Claypaky Axcor Beam 300

By: Mike Wood

Figure 1: Fixture as tested.

Interesting product this month: Over the last few years, we've seen just about every type of automated luminaire change its light source from HID to LED. The advantages of LED are clear: no restrike time, cooler running, no power consumption when dowsed, and no lamps to change. The efficacy may or may not be better than an HID lamp, but the other advantages far outweigh just about everything else. That being said, there have been two luminaire types that, so far, have resisted this transition. The biggest, baddest luminaires require outputs that are still only achievable with HID arc lamps, and LEDs just didn't seem suited to the optical requirements of aerial beams. In the case of beam projectors, it's all to do with light source size. To get the very narrow beams needed for aerial effects, you need as small a source size as possible. It's our old enemy, etendue, again; small beam angles need small light sources, unless you are prepared to put up with huge losses.

The Claypaky Sharpy is a typical example of the type, an ultra-short arc source with a reflector that produces the narrowest source beam possible. Even then, the source is still not small enough, so we push that light through a tiny gobo, throwing much of it away as we do so, and end up by focusing the resultant beam through as large a final optic as we can justify. The result is a near-parallel beam of light. With an arc lamp, we can use to maximum effect the inevitable center hot spot we get from the arc.

How do we duplicate that kind of optical system with LEDs? We can't get as small a source, high-power LEDs are considerably larger than a 1mm arc gap, and we don't have the same hot spot. Up until recently, this has precluded LEDs from replacing HID lamps in beam units, but that time is coming to an end. Recently, we've seen LED-based units that are starting to rival their HID cousins, and, in this issue, we take a close look at one of them, from the same company as the Sharpy: the Claypaky Axcor 300 Beam. It's perhaps not the first LED-based beam unit to appear, but it's the first I've taken a close look at.

This review follows the usual format: We begin with the lamp and follow through the optical train, measuring everything as we go, ending with the light output. I've tried to take measurements objectively, based on tests I carried out on a single unit supplied to me as typical by Claypaky. However, as you've heard me say before when reviewing aerial beam luminaires, I urge caution in paying too much attention to lumens and output figures. The look and effectiveness of an aerial beam unit has as much to do with sharpness of the optics, beam clarity, and contrast ratio as with raw power. What matters is what it looks like to the audience or camera. All tests were run on a nominal 115V 60Hz supply; however, the Axcor 300 Beam is rated to run on voltages from 100V – 240V 50Hz/60Hz (Figure 1).

Light source and cooling

The Axcor Beam 300 uses a 110W white LED engine. This is a sealed unit, so I was unable to determine the manufacturer. My assumption is that this is a small array of COB white LED emitters with primary optics and a collimation

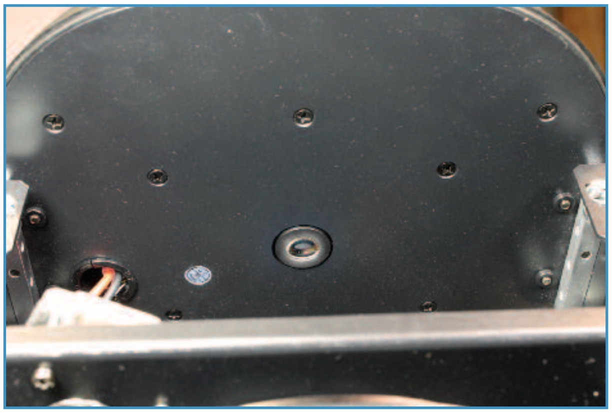

Figure 2: Light source.

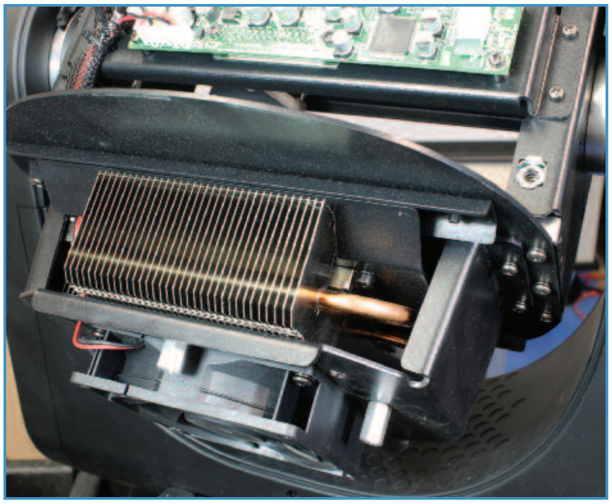

Figure 3: Heat sink.

