Clay Paky Alpha Spot HPE 700

By: Mike Wood

Fig. 1 - Fixture as tested

It's perhaps time to get away from LEDs for a moment and get back to reviewing a more conventional automated light. More than a year ago, we looked at the Alpha Spot HPE 300 from Clay Paky. Since then, the company has developed several other versions in the Alpha Spot range, with the most recent being the 700, launched in May. Clay Paky is a long-established and very well-known Italian manufacturer of moving light products, and it has a solid and consistent line of products going back to the Brilliant range of the 1980s. For a long time it was known as a user of condenser optical systems, which gave its luminaires very flat outputs and huge depths of field—but also tended to make them a little on the large side. The Alpha range embraces the trend towards smaller units, as well as the inevitable use of ellipsoidal optical systems.

As the newest member of the Alpha Spot family, it is interesting to take a closer look at the Alpha Spot HPE 700 (Fig. 1). How much of the previous Alpha Spot design has been retained, and how much has been tweaked to suit the new lamp and solve any earlier problems? It's certainly a very small unit for a 700W—but has anything been given up to achieve that compact size? As usual in these reviews, I start at the lamp and work my way through the optical system, ending at the output lens, measuring and testing each component as we go, trying to present everything in as objective and impartial a manner as possible. Although I usually avoid comparisons, in this case I think it's relevant—so I'll also make a few observations of how the 700 differs from the previously tested Alpha Spot HPE 300.

All tests were based on a single unit supplied to me and represented as being typical; tests were run on a nominal 115V 60Hz supply. However, the Alpha Spot 700 HPE is fitted with universal power supplies and will run on the standard worldwide voltages of 100-240V 50/60Hz. In my tests, it consumed 7.8A on that 115V for 896W of power. Total input power was 902VA at a 0.99 power factor.

Lamp

The lamp supplied and used was the Philips MSR Gold 700/2, using the Mini FastFit base (Fig. 2). These FastFit bases are becoming ubiquitous in automated lighting fixtures; thanks to them, changing lamps is a lot easier than it used to be. Access to the lamp is through a simple single removable panel, which also provides access to the three screws for lamp adjustment (Fig. 3). This panel remains captive on a small safety bond and can be safely removed while the Alpha Spot HPE 700 is in the rig. Once that's out of the way, you have the now-familiar quarter-turn-and-lock removal and insertion of the lamp (Fig. 4). The beauty of the FastFit system is that changing the lamp doesn't change any of the lampholder positioning relative to the reflector and the rest of the optical

Fig. 2 - Lamp

Fig. 3 - Lamp adjustment

Fig. 4 - Lamp replacement

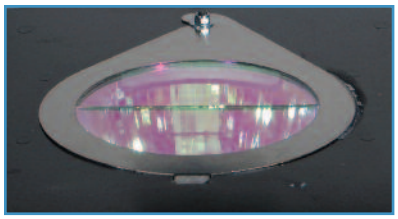

Fig 05 - Hot Mirror

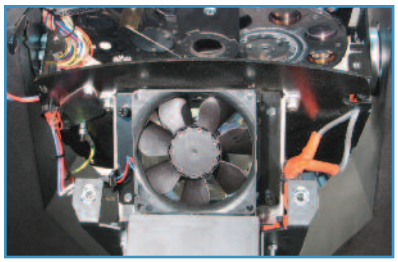

Fig. 6 - Lamp cooling

system; not only is it much easier and safer to change the lamp, but you are less likely to mess anything up while doing it.

The lamp is mounted in a faceted ellipsoidal glass cold mirror reflector capped by a split hot mirror (Fig. 5). Interestingly, the Alpha Spot HPE 300 didn't need the hot mirror, but the extra power of the 700W lamp clearly required Clay Paky to add it back in again. Also differing from the 300W unit, the ignitor has been moved from its position adjacent to the lamp down into one of the yoke arms. The addition of the hot mirror effectively creates a closed lamp housing, and this assembly is cooled by a dedicated fan (Fig. 6). I had no noticeable problems with heat during my tests, and the unit remained acceptably cool at all times.

