GLP GT-1 Hybrid Fixture

By Mike Wood

Figure 1: Fixture as tested.

LEDs have invaded all elements of our lighting rigs, including automated units, but there's still has one area where those ubiquitous chips can't compete, and where the arc lamp—at least for the moment—remains supreme: aerial effects with ultra-narrow beams. The optics for these systems require light sources with the smallest etendue possible if they are going to have any efficiency. This effectively means you need a tiny, very bright, light source. LEDs may be small, but they don't have the surface brightness of an arc, which, coupled with its size, gives us the etendue we need.

Note: This is not the place to delve too deeply into etendue. If you are interested, you'll find articles on my website (http://www.mikewoodconsulting.com/), where I discuss it at length. In broad terms, etendue—the measure of the spread of a light source—is a very important parameter of optical design. Optical systems can make light beams narrower in angle or they can make them smaller in diameter, but they can't do both at the same time without loss of light. A lens can make a light beam narrower in beam angle, but that beam must then be larger in diameter. Similarly, a lens system can make a light beam narrower in diameter, but the beam angle must then increase.

In the case of an aerial beam unit, we want the narrowest beam angle we can achieve; parallel would be ideal. That means starting off with the smallest light source we can. For now, that means an arc. I'm sure LEDs will get there very soon—they are already appearing in larger units with fatter beams—but not just yet in small units designed for stage use.

This leaves the luminaire manufacturer with a decision. An arc lamp-based unit has a certain necessary overhead in terms of lamps, power supplies, cooling, and so on. How does one justify all that for a single effect? Instead, manufacturers have been developing all-purpose units that use an arc source as a regular spot unit, as well as offering beam effects. We've seen these universal multi-purpose units from various manufacturers over the last year or so, and, this month, I'm looking at a recent entry from GLP, the GT-1. With it, GLP has made a product as small as it can, with a lot of utility squeezed into a compact body.

In prior reviews of this type of luminaire, I've modified my testing in some areas to reflect the usage as an effect beam projector as well as its more conventional use as a gobo projector, providing the usual spot effects. You may notice switches in criteria a little as we discuss various aspects of the unit. As usual, I've tried to measure and quantify what I can, to give you a feel as to whether the GLP GT-1 is a unit you'd like to use. All my tests were run on a nominal 115V 60Hz supply; however, the GT-1 is rated to run on 100/240V 50/60Hz (Figure 1).

Lamp

The GT-1 uses an Osram Sirius HRI 440W lamp (Figure 2), rated to produce 22,800lm from a 1.3mm arc at a color temperature of 7,000K. It's a lamp with integral reflector, ensuring good optical alignment.

Figure 2: Lamp.

To me, the worst part of the GT-1 is the lamp change. To access the lamp, you must remove three outer covers, two fans, the ignitor, and two support brackets. This involves lots of screws—most of them captive, thank goodness—but some of them in awkward spots. It's not doable on a rig; it's definitely a bench

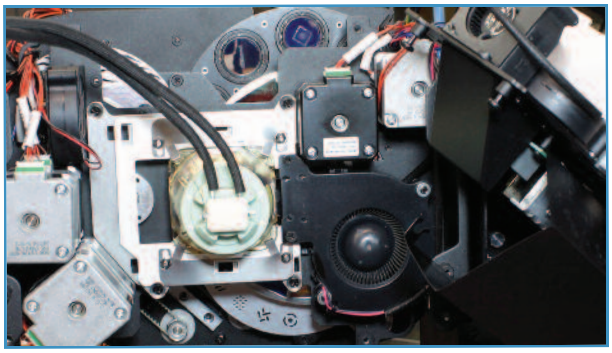

Figure 3: Lamp access.

task. GLP isn't the first manufacturer using a lamp buried inside the system like this—the Claypaky Mythos has the same problem—but I hope it doesn't become a trend. The engineer who designed it should be made to climb a truss and replace a lamp him or herself! The GT-1 lamp is rated at 1,500 hours, which helps a little (Figure 3).