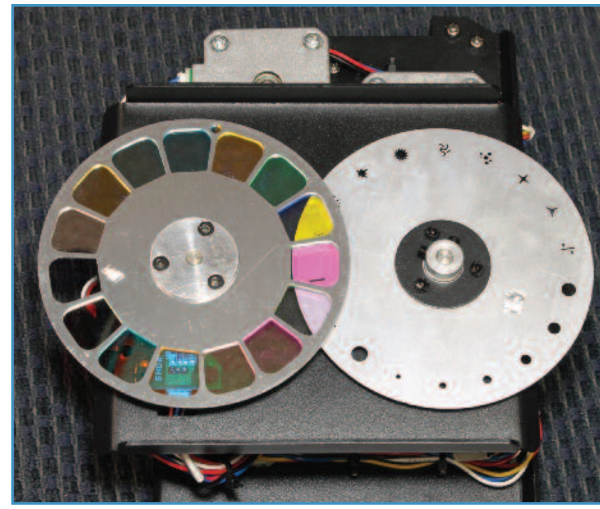

Figure 4: Color and gobo wheels.

system. A typical output for a 110W white LED system would be around 8,000 – 10,000 source lumens. The only thing visible is the small output lens on the rear bulkhead shown in Figure 2. This is a final collimating lens, about 10mm in diameter, which focuses the light onto the gobo wheel. Behind the sealed LED is a heat sink with two heat pipes leading to fins and a single large fan (Figure 3). The fan, as you would expect, is thermostatically controlled to keep the LED within its safe operating region. Some droop in output as the LEDs warm up is inevitable but was relatively small. I measured the output as dropping by about 7% when run at full power for 15 minutes.

Color wheel

Immediately after the collimating lens is a color wheel. This, like its Sharpy predecessor, has 14 permanently attached dichroic colors plus an open aperture. However, unlike the Sharpy, the color wheel is screwed in place rather than using quick-release magnetic couplers. There is a relatively small bar between colors, so half-colors are possible. Figure 4 shows the color wheel.

about 50% of the Sharpy. The Sharpy will lose output as the lamp ages. (However, please note what I said above: Don't take raw lumen power as the only metric with a beam projector. The beam qualities are very different between the Sharpy and the Axcor—more about that later.)

I measured the native color temperature of the Axcor 300 Beam, with no filters, at 8,250K; with the CTO filter added, this dropped to 2,840K, and with the CTO 3200 filter, to 3,650K. (Note: The Axcor supplied to me for test was an early unit, Claypaky tells me the native color temperature is lower in those units currently shipping.)

The small wheel size helps with the color-change speed. Spins were also quick. All movement speeds were about half those of Sharpy.

COLOR WHEEL

Color change speed – adjacent	< 0.2 sec
Color change speed – worst case	0.7 sec
Maximum wheel spin speed	0.68 sec/rev = 88 rpm
Minimum wheel spin speed	82 sec/rev = 0.73 rpm

FIXED COLOR WHEEL

Color	Red	Orange	Aqua	Green	Light Green	Lavender	Pink	Yellow	Magenta	Cyan	CTO	CTO 3200	CTB 8000	Blue
Transmission	3.2%	52%	47%	24%	75%	76%	48%	99%	12%	16%	63%	55%	38%	0.5%

The colors, not surprisingly, are exactly the same as the Sharpy's. Claypaky has clearly designed this product as a close replacement for that older unit. The different lamp spectra mean that some colors are brighter and some dimmer than on the original Sharpy, as the LEDs favor different colors to the HID lamp. Overall, though, the colors should be similar, bearing in mind that the total output of the Axcor 300 Beam, when the lamp in the Sharpy is brand new, is

The movement in both slow wheel rotation and color selection was very smooth.