Dimmer

Following immediately in the optical train is the dimmer/CMY module; first in line are the twin dimmer flags (Fig. 7). Following the same design Clay Paky has been using for a while, these comprise an opposed pair of metal sawtooth flags with frosted—and also sawtooth—glass edges to smooth the dimming. Figure 8 shows a sequence illustrating how these two flags operate and overlap to progressively reduce the light output (Fig. 8). These flags work together with the electronic dimming system provided by the lamp power supply to provide a two-stage system. The lamp is dimmed electronically from 100% down to 50%, at which point the mechanical dimming kicks in and takes the lamp down the rest of the way to blackout. Dimming was acceptably smooth, with some artifacts visible at low levels, but nothing objectionable. The Alpha Spot HPE 700 offers two different dimmer curves (Fig. 9), giving a choice between "linear" and "conventional" dimming curves. The names used are a little strange, as neither curve is either linear or conventional! I found both curves to be very similar in practice, with a fairly steep drop-off at the top end from the electronic dimming, and less control at the bottom end from the mechanical dimmer. As you can see from Figure 9, the default "linear" option was actually much closer to a Square Law curve than an actual linear, and probably provides the best feel across the range. Both curves show the changeover between electronic and mechanical dimming as a slight knee in the response. The very peaky beam you always get from an ellipsoidal reflector makes designing good mechanical dimmers very difficult, especially when trying to design a compact unit with everything very close together. The end result here, although not the best I've seen, is perfectly usable.

As an option, through a control channel you can also check back the lamp power supply to adjust the power going to the lamp. I measured this as giving you control from 100% output down to 54% output, with a consequent 322W drop in fixture

