speaking.

"They said there were three problems: designed in Spain, by a Woman, and made in Spain."

Left to right: Andres Valles, Cristina Alcaide, and Alfredo Valles.

"We talked with engineers who had lots of experience and extensive backgrounds in cinema optics, and they said it's impossible to do an anamorphic so much smaller. That's when we decided to hire young people. We discussed ideas about the existing lenses in the market, and then they started making the designs with our ideas about how to do it.

"When we finished the design, we showed the plans to some manufacturers. They found three different problems. The first problem was they couldn't imagine somebody from Spain designing something like this. The second problem popped up when they learned the optical designer was a lady, Cristina Alcaide. Never mind that she has advanced degrees in optics and physics. Impossible. And the third problem they found was that it would be impossible to make a lens like this in Spain.

"Three times 'No' because the engineers in those meetings were all people who thought that if something like this hadn't been conceived or built before, then it was impossible to manufacture. Therefore we decided to build the lenses ourselves, because we know how to build advanced products, and we also knew they would be possible to build—because we think like a manufacturer.

"Every year we go to all the exhibitions and we always see the same things. Small changes but not big ideas. It's rare to see something very new, something really different, a big idea. If someone has an idea, they may not have the money to make it. If somebody has the money, they may not have the idea. We are lucky because we have the idea and also we have a little money just to make this idea a product.

"Of course, several different people in the film world had very good ideas. One of them was Beauviala with Aaton: great ideas in audio and cameras. Another is Delacoux and Transvideo with their monitors. And the third one was Bauer, a director and cameraman, with his Moviecam. There are others.

"So, who has the first idea in the big companies? Usually the sales people. The sales manager says, 'My clients are asking for something like this—what we can do?'

"For the accounting people, the first question is 'How many can you sell in one year?'

"The sales manager says, 'I don't know, but I don't want to make a mistake because if I make a mistake tomorrow, they'll fire me.'

"That means they have to go slowly. If, finally, they go ahead, then it goes to the engineering department. The same problem. The engineering department, before they start working, have to study the market and analyze the cost. Then they put all the numbers together and invest in the mechanical development and the optical development. After a couple of years, it goes back to the accounting people who say, 'This is the price that we have to charge to be able to sell the lens.'

"And then the managers, sales team, engineers and accounting people fly first class to the next exhibition. At Servicevision, we take the risk. It's just the two of us deciding. We decide quickly. And we don't fly first class. But we do stay in good hotels. And we love the best restaurants. (Laughs)."

This is true. (See page 29 about the best restaurants of Barcelona).

Alfredo said, "When we started making the 100 mm lens, people started thinking that maybe it was possible for a lens designed in Spain, by a woman, and built in Spain to actually work. A lot of people saw your first articles about the Scorpio anamorphic in *Film and Digital Times*. By the way, we like FDTimes and we learn a lot from your magazine.

"One thing many people overlooked was that we did both the optical design and the mechanical design in-house. And we build it all in-house.

"Many people did not realize that we have very good mechanical engineers, whom you have met. Many come from the aerospace industry. We're a few miles from Barcelona airport. This is an area of high-tech industries. We have the most sophisticated CNC machines from the aerospace industry. You saw them building parts for our stabilized remote head that require tolerances as precise as a lens—down to 5 microns.

All the design is done in-house, optical and mechanical. The optical elements are subcontracted outside. Because we always think like a factory, when we did the design, one very important point was that 70 percent of the mechanical parts are the same for all lenses.

All the lenses barrels look similar. Many use the same barrels. The design is done like construction of a car. A lot of components from different lenses are the same. That is why it's very important for us to have this cooperation between the optical and mechanical people.

If the optical designers are in one building and the mechanical department is in another place, they don't interact. They don't even speak to each other. Then nobody wants to modify anything. But in-house, what we do is when the optical people have something to modify, they go downstairs to the engineers in the mechanical department and they modify whatever they have to, if it is possible. And the same happens reverse. It's very easy.

Specifics about the Scorpio anamorphic prime lenses

Andres said, "The Scorpiolens anamorphics all have a 95 mm front diameter. With this design, our widest angle lens is a 20 mm. I don't think anybody else goes that wide. These lenses don't have distortion. Even at 20 mm, you don't have distortion on the corners—the geometry is straight. Faces look normal. No mumps, even at close focus, which for most of our lenses is from 1.25 to 1.75 feet.

"Anamorphic mumps are a phenomenon that happens when all the cylinders are in front of the iris. On those lenses, it is difficult to focus closer than 3 feet.

"We did not want to make lenses with just a rear anamorphic adaptor--because it's not the same look—it would lose the anamorphic identity. The lenses we are building have a maximum wide-open aperture of T2. The anamorphic cylinders are not in the front, not at the back. The anamorphics are in the middle. They are not like an adaptor. We feel that for anamorphic lenses to have a kind of 3D effect, the maximum aperture you should work at is no more than T4. That way the background goes soft. Otherwise everything is together...too sharp, too flat."

With cylinders spread out in the middle, the focus group is done with floating elements. They move together forward and back. The floating elements make corrections, minimize breathing, optimize close focus, and retain quality to the corners. It's a complex mechanical design.

Alfredo commented, "Because we are also a rental company, we designed the lenses to take into account the things rental companies need. Easy to repair. Strong. If something happens with our lens, it's very easy to fix it.

"The original 100 mm prototype had a choice of PL or PV mount. The new one doesn't. For a simple reason. The Panavision mount is smaller in diameter, which means we would have had to make the rear element smaller or the mount would cut into the image circle. And when that happens you see half moon bokehs.

"Many anamorphics have a 28 mm image circle. Ours have a 32 mm diameter image circle.

"To change the focus scale from feet to meters, we remove 3 screws. We flip the focus ring, and that's it. It's the same part—not a separate piece. For a rental company, you don't know who's going to use your lens, and you need to be able to quickly change from feet to meters. And the mount is titanium."

Pedro Povill explained the timetable for Scorpio Anamorphics. "We're planning to finish all the prototypes this year, 2013. We have already invested more than two million Euros in design and development, which includes our new clean room, the machines and test equipment.

"The lenses are going to cost between 22 and 26 thousand Euros each. We decided to keep the price reasonable so more people can use them. We calculated the cost of making the lens, of course, but also we also spoke with rental houses and we know what they can and cannot charge. Like our cranes and remote heads, we sell directly and we work closely with non-exclusive dealers.

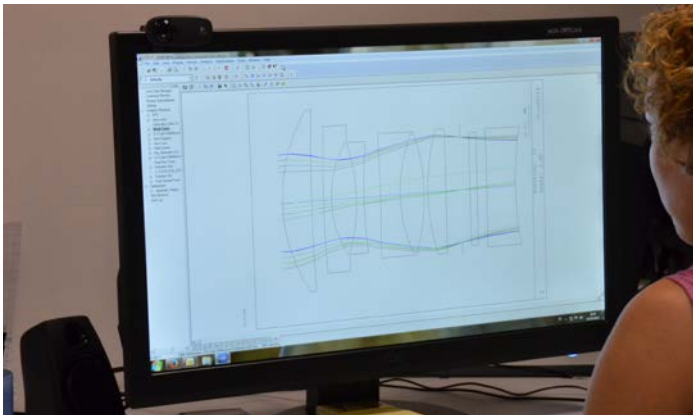
"The plan is to start delivery in March or April of the first sets of five lenses. As of now, we have preorders for about 85 sets. Before that, as soon as we finish three prototypes, the 75, the 50 and the 35, we will go to the US. We will test with Clairmont, other rental houses, and cinematographers.

"If everybody says the lenses are fine, then we will start production of these three lenses the next day. At the same time, we are finishing the rest of the prototypes. The first production run will be 20 sets and then we will do another 20, and so on. At the moment, with the people we have, we can assemble two lenses every day."

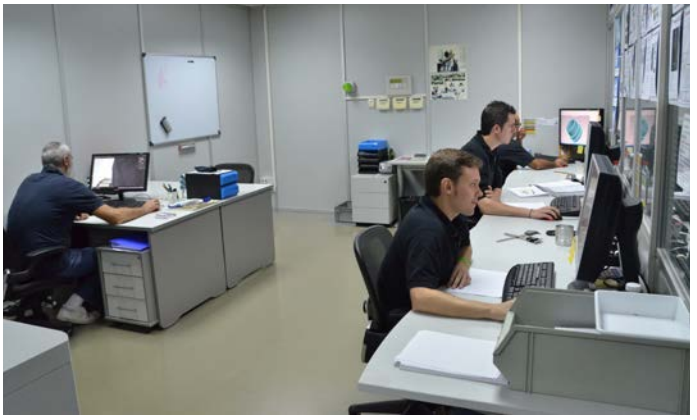
Making an Anamorphic Scorpiolens

1. Design work on the Servicevision Scorpiolens anamorphics began more than 4 years ago. They got feedback at tradeshows and from rental houses. Above, at Cinec 2012, Alfredo Valles, Cristina Alcaide and Howard Preston discuss focus mapping.

2. The design concept was for 2x anamorphic primes that were light, small and reasonably priced.



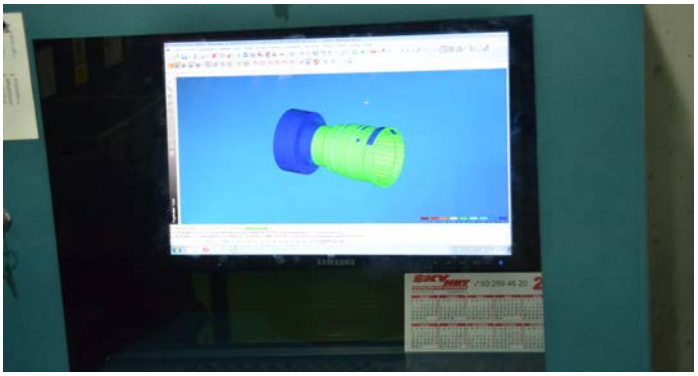
3. Optical design with Code V software and several years of work.



4. Servicevision's mechanical design department is one floor below the optical design office.

5. Above: because Scorpio remote heads require CNC machining to less than 5 micron tolerance, work on lens barrels is business as usual, and done entirely in house. 6: Below: design is transferred to CNC machine.

7. Above: The lens barrel begins life as a solid block of high quality aluminum. 8. Below: CNC machine room in the spotless basement of the massive Servicevision building.



Making an Anamorphic Scorpiolens, cont'd

9. The lenses were designed so all focal length fit into one of three barrel styles. Masks, cams, followers and other elements are made here.

10. Alfredo Valles with Scorpiolens CNC mechanical components.

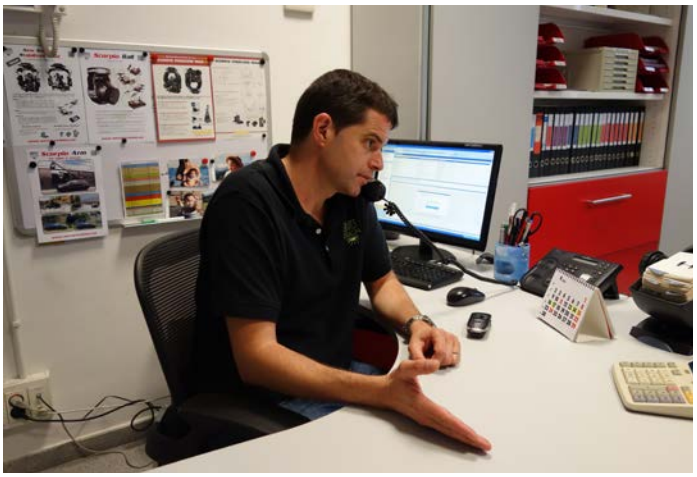
11. Above: Andres Valles measuring accuracy of machined barrels.

12. Below: Thais Valles and Rafa Piqueras, Sales Department

13. Measuring to 5 micron tolerances.

14. Anodized lens barrel.

15: Below: Pedro Povill Garcia, Sales Manager



Servicevision: Inside the Clean Room

Scorpiolens Anamorphics are assembled inside a new class 10 clean room at Servicevision.

Above: I was given full access and permission to take pictures of everything—free range cinematographer.
Below: clean room fashion show. Nice leopard print pants and cool white Crocs.

Inside the Scorpiolens

Above: Blacking edges of optical elements.

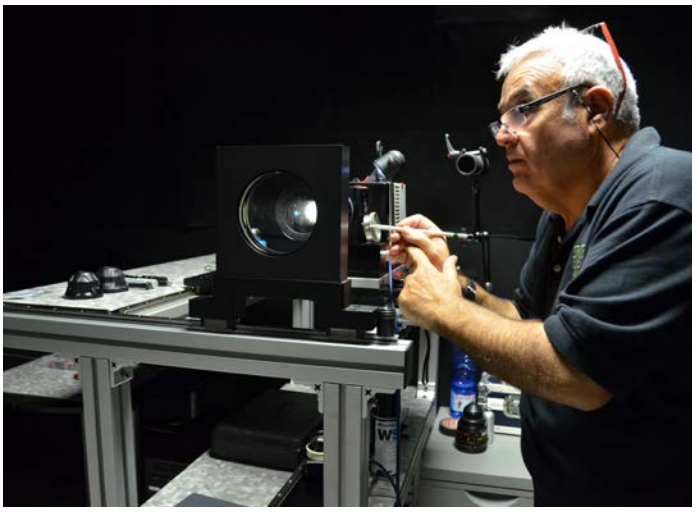
Above: We had lots of discussions about choice of paint color.

Above: Mounting optical assembies in lens barrel.
Below: QC and measuring optical elements.

Above: Cleaning optical element in parallel beam of light (projector).
Below: Testing optical centering and QC of assembled lens.

Calibrating Scorpiolens Focus Scale

1. In a room adjacent to the clean room, Andres projects each lens to calibrate the focus scale. He uses a monocular for viewing.

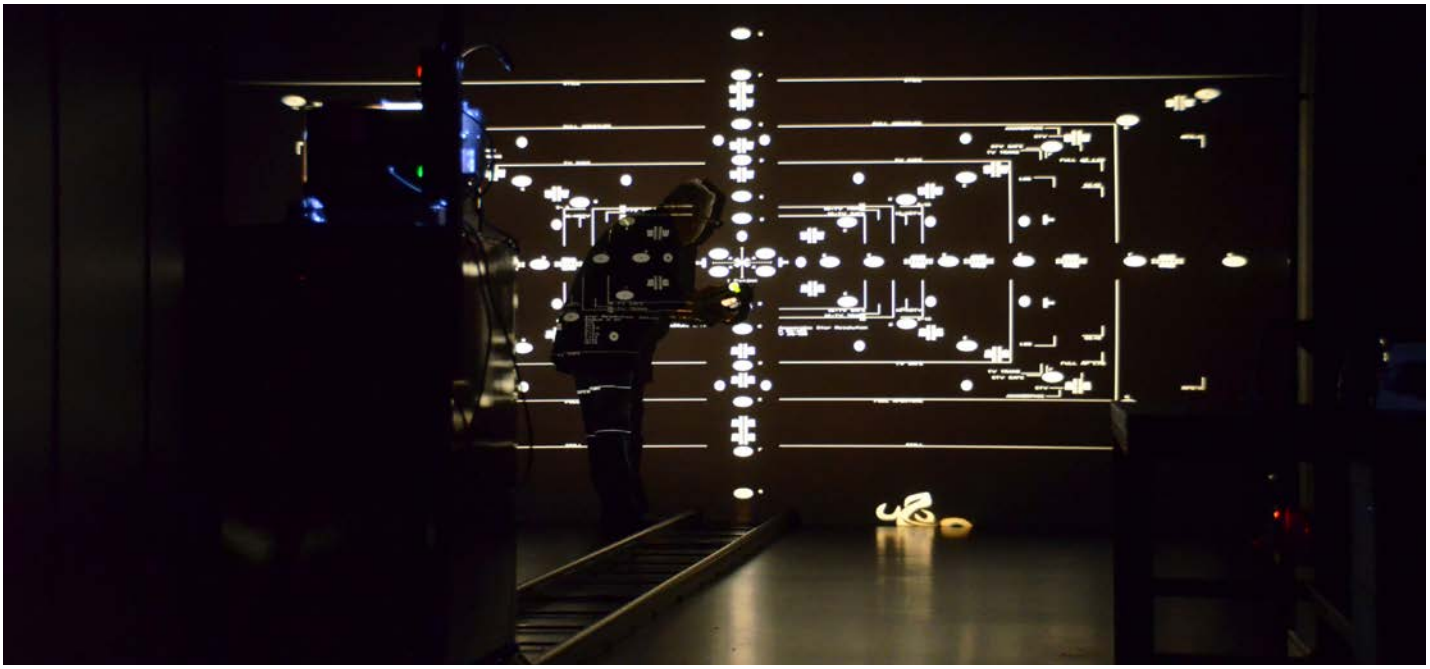


2. Each mark is scribed with a white marker. A moveable diopter slides in front of the lens for far distance marks.

3. The barrel goes downstairs for engraving, then returns to the lens assembly room upstairs.

4. The engraved barrel is installed and tested again.

5. Below: Andres checks each lens on a Gecko-Cam Lens Projector in a large projection room. The prototypes looked contrasty, very sharp (high resolution), with very straight geometry.



Dr. Winfried Scherle, ZEISS Senior VP & General Manager

Dr. Winfried Scherle is Senior Vice President and General Manager of ZEISS Camera Lenses. We got together in New York before and during PhotoPlus Expo, and continued our discussions by email.

Jon Fauer: How did you get started in optics?

Dr. Winfried Scherle: I have always been fascinated by uncovering things that were previously invisible and by exploring dimensions that were inaccessible. I think this is one of the reasons why I specialized in the physics of electron microscopy. At the German University of Tübingen I developed methods to calculate electromagnetic lenses for electron microscopes. At one point ZEISS was interested in taking over one of my methods and I decided to join the company to implement it into their technology.

Was ZEISS your first job out of university?

ZEISS was my first and only job after I left university. I can say that I'm highly committed to the company and therefore it is the only company I have worked for in my career. The most important reason for me is that ZEISS as a foundation is able to follow a long-term plan and strategy. All revenue It generates can be reinvested. That allows us to act reliably, innovate continuously and keep our customer in the focus of our decisions. I'm proud to say that our scientific research and development has enabled the work of many Nobel Prize winners.

How did Jena become such a significant lens manufacturing city—almost the center of the universe for optics?

In 1846, Carl Zeiss, an entrepreneur and the founder of our company, opened a workshop in Jena, Germany to repair optical instruments for the University of Jena and to build microscopes. At that time there were no mathematical equations available for the consistent production of lenses, so Carl Zeiss specialists manufactured microscope lenses by trial and error. They would build, test, and if it wasn't good enough, then they would try it again. But there was no clear or consistent procedure. Nevertheless, Zeiss's microscopes were good. As the business grew, he became frustrated with the poor yield and waste caused by the random process. In order to achieve higher reliability, he partnered with Ernst Abbe, a leading scientist at the University of Jena. Their combined efforts led to the discovery of what is known as the "Abbe sine condition", an equation for a lens to produce sharp images off-axis as well as on-axis. This enabled the specialists to define the shape of a lens before its creation and greatly improved the way lenses could be made.

Jena's international reputation as an optical center was created in the 19th century by a fortuitous constellation of personalities centered at the university. Zeiss's precision optical engineering workshop and the glassworks Schott & Gen. came about almost as spin-off enterprises from their Alma Mater—much in the same way that science, education and the business world dovetail in contemporary Germany.

Otto Schott, who received his doctorate at Jena in 1875, was the third to enter into this alliance by founding, at the instigation of Abbe and Zeiss, a "Laboratory for Glass Technology" in 1884, to produce the first pure optical glass material. This enabled them to produce special lenses for Zeiss's microscopes and optical equipment. That's how Jena and the University became the "Holy Place of Optics." Today, after more than 160 years, the ZEISS group of companies is the one of the world's biggest players in optics and enables global technological and scientific progress with its groundbreaking innovations to this very day.

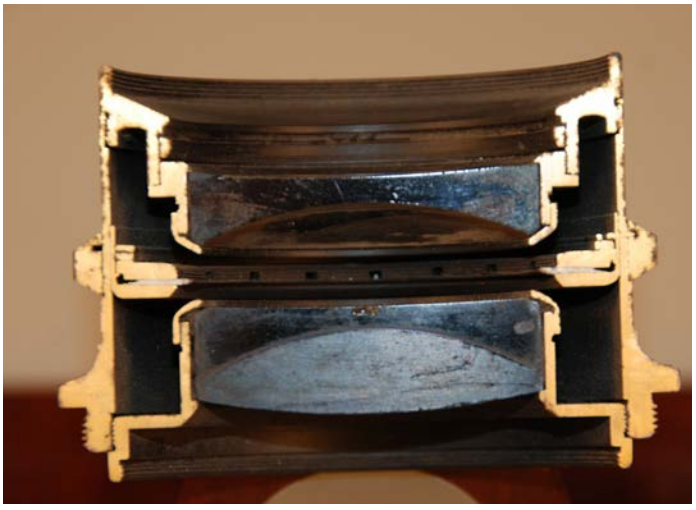
What did Abbe's optical equation actually predict?

Ernst Abbe understood the laws of interaction between light rays and material. An optical ray of a certain wavelength (color) that hits, for example, a glass surface, changes its direction depending on the the rafractive index and dispersion of the dedicated glass material. Abbe's great contribution and the breakthrough for the industry was the ability to make reliable predictions by the use of formulas. Today we use around 150 different types of glass to achieve the performance of our lenses.

When was the first ZEISS cine lens built?

In the beginning the first ZEISS lenses were built for still photography. But because, just like today, they offered the highest performance available, cinematographers began using the still lenses for motion pictures.

One of the first high-end ZEISS camera lens types was the Planar, presented in 1896 – the same year the Lumière Brothers first went on tour with their Cinématographe motion picture camera system. At that time no coatings were available. This created the need for designs with fewer optical elements to reduce the amount of stray light caused by reflections. In 1902, ZEISS pat-



Early Tessar from CARL ZEISS JENA. George Eastman House Collection.

ZEISS Touit (APS-C Sony E and Fujifilm X mounts)

ZEISS Otus (Full Frame Canon EF, Nikon F mounts)

ZEISS Full Frame SLR Lenses (EF and F mounts)

ented a lens with only four elements that would become the most famous camera lens: the Tessar. With its four elements ("tessares" is Greek for "four."), it is a triplet including a cemented doublet for better reduction of chromatic aberration and reflections. The first model was f/6.3. A few years later, an f/4.5 model was available for cinematography and projection. The ZEISS Tessar was fast, very sharp, and led to the design of smaller and more portable cameras—I suppose you could say it enabled mobile photography. More than 150 million Tessar lenses have been produced. After ZEISS invented anti-reflective coatings, the Planar design became even more attractive too—enabling even faster lenses.

History is repeating itself: still lenses used for cinema. What happened next in the history of ZEISS?

The history of ZEISS closely paralleled the history of Germany. After WWII the company was split into Carl Zeiss Jena (East Germany) and Carl Zeiss West Germany. For 44 years there were two ZEISS companies, in two different cities, producing almost the same products.

In West Germany, the business was restarted in Oberkochen (in southwestern Germany) under the name Opton Optische Werke Oberkochen GmbH in 1946, which became Zeiss-Opton Optische Werke Oberkochen GmbH in 1947, but was soon renamed Carl Zeiss. West German Zeiss products were labeled "Opton" for sale in the Eastern bloc, while East German Zeiss products were labeled "Jenoptik" for sale in Western countries.

Following German reunification, VEB Zeiss Jena - deemed one of the few East German firms potentially able to compete at a global level—became Carl Zeiss Jena GmbH, and then was renamed Jenoptik Carl Zeiss Jena GmbH in 1990. In 1991, Jenoptik Carl Zeiss Jena was split in two, with Carl Zeiss AG (Oberkochen) taking over the company's divisions for microscopy and other precision optics (effectively reuniting the pre-war Carl Zeiss enterprise) and moving its microscopy and planetarium divisions back to Jena. To distinguish the company from the founder's name, we capitalize the spelling: ZEISS.

Is Schott a division of ZEISS?