I'm sure that the reason for this structure has to do with the fact that these lamps are very fussy about their cooling and need complete enclosures. The GT-1 lamp is enclosed in a fan-ventilated lamphouse capped with a pair of angled hot mirrors.

Dimmer and strobe

First in line after the hot mirrors is the dimmer/shutter system. This comprises a pair of opposing flags, each with its own motor, that close like a pair of scissors across the beam. Dimming quality is slightly messy, with visible patterns in the beam as the blades move across. Unfortunately, this is not unusual with ultra-narrow beam lights, as that same low-etendue design we want makes homogenized dimming particularly tricky. The dimming curve, shown in Figure 4, follows a square law (with the

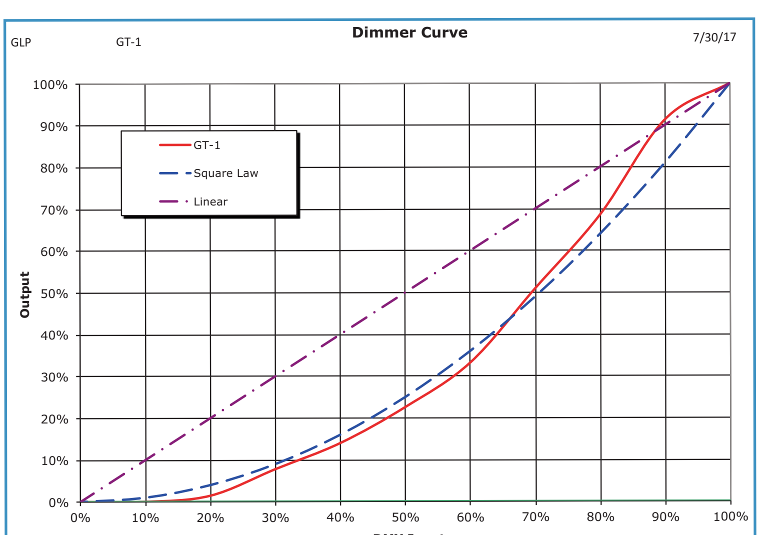

Figure 4: Dimmer curve.

Figure 5: Color system.

default settings I used) very well. As mentioned, there is visible vignetting of the beam by at least one of the blades over the last 20%. I measured the strobe as providing speeds from 1Hz to 10Hz. I also saw visible arc flickering in the beam at some points, particularly when dimmed down.

Color

The GT-1 has a fairly conventional color system, with a three-wheel CMY dichroic color mixing and a fixed color wheel. Figure 5 shows the two systems in situ. Mixing was smooth, with edge-to-edge color difference only visible in hard-to-mix pastels, such as lavender and aqua. The color wheel has 11 colors, plus an open slot. The colors are permanently glued in position and are trapezoidal in shape, with no gaps in between, providing a direct transition from one color to the next. As well as some saturated colors that are tricky to mix, GLP has provided a range of color modifiers on the wheel, including three different CTOs, a minus green filter, and a light frost to use as a homogenizing/field-flattener filter with gobos.

COLOR MIXING

Color	Cyan	Magenta	Yellow	Red	Green	Blue
Transmission	16%	5.7%	85%	5.0%	7.0%	0.8%

FIXED COLOR WHEEL

Color Wheel	Red	Congo Blue	CTO 1	CTO 2	CTO 3	Minus Green	Frost	Pink	Cyan	Orange	Blue
Transmission	1.3%	0.4%	50%	79%	62%	72%	64%	36%	22%	20%	5.1%

I measured the open white color temperature of the GT-1, with no color correction, at 6,890K. CTO 1 reduced the color temperature to 4,103K, CTO 2 to 3,547K, and CTO 3 to 3,088K. The frost also reduced color temperature slightly, to 6,300K.