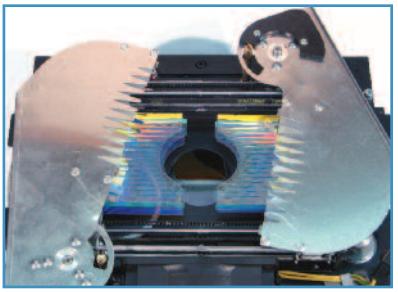

Fig. 7 - Dimmer and CMY color mixing

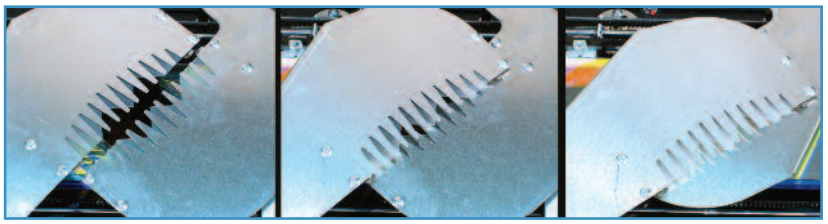

Fig. 8 - Dimmer

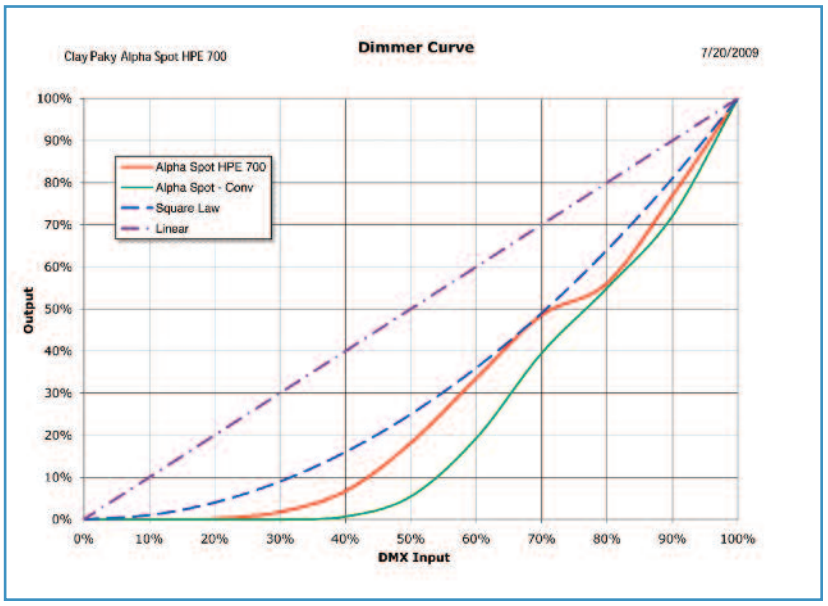

Fig. 9 - Dimmer curves

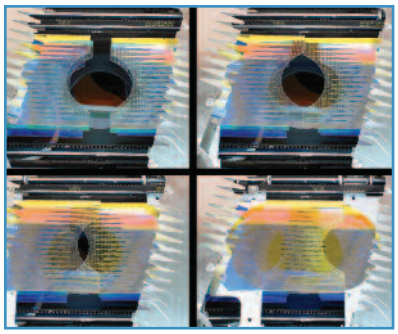

Fig. 10 - Color mixing flags

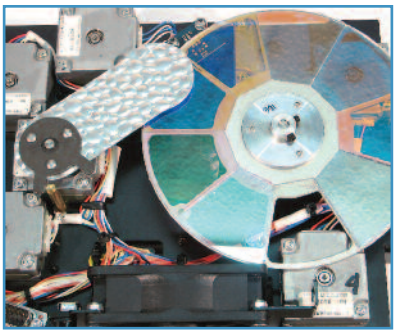

Fig. 11 - Color wheel and strobe flag

power consumed. This performs very nicely and is definitely the "green" option to take if you have long periods of the show when the fixture is running checked down.

Color mixing

Next in line are the three pairs of CMY flags, which look very similar, if not identical, to those used in the 300W unit. Etched and water-jet cut-shaped dichroics operate like pairs of curtains with a linear belt-driven motion; a single stepper motor drives each pair for each of the three subtractive colors. This system works very well, and the color mixing was smooth and controllable. In my critical viewing on a white screen, I saw a little bit of patterning from optical interference between adjacent teeth on the flags, but nothing that wouldn't disappear in real use. Figure 10 shows an operating sequence as a pair of flags closes over the aperture.

Color mixing						
Color	**Cyan**	**Magenta**	**Yellow**	**Red**	**Green**	**Blue**
Transmission	**16.8%**	**6.6%**	**70%**	**5.6%**	**6.3%**	**0.2%**
Color change speed – worst case			**0.4 sec**			

The colors are pretty saturated, as you would expect given the market the product is aimed at. The very low blue figure needs some comment; it's a very deep blue—almost into violet—and, as we've discussed in this column many times before, this is an area of the spectrum where I don't believe light meters properly reflect the response of the human eye. In reality and to my eye, I believe the actual blue output of this unit is closer to a perceived 5%. Similarly, the magenta appears much brighter than the measured 6.6% would lead you to believe. If performance in these colors is important to you, I urge you to take a look at the unit yourself and make your own decision. In this case, perception is a better judge than a light meter.

Uniform field lens

This is one area where the Alpha Spot HPE 700 optical system differs considerably from that in its 300W sibling. If you recall, the 300 had the uniform field lens much earlier in the optical train—before the color mixing—and it was a doughnut-shaped filter using homogenizing glass with a hole in the middle. In the 700, this filter is placed after the color mixing, and is a solid filter with no central aperture. The intent is to perform the same function—flatten the field to give better gobo projection. From memory (which is always flawed), I don't think the 700 system does quite as good a job as the 300 of flattening the field. I suspect this is a consequence of the very small size of the 700 unit and the difficulty of finding a good spot in the optical train for this function. However, the flattening effect is noticeable and helpful—albeit, as you would expect, with some loss of output. In this case, the output drops less than it did in the 300 to around 85% with the lens inserted. More detail on this in the photometrics section further down in this review.

Fixed color wheel

Next in line, on the other side of the same optical module, is an aperture plate followed by the fixed color wheel (Fig 11). This looks to be the same as that used in the 300; it contains the same eight permanently glued colors. These are chosen to provide color correction to a couple of different color temperatures, as well as a minus green filter and a few colors that are difficult to mix with color-mixing systems.

The choice and positioning of colors on the wheel is carefully thought out; it provides some nice effects, as well as the corrections. I measured the uncorrected color temperature of the Alpha Spot HPE 700 at 6,800K (a lot lower than the 300) and, using the correction filters, measured 2,650K with the CTO 2500 filter and 3,550K with the CTO 3200 filter. Both are very usable and significantly better results than can usually be achieved using the CMY system. The positioning of the color wheel in the optical train means that you can get good half-colors with a straight line cut between the two colors.