No. When Abbe was getting older, he tried to figure out a way to secure the company for future generations. He was afraid of handing it over to private owners who could take money out of the company for their own personal profit. That's the reason why the "Carl Zeiss Stiftung" (Foundation) was set up. Whatever we earn, we can reinvest in new products. Nobody takes the money out for personal reasons.

Abbe established ZEISS and then the Schott company as part of the Carl Zeiss Foundation. Today the two companies are independent, owned by the Foundation, and each company has its own stock. There's one set of stocks from Carl Zeiss AG and there's another from Schott AG. All the stock is owned by the foundation and cannot be sold.

They operate separately. In the beginning they were very closely related, because optical glass was used for the optical instruments. We now use over 150 different types of glass in our lenses. Today Schott makes a lot of other things. They make ceramics and glassware for all kinds of businesses and households.

Explain the "Stiftung" concept a bit more.

Carl Zeiss Stiftung (Carl Zeiss Foundation) is the owner of Carl Zeiss AG and SCHOTT AG. The primary objectives of the Carl Zeiss Foundation are responsible management and financial security of the companies. The Carl Zeiss Foundation is the sole shareholder. The Foundation achieves its objectives and responsibilities by pursuing specific business activities of the companies, exercising social responsibility, promoting the general interests of the optical and precision engineering industries, and supporting local nonprofit organizations. Furthermore, the Foundation promotes research and education in the fields in which the Foundation companies and their subsidiaries operate.

What is the difference today between the ZEISS companies in Jena and Oberkochen?

Today ZEISS is headquartered in Oberkochen. Jena is the company's second largest site in Germany and hosts many important production departments. For camera lenses, Jena is responsible for the prefabrication of precision parts such as glass elements and key mechanical components. Final assembly and quality control are sited in Oberkochen.

Let's talk about the high-end cinema lenses.

The requirements to be met by these lenses are extremely high. Therefore, we build all cinema lenses in Oberkochen where we have optimal control over the process and the quality level. The still photography SLR lenses like the ZE, ZF and mirror-less lenses are manufactured by production partners in Japan under our direct supervision.

We keep the really high-end products in-house. That includes Master Primes, Master Anamorphics, Ultra Primes, Compact Primes and our new Cinematography Zooms.

Are you still making ARRI/ZEISS Ultra Primes?

Of course. Up to now, we have built approximately 20,000 Ultra Primes. Just last year, we provided around 3,000 new Ultra Prime lenses to the market. Being in the market for around 15 years now, they have gradually become kind of a standard for the industry.

For the absolute top end we continue to offer the Master Prime series - lens # 5,000 was handed over during the last Cine Lens Day. For this product segment, that is a number we are very proud of.

ARRI/ZEISS Master Prime T1.3 Set

ARRI/ZEISS Ultra Prime T1.9 Lens Set (8R is T2.8. 10 mm is T2.1. 12mm is T2.0)

ARRI/ZEISS Master Anamorphic T1.9 Set

What about the ZEISS CP.2 Compact Primes?

This success story started in 2010 when we recognized a demand for professional cine lenses in combination with the latest HDSLR cameras. We modified our DSLR lenses for still photography (ZE, ZF) by adding a dedicated cine housing, narrowing the production tolerances and adding some other features for use with HD video cameras, like a new, extremely round iris and the interchangeable mount. The interchangeable mount system is important because it enables the same lens to be used on different camera systems. Together with their full DSLR format image circles, these lenses are also future-proof when users change their camera body or system—in other words, they are a perfect protection of your investment. Today we offer a set of 14 Compact Primes that have proven their excellence in many different motion picture productions, from corporate films to features and big budget productions.

In general, still lenses require higher specifications in terms of resolution than cinema lenses. Image details of still pictures are analyzed and viewed for a long time. Motion pictures live in the moment and small details are fleeting. Therefore, still lenses generally have to offer higher performance in terms of image quality than motion picture lenses.

And you now have a set of CZ.2 Compact Zooms?

In 2012 we introduced a completely new cine zoom, the Compact Zoom CZ.2 70-200/T2.9. Then we added a 28-80 mm in fall 2012 and a 15-30 mm at the IBC 2013. All three zooms offer the same maximum aperture of T2.9.

The family is designed to be used in combination with all high-end prime lens sets. They feature a completely new optical and mechanical design concept. They also cover the full-frame still format and offer the interchangeable mount system; therefore, they share their name with the Compact Prime lenses. But unlike the Compact Primes, they are not derived from still lenses and therefore offer much more performance and possibilities. Actually, they are in a class of their own and are beginning to be discovered by many more filmmakers.

What was the original concept for these zooms?

Like the Compact Prime lenses the original starting point was adapting DSLR still photography zoom concepts to the special demands of cinematographers.

Unlike the Compact Primes, we discovered during the development process that they would never fulfill customer needs. Still zoom lenses incorporate a varifocal design with associated focal shift, zoom shift and often with aperture ramping. These characteristics are not acceptable for cine applications. What was needed was a brand-new optical and mechanical design that meets the needs of the filmmakers but still offers the advantages of the Compact Primes.

What was the original idea for the Compact Primes?

We saw some filmmakers shooting commercials and videos for YouTube with our DSLR lenses adapted to a video camera. The results didn't look too bad but the workflow was inefficient. We thought it would be much better if we could provide lenses with a real cine style housing so they could use all the established accessories. Their work would be easier and more professional and they'd still have the advantages and quality of a good DSLR lens.

That led to the adaptation of the ZF lens, developing the optics from the DSLR. We added an optimized aperture module with a more rounded iris, provided interchangeable mounts, narrowed the production tolerances and developed a housing with cine-style interfaces that could work on all rigs. Our goal was to provide a series of lenses that provided our customers with the best value for their money..

I think you were the first ones in the industry to do this, and it was a big success.

The Compact Primes where introduced four years ago, and instantly created a new market. In the beginning the success was primarily attributable to the EF (Canon) mount. Now the majority of customers are asking for Compact Primes with a PL mount. So the majority of our lenses are shipped with PL mounts. Tomorrow, new mounts may well become more dominant.

ZEISS CP.2 Compact Prime and CZ.2 Compact Zoom Full Frame Lenses (PL, EF, F, E and MFT mounts)

But customers will be able to adapt their lenses to these systems by simply changing the mount. It is our best-selling cine lens program.

It would be nice if the industry settled on one standardized mount?

I'm a fan of open systems as they offer big benefits for customers. Personally I would like to make things easier for our customers, but going from the feedback we are getting from camera manufacturers, I can say we still have some way to go.

What mount would you recommend?

That's a difficult question. I wouldn't make this decision without the customers involved. I'd invite industry experts like Denny Clairmont, Otto Nementz, and others to incorporate them in the decision process. We need a mechanically very stable mount with an open architecture for future developments in electronic data exchange.

What gave you the idea to do a new set of anamorphic lenses?

That was a very complex decision. We started with a draft lens. It was a 50 mm T1.4 to see what was possible. We looked at what was out there and saw a segment that had not yet been addressed. The challenge was to create something that wasn't just a simple "me too," but that would be truly exceptional, a new benchmark for the industry.

We envisioned building anamorphic lenses with quality that had never been achieved before and would overcome existing boundaries in performance. We went to the market with this draft lens and learned a lot from our many discussions with rental houses, cinematographers, and users. They shot real tests to evaluate the basic concept. For example, we learned that T1.4 was not necessary; that T1.9 would be better, less expensive, and assistants would be happier with the focus. Our customers said, "Reduce the weight, make it smaller, more compact, less expensive. And maybe a size in between an Ultra Prime and a Master Prime."

Based on the discussions, we decided to produce a series of seven lenses. And we will probably expand the range beyond these seven.

As with all other high-end cinematography lenses, we collaborated extensively with ARRI. In parallel, they developed a compatible digital 4:3 sensor that fits the format of these 2x anamorphic lenses. The combination of the ARRI/ZEISS Master Anamorphic lenses and their ARRI Alexa Studio enables filmmakers to achieve image performance never seen before with anamorphic lenses.

At the moment, ARRI Alexa is the only digital camera that can really take proper advantage of 2x anamorphic. Do you see any other companies going to a 4:3 sensor in the future?

I'm convinced this will be a success on its own. But companies like Sony, Canon or RED might adapt and therefore I think it would be only natural for them to provide a 4:3 sensor sooner or later. They have a good understanding of the industry, the implications, and I wouldn't be too surprised if they offered systems in this format.

Why is there so much interest in anamorphic these days?

As far as we know, there are two reasons. One is that anamorphic provides a special experience to the viewer. If you enjoy an evening in the cinema it is much better to have the wide, broad view of a panorama picture which gives you a much more immersive experience. The other reason is that the anamorphic optical principles create special effects in the picture which many cinematographers like because of the special cine look given to their images.

Your ARRI/ZEISS Master Anamorphics are shipping now?

We started to deliver the first 10 sets before IBC and are continuing deliveries. Since the manufacturing process is very demanding it needs some time to get the production up to speed. Unfortunately some customers may have to wait for their lenses, but we promise that these lenses are absolutely worth the wait. As far as the schedule is concerned, we are on track with the complete set of seven: 35, 40, 50, 60, 75, 100, and 135 mm T1.9. and have plans for additional focal lengths.

As always, any comments and recommendations from customers are, of course, welcome.

Dr. Aurelian Dodoc, ZEISS Principal Scientist

Dr. Aurelian Dodoc (left) and Dr. Winfried Scherle (right).

CZ.2 Compact Full Frame Zooms

CZ.2	70–200 mm	28–80 mm	15–30 mm
Aperture	T 2.9–22	T 2.9–22	T 2.9–22
MOD	1.52 m / 5’	0.83 m / 2’8”	0.55 m / 1’10”
Length	250 mm / 9.8”	196 mm / 7.7”	198 mm / 9.9”
Front Ø	95 mm / 3.7”	95 mm / 3.7”	114 mm / 4.5”
Weight	2.8 kg / 6.2 lb	2.5 kg / 5.5 lb	2.6 kg / 5.7 lb

Dr. Aurelian Dodoc is Principal Scientist, ZEISS Camera Lenses. We spoke by phone and corresponded by email for this interview.

Jon Fauer: You’ve been busy designing lenses.

Dr. Aurelian Dodoc: Yes, indeed, we presented a lot of new lenses at ZEISS Cine Lens Day. It was a great event with around 120 guests. In addition to our Master, Ultra and Compact Primes, we showed the three new CZ.2 Cine Zooms and a set of seven new Master Anamorphic Prime lenses.

You mentioned the CZ.2 full frame Cine Zooms. Do you think the motion picture business is heading toward larger format sensors? Or will we stay with the academy format?

First of all, the idea of covering the full 24 x 36 mm still format was to satisfy the requests of customers making movies with HD-SLR cameras. This was our guiding idea at the time with the advantage that the full-frame still image circle does not disturb the smaller Academy format. So you can use these three zoom lenses in Full Frame Still, Academy, or Super 35mm formats. You only get correspondingly different fields of view according to the selected format.

From a technical point of view, do you sacrifice anything when you build a lens that covers this larger image circle?

No, not at all. If we look at similar focal lengths from other companies doing Academy format zoom lenses, which cover an image area 2 times smaller than our full format, it is remarkable that the physical size of our ZEISS Compact Zooms are quite similar. We have been very successful here, due to an innovative lens design.

How did you do that?

Again, the concept was to make a lens that would cover full format, with a size not larger than existing academy format zooms. The CZ.2 zooms are all multi-aspheric lenses with a very advanced optical design concept and a lot of special glass elements.

It almost seems to defy physics.

Yes, almost. We have challenged the existing performance limits using ZEISS leading technology in optics, fine mechanics and measurement systems. The optical designs are very robust and optimized for image performance and manufacturability. We call them Compact Zooms because of the compact size, not because of compact quality. The quality of these lenses is much better than the range of our Compact Primes. Their performance matches our Ultra Primes series of lenses.

Design is very important, but manufacturing and measurement technology are essential and we know from history that exceptional experiences can only be made with perfect optics. This was possible only with our high precision aspheric technology. A lot of companies are manufacturing aspherical lenses by polishing. But how many can make 100 a day with very high quality? Because of the high quality requirements, molding is not an option.

We all know the telescope of Galileo Galilei. I saw it some years ago at the Science Museum of Florence. They took the lens out and put it on a machine to measure the shape and found it to be slightly different from spherical. The question I asked was how could Galileo deliberately make it aspherical? The answer is he didn’t. He didn’t know it was aspherical. But he polished it a long time, and worked by trial and error. “It’s better,” Galileo must have said. “Now let’s polish a bit more over here…no…take a bit more off there.” In the end, he unwittingly made a lens with optimal shape and a telescope with exceptional quality for that time. It took a long time to finish the lens and this is how most companies are fabricating precision lenses.

(Aspherical lenses have complex curved surfaces, where the curvature changes according to distance from the optical axis. Spherical lenses are subject to aberration and have difficulty focusing light onto one point. Aspherical lenses, however, can focus light onto one

point and thus provide better resolution. Only two of Galileo's original telescopes have survived, and they are preserved at the Museo di Storia della Scienza in Florence. Dennis Overbye wrote, (March 27, 2009) in The New York Times, "It looked like a lumpy, mottled tube about as long as a golf club and barely wider in girth, the color of 400-year-old cardboard, burning with age. The tube's focal length is written 'piedi 3'…three feet…in the hand of Galileo Galilei.")

So design is not enough. You need advanced manufacturing technology as well. This is what I mean about high technology, to make very high precision products in large numbers in a very short time. You also need perfect processes in manufacturing, mounting, adjusting, and so on. For all this you need a substantial company with many years of experience. And you also need to have a solid base of high precision measuring instruments. ZEISS is in a very unique situation because we are not dependent on instruments made by other companies. We manufacture our own. We build our own world-class MTF measuring machines and interferometers and so on.

Tell us about the Master Anamorphics. Are you using freeform elements to achieve the small size and high performance?

There are no freeforms. An early design was considering them, but freeform surfaces are difficult to manufacture, expensive, and hard to align. We didn't want to take such risks, even with the technology from our SMT lithography division, which is very precise. I worked there for many years and was involved in designs with freeform surfaces.

But with these anamorphics, we don't need them at all. We have used cylindrical elements to split the two focal lengths inside the lens and multiple high precision aspheres and a lot of special glass for advanced correction. The result is a set of wonderful lenses with amazing performance.

What is the most impressive thing about Master Anamorphics?

The bokehs. By far, the bokehs.

I think they are the best we have ever seen. We have worked on them for a long time. Since from a mathematical point of view, a perfect lens is possible with given resources, the big challenge was to provide special image properties. Knowledge and experience is needed to give it a special artistic look. The Master Anamorphics have a smoothness that you don't find in any other prime lenses. It's something very unique. I don't really want to use the word "look" because it sounds like another company that talks about a look that is difficult to explain.

Maybe we cinematographers are the ones guilty of calling something a look because when we're trying to describe a lens to a director or a producer, we talk in abstract terms. It's almost like describing a fine wine or a beautiful woman. It's more adjectives and less science. I think that the Cooke Look honestly came about when some British DPs were trying to describe it and came up with the name. And it stuck.

You know, Jon, I very much like movies. When I watch a movie I am always commenting about it and the technical issues I see on the screen or imagine to have been used for the scene. We usually can tell we're watching an anamorphic movie by these elliptical highlights. But what's very important with an anamorphic lens is not so much the bokeh at nighttime when you see these elliptical highlights, but the out-of-focus shapes in daylight. How are the image elements, which are not in focus, represented on screen? I think this has a very strong artistic meaning. If we are talking about artistic, everybody thinks differently, but there are real common glimpses of truth. We have searched for something universally beautiful and I think we have found it.

Galileo Galilei (1564–1642) with aspheric element telescope.
1636 Portrait of Galileo Galilei by Justus Sustermans (1597–1681). National Maritime Museum, Greenwich, London.

Me too. How were you able to achieve these unique bokehs?

It has to do with the structure of the lens and the position of the cylindrical elements. Let's begin by talking about a normal, spherical lens. The image is what we call stigmatic. Stigmatism means the rays from an object point are converging to one image point. So if you want to build an image you have to bundle the rays to one point. For one object point you have to have one image point. With anamorphics, it's not just two different focal lengths in two different planes being perpendicular. You have a feature which you don't have in other lenses. In an anamorphic lens, for an object point which is not in focus, you have two image points instead of one. This image is not stigmatic. It is astigmatic. And this is a rule.

This is a rule for additional points in the object which are not in focus: our image has two points. And you have only to establish how far the image points are one from another. That is their interaction because when they are out of focus, they have a unique shape and that is the main effect.

ARRI/ZEISS Master Anamorphic T1.9 Set:
35, 40, 50, 60, 75, 100, 135 mm

If you have an object which is not in focus on a normal prime lens, the blurred image of a point is appropriately rotationally symmetrical. Even though it's out of focus, your brain is still very much able to determine what it is. The human brain is very well trained in computing and interpreting images. If something is happening out of our direct line of sight, coming from a lateral direction, our brain quickly computes what's happening. This probably comes from our ancestors long ago, where we had very big and hungry animals in the wild. Evolution favored people whose brains could quickly interpret images that were not in focus, were able to recognize the danger, and survive.

Survival of the fittest focus pullers...

If something is coming at you, attacking from the side, your brain computes the image which is not in focus, interprets it quickly, and tells you to be aware of that danger. This feature of your eye and brain is very well trained. It may not be a wild animal nowadays, but if you see a car that is not in focus, you still can interpret it as a car.

These mechanisms are not functioning if the image is astigmatically focused—as it would be with an anamorphic lens where you have two image points instead of one. In an astigmatic image, your brain does not function so cleverly. All these algorithms for computing the image are not working. So you are not able to recognize the object and this makes the bokehs so interesting. All the objects which are not in focus become very curious, very fascinating, because you do not know what they are. You think you recognize something, but you do not.

That is the reason the anamorphic image is so interesting—because we want to know something which is unknown. We are curious by nature and the brain is trying to interpret the image but it is not successful. So your brain keeps asking, "What's behind the focused elements?" This is my interpretation about anamorphic bokehs.

That is a most interesting explanation about the fascination with anamorphic images. Some people have described it as "almost 3-D like".

It isolates and highlights your subject in a unique way. You are not able to recognize what's behind. This makes it fascinating because it's not in the active conscious. You are not thinking about it, but you expect to recognize it. If somebody asks you what was in the background of a scene, and the object is far out of focus, then you cannot answer this question. You might say, "It was green and I suppose it was a tree." But you only suppose what's there because of the color, not because of the shape. Something is there, but you cannot interpret it.

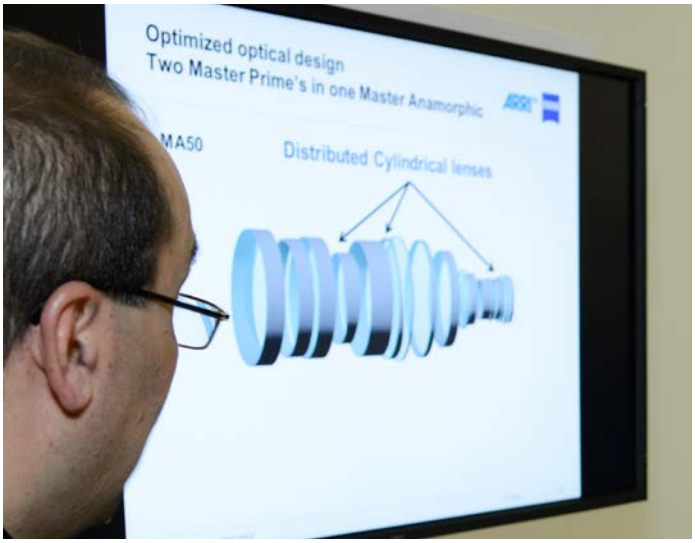
In 2007, ARRI Product Manager Mark Shipman-Mueller met me in Berlin and we spent 3 days driving to Jena and Oberkochen for tours of the ZEISS factories and visits to the optical museums. At the time, ARRI and ZEISS were in the first stages of investigating the idea of this new set of anamorphic lenses. Marc grilled me on what I thought contributed to the anamorphic look from the point of view of Cinematographers. For the entire three days all we did was talk about movies we liked and what contributed to the "anamorphic look." Is that the way you, as a lens designer, also approach it? How does it really start for you?

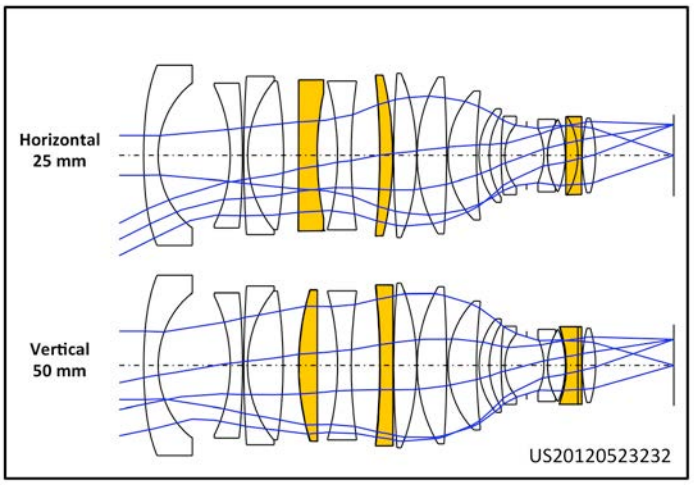
It began with a pilot project in the beginning and then we presented a lens. This lens was T1.4, big, heavy, expensive, and extremely complicated to manufacture. When I took over the project, my first idea was to make a family of lenses with a common optical structure that had unique performance characteristics. Then we established the specifications, but in this specification there was no indication about the look. If you ask somebody to tell you something about "look," nobody can define it. You can only discuss it by referring to pictures. This is something I like.

Another thing: everybody has a different opinion—they each understand something different about what's nice. So it was very difficult to follow one leading idea here, because there wasn't any. As I told you, I am very fascinated about how movies are realized and I have watched a lot of anamorphic movies. I cannot say we have designed our lenses to look like one of these movies. Instead we have done something new—which we call cinematic.

Optical designs for anamorphics are like conducting a very high-level master class in building lenses. From my point, it was absolute freedom.

When I showed the designs and calculations to the other members of our project team, I realized that we had to believe in the





results before seeing them, relying on numbers, experience, art, and intuition. Let's say it was a matter of trust.

It almost sounds like the SMT (Semiconductor Manufacturing Technology) division at ZEISS, where the prototype is your finished lens design because the product cycle is so fast?

Yes, I worked in the SMT (Semiconductor Manufacturing Technology) division for eight years. This is the lithography division, where we build the lenses used to make microchips, and Moore's Law is prominently written on the walls. Eighteen months for a doubling in chip performance. So we had less than 18 months to design and build the next generation lens for increasingly smaller and more complex chips. The SMT work demanded high precision. More than one thousand times smaller than anything you can ever imagine.

With the anamorphics, we were also working every day to the very limits of perfection.

When did you begin working at ZEISS?

It was a cold snowy day in March 2001 when I first arrived at ZEISS in Oberkochen. I found a warm and hearty atmosphere inside with wonderful people and I stayed. It was a perfect match.

Are the Master Anamorphics as critical as the Master Primes in terms of tolerance?

No. They are not. As already mentioned, the first goal was to create a common, robust optical lens structure as a basis for all lenses. Each lens group has a dedicated role and this unique structure is optimized for optimal assembly and adjustment. For our family of anamorphics, the designs of each is very similar in shape. This was the key to success to making these lenses easy to manufacture, assemble and to adjust. If you look at the layouts with ray bundles , we have very smooth ray bending and optimized sensitivities for all lens elements. There is a lot of care behind it and a lot of experience.

How could we describe the difference between the look of a Master Anamorphic and a Master Prime? Let's say we are in a theater and the first test is with a Master Prime cropped to spherical 2.39:1 and the other test is your Master Anamorphic, de-squeezed to 2.39:1.

Let's define an anamorphic lens in another way. Our anamorphic prime is a like a lens incorporating two Master Primes. That's because the idea of an anamorphic prime is a lens containing two focal lengths. So you have one Master Prime in the horizontal direction and the other Master Prime in the vertical direction. It's one lens with two focal lengths. You cannot separate them, but if you want to do it from a design perspective, you can take one of the structures and make it rotationally symmetric. You also have to de-squeeze the image after shooting. And it is not only the bokeh. The image from the Master Anamorphic is something entirely different.