Gobo wheel

Again, this is very familiar. The gobo wheel is identical in patterns, if not in exact size, to that in the Sharpy. As you can see in Figure 4, it's a single metal wheel with etched patterns. The open aperture is the one at the bottom left of that image, adjacent to the color wheel, while the small aperture next to it is the tightest beam, at about 30% of the size of the open hole. To put this in scale, that small aperture is only about 2mm in diameter.

Visible on both the color and gobo wheels in Figure 4 are small pieces of aluminum tape, securing the alignment sensor magnets.

This lightweight wheel moves smoothly, with change times very similar to those of the color wheel. Slow rotations were smooth and step-free, with accurate repositioning.

GOBO WHEEL	
Gobo change time – adjacent apertures	< 0.2 sec
Gobo change time – max (Gobo 0 - 7)	0.8 sec
Maximum wheel spin speed	0.84 sec/rev = 71 rpm
Minimum wheel spin speed	47 sec/rev = 1.3 rpm

Given the intended use, focus quality was perfectly acceptable. This isn't a corporate logo projector, after all.

The field size at the gobo plane is actually much larger than the gobos; this gives the Axcor 300 Beam a lot of room to move a gobo from side to side and still keep it in focus—something like three times the gobo width in total. Thus, the gobo-shake function moves the image much further than most normal moving lights.

Prism

Immediately after the gobo wheel, on the reverse side of the optical module is the rotating prism. It is an eight-facet design, with symmetrical facets, that provides good image separation, particularly of the smaller patterns. I measured the prism insertion/removal time at 0.5 seconds and, once in place, it provides indexing control and a good range of rotation speeds from 100rpm all the way down to 0.3rpm, or 200 seconds for a full rotation. Figure 5 shows the prism.

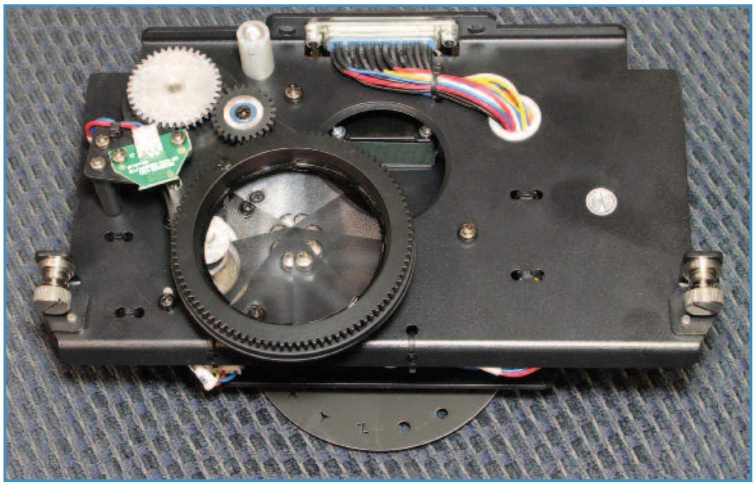

Figure 5: Prism.

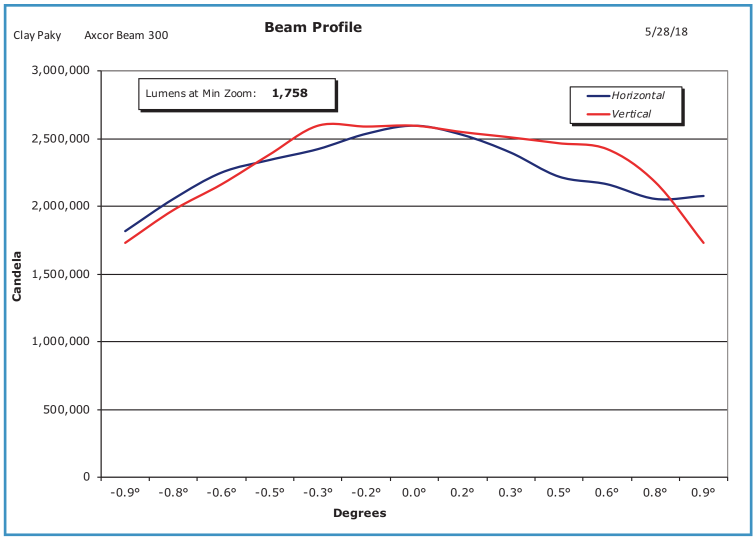

Figure 6: Beam distribution.