One of the strongest points of the color wheel is its speed—it's really snappy in its movement—and I had a hard time seeing the difference between snapping between two adjacent colors and going half way around the wheel. Clay Paky has done an excellent job here. The very slowest speeds—and it can rotate very slowly, —showed a visible "tick" in the movement every few seconds. I saw this on most of the slow movements in the fixture, but it was most noticeable on color wheel rotation. It's a small aber-

Fixed Color Wheel								
Color	**Red**	**- Green**	**CTO 2500**	**CTO 3200**	**Green**	**Aqua**	**Orange**	**Blue**
Transmission	**3.1%**	**67%**	**51%**	**61%**	**21%**	**40%**	**44%**	**0.3%**

Color Wheel	
Color change speed – adjacent	**0.1 sec**
Color change speed – worst case	**0.3 sec**
Maximum wheel spin speed	**0.375 sec/rev = 160 rpm**
Minimum wheel spin speed	**300 sec/rev = 0.2 rpm**

ration and likely won't be seen by any but the most critical user.

Strobe shutter

The strobe flag looks to be identical both in design and performance to that used in the 300 unit. It performs very well, with a measured range of 1Hz to 12Hz. Notably, it also does so almost silently.

Iris

As can be seen in Figure 12, the iris is part of the gobo assembly mounted as close as possible to the rotating gobo wheel. Unfortunately, the very short depth of field of such a fast ellipsoidal optical system means that even this isn't close enough, and it isn't possible to iris in on gobos. Iris movement was very smooth and fast, going from open to closed in around 0.2 seconds. When fully closed, it reduces the beam size to 15.4% of the full size—the beam with minimum iris is thus 2.3° when zoom is set to minimum beam angle and 5.2° when at maximum beam angle.

Gobos

Following on through the optical train in the Alpha Spot HPE 700, we next get to the two gobo wheels—a rotating wheel with seven replaceable indexing and rotating patterns, followed by a fixed wheel with eight replaceable patterns. Figure 13 shows examples of the two gobo styles removed from the wheels. All gobos were straightforward to replace; the rotating wheel uses a variant on the cartridge system that's becoming common: The planetary gear and gobo holder removes from the wheel, allowing the gobo to be changed external to the unit.

The Alpha Spot HPE 700 shows much-improved accuracy over the 300 in both positioning and indexing of the rotating gobo wheel, with none of the jumping and judder seen in earlier

Fig. 12 - Iris and rotating gobo wheel

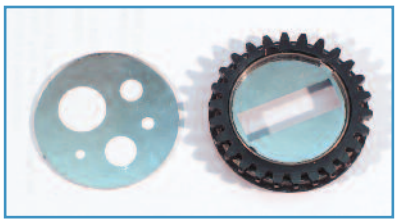

Fig. 13 - Gobos

units. I suspect the controlled dampening device clearly visible in Figure 12 has a great deal to do with this, as it controls the hysteresis and overshoot of the rotation—particularly when changing direction. I measured only around 0.04° of error with the 700, which equates to about 0.2" at a 20' throw. The rotating gobo wheel does not offer quick path operation, and avoids the open hole in changes.

The fixed gobo wheel had a good change time of less than 0.2 seconds for adjacent patterns and around 0.4 seconds worst-case for distant patterns on opposite sides of the wheel. Wheel spin speeds ranged from 0.6 seconds/rev (100rpm) down to 12 seconds/rev (5rpm). The wheels are close enough to each other that you can get some morphing effects between them; focus quality was good, with just a little spherical aberration visible.

Rotating Gobo	
Gobo change time, adjacent apertures	**0.3 sec**
Gobo change time, max (Gobo 0 to 3)	**0.5 sec**
Maximum gobo rotate speed	**0.33 sec/rev = 182 rpm**
Minimum gobo rotate speed	**1600 sec/rev =2.25 rph**

Lenses and output

The lenses in the Alpha Spot HPE 700 are arranged in a three-group zoom system. There are two moving lens groups providing focus and zoom, with the frost and prism mounted between them. Finally, there is a static group providing the output. As mentioned previously, the output quality was excellent, with almost no chromatic aberration and just a small amount of spherical aberration showing up as slight difference between center and edge focus. The time to take zoom from one end to the other was 1.3 seconds and focus end to end was one second. Both of these are quicker than the 300.