I need to say another thing at this point. I have heard some DPs say that our Master Primes are too perfect. From my point of view, if you have a very good and sharp lens, with very rich contrast, an almost perfect lens—you can always change the image. You can always make the image worse. But if your lens is bad, if you have a soft image, you are not able to make it sharp again. No one can do that because you don't have enough information from the object to make the image sharp.

Nevertheless, with the Master Anamorphic lenses, we have created an image that is at the same time extremely sharp, but is also a little bit smoother. It has almost the resolution of the Master Prime, but it's a smoother, silkier feel for skin tones. Both lenses share a common feature which was essential in our concept: you get full and constant optical performance at the maximum aperture over the entire image. This is new and unique in the world of anamorphic lenses.

I think anamorphic is going to be big. Some people say it's just a cycle or just a current style, but I think it's going to continue very much in the future. Don't you?

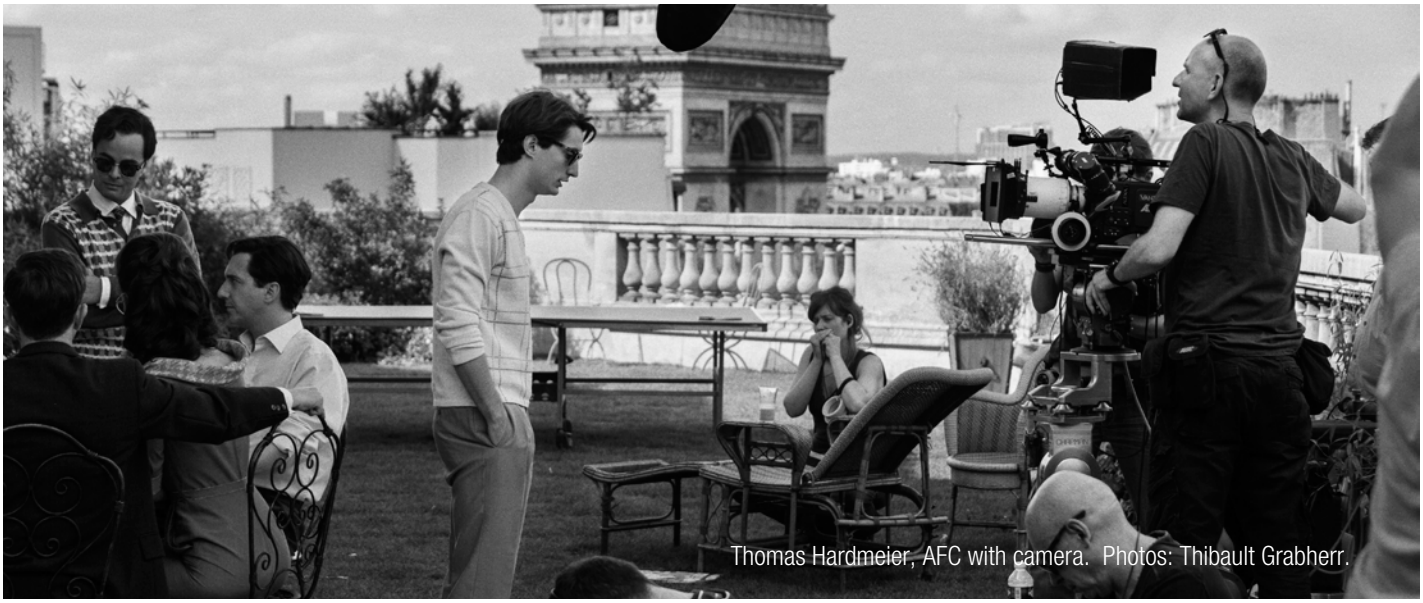
Oh, yes. The big question being asked is why to use rotationally asymmetrical lenses anymore (instead of spherical lenses). Because with anamorphics you are getting more artistic effects on the image. My feeling and wish is that more and more movies will be shot with anamorphics because they create a wonderful image. It's a pleasure sitting in a theater. And if you know that the movie was shot with lenses you have designed, the satisfaction is complete.

Thomas Hardmeier, AFC and *Yves Saint Laurent*

1970s “modern” look, with more color and contrast, using Hawk V-Plus 45-90 mm T2.8 front anamorphic zoom.

Above: 1958. Hawk Vintage ‘74 65mm lens.

Below: 1976. Hawk Vintage ‘74 110mm. Hard backlight and bright practicals.



Thomas Hardmeier, AFC with camera. Photos: Thibault Grabherr.

Thomas Hardmeier, AFC was the cinematographer on *Yves Saint Laurent,* released in France a couple of weeks ago to rave reviews. The Hollywood Reporter glowed, "French actor-turned-director Jalil Lespert makes his best film yet with *Yves Saint Laurent*. It traces the life of the precocious talent, who took over from his mentor, Christian Dior, in 1957, when he was only 21."

Praise for Thomas Hardmeier was as lavish as the images in the film. He grew up near Zurich, Switzerland, lives in Paris, is a member of the AFC (Association of French Cinematographers), and works everywhere. We spoke with Thomas about *YSL*.

Jon Fauer: How did you decide to shoot anamorphic and use Hawk lenses?

Thomas Hardmeier: I had another project last year and tested the Vintage '74 anamorphics from Hawk. That project fell through, so when Jalil proposed this movie I thought they would be appropriate to do a period piece like this one, because of their look.

We were shooting digital, and I wanted lenses that would take away some of the sharpness and add soul to the image. I wanted to use the ARRI Alexa Studio because of its 4:3 format sensor, which would provide the best quality—softened by these lenses.

Many of our colleagues say that digital cameras don't have too much soul. What does that mean?

There's no texture any more. You try to get it with lenses, add grain in post, but the look is really defined by the lenses we use.

Please tell us about the style and look of *Yves Saint Laurent*.

The script is a love story between YSL and Pierre Bergé. It starts in 1958 and ends in 1976 with a prologue in 2009 when Pierre sold their art collection in Paris.

We divided the film in 3 different periods. We looked at archives and photographs from these periods.

1958 was defined by restrained camera movement, classically slow cutting, no over-shoulders, and a very desaturated image—not too sharp, creamy and with aberrations. For that, we used Hawk Vintage '74 anamorphics.

The 1960s were characterized by more movement, more shots, over-shoulders, and images a bit less desaturated with an imperfect reproduction of color.

The 1970s had a more modern look, more color, more contrast, and sharper. We used two Hawk V-Plus front anamorphic zooms: 45-90 and 80-180 mm T2.8.

Did you use filters?

Only NDs. Hawk Vintage '74 lenses create a gentle softness and are great for beauty shots. I light very softly. I had one filter from Vantage, the Bethke filter, for a discotheque scene. It added blue flares. It's like a sandwich with little glass particles inside.

How would you define the anamorphic look compared to having shot this spherical?

What I always like about anamorphic is the shallow depth of field. I'm a great fan because of that. I think it is more cinematographic. So many great films were shot in anamorphic, subconsciously you have this in mind as a viewer. I thought this particular story needed to be done in anamorphic, not spherical.

Why is there a fascination now with vintage lenses, older glass?

Because of digital. It depends on what you want to do. For a period piece, I wanted to go softer.

If you had shot this project on film, would you have chosen the same lenses?

Same thing. I would have loved to shoot this on film, of course. When I came on the movie, there was no discussion about this. It had already been decided—digital. This was not a big budget movie. It was something like 7 million Euros. It's really a small budget for a period piece. We have very few exteriors. But that's how we were able to do it within that budget.

I did Jean-Pierre Jeunet's *The Young and Prodigious T.S. Spivet* last year in Canada with Production Designer Aline Bonetto. We worked very well together; we had a good understanding of what we wanted to do. On *YSL*, we had a great building with four floors where we did a lot of setups. We were there for four weeks.

How did you light these interiors?

Mostly from outside, mostly with Arrimax 18K HMIs. And inside, China Balls, because you can put them everywhere, switch them on and off, and it's soft light. And a lot of Kino Flos. I like them because they are soft and you can still control them with eggcrates and Snapgrids. I don't use anything very special. A lot of practicals.

Above: 1961. Hawk Vintage '74 65mm. 25 China Balls hanging from ceiling.

Above: 1976. Angenieux Optimo 24-290 with rear 2x anamorphic adapter.

Below: 1976. Hawk Vintage '74 110mm.

What kind of China Balls did you use?

Nothing special. We bought them from Ikea, 60 cm wide. We asked the costume department to make us some black skirts to drape around the outside to control the light—as light weight but dense as possible. We put 500 watt bulbs inside and they all go on a dimmer board. The shot with YSL in a white coat and lady in a red dress was in a long room that had a high ceiling. We had 25 China Balls hanging from spring-loaded poles. We just switched them on and off, depending on which ones we needed and where the actors were. It's quite cheap, home-made, basic, fast and straight forward. China Balls give a nice soft light.

They didn't catch fire?

No. My gaffer Laurent Héritier doesn't like to put in 500 watt bulbs; he would prefer 250 watts, but as we dim them, that's not enough. And with the anamorphics, we need a T2.8 or 2.8½. But we dim them quite a bit.

Originally production didn't have anamorphic lenses in the budget. So I said, "Let's do anamorphic and I'll save money everywhere else I possibly can in lighting. This is the place we have to spend the money—the lenses. The rest we did quite simply."

You rated the Alexa at 800 ISO. Did that mean smaller HMIs outside than if you'd shot film?

The same. I used 18K Arrimaxes or some new 9K Arrimax lights, which are nice. When shooting day interiors I need a lot of light to overexpose the light beams. When using them as a soft source, I have two or three layers of diffusion, so I still need 18Ks.

I also used 4K and 1.8K HMIs. For diffusion, I like full Grid Cloth half, Lee or Rosco 216, and lots of dense diffusion. I do very soft lighting, no fill, or almost no fill, with light coming from outside the windows. Grip and lighting came from Groupe Transpacam.

Discuss the lighting style and the visual style of this film.

I like to have a bright light or practicals in the background. I try to keep the actors out of the bright light. So we are not so much lighting the actors as lighting the background.

As far as the style of the movie—first we talk about production design. Everything follows that. If the production design is bad, you are in trouble. If the locations are well chosen, you have already done quite a lot of your job. And then the costumes. Of course you have to judge the lighting on the shooting day. But whatever appears in the frame, you have to design well in advance. That's why I like to prep a lot. 2 months for a movie of 40 days.

How did you move the camera?

Key Grip Jean-Pierre Deschamps drove our PeeWee dolly. We always had 2 cameras—one on a Steadicam. Valentin Monge was our B camera/Steadicamer for the whole movie.

With the Alexa, did you shoot RAW?

No, we didn't even shoot RAW because we didn't have the money. When I came in and said we should shoot anamorphic and RAW, they said I could only have the anamorphic lenses. But I think for this movie RAW was not the most important thing. You get a little more resolution, but we added grain in post anyway. I didn't want an image that was too sharp, and for the grading it was fine doing ProRes 2K Log C. We didn't have a DIT on set either. Basically I worked as if it were 35mm film. Our 1st AC was Maud Lemaistre, assisted by Agathe Corniquet and Ada Detraz. And that was it. I had my light meter, and we shot like that. We used the Alexa Look Up Tables to have a decent image on the monitor for the director.

But I insisted on having dailies done by the timer Lionel Kopp who also did the final grading. We watched dailies on my MacBook Pro. This is funny. In the States, you come from a country with a film industry that has definite procedures. Here we sometimes do it a little strangely, because we don't have your budgets. But it works.

What about your final grading?

Our grader Lionel Kopp and I used various LUTs for the different periods and as a digital image lacks texture with added grain and glow to a different degree on his Nucoda. We graded for 4 weeks, and we had access to the graded rushes.

Why did you decide on Vantage and Hawk lenses?

Alexander Bscheidl is a good friend and very helpful to his customers. I like Hawk lenses and the Vantage company. You send them your equipment list and half a day later you have the quote, and when you arrive everything is there, well organized and it all works. Coming from the Switzerland, that's the way I work, and I like that.

Hawk Vintage '74 anamorphic 2x lenses provide lower contrast, chromatic characteristics and flares of older 1970s anamorphic lenses—with precise, modern mechanics and the sharpness and consistency of modern Hawk V-Lite lenses. The set includes V-Lite 28, 35, 45, 55 ,65, 80, 110, and 140 mm.

Hawk V-Plus 45-90 T2.8 zoom focuses to 2'6" and the 80-180 mm T2.8 focuses to 3'3". Both are front anamorphic zooms.

Cooke Anamorphic Test in Paris

Danys Bruyère, TSF Managing Director of Technology and Ops, writes from Paris:

"We were thrilled to have the opportunity to test the first pre-production prototypes of the 40, 50 and 75 mm Cooke Anamorphics. We went out on location with Les Zellan, Patrick Blossier, AFC, First Assistant Maeva Drecq and DIT Julien Bullat. We used an Alexa XT in ARRIRAW mode at 24 fps. We threw a Cooke S4 40 mm lens into the case for good measure, not really to compare, but to illustrate certain qualities we had already gotten a feel for during the day. We drove around trying to get Paris scenery until the gendarmes told us we needed shooting permits if we were to put a tripod on the sidewalk.

"With anamorphics, the oval bokeh is the obvious draw, but more importantly to me, the smoothness of the foreground elements really stand out with the new Cookes. You feel it in the comparative shot of our trainee Meriem Housni (at left, top two). Certainly, the anamorphic backgrounds stand out, but more importantly her face and skin change subtly, bringing a silky, creamy feel to skin detail, even in the cold of a winter night in Paris, with sodium lighting and a single SoftLights T5 fluorescent tube. The distortion of the pixel structure really changes the structure of the digital image.

"On the shot of 2nd AC Florent Bertholet in front of La Samaritaine (middle picture), it is really interesting to see how the horizontal and vertical planes play differently when we focus from background to foreground. These are real anamorphic qualities which go beyond the ovalization of highlights.

"On the Les Zellan interview shot (bottom), as car headlights zipped by toward the camera, we never saw any out of control flaring, but rather, very subtle diffusion around the headlights without ever altering the contrast in the dark areas, keeping the image rich in low light detail and faithful color rendition.

"Another effect of anamorphics can be seen in the way that objects enter or exit frame. When panning, you get a feel that objects entering the frame are being pulled into the center, keeping our attention focused on the key parts of the image, rather than getting lost in unnecessary details at the limit of our peripheral vision."

Cooke Anamorphic Tests from Paris, London, Toronto and New York ("Look") are online. vimeo.com/cookeoptics

"Look" Cooke Anamorphic Test in New York

Jon Fauer tested the lenses and writes from New York:

No sooner had I returned from my visit to the Cooke factory than Marc Paturet, President of Handheld Films, called to propose shooting a test in New York with the pre-production Cooke Anamorphics.

I wanted to pursue Les Zellan's description of "anamorphic funkiness" and try to illustrate the qualities learned about the "Cooke Anamorphic Look" from the designers at the factory. Engineering Manager Stephen Pope had said, "It isn't fair for you to be asking all the questions. Now it's our turn. What do you think about our anamorphic look?"

I commented how, in the Paris opening shot of Les, the skin texture was cosmetically smooth. But his beard was totally sharp (opposite page, bottom). We told Les that he was a perfect lens test target. He replied, "Should I call my agent?"

Different agents in New York led Marc Paturet, a serious practitioner of Yoga, to entice three Yogini classmates to star in our test. The theme of the short film—"Look"—was a day in the life of a camera prep checkout at New York rental house Handheld Films—sort of an invasion of the Yogini Camera Assistants.

We wanted to push the lenses Les provided (32, 40, 50, 75 mm Cooke Anamorphic/i) to do all the things we're not "supposed" to do with anamorphics: minimum focus, wide open with a wrench, major flares, and more. We shot ARRIRAW with Handheld Films' Alexa Studio (4:3 sensor) and Codex Onboard. Timothée Arene was the terrific Camera Assistant. The camera was rated at 800 ISO.

Goldcrest Post Production did the finishing. Ricardo Madan edited. Tim Spitzer supervised and grading was on Qantel Pablo by legendary John Dowdell III.

In the framegrabs at right, top to bottom:

1. Next time the producer calls you halfway through checkout and changes the entire order from spherical to anamorphic, this is the stress-relief routine.

2. Oval bokehs. The foreground is a bare Maglight bulb held at the edge of matte-box.

3. Cosmetically smooth skin tones, oval background bokehs from little LEDs on battery chargers.

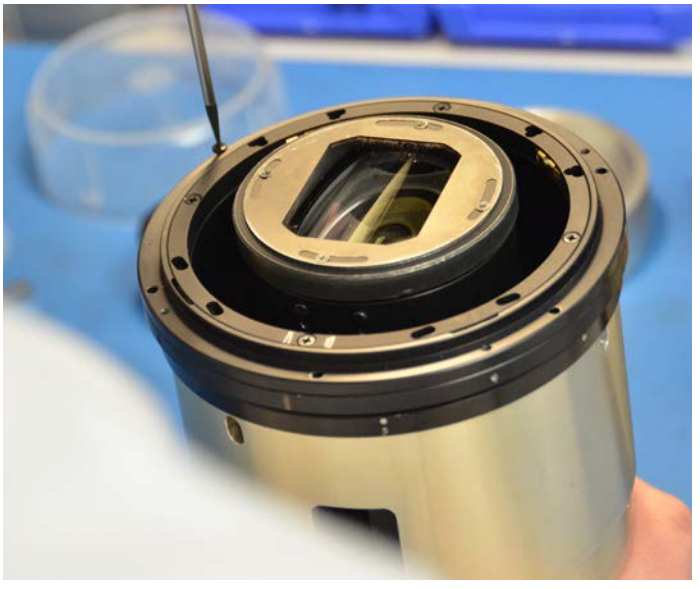
4. Funky flares and nice contrast. There is one shot in the finished short done with a Blue Streak Filter.

A Look at Cooke Anamorphic/i

"Class picture" of Team, photographed with Cooke 2x Anamorphic 40mm

The "Inner" being mounted into the "Outer"

Anamorphic cylinder element mounted inside.



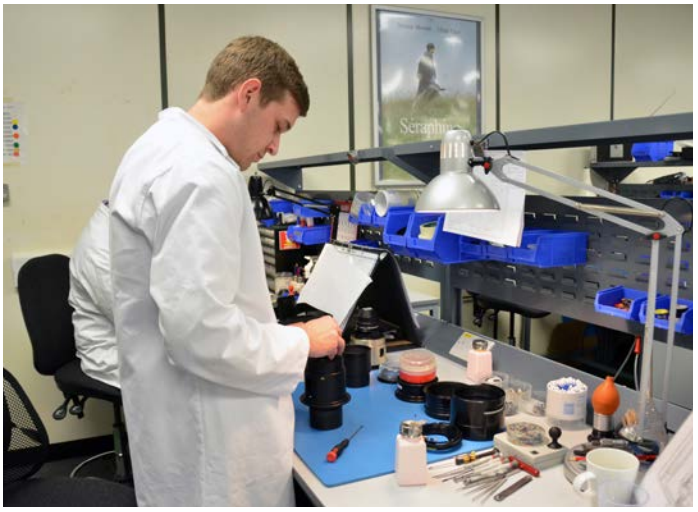
Screwing the innner and outer together

Lens cells

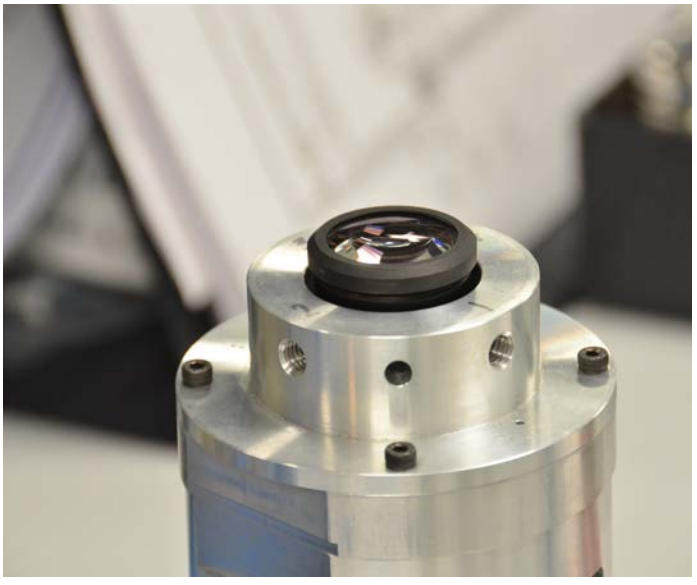
Cooke Anamorphic/i (cont'd)

The Basic Set of Cooke 2x Anamorphics: 32, 40, 50, 75, 100 mm

Iris assembly



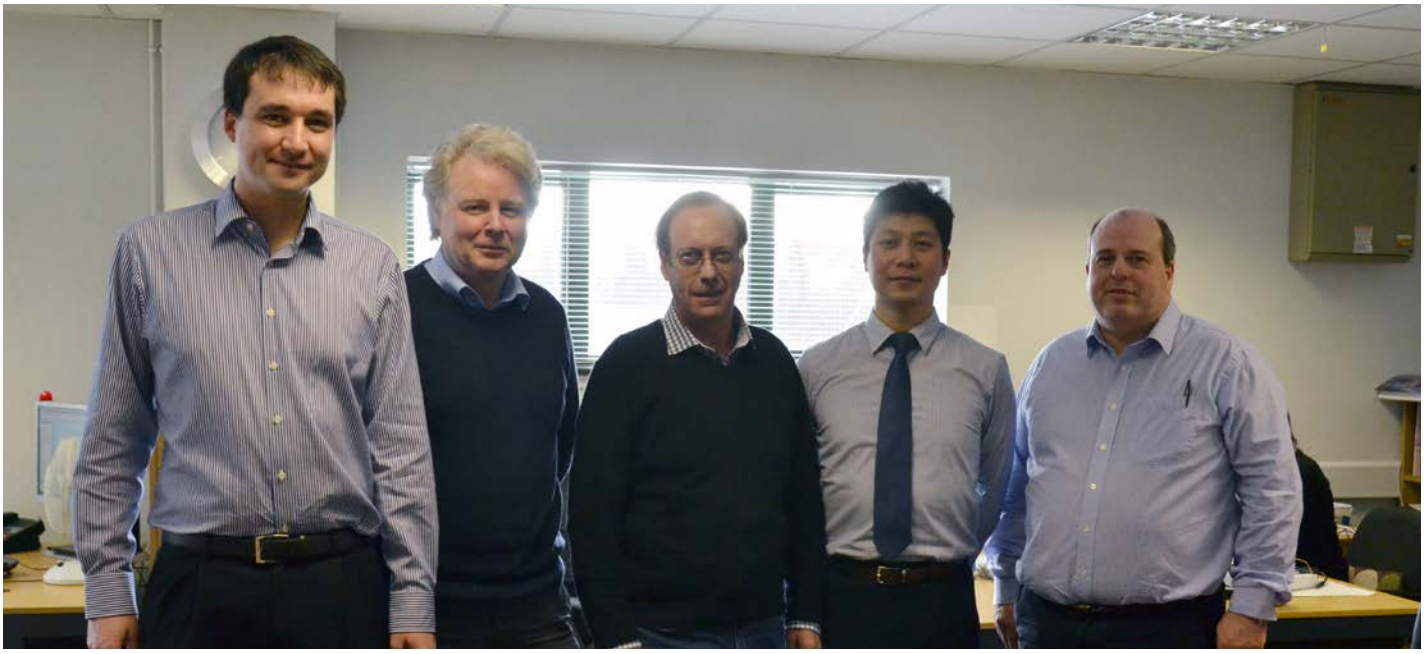
Jamie Cluer



Tool to align optical elements

Fiona Cheetham started building outers for miniS4/i and is now building 5/i

Cooke Anamorphic Optical Design Team



Cooke Optical Design Team: Graham Cassely, Philip Watson, Iain Neil, Leo Chen, and Stephen Pope (Engineering Manager).