Lenses and output

The Axcor 300 Beam has two lens groups after the prism. The rear lens group moves back and forth to provide focus adjustment, while the front, output, group is fixed. All lenses are large in diameter compared to the aperture size, as required for narrow beam angles. The output lens is 140mm in diameter. The focus lens can be moved from one end to the other in 2.6 seconds via a pair of motors and leadscrews.

You may have read in one of these reviews that I sometimes take outside lights, particularly ultra-narrow angle aerial beam luminaires, to get the long throws needed for measurement. I have a new method. Instead of being limited by my workshop, I've installed a large front-surface mirror through which I can bounce the output beam, effectively doubling its path. I've measured the reflectivity of the mirror, so I can allow for any losses it introduces into the measurements. I'm also about to move to a larger workshop so that, in the future, I will get a clean 25' throw, which I can double to 50' with my mirror.

Using this technique, and allowing for the mirror losses, I measured the output of the Axcor 300 Beam at 1,750 lumens with a native field angle of 1.8°. By my reckoning, about 10% of the light produced by the LED source makes it out of the front. Don't dismiss this: It's actually a pretty good efficiency for a beam unit. Those tiny gobos really drop the output. There are two major differences between the Axcor 300 and Sharpy. The output is lower in the Axcor, but it's also much, much flatter. The Sharpy beam is extremely peaky, which isn't necessarily always what you want. In fact, with a beam in a theatrical fog or haze, the visible effect comes as much from the brightness at the edge of the beam, and the contrast with the unlit haze, as it does from that in the center. This is why I keep saying that lumens aren't everything with a beam unit. With that in

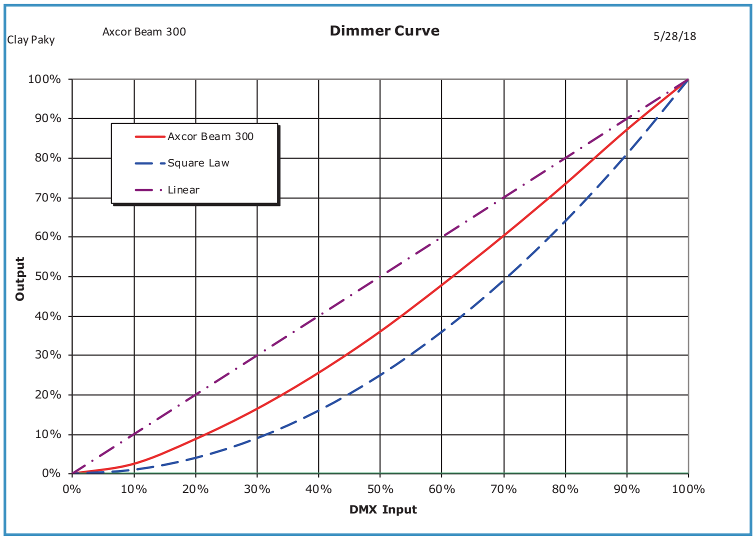

Figure 7: Dimmer curve

mind, I can't say exactly how the Axcor 300 Beam will look in use when compared a Sharpy; it will depend on the usage, throw, haze level, and so on. Figure 6 shows the extremely flat beam distribution.

Where an LED source gives an undeniably huge improvement over an HID is with dimming; there's no need for a mechanical shutter flag and the dimming is natively flat across the beam. Figure 7 shows the dimming, with the default dimming curve selected. It's pretty much halfway between linear and square law dimming. The strobe is also clean; I measured available strobe speeds ranging from 1Hz up to 20Hz. Turning to PWM rates, I measured the frequency at 600Hz. Claypaky tell me that, in later versions of the firmware, the PWM is adjustable from 600Hz all the way up to 25kHz. Finally, Figure 8 shows the output spectra with, from top to bottom, no filter, the CTO filter, and the CTO 3200 filter inserted.