Intermediate, or half-colors, are possible, however. Note that the two adjacent colors tend to merge and mix rather than having a distinct cutoff line. I actually prefer this in many cases. If you want to get a hard line, the GT-1 has enough range to focus back onto the color wheel itself.

That way, you get a hard-edged split color—but no gobo, of course. Similarly, you can also focus on the color-mixing wheels and watch the etch patterns as they move by. The snap color changes are quick. The unit always takes the quickest path between colors, to minimize th time.

COLOR WHEEL

Color change speed – adjacent	< 0.1 sec
Color change speed – worst case	0.4 sec
Maximum wheel spin speed	0.53 sec/rev = 113 rpm
Minimum wheel spin speed	204 sec/rev = 0.3 rpm

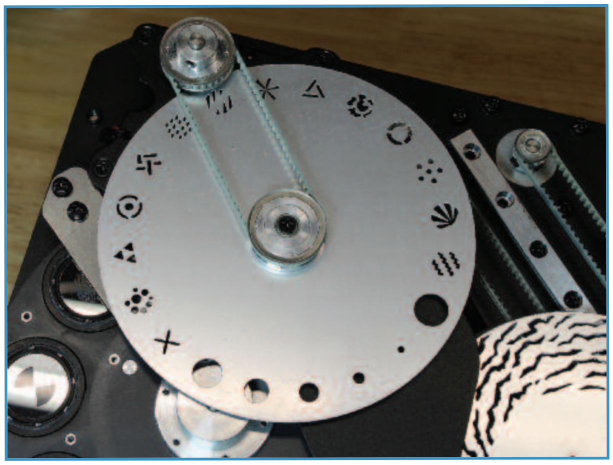

Figure 6: Fixed gobo wheel.

Gobo wheels

The GT-1 has two gobo wheels: a static wheel, next to the color system, and a rotating gobo. Figure 6 shows the fixed gobo wheel with 19 gobos plus open hole. Five patterns next to the open hole are reducing aperture sizes, designed for the beam effects. The smallest aperture reduces the beam angle to about 1° when the lenses are in the narrow zoom position. All patterns are cut into a single large wheel, meaning swapping patterns is not possible; however, this construction minimizes weight and allows the wheel to move rapidly.

STATIC GOBO WHEEL

Gobo change time – adjacent apertures	< 0.2 sec
Gobo change time – max (Gobo 1 - 9)	0.7 sec
Maximum wheel spin speed	0.35 sec/rev = 171 rpm
Minimum wheel spin speed	128 sec/rev = 0.5 rpm

The rotating gobo wheel has eight changeable patterns. These are retained by a removable spring clip, holding the gobo into a carrier on the wheel.

ROTATING GOBO WHEEL

Gobo change time – adjacent apertures	0.3 sec
Gobo change time – max (Gobo 1 - 5)	0.6 sec
Maximum gobo spin speed	0.43 sec/rev = 140 rpm
Minimum gobo spin speed	1640 sec/rev = 0.04 rpm

Focus quality on both gobo wheels was good. Figure 7 shows an example on the rotating wheel. At wider angles, there is some radial distortion (pincushion) at the edges of the beam, but nothing objectionable. The rotating gobo wheel showed negligible positional hysteresis and very smooth slow-speed rotations.

Figure 7: Gobo quality.

Figure 8 shows a gobo morph as I pulled focus from a rotating gobo (left) through to a fixed gobo (right).

Figure 8: Gobo morph.