It was a cold, rainy day a couple of weeks in Leicester, about two hours north of London. I was in the second floor conference room at the Cooke Optics factory talking about the new Cooke anamorphic lenses with Les Zellan and the optical and mechanical designers. I had expected to be meeting with one designer or two…not a group large enough to comprise an entire football team. We divided the discussions into three sections: optical, mechanical, and management. The optical design team was introduced first: Graham Cassely, Philip Watson, Leo Chen, Stephen Pope (engineering manager), and…Iain Neil. Iain Neil—what was he doing here? Les Zellan is an accomplished prankster, known for surprise parties for his wife Barbara, his family, and far-flung special encounters for his staff. Now I knew why he had vigilantly shepherded me from Micro Salon in Paris directly to the Leicester factory.

JON FAUER: I see some familiar faces here.

LES ZELLAN: When we started this project, I came to the designers and asked them for a set of modern anamorphic lenses. I wanted them to have the classical anamorphic character—what I typically call "anamorphic funkiness."

The reason is that, in the "old days," five or six years ago, when we used to shoot film, there were dozens of film stocks and processing options, and there were all kinds of things that let the cinematographer achieve different looks. In today's world, as we go more and more digital, those choices have been reduced to just a handful of sensors. That gives films a certain sameness in look. As these digital sensors get better, I think we're seeing cinematographers wanting to use not only modern lenses like our Series 4, 5 and miniS4, but they also want to use vintage lenses like Cooke Speed Panchros, Baltars, Standards, Super Speeds, and other older lenses. They're trying to inject personality and character into the digital medium, which can be fairly sterile. This renaissance of anamorphic is an attempt by cinematographers to get the image they want, give it some personality, and show character.

I asked our design team for a modern set of anamorphic lenses, with reasonable speed, new /i Squared Technology, and with the Cooke look (because it's going to have our logo and name on it). I wanted to keep the anamorphic character that's interesting to cinematographers today. It would have to go beyond just having classic elliptical bokehs, which are certainly a telltale sign. When building an anamorphic lens, you're sort of combining two lenses together. You've got the "normal" lens in the vertical axis, and you have another lens in the horizontal direction that is twice as wide. These two focal lengths give you multiple depths of field, all kinds of strange and wonderful artifacts and distortions. These are the things that give anamorphic its personality.

When did you assemble this dream team?

LES ZELLAN: It took a while. This is a highly experienced team and one person who's missing today is Jon Maxwell, a designer here for a long time. Although retired, he continues to work with us as a consultant and is very influential in what we do. This is a pretty young team. We knew we needed a little guidance here—somebody with a little bit more experience, especially going into anamorphic territory, somewhere we haven't been in years. So we approached Iain Neil and luckily he was available and didn't have any other anamorphic projects. Iain Neil is the optics technology consultant to Cooke and has taken the lead on the anamorphic project. We also have a continuing and ongoing arrangement with Iain to encompass other projects.

This team works well together and the proof is we're going to be delivering the first 5 of our 7 anamorphic lenses at NAB 2014. Later this year, we will deliver an additional 2 focal lengths, 25 and 135 mm, and we'll be announcing a few more. I think the set will finish with about 10 or so prime lenses.

Describe the process of designing this new set of anamorphic lenses and what each of you do.

PHILIP WATSON: Our approach was to come up with a completely new lens and so we began by making a whole pile of notes.

GRAHAM CASSELY: I translated that pile of notes, "the specs," into a lens design by tracing rays of light through the lens on the computer, deciding on elements and glass types, and tolerancing.

When I was here last, there was a gentleman who was dropping S4 lenses on the floor to test their durability.

GRAHAM CASSELY: That was Dave Nettleton. He has since retired. You'll be talking to his son Paul later—the mechanical de-

signer. But I don't know if they'll be dropping any of these anamorphics today. Anyway, we came up with the optical designs and then we handed them over to the mechanical designers and they worked out how it all fit together, how it all moved.

PHILIP WATSON: As an optical designer. I was mainly involved in 5/i designs. Now I'm now keeping an eye on the anamorphics.

LEO CHEN: My major responsibility on the project is actually doing tolerancing analysis—how the system is being designed within the team. We evaluate whether the designs these guys create are buildable. We look at ways to bring down the cost and whether we can actually improve the design. My post-graduate work was in lens and optical design. The tolerancing skill was acquired at my previous and current job.

STEPHEN POPE: I've been doing this for 25 years. Background in military optics. Also worked in telecoms and high volume optics. Now it's come back full circle. It's about traditional optics really.

I'm the engineering manager on this project, which involves knowing what's going on in the optical design and translating that over to the mechanical design team and making sure all that work happens. I look at what tooling we're going to need on the shop floor to put the lenses together. All the components have to be manufacturable. All parts have to be within our manufacturing tolerance limits. I identify any new processes that we need. There's quite a lot going on in this "little" project of ours.

LES ZELLAN: In addition to requesting an anamorphic lens with character, we wanted this to be a Cooke lens in the S4 tradition, meaning the Cooke Look, of course, as well as S4 ergonomics, sharp focus and good shadow detail. Camera assistants had a big influence on the design of the ergonomics with all our lenses beginning with the S4—particularly with the gears and the windowed scaling. The rental houses were also very involved by demanding a lens that was serviceable.

Like all Cooke lenses, there are different levels of complexity, but they're also serviceable by competent technicians. We didn't want a lens so complex that it's unserviceable. When you talk to the mechanical team, you may well come to the same conclusion as mine. The optical team runs numbers through their computers. It's the mechanical team that has the harder job of making the lenses work at all temperatures and maintain the air gaps and the spacing and make it focus.

The entire design was not a trivial exercise. But there always was a balance. The goal was to come up with a series of lenses that deliver what cinematographers are looking for and that we can assemble relatively easily to keep the costs from spiraling out of control, and that could be easily serviced at rental houses and repair facilities. I think we've come up with the right balance.

GRAHAM CASSELY: This balance is a tricky thing. We look at the possibilities, and sometimes come up with a different approach, and it's very much a trade-off among all the different departments—glass, mechanical, manufacturing, assembly. So it is a give and take.

Who cracks the whip and sets the deadlines? With NAB looming, who decides when something should be ready and who says when to make compromises to enable it to be ready? Because building lenses, not just anamorphics, often seems like a turtle race. It seems like a race to see who's going get there, not first, but eventually.

IAIN NEIL: The approach used here, I believe, is probably different from anything done before. We used new methods to figure out how to tolerance the optics and the optical designs in such a way that they suited the manufacturing techniques.

Because anamorphic lenses have cylinders, which we call non-symmetrical components, they once were extremely difficult to manufacture, to align, and to calibrate. It was very tedious, involving a lot of tapping of elements with little hammers and that kind of thing. That was in the old days—involving a lot of fine adjustments. The approach taken here was to minimize all these little, almost random, adjustments. And reduce it to something that's more scientific or…

GRAHAM CASSELY: Logical.

PHILIP WATSON: Systematic.

IAIN NEIL: It means that you can build anamorphic lenses in a very similar way to spherical lenses. And that's very important. Because if you don't do that, it can be, as you said, like a turtle race trying to get the product finished.

That was one of the fundamental things at the beginning of the project: to say this is how we want to do it. It had quite a bit of influence on the optical design. If you don't include those thoughts, you end up with a design whose tolerances can't be maintained and you can't build it.

When Leo mentioned the tolerancing, we actually used different software to do different kinds of analysis to make sure that what we were talking about technically was going to happen in practice. And then Stepheen would let us know whether it would work or not with the tooling and the test fixtures. All these things had to come together. I would amplify what Les said: it's very important that the optical design at the beginning starts with all this in mind.

Iain, please take us through the design process.

IAIN NEIL: The mandate was a new set of anamorphic lenses, with anamorphic imaging character, with the Cooke look—the anamorphic Cooke look. That was important because it would follow the Cooke spherical lenses: the S4/i, 5/i, the miniS4/i.

In terms of the optical design, we looked at the history of anamorphic lenses. They were used extensively shooting movies beginning in the 1950s. There were several different lens systems available. Anamorphic lenses came out as part of the studios' fear that television was going to take over and so they were looking for new, larger formats. People often think of 65mm film. But what's interesting about anamorphic was it didn't depend on a big piece of film, so it was a very cost-effective way of shooting in terms of film using standard cameras, for capturing the image, for processing. It was 35mm, 4-perf and it used the same film as a spherical production—and the same camera. The key point is that the camera system could stay the same. The only part that really changed was the camera lens, the taking lens.

Another important thing was using the entire negative area, as opposed to a cropped or letterboxed image. So the anamorphic image was less grainy and looked sharper.

IAIN NEIL: That's correct. So we're now in the second decade of the 21st century, almost 50 or 60 years later. You could say we've reached a point now where something's changing again in the entertainment business. This also harks back to the "old days" when cinematographers were looking for new ways to capture an image, to produce a different look.

So the anamorphic look comes back into play, because it's the same situation again. You keep the camera, but if it's not film in the camera, now it's a chip in the camera. You can keep the camera basically the same. And what you do is change the lens.

About our anamorphic lenses and the optical design. There were a couple of very important factors at the beginning. One was that we did not want to go technically crazy and push the cost of the lens through the roof. Anamorphic lenses have always been considered to be expensive, whether you bought them or rented them.

You're democratizing the anamorphic process.

IAIN NEIL: Yes. We wanted to carefully consider what people wanted from the lens, but also to be careful with the cost. There was definitely a cost constraint.

Anamorphic has been the object of desire for many directors and cinematographers, and, rightly or wrongly, an object of budgetary dyspepsia for producers.

IAIN NEIL: That was the opportunity, but only if the cost of the lenses could be controlled. Our team looked at what might be possible in terms of a new kind of optical design, with the anamorphic Cooke look, with character, at a reasonable cost, with the main features that the market was asking for. It was really important to listen to the end users. We're not just talking about rental houses. What is it they see or what are they looking at? Is it the out-of-focus highlights, the bokehs? Everyone hears about the bokehs. But that's just one part. It's also skin tones and color temperature and textures.

Can you define the anamorphic look that a spherical lens cannot provide? Specifically in your design.

IAIN NEIL: There are quite a few characteristics. One of these is the treatment of aberrations. Should we correct this aberration or leave that one alone? We heard many different cinematographers talking about aberrations they liked or didn't like. And we discussed producing or reducing some of these effects. Again, it's very easy to go crazy with the optical design and end up with many lens elements doing all sorts of things. So we reduced it to what we think are the key things.

If you take the anamorphic bokehs, which seem to be a big topic when people think of anamorphic pictures, there's more to it than is normally discussed. Some people might agree or disagree. First of all, to create what I would call the true anamorphic bokeh or character, you've got to really produce a two-to-one ratio.

There are different ways to describe the bokehs. You can call them elliptical or oval in shape. And the shape can even vary a little bit, depending on certain lighting situations, the focus distance setting of the lens, and the distance of the out of focus objects.

But having elliptical or the expected bokehs are very important not just because of how the shape looks, but because there are two or three other things that go on over the whole picture, related to the bokeh. The first one is not just the bright point source that's out of focus and shows up as a bokeh, but everything else out of focus in the picture. I would call it the out-of-focus highlights overall. You end up with that certain look when you have all the anamorphic optics, the cylindrical optics, in front of the iris.

And the out-of-focus background is going to look different with a front cylindrical lens as opposed to rear?

IAIN NEIL: Yes. In the past, you've seen rear anamorphic zoom lenses. They have a different look. But, yes, let's call the traditional approach with anamorphic lenses as having some sort of anamorphic cylindrical lens module in front of a spherical lens module. And the spherical lens module would normally have the iris inside, so it's just a taking lens.

The key point I'm making is that the anamorphic optics are basically between the object and the iris. That's where they sit. And that's what gives you the classic, elliptical out of focus look as well as the bright streaks across the picture.

GRAHAM CASSELY: Which is created by the two focal lengths and a combined depth of field.

IAIN NEIL: Graham makes a very good point concerning depth of field and focal lengths—which is also related to the shape and area of the bokeh. If you have a 100 mm anamorphic lens, it's about 100 mm in the vertical direction, and it's about half of that, 50 mm in the horizontal direction. For any point in the picture, the depth of field is different vertically and horizontally. For example, a 100 mm anamorphic 2x squeeze lens has a vertical focal length of a 100 mm spherical and a horizontal focal length of 50 mm spherical lens. So, the difference of the two focal lengths is 2x (100/50 = 2). However, the difference of the two depth of fields is 4x. Why is that?

Pull out your *ASC Manual* or lens manufacturer's depth of field charts—dust off your *Guild Kelly* or *Samcine* calculator—or click on your *pCam* or *Toland app*. For spherical lenses having a 2x difference in focal length, like our 100 mm and 50 mm example, with both lenses set at the same T/stop and focus distance, you will see approximately a 4x difference in depth of field. In other words, if the depth of field on the 100 mm is 2 inches, it will be 8 inches with the 50 mm lens.

So, if you don't have depth of field charts specifically for anamorphic lenses, you would be safe looking up published depth of field data for the vertical focal length "component" of your anamorphic lens, easily covering the horizontal focal length depth of field.

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

Earlier, I mentioned the out of focus highlights (bokehs). In addition to those, the overall anamorphic look of the picture is also created not only by the in-focus highlights but also any objects in the picture. The large 4x difference in depth of field actually contributes substantially towards the overall look of the image, with and without bokehs. This is something that is not easily reproduced with spherical optics shooting Super 35 flat, or even with post processing of captured images.

STEPHEN POPE: You can see whether the cylinders are in front of the iris or behind by looking down the front of the lens. If the cylinders are in front, then you'll see an elliptical shape when you look at the iris. If the cylinders are behind the iris, when you look through the front, it'll be a circular shape.

IAIN NEIL: Bokehs from a front cylinder anamorphic lens are much larger vertically than from a spherical lens. In other words, if you take out 100 mm spherical and 100 mm anamorphic lens, the anamorphic bokeh is much larger in size vertically. The width should be about the same, but the height is much larger.

What do you see on the Panavision C series?

IAIN NEIL: That's what I believe you will see. People generally like to see a very clean, smooth, homogenous look to the bokeh. In other words, you don't want to see a bright center and a very bright edge. You like to see it evenly illuminated. One of the things we did not want to do was to introduce optical surfaces other than are spherical and cylindrical ones. The cylindrical surfaces we need to achieve the two-time squeeze. But we did not want to use aspheres, because aspheres can show machining artifacts that look like lines and squiggles and little circles and ellipses, and other effects that may look like the rings of a tree. They are caused by thee grinding, polishing, and various other techniques involved.

What else went into the design?

IAIN NEIL: We wanted same size diameter and similar weight for the base series. We weren't looking for a super lightweight nor a monster lens. The base series is 32, 40, 50, 75 and 100 mm. The optical design approach we're using employs all the anamorphic cylindrical optics in front of the iris. It's a novel approach, because we're using cylindrical optics but some of the cylinders go in one direction and some go in another direction. They're not all cylinders going in the same direction. And there's actually a patent pending.

And what's the advantage of that?

IAIN NEIL: The advantage of that is gaining more degrees of freedom to tweak or optimize the performance to get as much of an anamorphic look as possible.

GRAHAM CASSELY: I think traditionally most anamorphs previously built had all the cylinders in the same plane or there was just one cylinder.

IAIN NEIL: In the Cooke anamorphic lenses it should be noted that the front element is actually not anamorphic, it's a spherical element. All the anamorphic optics, all the cylinders are between the front element and the iris. This is a novel, new concept.

There were certain aberrations we made a point of correcting that are worth mentioning, which directly relate to digital sensors. We tried to reduce the chromatic aberration. Because that can be difficult to post process. We tried to keep a near telecentric output, which improves the efficiency of light collection at the sensor. We've eliminated shading by achieving high illumination at the corners of the picture.

What's the image diagonal?

IAIN NEIL: We're optimizing for greater than the Alexa anamorphic 2.39:1 format dimensions 2x squeezed on the 4:3 sensor.

Alexa Studio and Alexa 4:3 sensor in anamorphic mode occupies an area of approx. 21.20 wide x 17.74 mm high (27.64 mm diagonal), occupying 2570 x 2150 photosites, with a ratio of 1.195:1. Unsqueezed, 1.195 x 2 = anamorphic widescreen 2.39:1 ratio.

You said optimize for digital. Will this lens look equally good on film cameras?

IAIN NEIL: They are optimized for maximimum performance with digital. But they work equally well with film.

Here are some points that could be controversial. As I see it, there are three ways to evaluate the imaging performance of anamorphic lenses. One is the computer, looking at numbers on the computer screen. The second way is to look at them in projection. And the third way is to actually use the lens, shoot something.

The rule of thumb with anamorphic lenses is that perhaps the worst way to look at the lens is on the projector. I think it's very important not to look at the textbook and get too caught up with MTF and test charts. As we noted, the depth of field on anamorphic lenses is 4x less in the vertical azimuth than the horizontal azimuth. So, if you project the lens slightly out of focus, the vertical test target line pairs will be 4 times more out of focus than the horizontal line pairs. But the projector can't go away, because you need the projector to build them. So to me the projector is part of the manufacturing process. It's building, assembly, alignment, testing, calibration, etc. But in terms of overall evaluation I think projection is limited and can even be misleading.

What I really want to say to rental houses is don't go bananas with projection. Anamorphic is more than what Les calls "funkiness" and more than just the bokehs. The anamorphic look involves artifacts and compression and curvature—which are difficult to evaluate projected on a flat wall. They are best evaluated in real-world situations. One other point. We keep the image performance good throughout the entire focus range.

Stephen, how do you take all these design parameters into account and how do you then manufacture this?

STEPHEN POPE: All those specifications have been distilled down and refined at the start of the project. It's also tied with the "trivial" things that we think about: length, diameter, weight, and all those good things that fit in with the cost. We take the optical designs from the computer in our first phase, put it into the CAD system, and try to wrap some metal work around it and say, "Yes, we have something here that looks promising to go forward."

We get an initial optical design and then Leo churns away doing all sorts of modeling in the background. He comes back and says that he has a question about an optical design parameter. We get those figures back and say, "Oh, that one's a bit tight."

Next, we might say to the team, "What resolution do we need to move that?" And they say, "Half a micron would be good." And then we might say that we're not too keen on half a micron, no. But if they come back and say 10 microns, we'll say, "Great!" That's the kind of iteration that goes on.

We went out and tried new techniques on this project as well. We had to develop some new tools to do the centering of the lenses. Most of our strategy was to avoid doing iterative adjustments. We prefer to do it by making many measurements. We try to reduce the time it's taking to build by making measurements and calculations. These lenses are very well measured.

GRAHAM CASSELY: I would use one big word here. It's not random assembly. It's predictable.

Who does the sourcing? And who says we need to get this element from such and such a company or another.

STEPHEN POPE: Alan Merrills is in charge of that and I do a little work on that as well. If the guys in the glass shop don't like a certain glass type because it stains or something like that, they say, "We don't like that one, can we have a different one?" You go around the loop and then you come back and say, "No, sorry, we must have this one because of such and such a reason." These are the sort of debates during the design process. It's a two-way collaboration. Every time we come back and say it might be easier one way, someone says we really have got to have this, and then we'll go find a certain material. These are the decisions we get into.

Earth. The Four Elements: Earth. A Fruit and Vegetable Market with the Flight into Egypt in the Background. Joachim Beuckelaer.
1569. Oil on canvas 157.3 x 214.2 cm.
NG6585. © National Gallery, London / Art Resource NY

Water. The Four Elements: Water. A Fish Market with the Miraculous Draught of Fishes in the Background. Joachim Beuckelaer.
1569. Oil on canvas. 158.5 x 215 cm.
NG6586. © National Gallery, London / Art Resource NY

I should say that an essential part of the process is the entire team in the optical, mechanical and assembly departments building the lenses. They also contribute valuable ideas during the design phase that continues during manufacturing: Keith Wykes, Jaimie Cluer, Paul Prendergast, Raj Mistry, Mick Maher—in fact, every one of the people you just photographed with our Cooke Anamorphic 40 mm lens in front of the factory today.

GRAHAM CASSELY: As a designer you work to a particular specification until you've actually built the lens and it's out there and people are actually using it. Until then, you don't know whether or not you've really got that specification right.

LES ZELLAN: That's exactly it. The anamorphic is even more subjective than the spherical lenses we're making. One person's awful artifact is another cinematographers, "Oh, I love that look."

Is there a Cooke Look in your computer program?

IAIN NEIL: The Cooke Look is in the computer. It's absolutely clicked in like an equation.

Can we go around the room and have each one of you designers explain to me how you interpret the Cooke Look. We cinematographers talk about it like fine wine. Oh, it's rounded or it's smooth or thin...

STEPHEN POPE: As scientists and engineers we are usually accustomed to nice specifications that are clear. Whereas here, it's great, we can say we want an MTF of this much here, and certain colors, and we get the challenge to think artistically as well.

LES ZELLAN: We at Cooke spent a lot of time in the early days (15 years ago) of really understanding what the Cooke Look is. We had all talked about it and we knew it when we saw it. But we hadn't necessarily codified it in engineering terms. Mark Gerchman, Jon Maxwell and Mike Salter spent a lot of time understanding it at a fairly deep level. We now have a very deep understanding of what it is and why it works so well.

But we're not going to tell you. It's like your asking Coca-Cola for their recipe.

GRAHAM CASSELY: But you can see what it looks like.

LES ZELLAN: Exactly. And that's what you cinematographers do.

If I were to describe the Cooke Look I would say it's smooth face tones, with a gentle fall-off in depth of field. You see sharp eyelashes and yet you have silky facial tones. The background falls off gently. It's slightly warm. That's how I would describe your ineffable Cooke look.

IAIN NEIL: I can think of two aspects. It takes away the harshness of an image and gives it a certain texture—for example, a person's face. The second thing is it makes skin tones look better, in that they have a slightly warm appearance. They have a pleasing look.

LES ZELLAN: It's not the same as using a filter. Other companies may go for contrast over resolution. But we clamp down a bit on the contrast. In return, we get resolution and more detail in the shadow areas where cinematographers love to have stuff hiding. It doesn't make one of us wrong or right. It's just gives you as the cinematographer a different brush to use.

When you designed the Cooke anamorphics, did you have in mind the S4 and your other Cooke lenses in terms of matching and characteristics?

GRAHAM CASSELY: Yes, we wanted to get the Cooke Look in there. I think they are pretty good matches. In the Paris test there's a shot with an S4 and another one with the anamorphic, and I would say in terms of the look there are similarities, other than the bokehs and anamorphic qualities, what Les would call anamorphic funkiness.

PHILIP WATSON: There's something more about color balancing. It's like lighting. When you say warm, what kind of warm? When you say bright, how bright? And what kind of white are we talking about? So color balancing is very important to the look.

IAIN NEIL: We can measure it. We see it as numbers or graphs.

GRAHAM CASSELY: I'll say we've been doing it for a long time. We have quite a good understanding of what's going to work and what doesn't.

In terms of the design, it's not like taking a 100 mm S4 and a 50 mm S4 and simply combining those two? It's a totally new science, right?

IAIN NEIL: Really, it acts in a completely different way.

Air. The Four Elements: Air. A Poultry Market with the Prodigal Son in the Background. Joachim Beuckelaer.
1570. Oil on canvas. 157.7 x 215.5 cm.
NG6587. © National Gallery, London / Art Resource NY

Fire. The Four Elements: Fire. A Kitchen Scene with Christ in the House of Martha and Mary in the Background. Joachim Beuckelaer.
1570. Oil on canvas. 157.5 x 215.5 cm.
NG6588. © National Gallery, London / Art Resource NY

LEO CHEN: I think designing a lens is not a leap of faith. We actually get numbers from the software or the computer, and then we see if it's going to be okay. The software predicts our figures. Much of what has been built in the past is considered. We have the belief in our particular sets of figures. We match the design with the specifications and we actually reproduce what has been discussed about the Cooke Look. It's all related.

Using this "stethoscope" approach will save a lot of time as well. We actualize with the prototypes and compare projection, distance, and, of course, we all worry about uncertainties regarding how the cinematographers will feel about our work. That's actually what makes the whole design more challenging. We talk a lot about "look." But one person might like it, and another person may not like it.

I actually saw 4 paintings in the National Gallery. The title is "The Four Elements," and it is a series of four paintings, "Earth," "Wind," "Fire" and "Water" by Joachim Beuckelaer. The painter actually had to point out the names in the titles, because each viewer might call it something else.

Our discussion today of out-of-focus bokehs and the design processes reminded me of these four paintings. Even objects far away or close up, sometimes out-of-focus, can be used to tell a story.