Pan and tilt

The Axcor 300 Beam has full pan-and-tilt ranges of 540° and 270°, respectively. I measured pan speed over the full 540° at 2.75 seconds and 1.6 seconds for 180°. In tilt, the figures were 1.9 seconds for the 270° and 1.6 seconds again for 180°. Both pan and tilt have optical encoders to reposition the fixture if it is knocked out of place. Hysteresis, or repeatability, was measured at 0.02° for pan, which is about 0.1" at a 20' throw (6mm at 10m). Tilt was 0.05° which is 0.2" at 20' (9mm at 10m). Movement on pan and tilt was smooth and clean.

Noise

As usual with LED-based units, the fans provided the noise base for the Axcor. Motors were only slightly higher at full speeds.

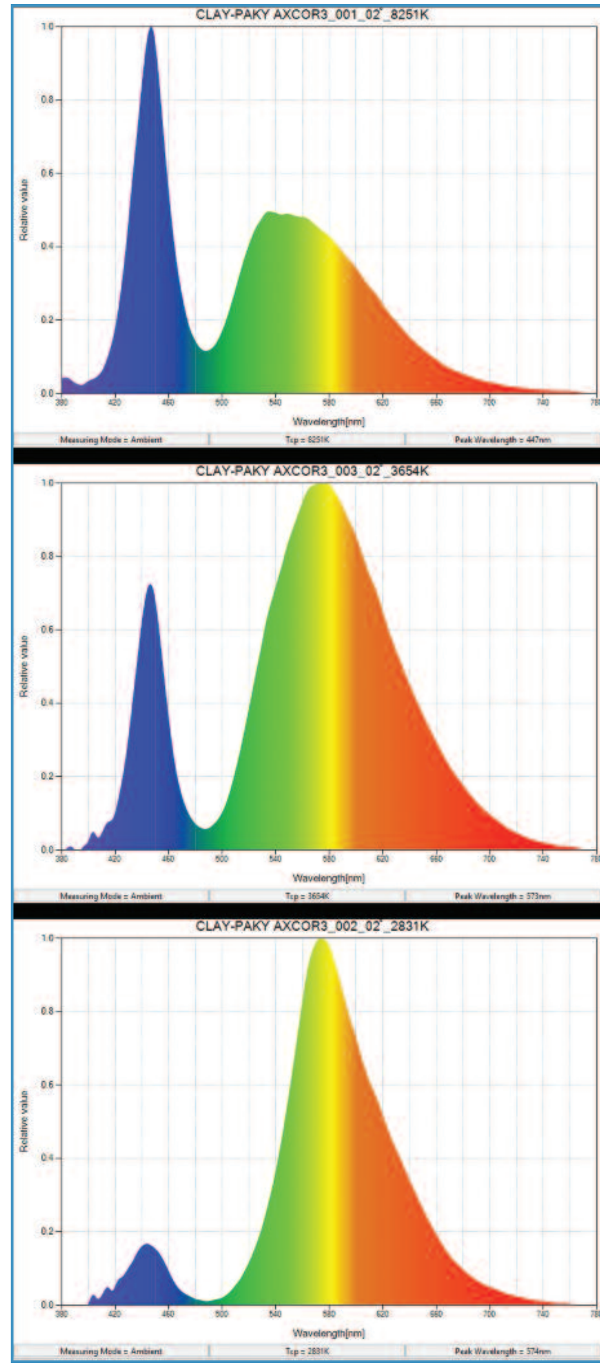

Figure 8: Spectra.

SOUND LEVELS

Ambient	<35 dBA at 1m
Stationary	47.4 dBA at 1m
Homing/Initialization	48.8 dBA at 1m
Pan	49.2 dBA at 1m
Tilt	50.1 dBA at 1m
Color	47.5 dBA at 1m
Prism	50.8 dBA at 1m
Gobo select	47.5 dBA at 1m
Focus	49.5 dBA at 1m

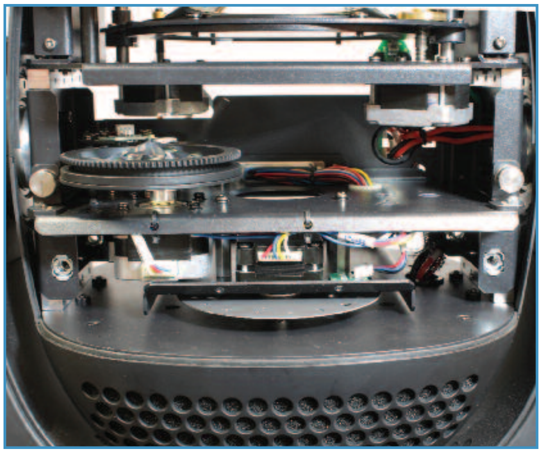
Figure 9: Head.