The measured output from the Alpha Spot HPE 700 was 11,483 lumens in narrow and 11,308 lumens in wide, with a corresponding field angle range from 15° to 34°, or 2.3:1. This is just under twice the output of the 300 and is well in line with expectations. This is a very acceptable and usable output, given the unit's compact size, and shows that Clay Paky has come to grips with ellipsoidal optics after years of using condensers.

The normal output curves are shown in Figures 14 and 15, while Figure 16 shows the flattened and slightly reduced output of 9.753 lumens with the uniform field lens in place. Note: All measurements were done with a seasoned lamp that had run for approximately 70 hours.

Prism and frost

As mentioned above, the prism and frost systems are mounted between the two moving zoom and focus lenses. This requires some nifty work with the positioning of those motors, to ensure that they can be deployed without hitting either lens. All this takes place automatically, without any user intervention, and it isn't possible to crash anything together. Both effects

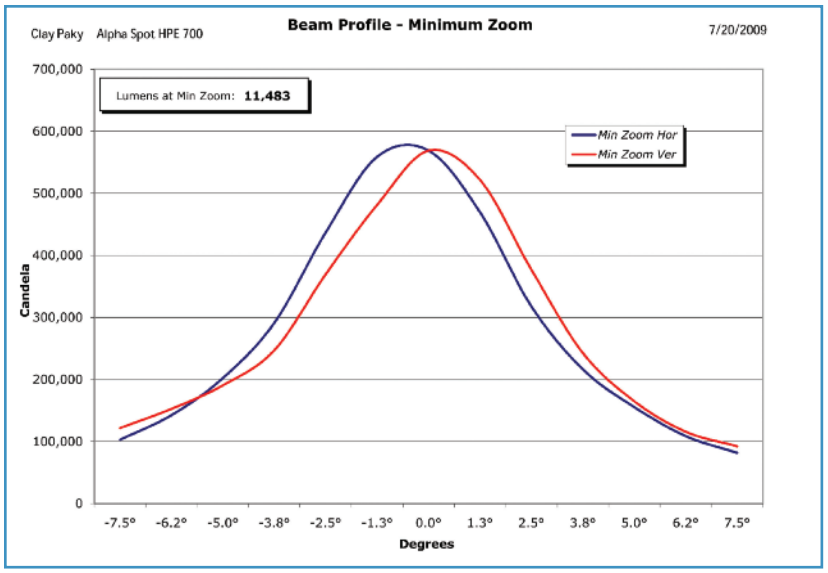

Fig. 14 - Output at minimum zoom

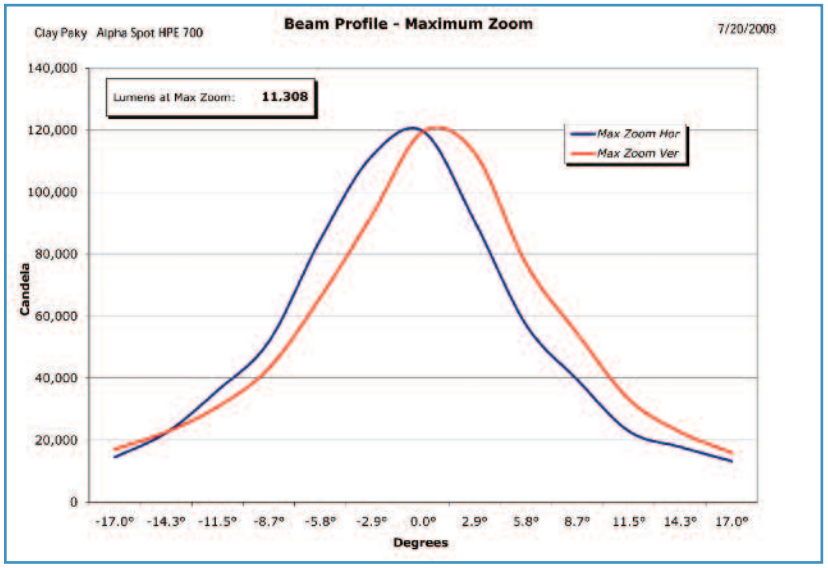

Fig. 15 - Output at maximum zoom

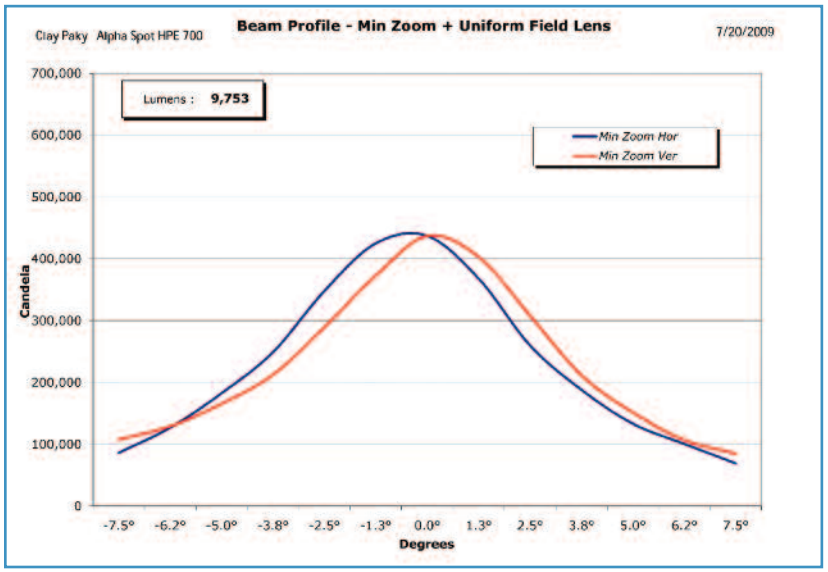

Fig. 16 - Output at minimum zoom with uniform field lens

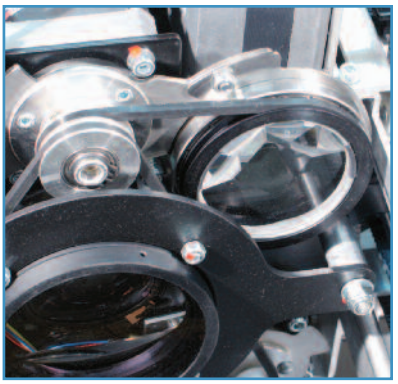

Fig. 17 - Prism

share the same optical position, so cannot be used simultaneously—it's one or the other. I measured a worst-case time for prism insertion at 0.8 seconds and a very snappy 0.2 seconds for the frost. These are much improved times over the Alpha Spot HPE 300; it seems that Clay Paky has been able to adjust the optical train slightly to avoid potential interferences between the flags and the lenses, so that lens movement is minimized.