I think the artist, Joachim Beuckelaer, intended that we focus on the physical (the four elements) while aspects of the spiritual world are seen in the background, far away and out of focus, and by their very uncertain nature, are hard to grasp. For example, each painting has a subtitle, in case you, the viewer, missed it. "Earth" has the subtitle "A Fruit and Vegetable Market with the Flight into Egypt in the Background."

It's a similar thing in lens design. We can try to correct the aberrations or leave them in. It's like the "Four Elements." If you look inside, there are more things to consider than just the background and out of focus areas.

Just as we can see references to biblical parables in Beuckelaer's paintings, there is much embedded information in the backgrounds of anamorphic lenses that actually makes the filming more interesting.

"Just as we can see references in Beuckelaer's paintings, there is much embedded information in the backgrounds of anamorphic lenses that actually makes the filming more interesting."

Hamlet to Horatio: "There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

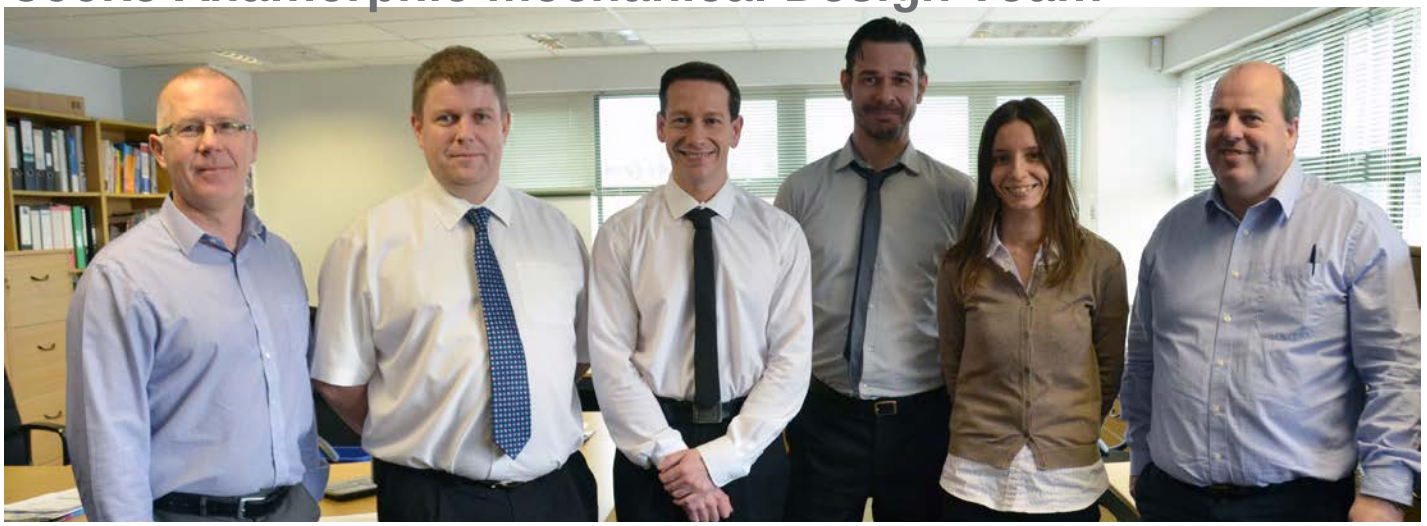
LEO CHEN: That is what makes the design process very rewarding and very interesting to carry through. Sometimes we have a debate. Should we be testing this way? It is a learning process so we can understand a bit more.

At what point do you then say, okay, now I am safe to order the barrels and cams and the mechanical stuff?

STEPHEN POPE: When we get to the point where we say that we are we happy with the optical design coming from the team, we like to call it a "freeze." But I think a better phrase than "freeze" would be "chill." So when we're good to go, essentially we're getting a prescription which says use this radius, this thickness, this glass type, and this distance behind it. And we have to take that and work out the mounting techniques to hold all those elements in there. In addition, we have to maintain an external diameter and a length that constrains us. And then we'll have a chat with the mechanical guys.

LES ZELLAN: I have to say that over 16 years that I've been here, the confidence in our computer tools has grown exponentially. We can move much more rapidly into pre-production. Because of the experience we have with the tools, when we see these numbers and translate them, we know we're getting what we expect and what we want to see on screen. That's the point. We have engineers translating specifications and numbers into what gives that look.

Cooke Anamorphic Mechanical Design Team



Cooke Mechanical Design Team: Kevin Warren, David Payne, Paul Nettleton, Kurtis Brooks, Catia Mao De Ferro, Stephen Pope.

I had kept the optical design team long enough, and I didn't want to be accused of delaying the imminent NAB introduction of the Cooke Anamorphic lenses. After a short break, the mechanical design team entered the conference room. The cast of characters included: Kevin Warren, mechanical design engineer; David Payne, mechanical design engineer; Paul Nettleton, senior mechanical design engineer; Kurtis Brooks, mechanical design engineer; Catia Mao De Ferro, mechanical design engineer, Stephen Pope, and Les Zellan.

You told the optical design team that this group, the mechanical designers, actually have the harder job. Why?

LES ZELLAN: The mechanical team has the harder job. This team has to take all the optical team's numbers and hold them precisely. The lenses have to move. And they have to keep that precision whether it's minus 20 or plus 110 degrees. The other thing they have to be looking at are ways to manufacture the lenses in such a way that we can make them, put them together, and service them easily. The optical team works very closely with the mechanical team. There's a lot of back and forth during the design process. Paul is the lead mechanical designer on the anamorphs. Kurtis has been doing the iris. And everybody else supports this effort.

The one thing that impressed me is how many designers you have working on this project. I thought at most there would be one or two people. I had no idea you had so many. I don't think I have interviewed so many optical and mechanical designers in one place at one time. You have enough people to start a football team.

PAUL NETTLETON: We have a football team. The Alpha Bokehs.

Alpha Bokeh! So, is it a chicken or an egg situation? What comes first, the optical or the mechanical design?

PAUL NETTLETON: They came together simultaneously on this project. I was working on the principles of the mechanical design while the optical team was working on the start of the optical side. We discussed a size that were going to try and stick to. It was just a space envelope on the inside. I didn't see an optical design for a number of months while we were doing the space envelope.

LES ZELLAN: It was driven by the main spec that you've got a diameter and length to meet. And then you try to estimate what the other focal lengths are going to look like, and can they all fit?

What are the dimensions?

PAUL NETTLETON: As small as possible, if you ask Les.

LES ZELLAN: We wanted everything to stay within 110 mm diameter, like the S4, and roughly an S4 shape. Which I think is sort of a good shape to sit in the hand. It's a manageable size.

KURTIS BROOKS: The length is mostly around 202 mm from the flange to the front.

Were these specs flexible? Did you come up with a design and then say, oh, but if we could make it slightly bigger or smaller, we could save $10,000.

LES ZELLAN: If you look at the original spec that we published a year ago, all the lenses were actually the same size. Now you'll see that the 25 has a wider front diameter and 135 is longer. It's flexible until the fat lady sings.

Take me through the design process as specs come in from the optical team, the mechanical team, and others.

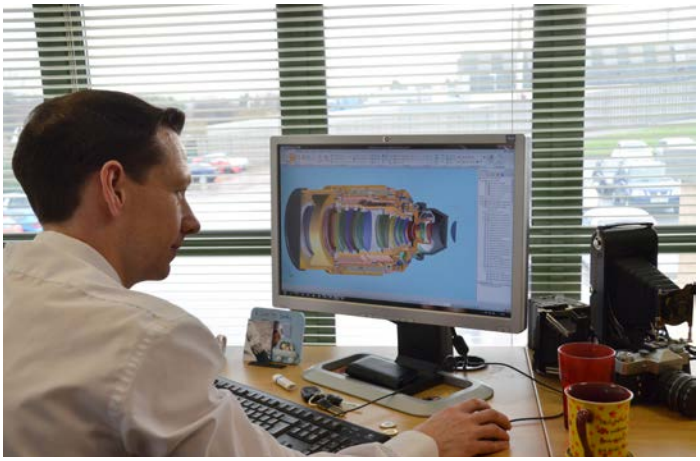
PAUL NETTLETON: When it first started, the brief was basically to try and make the mechanics as S4ish as we could. It's easier to build similar things. So I'll try and use as many standard parts from the S4 or 5 series. Some worked, some didn't, and I've got a lot of different design concepts that didn't work, or just hit a brick wall and stopped. This was the outer barrel, the parts that you're going to see and people are going to touch. It had nothing to do with the mounting of any of the elements, because that was a completely different ballgame. The idea was to use as many familiar parts as we could, because people are used to using Cooke lenses and how they look and how they work. There's a certain kind of classical physical look to them.

KEVIN WARREN: And this is all before Kurtis and Dave Payne and I were brought in, because Paul did quite a lot of the front end work, loading in the designs and so on.

KURTIS BROOKS: Then it was a question of the keeping different focal lengths consistent, one after the other. Paul would be doing one focal length. Dave would be working on another one. And then they would oscillate between the two.

DAVID PAYNE: Paul got to see all the initial designs and then they sort of filtered down to me. I would trace it forwards. And start running it through the process.

PAUL NETTLETON: Once we got a fixed idea of how we were going to design it, we followed the principles to make it quite easy for anyone to build and also to service. So the scales on one focal length are pretty much the same scales on all the focal lengths. If



Above, left: Paul Nettleton working on Cooke Anamorphic mechanical design. Above, right: Dave Nettleton drop-testing Cooke S4 in 2006. Paul is at the same desk, same place--older computer.

you know what you're doing with one of the lenses, you should be able to strip down or rebuild another one. It was me doing it, so I tried to make it as simple as possible. Because, that's the Cooke philosophy, keep things elegantly simple. Almost always a simple design is harder to do than a complicated one. But this extra effort at simplicity pays off in many ways.

KEVIN WARREN: The next step was completing the "outer" – which is the housing, the part that's got the cam, and the iris gear. The "outer" is the front cover, the focus, anything that you see from the outside.

KEVIN WARREN: It's like a shell, you have the mono body which is the main structure of the lens. Then you have the inners, which are the parts of the optical design that go inside. You have an outer and an inner and put them together.

And how are the elements held together?

PAUL NETTLETON: That was the hardest thing that we got to come across. Normally we put in spacers, clamp onto radiuses. It's perfect. So we had to come up with a new idea. We talked about potting. Gluing in position. We talked about spinning them in place. Using the old Panchro style, which is you get the position, and then you roll metal to get into the right position. In the end we decided to use a design of putting profiles in. And then putting clamps, proper spacers between these funny shapes. So basically we're going bigger and making our own full diameters to contact on.

How does that work?

PAUL NETTLETON: Imagine you've got a Pringle shape (representing a cylindrical element) that you can't clamp. We have to make the diameter bigger, make it round, cut out a full circle, and then clamp straight onto that. That way, we control the angles, and have the ability to make a few tweaks to make sure they're perfect.

STEPHEN POPE: Because you're working with cylindrical lenses, it's not rotationally symmetrical. So whenever you look at a 2D drawing in your head you'd rotate it around to see what it looks like. But it doesn't work because you're taking an X section and a Y section on this one. You have to go between the two. It's a very different way of working in the mechanical design because your brain is sort of hard wired when it looks at drawings. A number of times I would focus and the lens wasn't there. And then you look at the other section and it is there.

PAUL NETTLETON: On a normal design, we'll just work on a section. And we'll revolve it, and it'll be fine. Like Steve just said, you can look in one section and it's all making perfect sense. And then you go over to the other section and it looks like everything's in mid air. But it's not, it's just located 90 degrees round. So doing the glass drawings was interesting.

Shall we talk about the iris?

STEPHEN POPE: The iris is important because it affects the shape of the bokeh and what the bokeh looks like. We have a very round 11 bladed iris, which means that the bokeh look pretty smooth at the edges, at any T stop. The nice smooth shape is not just a matter of the number of iris leaves. Of course, the more leaves you have sometimes the better. But it can become excessive. It's having a suitable number of leaves, well designed, that's very important for the bokeh. What you might get away with for a spherical lens is probably less so with an anamorphic lens, because you want those smooth bokehs. If you don't have that it sort of takes away part of the anamorphic look. It's an interesting mechanical challenge and Kurtis has been looking at the iris.

KURTIS BROOKS: I've worked on the 5/i iris, which is spring loaded and has 7 blades. For the anamorphics, we wanted a very round iris, so I was going for as many blades as I could physically fit in. Which ended up being 11, still a tight squeeze. The S4 iris is round, and has 9 blades.

When did you start working on the mechanical design of these lenses?

KEVIN WARREN: It was, July 2012. The optical design had started earlier. And by Christmas we were doing glass drawings for manufacturing to show the first prototypes at NAB 2013 last year. And then we were talking about hitting the date for NAB 2014.

DAVID PAYNE: Then Catia came in. And helped us get as many drawings out.

KURTIS BROOKS: After the mechanical design, we did the tooling design to trim that timescale down. Which has been a useful feature on this.

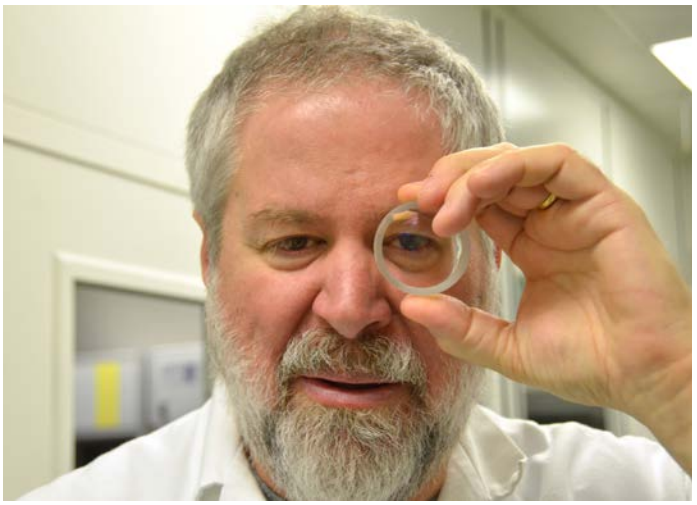
Has this been a faster development time?

PAUL NETTLETON: The miniS4/i and the 5i's took about 16 - 18 months. This has been faster, about 14 – 15 months.

And your deadline is NAB of this year, right?

PAUL NETTLETON: Yes. A short set of 5 Cooke Anamorphic lenses. And I was going to say it's a credit to the entire team that we are in this position now.

Above the Line at Cooke



Les Zellan, Chairman

Robert Howard, Managing Director

Having met the optical and mechanical designers, there remained one more team: the executives— the "Above the Line" group. Les Zellan is Chairman of Cooke Optics. Robert Howard is the Managing Director. Alan Merrills is the COO.

Alan, please take us through a day in the life of what you do at COO of Cooke Optics.

ALAN MERRILLS: Basically, I manage the factory. This job varies every day. No two days are the same ever, and I think that's what makes it enjoyable. Every day brings different problems and different opportunities. The factory normally opens up around 6:00 in the morning. The night shift has finished, the day shift takes over in polishing, assembly starts up and it's just a matter of pushing things through, staying on top of it.

Tell me about the three different shifts.

ALAN MERRILLS: We run three shifts in a polishing department. It starts at 7:30 on Monday morning, and we don't stop polishing glass until 3:00 on Friday afternoon. In assembly, some people will start at 6:00, and normally we have people in there until between 5:00 and 5:30 at night. We don't run two shifts in assembly. That's an opportunity yet to be taken.

What's going to happen when you get 300 orders or 500 orders for sets of these new anamorphics?

ALAN MERRILLS: Well, we're currently cross-training people to build anamorphics. We've taken some people off S4/i line, we've taken some people off the miniS4/i section and we've taken one person off the 5/i group, and we've put together a group of people specifically trained to build the anamorphic lenses. Because with the introduction of anamorphic lenses, we want to change the way we build the lenses at Cooke.

Which is how?

ALAN MERRILLS: We want to take more of a sub-assembly approach, where we can build the lens in its various sections and then bring those sections together to build the final lens. Previously, we tended to assemble just one lens at a time. With the new way of building, we hope to get more productivity.

That's very un-Japanese. Isn't the Japanese style called "cell production," where one person builds one lens?

ALAN MERRILLS: Perhaps. But we want to have a whole bunch of sub-assemblies on the shelf and say, give me a 40 mm. Well, I'll take that bit and that bit, put it all together and, presto, there's a lens. I hope it's as easy as that.

LES ZELLAN: We're trying to surprise the industry by not being the Cooke of the past, where we introduced the 5/i to great fanfare and great demand, but we couldn't deliver, and that really cost us dearly in some sales. We were fortunate when we delivered the S4 lenses in that we were alone in the market. There were no competitive lenses for almost three years, and then we learned a lot with the Minis.

You should be aware that while this is the main project, obviously it's not the only the project we're working on. We have been working on future lens designs while the majority of the team has been working on the anamorphic project. But we'll save those discussions for another day.

We're trying to make these anamorphic lenses more manufacturable and more deliverable and we're trying to apply the knowledge that we gained to the anamorphs, because we already have a long waiting list of people who have put refundable deposits down. We hope to surprise them by delivering much faster than the 20 years they're probably thinking it's going to take us. *(laugh)*

Why did it take so long to do the 5/i lenses?

LES ZELLAN: That goes back to the overall management structure that we have changed. It was just the ingrained thinking here and nobody wanted to think out of the box, rattle the cage a little bit.

ALAN MERRILLS: Nobody was shaking the culture, but now the culture has changed at Cooke, although it didn't change overnight.

What do you mean by culture?

ALAN MERRILLS: The way in which we do things, the way we approach them, developing a little bit more aggressiveness and hunger for sales, for making lenses.

How did you change that culture?

ALAN MERRILLS: Day by day. It was a matter of introducing things differently, convincing our teams that there were better ways to work. Losing some of the culture of the old parent company, Taylor Hobson, but keeping the best of it. We still have a lot of Taylor Hobson people here. There are good things about Taylor Hobson, but there wasn't the hunger in the Taylor Hobson days. Now, it's about introducing a drive.

Robert, at NAB last year, you joked that your worst fear, as CEO of Cooke, was having to build as many anamorphics as people has ordered.

ROBERT HOWARD: Did I say that? *(laugh)*

Alan Merrills, COO

Les with Cooke's "library" of one of about 4,000 glass gauges

Do you feel confident that you'll be able to meet the demand? I think the demand is huge.

ROBERT HOWARD: Yes. I'm confident we can meet the demand, but you've got to put that into perspective in the sense that when you launch a new set of lenses, you get a massive increase in orders.

That bubble is there for a while, and until we eat into it, we won't be able to deliver everybody's lenses at the time they want them, because they all would like them now. And they all would like to be first. Unfortunately, there's only one set to be delivered be first. That's the way of it. Some people will have to wait and--but we've geared ourselves up to be able to produce a reasonable quantity of these lenses and we don't anticipate anything like the sort of waiting times that we've had with some of the other lenses, particularly the 5/i.

From what I saw today and talking to all the engineers and the people in assembly, it looks to me like it's a design that is practical to build.

ROBERT HOWARD: Absolutely right. There's no point producing lens designs that look wonderful on paper but nobody can build.

We have to have designs that we can build and build relatively easily without requiring 15 engineers to build each of the lenses. We just can't do that. We have to be able to build not only a product that people want, but also that we can deliver, and that's what we've got with these anamorphs.

It was interesting to see the synergy of your mechanical, optical and assembly team—with everybody all in one facility and able to talk to each other. You don't have one person in one country and another trying to deal with it on the phone.

ROBERT HOWARD: Both Alan and I have tried to make sure that the lens design is both optically and mechanically buildable.

LES ZELLAN: Achieving the vision that we had, I think they really came through.

What was it that convinced you that it was time to do build anamorphics?

LES ZELLAN: Digital. The anamorphic market was prestigious, but it was basically Hollywood, London, New York, Paris, and India, except India wanted anamorphic lenses for nothing. Panavision more or less owned that business, and then Hawk gained a lot of market share, and the rest of the field was using older or modified designs.

But predominantly, if you were going do a major film, you were going to use Panavision or Hawk.

If you're really want to make money doing anamorphic work, you've got to get the Panavision type big budget features, and so you can't do that with one set of lenses. You can't do that with two. You're going to need at least 3 to 5 sets of lenses--and probably at least 5--to take on a large 9-figure movie. So before you start buying anamorphic viewfinders for your film cameras, we assumed that an anamorphic S4 would cost twice as much as a regular S4, so around $35,000.

And let's you have 6 lenses in a set, that's around a quarter of a million dollars for one set. Multiply that by 5 sets, it's over a million dollars in glass, and you haven't even started to buy anamorphic finders or groundglasses for your cameras yet. You still want to play? And I lost people pretty much right there.

Then digital happened. And digital anamorphic became much easier to do. You just flipped the switch of the Electronic Viewfinder, and you're unsqueezing anamorphic. That was a big plus.

And then, going back to my usual mantra that when digital was born, it became almost immediately obvious that digital looked inherently boring, and people immediately started looking for the old speed Panchros and other vintage lenses, as you've heard me say too many times before.

So all of a sudden, from a worldwide market of 200 or 300 Rental Houses where maybe only a dozen of them were serious about anamorphics in the film days, we've now gone to 10s of thousands of new digital cameras and users who are hungry for digital personality. So the market has gone from maybe tens of sets to hundreds of sets. And maybe even more.

Are more companies building 4:3 sensor cameras?

LES ZELLAN: We certainly hope that other manufacturers will embrace a 4:3 aspect ratio or larger sensors. We're talking to any camera manufacturer who will listen that they should jump on board with 4: sensors instead of 16:9. But I think the driving force is still to get interesting images. The real driving force is character and personality.

Last time I was here, we took an S4 lens and did the drop test from 3 feet directly onto the carpet. Can we do that again?