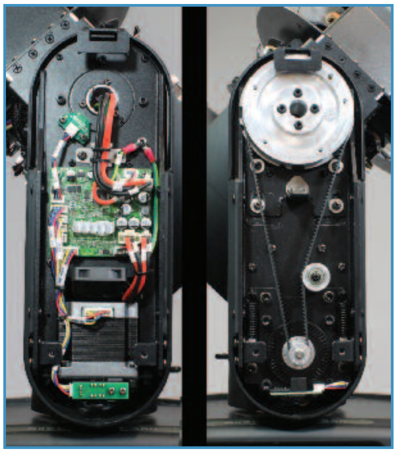
Figure 10: Yoke arms.

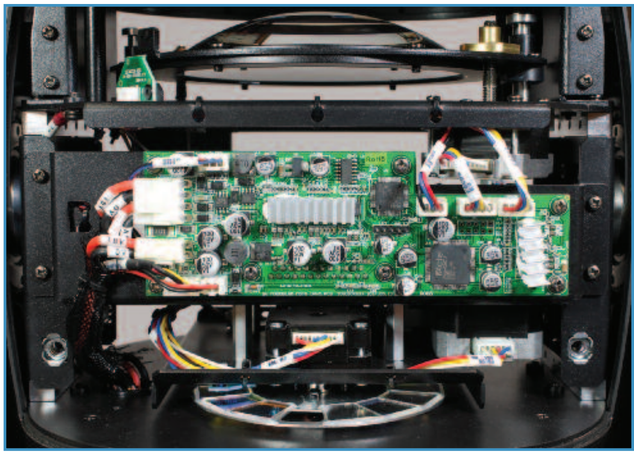
Figure 11: Head control.

Homing/initialization time

The Axcor took 30 seconds to complete a full initialization, from powering up or from a system reset while running. This early unit is badly behaved on reset, in that it brings the light output back on before the final move has finished. Claypaky tells me this has been fixed now.

Construction, power, electronics, and control

In operation on a nominal 115V 60Hz supply, the Axcor 300 Beam consumed 1.68A when at full output but stationary; that's a power consumption of 198W at a power factor of 0.99. The quiescent load with the LED dimmed out was 0.54A, 65W, at unity power factor.

Construction follows the industry norm, with internal data and power buses feeding distributed electronics for motor and LED control, and a fully removable module for the head optical components. Figure 9 shows the single head module: Remove the two large thumbscrews you can see in the photo, and this module lifts out for cleaning. Figure 10 shows the two yoke arms with the covers removed; the left arm contains the pan-and-tilt electronics, along with the pan motor, while the right arm has the tilt motor and drive belt. Figure 11 shows the head motor drive board mounted on the underside of the plug-in optical module.

The Axcor has a graphic LCD screen and control pad for parameter setting with the menu providing all the usual functionality. These can be run under battery power when the unit is in the road case or being set-up when rigging (Figure 12).

On the opposite side of the top box, the connector panel (Figure 13) provides five-pin DMX512 XLRs as well as power in and out via powerCON. Again, because I had an early unit, the Axcor supplied to me did not support RDM but

Figure 12: Display.

Figure 13: Connections.

Claypaky says that it is available in the latest firmware. The unit has a couple of DMX protocols, one of which precisely mimics the Sharpy so that it becomes a drop-in replacement on the rig.

That about does it for the Claypaky Axcor 300 Beam. Claypaky's LED answer to its own Sharpy. It's not quite as bright, but the much flatter beam may well compensate for that. The only way to be 100% sure, if you are interested, is to try it yourself!

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