A single choice of prism is provided—a five-facet rotating prism with rotation speeds varying from 70 rpm down to a glacially slow one revolution per hour!

Frost is an on/off option, with no adjustment possible, and is quite a dense filter. We've talked about this before in this column, so I won't bore you with it again. However, I see this

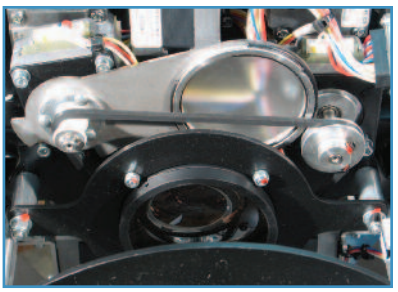

Fig. 18 - Frost filter

as providing a wash function rather than a frost. You can't frost out gobos, as the term is normally used. That having been said, it's a very useful effect—it's just the terminology that I disagree with! (Fig. 18)

Pan and tilt

The pan and tilt range of the Alpha Spot HPE 700 is 540° in pan and 250° in tilt. Movement speed was 3.6 seconds for a full 540° pan move and 1.8 seconds for 180°. In tilt, the figures were 2.1 seconds for the 250° and again 1.8 seconds for 180°. Both axes have encoders for repositioning the fixture if it is knocked out of place.

Repeatability accuracy was measured at 0.17° for both pan and tilt, which is about 0.7" at a 20' throw. Movement profiling was very acceptable with smooth, bounce-free movement, and an excellent deceleration and stop profile.

Noise

With the Alpha Spot HPE 700, Clay Paky has definitely improved the one weak spot with pan noise on the 300 unit. The stationary noise floor from the fans is slightly higher at about 44.6dBA at 1m (inevitably, a 700W unit needs more fan cooling than a 300W unit in the same-size body), and there is now almost nothing on the unit that brings the noise floor up above that.