LES ZELLAN: Only if you want to buy that one.

www.cookeoptics.com NAB Booth C6143

Cooke Optics Ltd Factory Tour

Erin Samuel cleaning glass elements

Talysurf machine

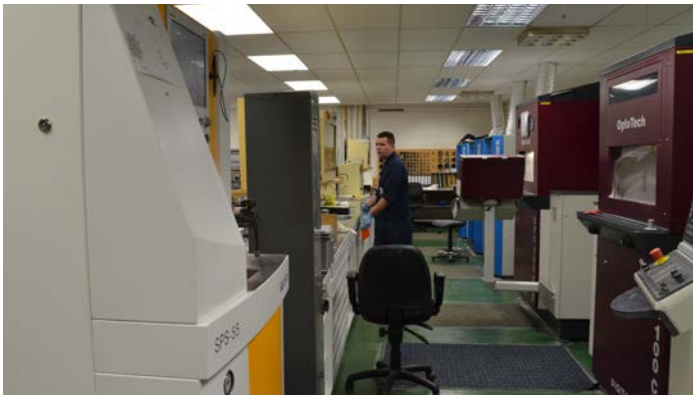
Philip Mathew inspecting glass elements

Glassing up the inner is done in a clean room

Chris Norton inspects the form of a glass element on a Zygo interferometer

Grinding

Aspheric polishing



CNC polishing

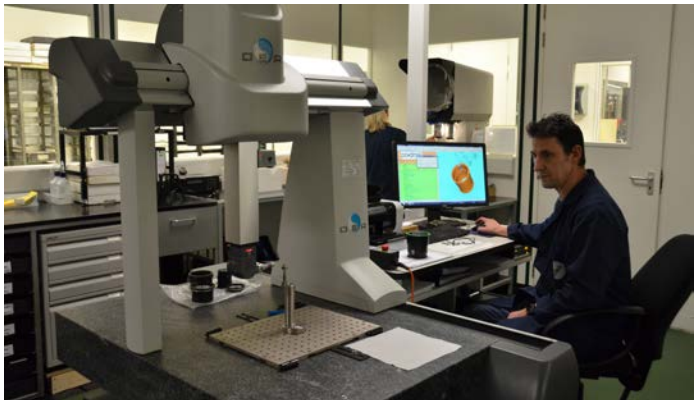
Cooke Tour, cont'd

Balzers coating plant

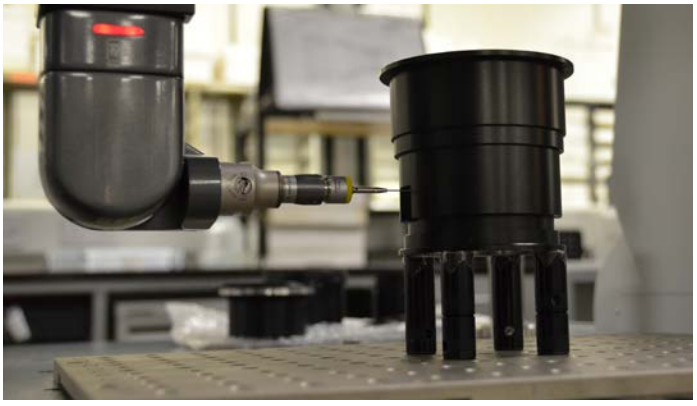
Catia Mao De Ferro, mechanical design engineer

Chris Norton, glass polisher and Les Zellan, Chairman

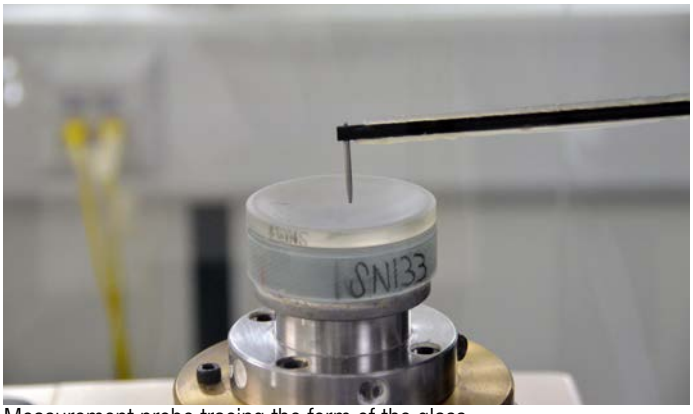
Iain Neil, optical designer, and Les Zellan in assembly area



Steve Newitt, CMM programmer



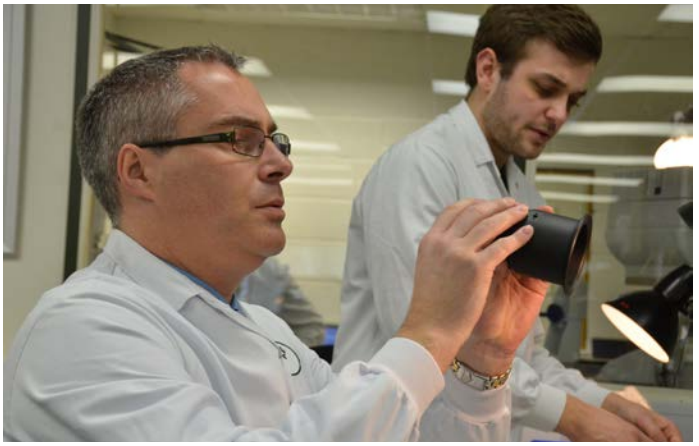
Coordinate measuring machine checking metal components



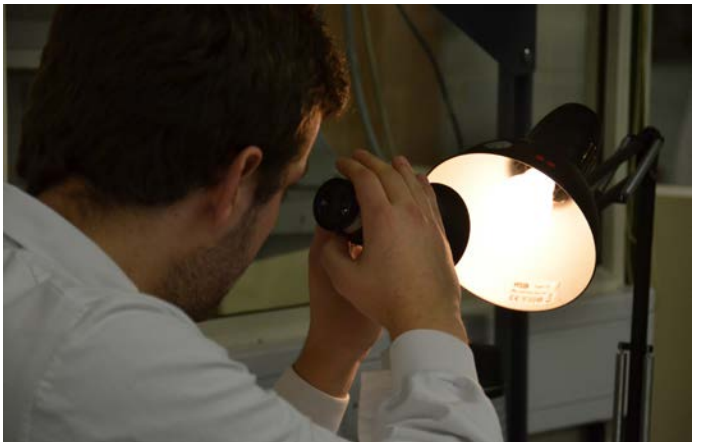
Measurement probe tracing the form of the glass

Optotech profiler, built especially for Cooke

Lens Assembly



Keith Wykes , Jaimie Cluer



Checking optical elements for dust and defects

Paul Prendergast, Optical Glass Shop

Hui Yen, Cooke /i Technology software designer

Calibrating the iris

Dee Roden using a shadowgraph

Checking Focus

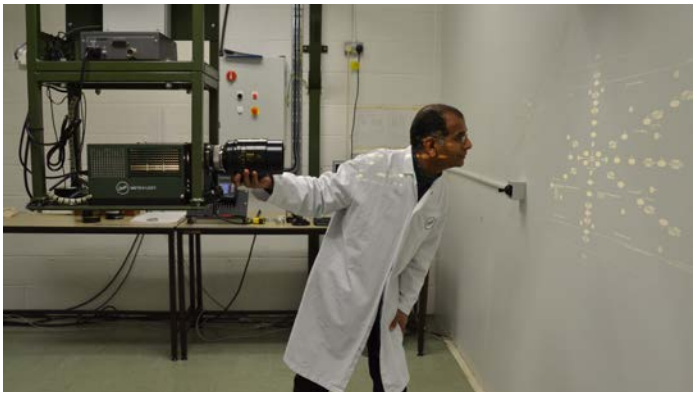
1. In the lens assembly area, Raj Mistry calibrates the focus scale individually for each lens.

2. The lens barrel is then engraved and checked again. Next, Raj takes the lens into the projection room.

3. On the projector, made by Cooke Metrology, of course, the flange focal depth is checked to be sure it is exactly 52mm.

4. Raj uses a metal rod to begin calibrating at exactly 3 feet. The rod is much more accurate than a sagging tape measure.

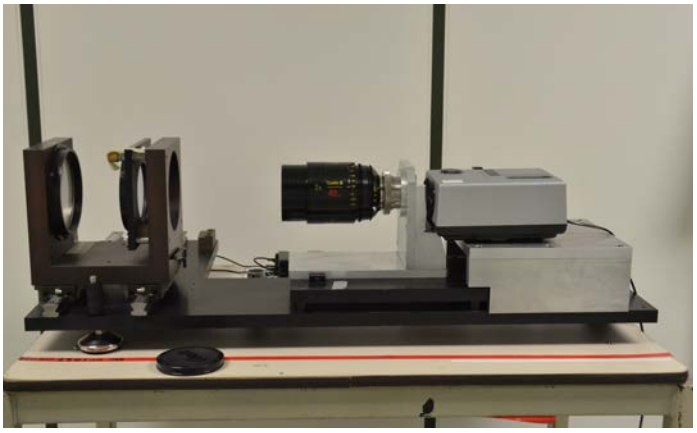
5. The lens is mounted and the focus scale set to 3 feet.



6. Raj examines the projected test pattern

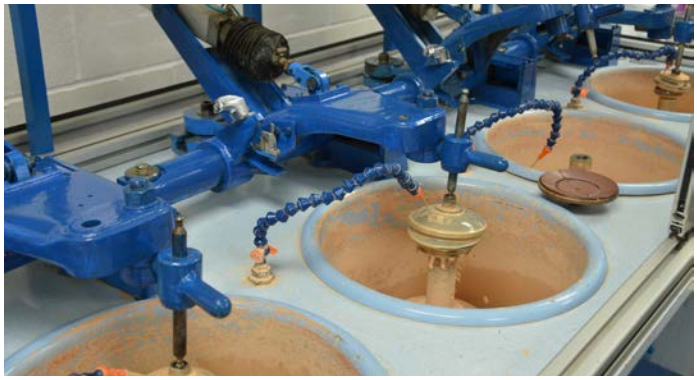
7. Below: Each lens is checked at each focus mark distance.

8. Below: infinity is checked separately by projecting through an additional element.



Mick Maher on Traditional Polishing

"My name's Mick Maher, and I've been working for Cooke for approximately 15 years. I've been in the industry for 35 years now. I started out in the early days when it was Rank Taylor Hobson in 1979. This process is a traditional process using serium oxide as a polishing compound. It's actually a mixture of Swedish pitch, beeswax, resin, wood flower, and red oxide polishing compound which gives it the pink colors. The tool is cast iron. The difference between using this traditional method and the CNC machines is that we often use these machines to finalize the polish, to get a good cosmetic, to get the radius to within plus or minus 3 rings. Then we hand paint it black, put it in the freezer to separate the glass from the pitch, clean the lenses, and then go to the QA department to be checked. Traditional polishing is often more suited to certain lenses. The CNC is used possibly more for smaller diameters and shallow curves. The steep curves and more difficult large diameters, we do over here."



Paul Utting on Traditional Edging

"My name is Paul Utting. I recently was made supervisor in this room, the edging department. What I'm about to do now is stick an optical element onto a brass choke and center the lens. To attach it, we apply pitch and some heat.

"To center the element, we have a collimator. When we look through it, we can see a green line, and then it's a matter of manipulating the lens very, very slowly until it appears perfectly stationary on both axes.

"Next, we put the lens on the edging machine, where we get the diameter accurate to within 5 to 10 Microns, and very smooth. These traditional machines do a wonderful job, often smoother than the modern CNC machines.

ARRI/ZEISS Master Anamorphics

The ARRI/ZEISS Master Anamorphic family made its debut at IBC Amsterdam in September 2012 with a 50 mm T1.9. The MA 35 mm T1.9 and 75 mm T1.9 were unveiled at NAB 2013, followed by the 100 mm T1.9 at IBC 2013, then the 40 mm T1.9 and 60 mm T1.9 at ZEISS Cine Lens Day in November 2013. The family will be complete when the MA 135 mm T1.9 is presented at NAB 2014. (Lens sets are rarely "complete." DPs, like Oliver Twist, always ask for more.)

ARRI/ZEISS Master Anamorphic lenses have an innovative optical design, with almost no breathing and minimal distortion. Anamorphic "mumps" (faces looking wider in close-ups) is automatically compensated by careful positioning of the cylindrical lens elements. There are 4 to 8 cylindrical elements in each lens. The optical design reduces chromatic aberrations and shading (darkening) at the corners of the image. Master Anamorphic lenses produce a smooth anamorphic bokeh, free of artifacts. The 15-blade iris helps create a bokeh that is elliptical (oval) and consistently illuminated. See the framegrabs (opposite page).

The lenses are compact, light, and have a fast aperture of T1.9 at all focal lengths. They are typically "ZEISS" with reliable and durable mechanical construction. Improved protection against dust and spray means less downtime and fewer repairs.

The ARRI/ZEISS Master Anamorphic lenses herald the return to an era of anamorphic big-screen productions at a new, previously unseen, level of quality.

ARRI/ZEISS Master Anamorphic lenses were developed by ARRI and ZEISS, manufactured by ZEISS, and exclusively distributed by ARRI. So far, about 50 mini-sets (MA35, 50, 75) have been delivered to customers, with many more orders placed. The MA100 is shipping now, and the MA40 and MA60 ship around the end of March. The MA135 will follow after NAB.

Both ZEISS and ARRI will be showing the Master Anamorphics at NAB 2014.

www.zeiss.com/cine NAB C9042
www.arri.com NAB C4337

Oval bokehs can be anticipated if the iris looks elliptical when viewed through the front of the lens.

Newest member of the Master Anamorphic family: 135 mm T1.9

ARRI/ZEISS Master Anamorphic Framegrabs

Sheng Lu
“I See”
(China)
MA 50 mm

Stijn van der Veken, SBC
“In Flanders Fields”
(Belgium)
MA 35 mm

Michel Abramowicz, AFC
“A trip to remember”
(France)
MA 50 mm

Michel Abramowicz, AFC
“A trip to remember”
(France)
MA 50 mm at close focus

Scorpiolens Anamorphics

Pedro Povill, Servicevision Sales Manager called with news for NAB 2014. "We are going to show the complete basic set of Scorpiolens 2x Anamorphics: 35, 40, 50, 75 and 100 mm, all T2.0.

"We will begin to take orders at NAB. Everybody will have the opportunity to see all 5 lenses. The 35, 40 and 50 mm are already the pre-production units. The 75 and 100 mm are the previous prototypes, and we hope to have the new ones ready by Cine Gear."

The picture above was taken on a Canon 5D with the new 35 mm Scorpiolens. "We'd like to show how good this picture is, without aberrations in the corners. It handles the big lights in the background nicely. The focus and the quality of the picture are also very interesting."

The photo below shows the Valles brothers and the assembly team in the clean room, working on the new lenses.

A short movie shot with these lenses will be shown at NAB.

NAB Booth C10542. www.servicevision.es

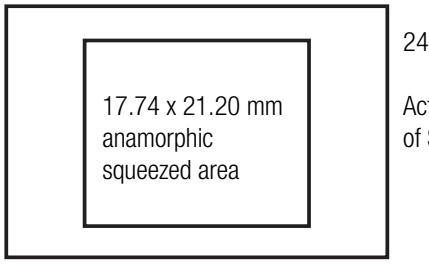
Sony α7R PL Finder

Sony's new α7 and α7R digital cameras are full-frame, 24 x 36mm, interchangeable lens cameras. They have the familiar Sony E mount—also used on their NEX APS-C and FS700 cameras.

The α7R has a 36.4 megapixel CMOS sensor and no optical low pass filter. The α7 has a 24.3 megapixel CMOS sensor with faster autofocus and an OLPF. Both cameras have a crisp, focusable, 2.4 million pixel built-in OLED viewfinder. Both cameras record impressive full HD AVCHD 1920 x 1080 60p video.

The mirrorless 18 mm flange focal depth of the E mount and full frame sensor make this an excellent DP finder with a PL adapter.

Full frame 24x36 is important because APS-C cameras crop the height of anamorphic lenses. Full frame is also an excellent way to see the image circle of the lens—and how much you can get away with and how much shading (vignetting) you're willing to accept.



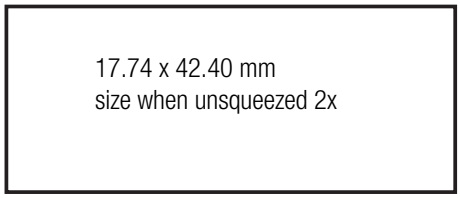
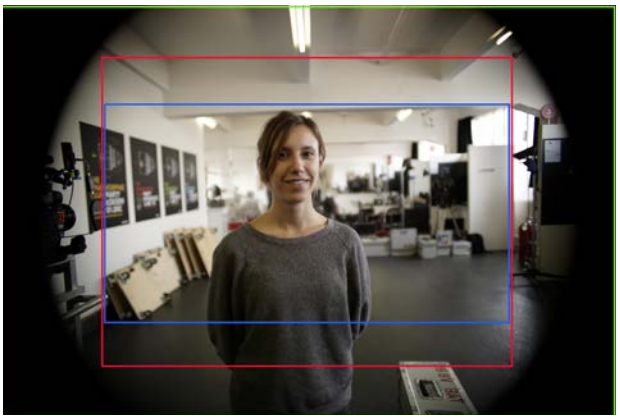
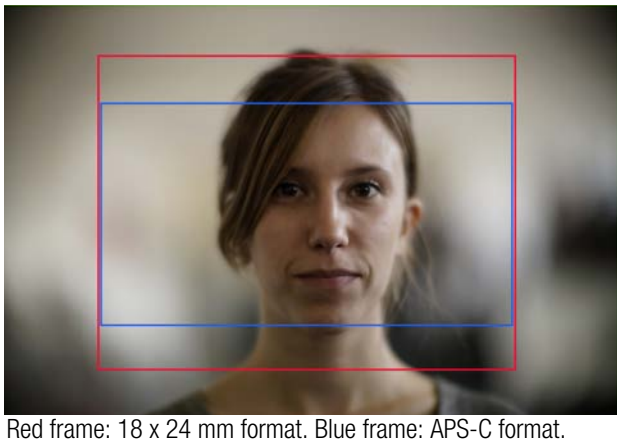


Image Circles and Confusion

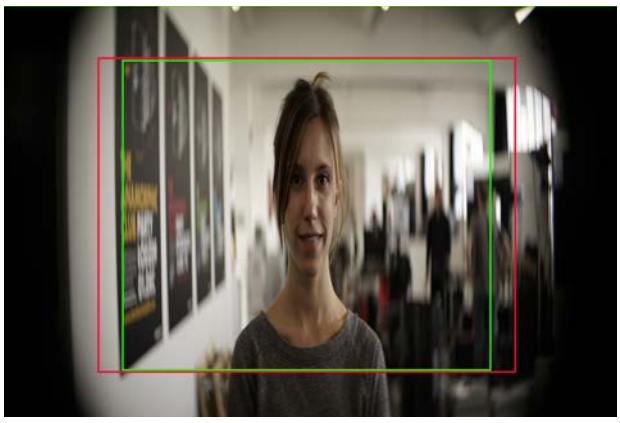


Photographed at Vantage Film Paris

Red frame: 18 x 24 mm format. Blue frame: APS-C format. Lens: Vantage One 17.5 mm T1.0. See image circle.



Red frame: 18 x 24 mm format. Blue frame: APS-C format. Lens: Vantage One 90 mm T1.0. Wider image circle.



Red frame: 18 x 24 mm format. Green frame: Anamorphic 17.74 x 21.20 1.2:1 camera format. Lens: Hawk V-Lite 55 mm T2.2.

Unsqueezed 2x to 17.74 x 42.20 mm from original Anamorphic 17.74 x 21.20 frame format. Same lens: Hawk V-Lite 55 mm T2.2.

How to Desqueeze Anamorphic

How do we get from what the camera captures (left) to the wide screen (below)?

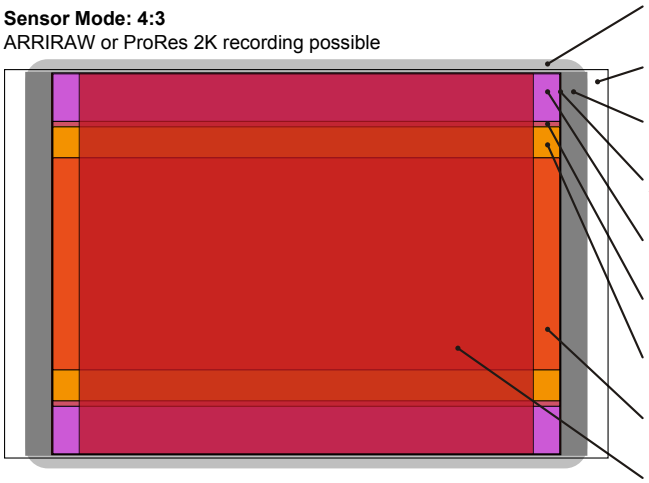
Shooting with anamorphic lenses, ARRI's Alexa 4:3 cameras capture ARRIRAW at 2880 x 2160 (23.76 x 17.82 mm sensor area = 1.33:1 aspect ratio). Inside this 1.33:1 frame, the anamorphic frameline is 2570 x 2150 (21.20 x 17.74 mm = 1.2:1 aspect ratio). So there is extra picture information to the left and right of the framelines.

In post, this extra information needs to be cropped, and we have to desqueeze the image from its native 1.2:1 aspect ratio to widescreen 2.40:1. (I know, I know, it should be 1.195:1 and 2.39:1, but the 2.40:1 math is easier and close enough.)

Goldcrest handled our recent Cooke anamorphic tests. Here are some recommendations. Desqueeze with DaVinci Resolve before editing. (Desqueezing in FCP or Avid is tedious and picture quality suffers.)

Above: Squeezed ARRI Alexa image with frameline. Cooke 40 mm Anamorphic at T2.3. Below: Unsqueezed image.

ARRI Alexa Framelines and Photosites



Sensor Mode: 4:3
ARRIRAW or ProRes 2K recording possible

Surround View Optical Viewfinder (Studio only, 1.38:1)
26.14 x 19.0 mm / 1.029 x 0.748", ø: 32.32 mm / 1.272"

Sensor Size 3414 x 2198 Photosites (1.55:1)
28.17 x 18.13 mm / 1.109 x 0.714", ø: 33.50 mm / 1.319"

Surround View EVF-1/MON OUT 3168 x 2160 Photosites (1.47:1)
26.14 x 17.82 mm / 1.029 x 0.702", ø: 31.64 mm / 1.246"

ARRIRAW 2880 x 2160 Photosites (1.33:1)
23.76 x 17.82 mm / 0.935 x 0.702", ø: 29.70 mm / 1.169"

ProRes 2K, Frameline ARRI 1.33 2868 x 2150 Photosites (1.33:1)
23.66 x 17.74 mm / 0.931 x 0.698", ø: 29.57 mm / 1.164"

Frameline ARRI 1.78 2868 x 1612 Photosites (1.78:1)
23.66 x 13.30 mm / 0.931 x 0.524", ø: 27.14 mm / 1.069"

Frameline ARRI 1.85 2868 x 1550 Photosites (1.85:1)
23.66 x 12.79 mm / 0.931 x 0.504", ø: 26.90 mm / 1.059"

Frameline ARRI 2.39 Flat 2868 x 1200 Photosites (2.39:1)
23.66 x 9.90 mm / 0.931 x 0.390", ø: 25.65 mm / 1.009"

Frameline ARRI 2.39 Scope 2x 2570 x 2150 Photosites (1.195:1)
21.20 x 17.74 mm / 0.835 x 0.698", ø: 27.64 mm / 1.088"

Alexa diagram and dimensions courtesy of ARRI

Anamorphic Desqueeze with DaVinci

1. Open DaVinci Resolve 10 Lite (free download).

2. Create New Project (click on the "+" bottom left of Project Manager screen) and give it a name.

3. In the main **MEDIA** window, click the gear at lower left for **PROJECT SETTINGS**. In **Master Project Settings** Set your **Timeline Resolution** to **Custom Pixel Size** and enter 1920 x 804 (1:2.39 for HD). In **Image Scaling** set **Input Scaling Preset** to "Scale full frame with crop."

4. In **Output Scaling Preset,** uncheck "Match timeline settings" and set the **Output resolution** to HD. Set **Mismatched resolution files** to "Center crop with no resizing." This will fit 2578x2160 pixels of the original ARRIRAW file into HD letterboxed.

5. Time to import our Codex RAW clips. In the LIBRARY window, top left—find the folder with roll number, and drill down two more levels to the folders labeled by individual take. (If you see 2880x2160 and xml folders, you've gone too far.)

6. In the FILE NAME window (to the right of LIBRARY) select all the takes (they are folders). Drag them down to the MASTER window.

7. Most important step: Select all the clips (represented by thumbnails) in the MASTER window. (You can drag to select or Command-a.) Right click one of the clips. This opens a big pop up window. Select CLIP ATTRIBUTES.

8. This is the key to successful de-squeeze. In the CLIP ATTRIBUTES pop-up, select VIDEO, and go to the Pixel Aspect Ratio drop-down box. Be sure to select CinemaScope. Click OK.

9. Your thumbnails will desqueeze in a matter of time, but no need to wait here. Select the EDIT tool at the bottom of the screen.

10. DaVinci 10 changed the way things followed from here. So, click the "+" sign at lower left of the TIMELINE window, top left.

- In the **New Timeline Properties** pop-up, uncheck "Empty Timeline."
- Give your timeline a name -- like "Cooke Test De-squeeze Timeline." And click **Create New Timeline**.

11. While we're at it, go to the MASTER window, select all and right click one of the clips. We applied the 3D LUT - ARRI - Alexa LogC to Rec709.

12. Time to Deliver. Click DELIVER at bottom of screen.

13. In the OUTPUT window, top right, be sure **Render timeline as:** is set to **Individual source clips.** Otherwise you'll wind up with one long clip instead of individual takes.

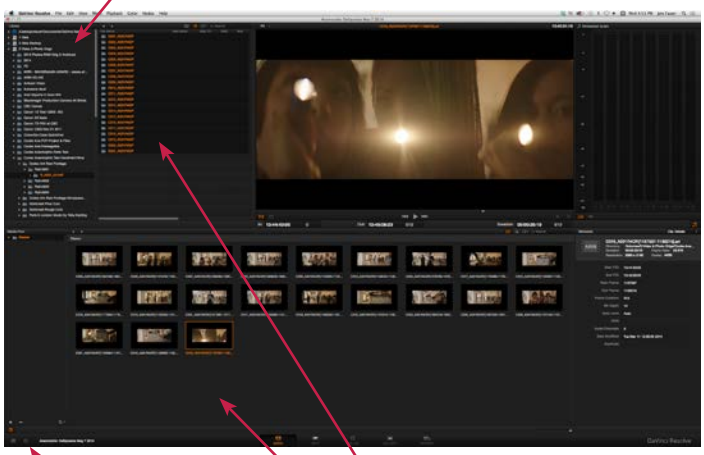
13. To render for editing, we selected Quicktime ProRes 422 (HQ), 1920x1080, 23.976 frame rate, and —very important — set our destination folder. To set the destination, first create a folder on your computer. We called ours "Codex Arri Raw Footage De-squeezed via Resolve." In the Output window, click **Browse**, navigate to that folder, and click OK.

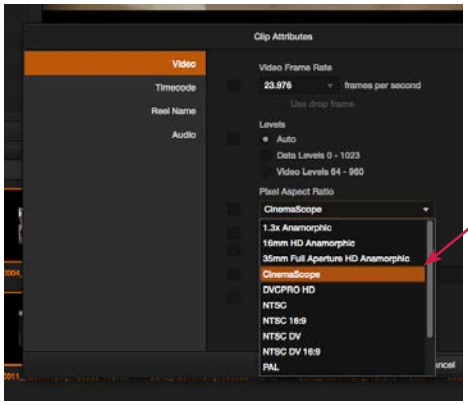
14. Select all your takes. Click the **Select All icon** on the right side of the timeline, next to the magnifying glass.

15. **Click Add Job to Render Queue** below Output Options window.

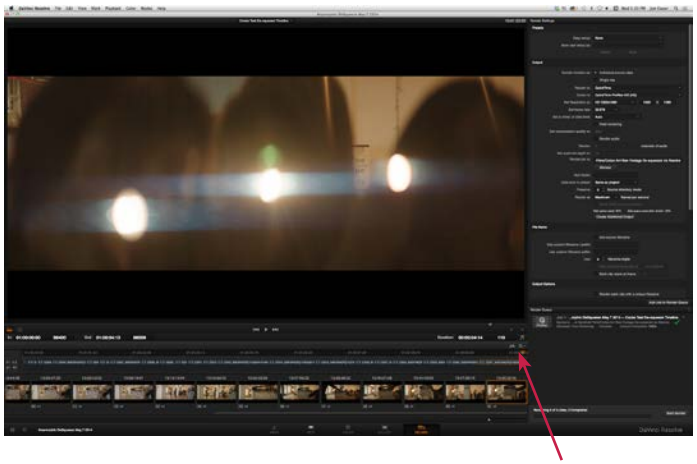
16. Finally, click the **Start Render** button at lower right.

On a new Mac Pro, rendering occurs roughly in real time. Our 20 minutes of footage rendered to .MOV unsqueezed in 19 minutes, ready for offline editing.





8. The key to successful anamorphic desqueeze: Clip Attibutes - Video - Pixel Aspect Ratio - CinemaScope



14. Select All

Credits: Cooke Anamorphic Test produced by Handheld Films. Director/Cameraman: Jon Fauer. Producer: Marc Paturet. Camera Assistant: Timothée Arene. Editor: Ricardo Madan. Grading and finishing: John Dowdell. Post: Goldcrest. Postproduction Supervisor: Tim Spitzer. Thanks to Tim Spitzer, Ricardo Madan, Marc Shipman-Mueller, Florian (Utsi) Martin, Lead Digital Colorist at ARRI, and Blackmagic Tech Support for help on this article.

The Aesthetic Role of Depth of Field in Anamorphic Cinematography

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

by Jon Maxwell

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

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

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

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

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

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

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

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

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

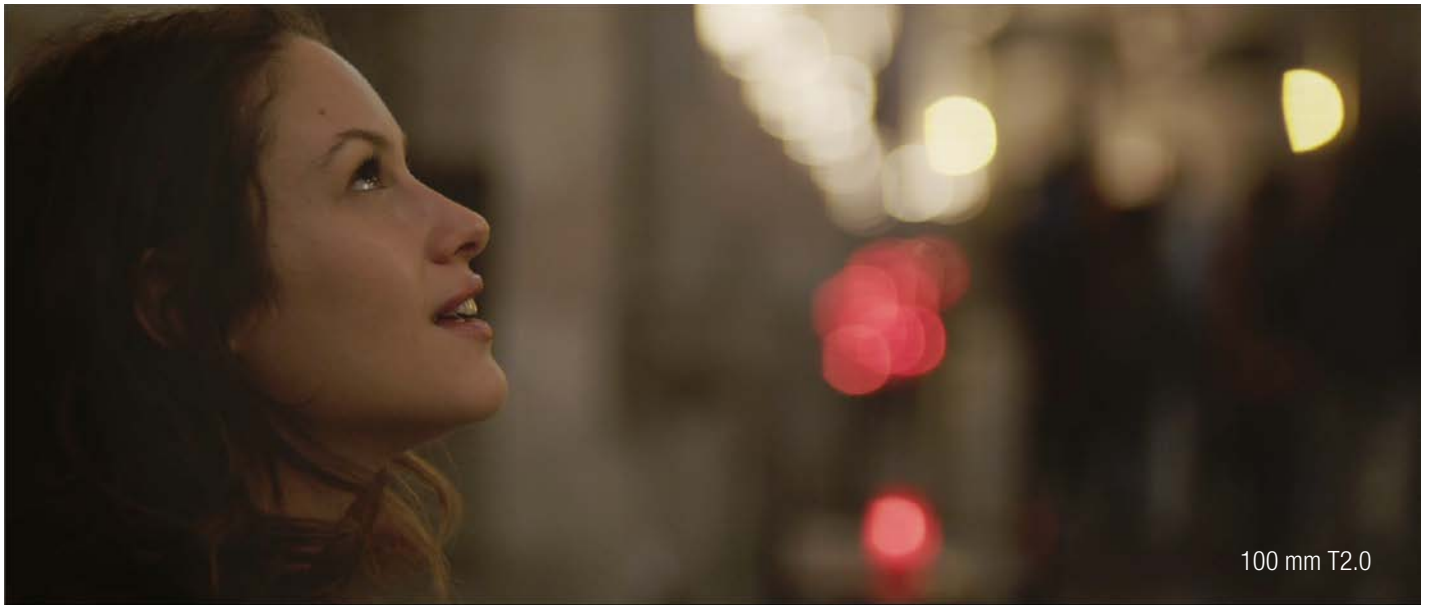
Earlier, I mentioned the out of focus highlights (bokeh). In addition to those, the overall anamorphic look of the picture is created not only by the in-focus highlights but also by any objects in the picture. The large 4x difference in depth of field actually contributes substantially towards the overall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

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

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

Scorpiolens Anamorphic Barcelona Test

Servicevision will present a 7 minute 30 second video at Cine Gear, “Walk in Barcelona.” Shot with their Scorpiolens 35, 75 and 100 mm 2x anamorphic lenses on an ARRI Alexa, here are some framegrabs. The complete video is online: http://vimeo.com/92372771 www.servicevision.es



Scorpiolens “A Walk in Barcelona” (cont’d)

Scorpiolens screenings will be held Saturday June 7 during Cine Gear in the Paramount Theatre from 10:15 - 11:15 am and from 3:15 - 4:15 pm. The Scorpiolens Anamorphic lenses will also be shown at their Cine Gear LA booth 78 — right next to Film and Digital Times.

Stephan Schenk on Anamorphic

Stephan Schenk, Managing Director ARRI Cine Technik, responsible for the Business Unit Camera Systems ((Sales, Product Management, Workflow and Service)

hat's your feeling about anamorphic? Is that going to be as big as I think it will be?

Yes, I definitely think it will because shooting anamorphic is one of the best ways to give your film that special cinematic look. If you look at the current films in the theatres, anamorphic is already big today. Actually, our Product Manager Marc Shipman-Mueller and you predicted that there would be an anamorphic era coming, since historically, there was always a rise in anamorphic after every wave of 3D. The question now is, since anamorphic always disappeared after a while, is it here to stay? Or is it another wave and it's going away?

I'm not sure if it ever went away.

True, but from what I learned it was rather cyclical in the past and also different in each region. Actually, when I started at ARRI five years ago, I was discussing the different lens types and asked, "Who is shooting with anamorphic lenses?" I was told that anamorphic is especially big in India. On my next trip to India, I visited our customers there and spoke with Tarun at Anand Cine Service about it. I asked, "Tarun, I heard India is an anamorphic country." But he said that this was gone and that there were hardly any anamorphic shows. But now we see it's back more or less everywhere. I believe it's here to stay this time on a broader regional basis and we have defined an anamorphic set of lenses that will contribute to that. When we started the question was, what defines anamorphic? The immediate answer often was, "It's the flares and the special look." But which flare? Which special look? We did intensive tests. Marc Shipman-Mueller, Product Manager for these lenses before Thorsten Meywald took over, went all around the world. And you, as well, right?

Yes, that was in October 2007. Marc was doing research on anamorphics. Beginning January 2007, he had been compiling a catalog of anamorphic characteristics, viewing anamorphic films, and talking to DPs. Marc picked me up in Berlin. He put me in his car and drove me to Jena and then to Oberkochen for a three-day anamorphic captive-audience lens discussion road-trip. All we talked about was anamorphic.

That was the beginning of the Master Anamorphic lenses. From discussions with you and many DPs, it was clear that people were talking about a certain look. But when we started talking about flares, you couldn't nail them down to a single flare or two or three or four. The only thing they all had in common was that they loved the oval out-of-focus highlights, and the shallow depth of field that separates background from foreground.

This was incorporated in the design, which was done by our partners from ZEISS. But lacking consensus on a definitive flare and knowing how powerful post tools are these days, we did not favor one particular flare. We believe that you have to start with a good and uniform optical performance over the entire lens range. VFX is getting more and more important. Breathing, distortion, mumps and other characteristics of classic anamorphic lenses sometimes are wanted but in many cases result in a lot of costly work in post. But, the signature look with depth of field and focus fall-of is something that you ideally have from the start.

What people who used the Master Anamorphics love is their beautiful, unique anamorphic look with almost no distortion, mumps or other optical aberrations. It is so much tougher to work around distortion and flares than to intentionally add them in post. With the Master Anamorphic lens series, we have a set of anamorphics that give cinematographers more freedom to compose the image: where to compose the main object in the 2.39:1 frame and whether to shoot wide open at T1.9 or stop down in a more classical way to T5.6. But again, it's all about choice. All the different anamorphic lenses will coexist.

Is it price-driven?

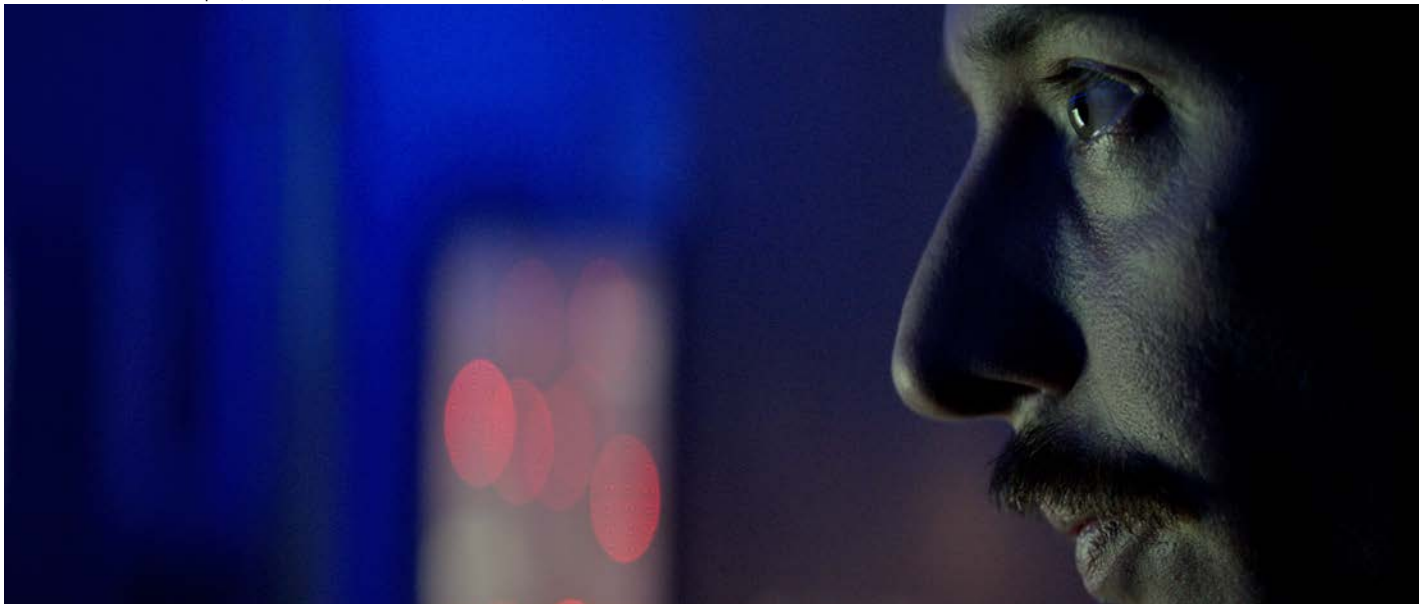
Yes and no. Of course, anamorphic lenses require a bigger budget. But what is a big budget feature that can afford Master Anamorphics? If we're talking about a three, four, five million Euro budget, it's rather small for the U.S. For the rest of the world, that's a great budget, and they use these lenses. If you look at the difference in comparison to the total budget of a project, then the budget for the camera equipment is very, very small. The more important question is, "What look do I want to achieve, and in particular, how cinematic do I want my images to look?"

Which big rental houses have the MA lenses now?

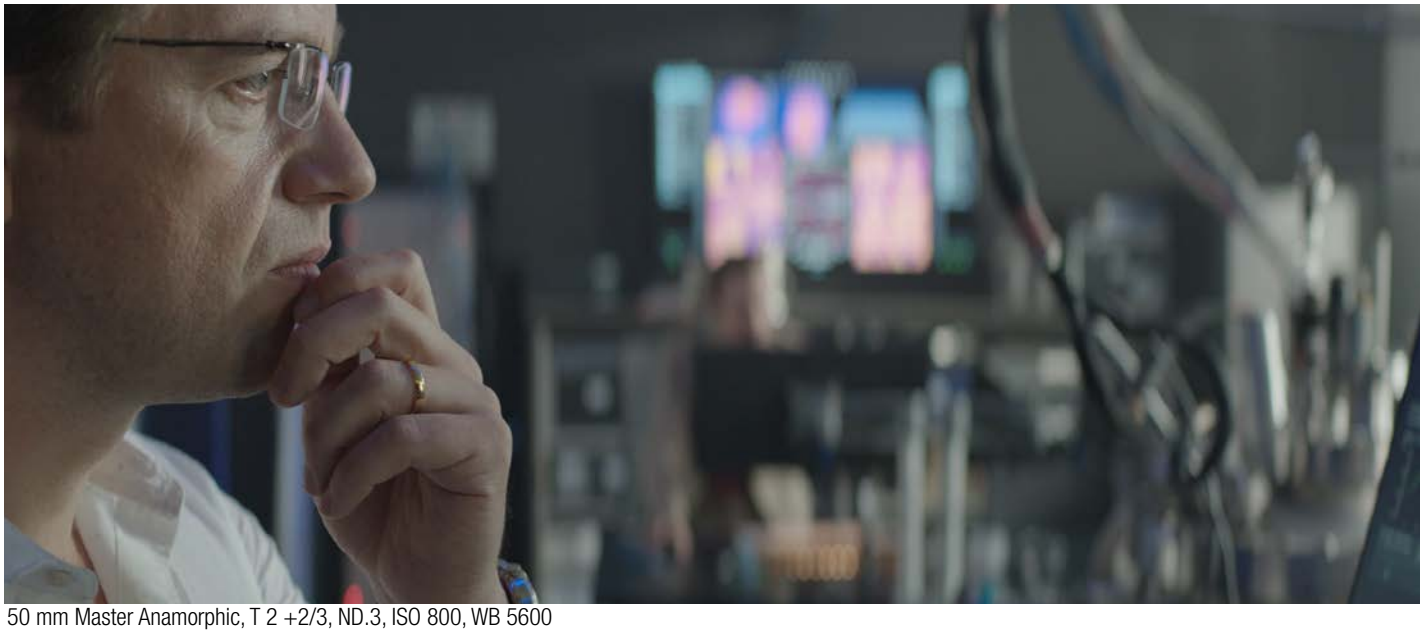
In North America, ARRI Rental, Camtec, Keslow, Radiant Images and Trudell were first. But they have been ordered right from the start. in Asia and Europe as well. They are shooting anamorphic even in countries you wouldn't expect, like Taiwan or the Philippines. They have ordered the Master Anamorphics because they want to have the latest and best lens technology to position themselves in a future-proof competitive position. And more orders have been coming in after the extremely positive feedback from the first projects. Some bigger feature projects are scheduled, and commercials like the new Ford car campaign are already using them.

ARRI/ZEISS Master Anamorphics

60 mm Master Anamorphic, T 2 +2/3, 1/2 Tiffen Black Satin, ISO 800, WB 4300



60 mm Master Anamorphic, T2 +2/3,1/2 Black Satin, ISO 800, WB 5600



50 mm Master Anamorphic, T 2 +2/3, ND.3, ISO 800, WB 5600

Stijn Van der Veken with Master Anamorphics

Alles Voor Lena (The Sum of Histories)

Production company: Caviar Belgium
Producer: Frank Van Passel
Director: Lukas Bossuyt
DP: Stijn Van der Veken, ASC, SBC

Technical info:
ARRI ALEXA XT – ArriRaw

ARRI / ZEISS Master Anamorphic lenses
Cooke S2 spherical lenses rehoused by True Lens Services (TLS) UK
Codex Action Cam on Codex RAW
Lucky Camera Brussels - rental company

The year is 2040. Professor Viktor (Koen De Graeve) discovers a way to send emails back in time. Using the Casimir effect (quantum field theory in which the space between micro-objects can attract each other) he tries to fight for his beloved Lena. But the past isn't easy to manipulate and every small intervention can have far-reaching consequences to the present—something that Viktor soon discovers. The *Sum of Histories* is a love story with a touch of sci-fi. Cinematographer Stijn Van der Veken, ASC, SBC explained his creative choices.

"The story happens 35% in the present and 65% in the future (2040). The Director wanted a light, romantic, "vintage" feel for the present ,which brought me to use old Cooke S2 lenses because of their warm, slightly soft and imperfect performance. We have a set rehoused by True Lens Services in England.

"For the future scenes we went for a set of ARRI/ZEISS Master Anamorphic lenses. They have a fabulous bokeh, a unique look—smoother than Master Prime lenses, and still an amazing and powerful image all the way open to T1.9. We have a set of six MA lenses, from 35 to 100 mm.

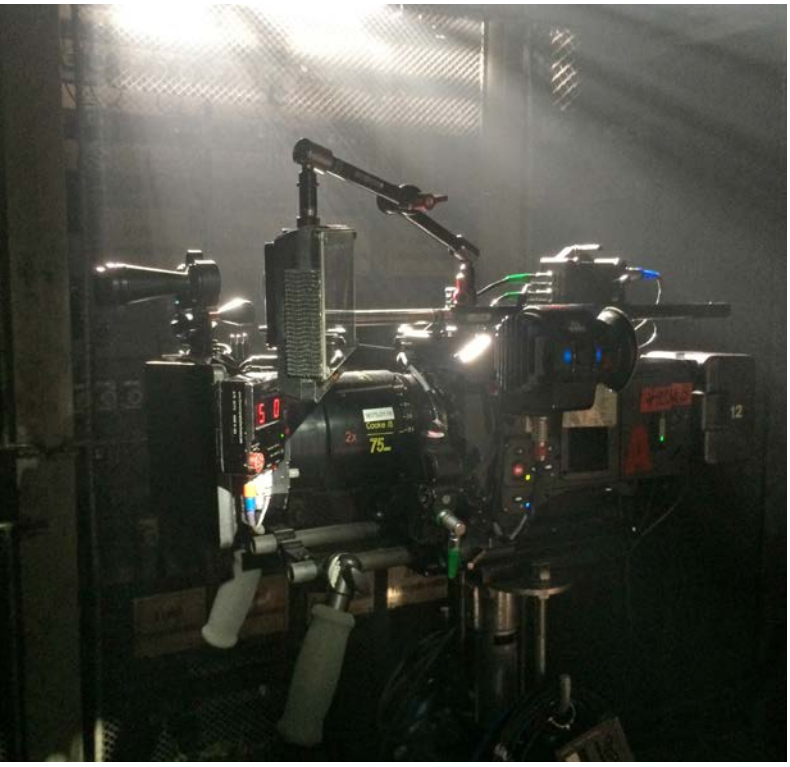
"A lot of people consider anamorphics mainly for artifacts. For me, shooting a movie is an artistic opportunity to use lenses in all conditions. We did a night shoot in a park, under difficult conditions, available night light, no practicals. I call it lighting with milligrams. Many lenses cannot handle these extreme, low light, contrasty conditions. However, like Master Primes, the Master Anamorphics maintained quality all the way to T1.9. As I said before, Master Anamorphics are smoother, a little gentler on faces than Master Primes. On MCU or CU shots, I'll soften them a little with Tiffen ½ Black Satin diffusion—which Kees van Oostrum, ASC recommended to me.

"I am a big fan of anamorphic, especially because of the way the focus falls off—which is the narrative aspect of the lenses. Their best performance for me in terms of storytelling for the main characters is situated between 3 and 6 feet, depending on the lens.

"A lot of people try to create their look in grading, but I rather set my look on the set. I don't like to put looks in grading—for me, that seems too artificial. I achieve the look with lenses and lighting."

Stijn is shooting Arriraw on ARRI ALEXA. They have one LUT: the same one is used on set, for viewing and editing. This LUT then becomes the starting point for grading. It's a custom LUT derived from the ARRI Low Con LUT with the same saturation, and. as Stijn calls it, "a bit more bite."

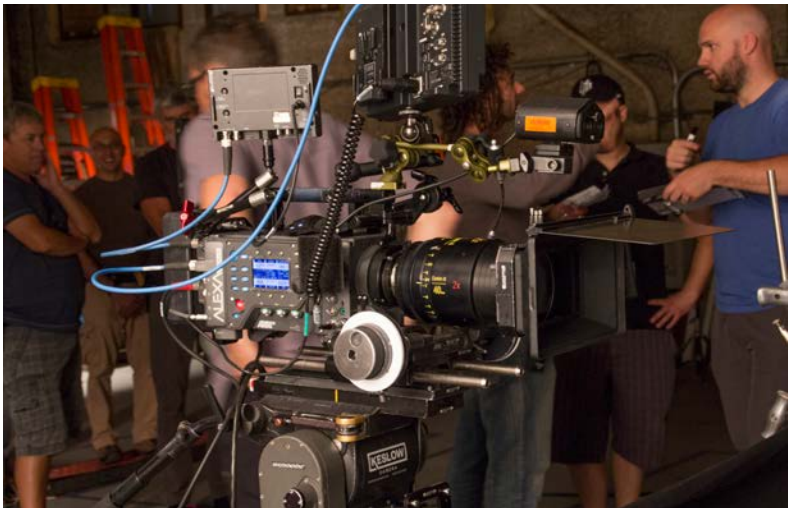
What's Cooking in Anamorphic?



The first sets of Cooke Anamorphics were delivered to TSF and Movietech, and then Clairmont, Keslow, Camtec, Cineverse, Camera House, and ARRI Rentals.

Above Left: Clairmont Camera's Cooke Anamorphic product shot by Jon Johnson, General Manager of Clairmont Camera Vancouver.

Above Right: Andy Kierans with Cooke Anamorphic 32mm at Clairmont Camera Vancouver. Photo by Jon Johnson.



Above left: Cooke Anamorphic 75 mm on location near Budapest on *Lazarus*. Equipment from ARRI Rentals. In addition to a set of Cooke Anamorphics, Bojan Bazelli, ASC is also using a set of Arri/Zeiss Master Anamorphics. Director: Nic Mathieu. Camera Assistant: John Holmes.