Sound Levels	
Ambient	<35 dBA at 1m
Stationary Homing/	44.6 dBA at 1m
Initialization	50.6 dBA at 1m
Pan	47.5 dBA at 1m
Tilt	46.5 dBA at 1m
Color	44.6 dBA at 1m
Color Mix	44.6 dBA at 1m
Iris	44.6 dBA at 1m
Prism	45.2 dBA at 1m
Gobo rotate	44.6 dBA at 1m
Gobo select	44.6 dBA at 1m
Zoom	47.0 dBA at 1m
Focus	47.2 dBA at 1m
Strobe	45.0 dBA at 1m
Frost	44.6 dBA at 1m

Homing/initialization time

The Alpha Spot 700 HPE took 51 seconds to complete a full initialization from first powering up and 42 seconds to perform a system reset while running. It shows the same elegant fade down before reset, and fade up after, that its sibling showed. That's a nice touch that I've always liked. It shows that someone thought about having to do a reset in a live situation.

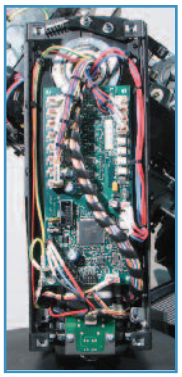

Fig. 19 - Main motor control

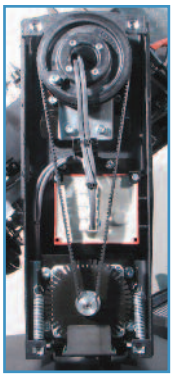

Fig. 20 - Lamp ignitor and tilt

Electronics and control

Clay Paky continues with a split design, mounting all motor driver electronics in one yoke arm while putting the lamp and motor power supplies in the top box. Both yokes are now pretty full, with one containing the main motor control electronics (Fig. 19) and the other the lamp ignitor and tilt motor (Fig. 20). This makes access and maintenance very simple, and minimizes the number of cables passing through the pan bearing.

Note: From a long-term reliability perspective, it's usually a good idea to minimize cables through the pan bearing, as it has the largest range of movement—540° in this case—and so has the most potential to damage cables by repeated twisting and untwisting.

Fig. 21 - Display and control

Figure 21 shows that there is a completely new menu and control system from the earlier units. The display has moved to a multi-line graphic-capable back-lit LCD, and the control buttons to a molded cluster. The overall result is much more usable and elegant than previous designs (Fig. 21). The menu system offers all the usual functions, and continues the very useful feature of providing internal battery power, allowing you to set the fixture address and other operational parameters when the unit is powered down. The Alpha Spot HPE 700 offers both three-pin and five-pin XLR connectors for DMX512 and a Powercon connector for mains power.

Construction and serviceability

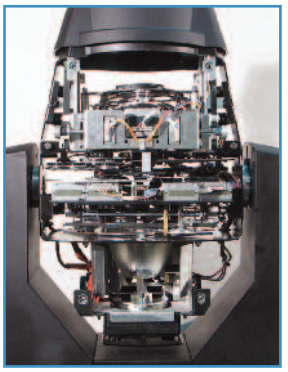

Fig. 22 - Optical systems

Figure 22 shows an overall view of the optical and mechanical systems in the head. The construction is based around a series of modules, all of which can be removed from the main chassis for access and servicing. It isn't necessary to do this to replace gobos but, if you had a lot to change, it might be easier. In each instance, removing modules is a case of slackening a few captive screws, unplugging electrical connections, and carefully sliding the module out. The gobo module is slightly more complex, as you need to move lenses, but is still pretty straightforward. I removed the color module to take the photograph in Figure 11.

As I've said before, I have no way to test for long-term reliability in use, but spotted nothing that gave me cause for concern.

There you have it—the Clay Paky Alpha Spot HPE 700. It shows obvious signs of being a natural evolution from last year's 300 unit, but also shows a number of small improvements and enhancements. It's a tough job squeezing a 700W unit into pretty much the same size body, and it always involves a few compromises. Did Clay Paky do a good job and make it the fixture for you? As always—you get to decide.

Mike Wood provides technical, design and intellectual property consulting services to the entertainment technology industry. He can be contacted at mike@mikewoodconsulting.com