Above: Amy Vincent, ASC is using Cooke Anamorphic Primes from Keslow Camera on her latest feature film, *Sinister 2*. Photo by Danny Saldana, Keslow Camera.

Left: Matthew Libatique, ASC is using Cooke Anamorphics from CamTec on "Straight Outta Compton." Matty said, "The Cooke anamorphics are a welcome addition to the world of anamorphic lenses providing sharp yet subtle imaging. They blend well with older lenses when aberration is too severe." Kavon Elhami added, "I really like how these lenses react to light coming at them from an angle. They exhibit some of the characteristics of our vintage lenses, but with more sharpness and less distortion in the corners. Matty was looking for a strong interesting look especially in some of the smaller interiors where he's working."

Also Cooking at TSF

Antoine Roch, AFC, DP Mathieu De Montgrand, 1st AC on "Un homme idéal" with Cooke 50mm Anamoprhic and ALEXA supplied by TSF

Danys Bruyère, Deputy Managing Director of TSF, writes: "This was the first feature to be shot entirely on Cooke Anamorphic lenses. Start date was May 22, 2014. *Un homme idéal* was directed by Yann Gozlan, produced by 24/25 Films, cinematography by Antoine Roch, AFC."

Antoine Roch discussed the Cooke Anamorphics with Danys. He said, "I really liked the velvety feel of the anamorphics; they have everything we like about the S4 Cookes. Like vintage anamorphics, we get fine anamorphic distortions all around the image, pulling us into the center. The Cookes are very easy to focus by eye, you really feel it when it all comes together.

"The 40mm was our favorite lens of the film, without any noticeable distortion on the outer edges. We would actually look for flares, and I would work the lenses to get them to flare when we wanted them to, yet everything remained predictable. We love to shoot anamorphic, as much for its qualities as its flaws. It really helps bring out the best of the digital cameras.

"The Cookes were not as 'dry' as other lenses I've used before; they have a wonderful round feel to them. What I really missed on this thriller with a lot of inserts was a nice extreme close focus lens, between 50 mm and 75 mm. Maybe a 65 mm could fill that gap beautifully. We really put the lens set through its paces, using them in a multitude of shooting situations, day, night, interior, exterior, rain, sun, even into a splash bag—and the lenses performed beautifully all the time, with nice oval bokehs."

John Morisson, Steadicam Operator. Photos by Haruyo Yakoto

Angénieux Anamorphic Zooms

New Angénieux Anamorphic 30-72

Angénieux Optimo 30-72 mm T4 2S Series Zoom
Zoom Ratio: 2.4X
Horizontal Focal Length: 30 - 72 mm
Aperture: f/3.6 - T4
MOD: 2 ft 2 in / 0.65 m
Image Coverage: 4 perf. scope+: 28.8 mm diagonal
Weight (approx.): 5.3 lbs - 2.4 kg
Length: 227 mm
Front Diameter: 114 mm

Internal Focus
Field of view for 35 mm 4 perf. (22 x 18.6 mm)

Focal Length:	30 mm	72 mm
Horizontal angular field of view:	72.5°	34°
Vertical angular field of view:	34.4°	14.7

FOV at MOD at focal min 593 x 244
FOV at MOD at focal max 246 x107

Angénieux Anamorphic 56-152 (Shipping Now)

Angénieux Optimo Anamorphic 56-152 mm T4 2S Series Zoom
Zoom ratio: 2.7x
Horizontal focal length: 56-152 mm
Aperture: T4
MOD: 2'1" / 0.63 m
Weight (approx): 4.8 lb / 2. 2 kg
Focus: 320° rotation, 50 marks, interchangeable feet or meters

Length: 210 mm / 8.3 " (actual size is the width of this page)
Front diameter: 114 mm / 4.5"
Image coverage: 28.8 mm diagonal (18.6 x 22 mm)
Anamorphic squeeze: 2x horizontal squeeze
Format: 35mm "4 perf." scope
Mounts: PL mount, PV mount available on request

Thierry Arbogast, AFC on Anamorphic

Thierry Arbogast, AFC (above) is an award–winning French cinematographer. His work with director Luc Besson began in 1989 with La Femme Nikita. *Their most recent collaboration,* Lucy, *starring Scarlett Johansson, opened this summer. Luc Besson's parents were Club Med scuba instructors. His first big success was* The Big Blue *(1988) about free diving. He founded EuropaCorp in 2000, built the Cité du Cinema stages and post facilities in Saint-Denis, and worked on more than 50 films as writer, director and producer.*

JON FAUER: What about anamorphic?

I love anamorphic lenses, but Luc has not wanted to work with anamorphic lenses for quite some time. When we did "Fifth Element," Digital Domain asked for it to be shot in spherical, Super 35mm. Since then, Luc has worked with spherical lenses. He came back to anamorphic lenses only for *Malavita* (*The Family*) with Robert De Niro and Michelle Pfeiffer. He was thinking it would probably be the last movie that he was going to make using motion picture film. He asked me if I agreed to shoot in anamorphic. And I said, "Wonderful, I love anamorphic lenses." We used the Panavision anamorphic G-Series lenses, Primo Close Focus, and some anamorphic zooms.

But for this movie, "Lucy," he preferred to shoot in spherical because it would be easier with effects, and also there would be a lot of close focus. Also with the F65, it would be bad to shoot in anamorphic because the sensor is not tall enough.

Because it's 16x9 and the sensor height is less than 18 mm?

Yes, it will crop. So we tested spherical lenses with the F65. We liked the Cooke S4 set. They are very good lenses, very sharp, very beautiful. But they are not too "crispy," you know? I think it's good for digital to be not too sharp…not too hard or harsh.

What do you think is the mystique of anamorphic?

Because of the style of anamorphic, because of the depth of field anamorphic lens, and especially the quality. We don't always need to be so realistic and anamorphic offers something that may be a little more poetic in style. A lot of us love anamorphic lenses, especially in digital because it blocks the digital style. I choose ARRI ALEXA for anamorphic because it's the only camera that has a digital sensor that covers the full anamorphic lens. The new RED DRAGON camera has a sensor that is bigger—it crops a little less – but it still crops. But the F65 crops too much when we use anamorphic lenses.

George Richmond on *Kingsman*

Photo: Jaap Buitendijk
© Twentieth Century Fox Film Corp

George Richmond, BSC was the cinematographer on *Kingsman: The Secret Service,* a Twentieth Century Fox Film production directed by Matthew Vaughn.

Anthony Lane's review in *The New Yorker* is always better than any spoiler alert: "The conceit upon which *Kingsman* rests is a simple one. The service in question is international, filthy rich, and independent of any government, although it is based in London and staffed by British agents. They are modelled on the Round Table, with sobriquets to match: Arthur (Michael Caine), Galahad (Colin Firth), Lancelot (Jack Davenport), and so on. They fight evil, crime, and other caddish deeds, and the front for their headquarters is a tailor's called Kingsman, in Savile Row.

"In case all this sounds too decorous for its own good, be advised that the director is Matthew Vaughn, who made *Kick-Ass* (2010), and whose idea of decorum, as far as I can gauge, involves switching to slow motion, in the wake of a savage punch, the better to show us an uprooted tooth sailing gracefully by."

Speaking of sailing by, ski jumping is the subject of *Eddie the Eagle*, a film now being produced by Mr. Vaughn's Marv Films. Eddie was Great Britain's beloved ski jumper in the 1988 Calgary Winter Olympic Games. The cinematographer is George Richmond. We spoke to George on location in Seefeld, Austria. He was using pretty much the same camera and lens package as on *Kingsman:* Hawk anamorphics on ARRI Alexa cameras, all from Vantage Film.

JON FAUER: How did you arrive at the look of the film?

GEORGE RICHMOND: The creative starting point was old spy movies from the 60s and 70s. We started referencing some of the early James Bond films as well as shows such as *The Avengers.* Matthew asked me early on, 'why don't films look like old films anymore?' We used that as a starting point, adding our own twist on the classic spy concept as we went along.

Cameras and lenses on *Kingsman*?

We had ARRI Alexa XT cameras recording ARRIRAW on the main unit. We used the Blackmagic 2.5K Cinema Camera to generate all the images for the monitors. Hawk V-Series anamorphics were our main lenses. We carried a set of Hawk V-Lites for the Steadicam. The other lenses were Cooke S4 sphericals, Angenieux handheld zooms (15-40mm and the 28-76mm), an Alura long zoom, and the Cooke mini/S4 primes for the skydiving sequence. Arri Media (now ARRI Rental) in London was the rental house. They own a few sets of the Hawk V-Series, V-Plus and V-Lites, but we went directly to Vantage for the second set of V-Series and two sets of their 45-90 and 80-180 mm zooms for both units.

On a VFX-heavy show, why use anamorphics?

Because the Hawk lenses gave a cinematic feel to the movie. Even though we cut spherical scenes in, 80 to 90% of the movie is anamorphic. They basically give you a cinematic feeling. They have pleasing aberrations. Anamorphic lenses give you wide backgrounds, but you're actually shooting with a longer focal length, because there's a longer lens inside of it that's being bent to make it wide. So you get a shallower depth of field. It makes actors look more film star-like. You really get the look of the actors because the lenses separate them from the background and it really allows you to concentrate on what you're looking at. I think it just makes them look good.

The other very good reason was that Matthew Vaughn had never shot on spherical. He wanted to shoot anamorphic too. So the big decision was what lenses to choose and you're kind of down


ENJOY

to two choices really; you go Panavision or you go Hawk. And Vantage Hawks were the ones for this, because they just have that look.

The thing I like about the Hawk V-Series lenses is that they don't have the blue streak flares that the Panavision ones do. They feel slightly smoother and they have slightly more extreme aberrations around the edges. It seems almost as if they were designed for digital.

Why are so many lenses looking better on digital?

It's because digital has a harshness; it has a sharpness to it because of the lack of grain and the lack of texture that's inherent in film. Film just softens everything off a little bit, which is why we use it. Actually, my first point of reference when shooting digital is the glass. I shot a mini-series for the BBC about the great train robbery and we used ancient Cooke Speed Panchro spherical lenses, which were basically 1930s glass rehoused. They made it feel and look old. They're warm and they're soft. And they have this slight portholing and loss of exposure on the edges. So the glass is the most important thing.

In ways that filters cannot do?

Filters just don't, no. Because filters affect everything in a flat way. If you put a soft filter on, it affects everything. If you use an old anamorphic lens it allows the point of sharpness to be sharp, but it affects everything else, basically in layers.

You used all the Hawks: the V-Series, V-Lite, and V-Plus?

Basically the main sets were V-Series, which are among the older ones that they have. I think the oldest set is the Hawk C-Series. The next series that they made, in the 90s, was the V-Series, and then they updated those with the V-Plus, which have a different baffle inside the lens and they're a little bit more contrasty. I didn't use the V-Plus primes; but I did use the V-Plus zooms. So all the primes were V-Series, the zooms were V-Plus, and then we used V-Lites for handheld and Steadicam. Most of the second unit and the fight sequences were done with spherical lenses.

The anamorphics matched the spherical lenses nicely.

Yes, but that's because we spend a lot of time in the DI suite grading them and a lot of those lenses were squeezed at the edges, to give a sort of anamorphic feeling to those spherical lenses. They digitally re-invented and added little bit of a pin cushioning in post, so to speak.

At what stop did you shoot?

Our target stop was sort of T2.8 to 4, and they work well there. If you're shooting anamorphic wide open you can get certain focus aberrations all around. But most of the movie was studio based so I could light it up to make the target stop.

Making a target stop, that's something the old movies did. They lit their sets up to make their lenses work best. I worked with Alex Thompson, BSC years ago. I was one of his clapper-loaders and he always maintained that anamorphic looked best at T4 to 4.5 on film. So he'd light everything up at T4 to T4.5.

What lenses did you use on your last film?

Unlocked was a Michael Apted film. It's very good, with an amazing cast. Michael Douglas, John Malkovich, Noomi Rapace, and Orlando Bloom. We shot in Prague and in London. We used the Hawks again. I like those lenses.

Describe the skydiving sequence on *Kingsman*.

Brad Allan was 2nd unit director; Craig O'Brien was aerial unit DP with helmet mounted cameras and a belly mounted 2.5K Blackmagic Cinema Camera.

We had six days to film this sequence, which we had previsualized and then broken down into smaller bite size pieces of action. With just under a minute of free-fall time on every jump, Brad and his team were able to film up to three different elements over 50 or so jumps. For additional cuts they relied on Blackmagic's Pocket Cinema Camera, equipped with a 16mm prime, and had it fitted to a special wrist mount. We got some fantastic shots, particularly when the hand goes up behind the back of the parachute to pull the release cord.

In filming that sequence there was a lot going on. We had a helicopter for two days, shooting air-to-air with long lenses, and we had cameras on the ground shooting up with long lenses. We filmed the sequence using spherical lenses as they were lighter and more manageable in the air. It also meant that we had the ability to reframe in post if necessary.

Speaking of post...

Joshua Callis-Smith was the DIT and Rob Pizzey was Goldcrest Post's colorist. We applied grades on-set that followed through to post production. I've become very aware of the 'science' of DaVinci Resolve when it comes to solving color issues and balancing cameras on set, more than I ever thought I would. We took ARRIRAW and applied LUTs on set to view warm, cold, dark and light setups. The LUTs were created in preproduction, which meant two or three days were spent doing lighting and camera tests at Warner Bros. Leavesden Studios ahead of principal cast arriving. We had stand-ins wearing the real wardrobe to test how these would look.

With the help of Goldcrest, we created a series of looks in Resolve, saved them as 3D LUTs and then applied them to a second set of tests using different lights and colors to make sure they performed correctly across all of the lighting conditions we might use during production. This allowed me to start creating the look of the film before the cast arrived and gave me options when the director showed up as to how we might approach a particular scene.

Shooting Lens Grid Charts

This article reminds me of Mel London's famous story about the client who asked for "just one more shot." They were filming in Hong Kong. The "one more shot" was in the middle of Africa.

Marc Paturet, President of Hand Held Films, called the other day. "Jon, how about a *little* article on testing lenses for anamorphic?" It was a good follow-up to our interview with Kingsman VFX Supervior John Paul Docherty about the need for lens grid charts.

Marc's got lots of anamorphic lenses in his rental fleet, including Hawk V-Plus, V-Lites, Elites, and the latest in Cooke and Angenieux. The *little* article grew into a massive project, and the results will be covered in a series of articles. The topic of this episode: shoot lens grid charts for all your VFX jobs during prep, whether spherical or anamorphic—but especially anamorphic.

Hand Held Films supplied the Alexa XT and Hawk V-Lites for a large "Rums of Puerto Rico" production (therumtimes.com). It begins as a period piece in 1598 and follows the hundreds of years of partying that followed. Sonnel Velazquez was DP and Jorge Garrido was AC. Francisco Cueto was the Post and VFX Supervisor at Reaktor Post.

Meanwhile, back in New York, the job had wrapped and Rick Gioia shot the lens grid chart tests at Hand Held Films in New York.

VFX Supervisor Francisco Cueto said, "They should always do that in the beginning. But Production is its own little island and they do not want to incur any additional expenses of shooting lens tests. Their concern is delivering the production on time. Post-production is not their budget. Production will avoid anything that will incur an additional cost because that may reflect negatively on their budget even though in the end it will save lots of time and money in post."

So the bottom line is to be sure the tests are done, even if it means sharing the cost across shooting and post production budgets. When you walk into Vantage Film in Weiden, Germany, one of the first things you see is a big, precise grid chart on the wall. Why is shooting lens grid charts so important?

Peter Martin, Owner of Vantage, said, "Every lens—anamorphic or spherical—has distortion, and every lens needs a grid when the job is important. CGI is widely used in many of the films we outfit. For these productions, grids are essential. We do grids all the time."

Francisco Cueto said, "As you get to a wider field of view you have a fair amount of geometric distortion and chromatic aberration. For creative reasons, the project decided they really wanted to use the Hawk lenses."

What happens if you don't provide VFX with grid charts?

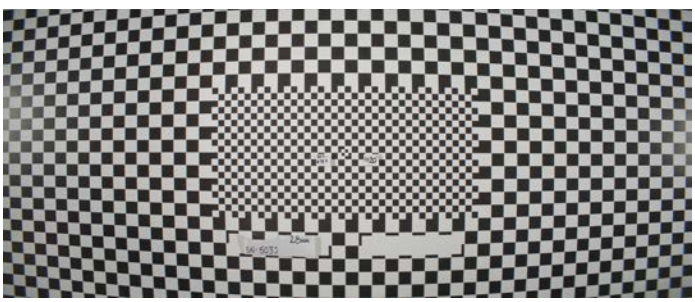
"This was a period piece, so it's lit by torches. We have some in the distance that are out of focus, and had to create additional composited torches equally out of focus, to give us the proper bokehs.

"What's really interesting is that most of our 3D software is based on the concept of a pinhole camera and they don't consider lens distortion. They can't really track a distorted image well. The lens grid helps us. If not, then you're going to start guessing. I would recommend you shoot the charts and also get the camera crew to fill out camera reports carefully. And be very careful to put the correct lens and camera information on the slate: camera name, format, lens name, focal length, distance, T-stop, serial number."

Here's a quick how-to, most of which camera assistant Rick Gioia followed when shooting the test at Hand Held Films:

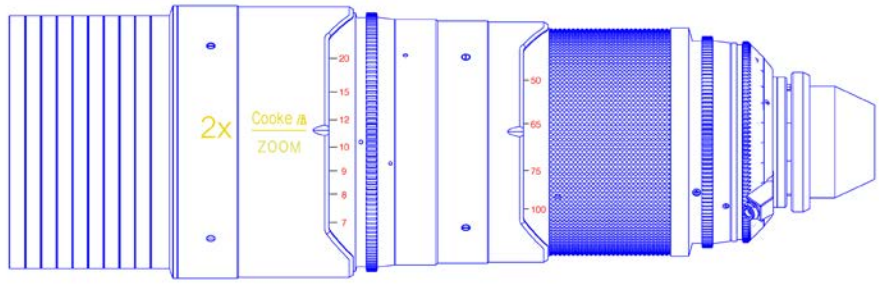
1. If the rental house doesn't have a lens grid chart, you can download and print them with a large format printer on 4' x 8' paper and mount to Gatorboard.
2. Camera should be level and centered—no pan, tilt or roll.
3. Ideally, camera is on a dolly to easily change distance.
4. The lens grid must fill the frame, ideally to the edge of chart.
5. Focus on the center of the grid. That helps determine curvature of the lens (how the edges may lose sharpness).
6. Use two lights, on either side, at 45° angle to chart
7. Your VFX Supervisor should advise on focus distance—usually around 8'.
8. Discuss lens aperture. In addition to shooting the grid at various apertures, you may be asked to shoot a large white surface at different T-Stops to see if there's any shading (vignetting).

handheldfilms.com



Example of lens test grid shot with an Anamorphic Prime Lens.

Cooke Anamorphic Primes...and now Zooms



Cooke is expected to begin shipping their 25 and 135 mm Anamorphic /i lenses around NAB 2015 with the 180 and 300mm to follow later this year. There may also be a few other surprises.

And here is one of those surprises. A Cooke Front Anamorphic Zoom is in the works. Like the Cooke Anamorphic Primes, it is a true front anamorphic lens with 2x squeeze. The focal length has not been divulged.

Cooke Chairman Les Zellan said, "In the storied tradition of Cooke 5:1 and 10:1 zooms, this is the first in a series of front anamorphic zoom lenses that will complement Cooke's set of anamorphic /i series anamorphic primes lenses."

The photos above are renderings that arrived just as we were about to go to press. We hear that another surprise lens may be coming for Cine Gear in June.

Cooke Optics will be at NAB booth C8643. cookeoptics.com

ARRI Anamorphic Ultra Wide Zoom 19-36 / T4.2

ARRI is introducing a new Ultra Wide Anamorphic Zoom based on ARRI's spherical UWZ 9.5-18 mm T2.9.

Thorsten Meywald, ARRI's Product Manager for Lenses, says, "The AUWZ is probably the most complicated lens we ever produced. It has 36 lens elements including aspherics and crossed cylinders. The lens is very high in resolution and contrast and extremely low in distortion even at the wide end. The mechanical design is similar to our UWZ but slightly longer and has a smaller front diameter. Because it's an anamorphic lens we have optimized the look. It has some very unique flares and a kind of creaminess and magical quality, especially with night shots."

- Very low distortion, even at 19 mm
- Rear anamorphic cylinders
- Almost no image breathing when focusing
- Uniform field illumination
- Extreme close focus up to the front lens element
- Fixed entrance pupil position over the entire zoom range
- LDS lens metadata
- Matches the ARRI/ZEISS Master Anamorphic Primes
- Interesting- anamorphic flares
- 180° optical image rotation (upside image to be flipped electronically)

Zoom Lens:	19-36 mm T4.2
Lens Mount:	PL with LDS data contacts
Image Circle:	29.26
Sensor Size:	22.5 x 18.7mm
Squeeze:	Anamorphic 2x squeeze
Aperture:	T4.2 - T22
MOD from Image Plane:	0.6 m / 2 ft
Length (lens mount to front)	397.1 mm / 15.634"
Front Diameter	114 mm / 4.488"
Weight	5.5 kg / 12.1 lbs

2x Anamorphic AUWZ 19-36 T4.2

Spherical UWZ 9.5-18 mm T.2.9

Flair with Flare: Master Anamorphic Flare Sets

ARRI has a new series of Master Anamorphic Flare Sets.

Each of the 7 ARRI/ZEISS Master Anamorphic lenses gets its own individual and easily replaceable front and rear glass elements. They can be used individually or in combination. This results in 4 Master Ana permutations: no flares, front flare element only, rear only, and combination front and rear.

When the Master Anamorphics were introduced in 2013, you could almost hear the collective cry of cinematographers for more aberrations, flares, veiling glare—all the stuff that the scientists at ZEISS and ARRI worked so hard to eliminate. In the meantime, for many the pendulum has swung back to a more pristine look and the Master Anamorphics are working hard on features worldwide.

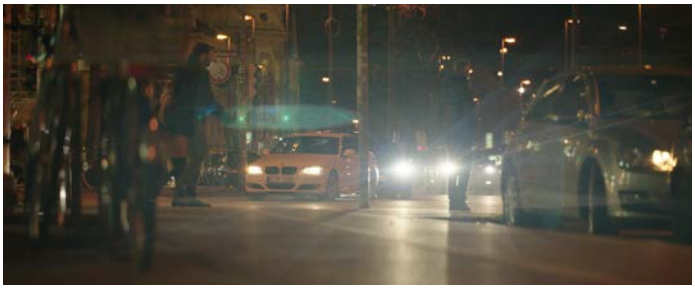
Still, the Master Anamorphic Flare Set is an essential toolkit, providing a range of customizable looks that can be tailored to individual style, story, and situation. As Zero Mostel said, "Something for everyone."

The front and rear glass elements of each Flare Set have a special lens coating that enhances flaring, ghosting and veiling glare. These effects are consistent across all of the Flare Sets. You can control the aberrations by changing the lens aperture or positioning extra flare lights out of frame (Maglights attached to matte-box aiming into the lens). The Master Anamorphics retain their resolution, lack of distortion and corner-to-corner optical performance even with the Flare Sets attached.

An ARRI Master Anamorphic Toolkit (purchased separately) is used to exchange the front and rear optical elements. It only takes a few minutes: each flare element is pre-aligned in a metal frame.

With the Master Anamorphic Flare Kits, a set of Master Anamorphics multiplies and essentially becomes four different sets, each with different characteristics, yet still free of curved horizons, focus breathing, mumps, barrel and pincushion distortion.

ARRI: C4337 arri.com
ZEISS: C9543 zeiss.comm/cine



Flare Set framegrabs from demo short shot by Tom Fährmann, BVK
Opposite: AUWZ framegrabs from Jonathan Yi's demo short

Scorpiolens Anamorphics - May 2015

Scorpiolens Anamorphics are shipping now:
35, 40, 50, 75, 100 mm.

135 mm will be next, followed by the
150, 25, and the rest of focal lengths.

NAB Booth C8139
servicevision.es
servicevisionusa.com

Late-breaking news for NAB: Servicevision is completing the design of a new 138-400 mm T4 Anamorphic Zoom.

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