Animation wheel

The GT-1 has an effect/animation wheel mounted after the rotating gobo wheel. This is a metal wheel with an over-

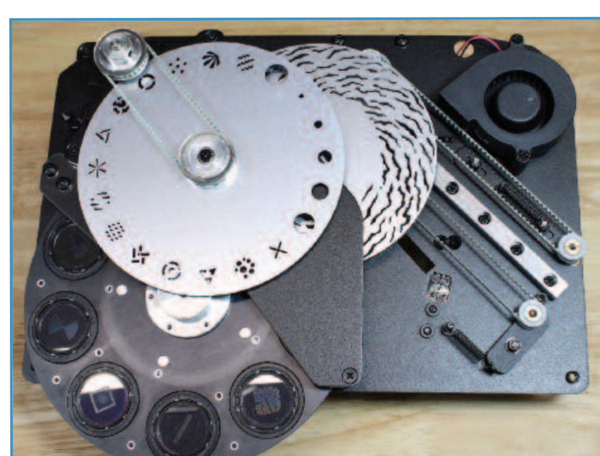

Figure 9: Gobo module, with effects wheel In.

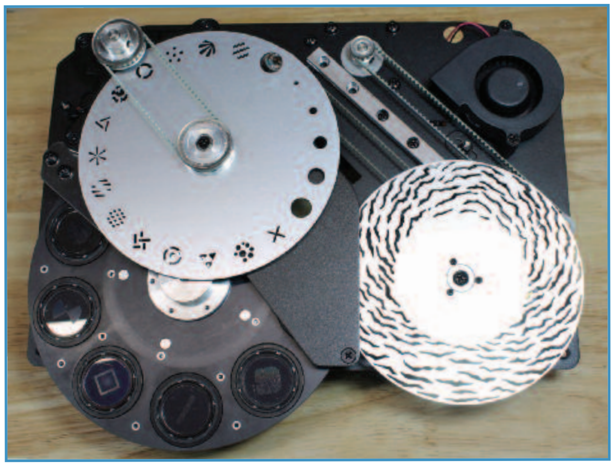

Figure 10: Gobo module, effects wheel out.

sized breakup pattern that can be moved across the beam diagonally. This allows the user to choose the direction of movement of the rotating pattern, whether it appears to move up and down, left and right, or anywhere in between. Once in place, it can be indexed or rotated at the angle you've positioned it. Figures 9 and 10 show the effect wheel in its two end positions. (It took about one second to insert this wheel.)

Figure 11: Frost and prism.

Prism and frost

The GT-1 has an eight-facet circular prism, a three-facet circular prism, and a four-facet linear prism, each of which can be individually be positioned across the beam. These are mounted on a wheel in fixed positions between Lens Groups 1 and 2 (not riding with a lens as often seen). Figure 11 shows the prism wheel with the three-facet circular at the bottom.

Either prism can be inserted or removed in about 0.8 seconds, and can then be rotated at speeds varying from 0.8 sec/rev (75rpm) down to 328 sec/rev (0.18rpm). It took 0.8 seconds to swap from one prism to the other.

The frost mechanism is a pair of flags, located next to the prism wheel, that are closed across the beam as desired. Movement of the frost, completely in or out of the beam, took 0.4 seconds. Figure 12 shows the progressive frost effect.

Note: As with other units of this type, this is the type of "frost" that doesn't affect the edges of a gobo; instead, it leaves the gobo in focus and progressively lowers the contrast ratio and diffuses light over the rest of the aperture. The other style of frost, which is more familiar to theatrical users, is a diffuser that softens the edges of a gobo projection in addition to spreading the light.

Lenses and output

The GT-1 has three lens groups, all of which move independently. The first two are internal, positioned on either side of the frost and prisms. The third group is the front lens, which remains at its inner position for most of the zoom range using gobo effects, but extends out a small way when the unit is at its extreme narrow angle for beams. I didn't notice this at first, as the motion is small, and the unit retracts the front lens when the unit is powered down. The frost and prism interfere with some combinations of lens position, so the system will adjust beam size slightly if a prism or frost is inserted when in those locations. Focus time from end to end was 0.5 seconds, while zoom took 1.7 seconds.

The zoom has a very wide range to accommodate the unit's dual use as a gobo projector and producer of aerial

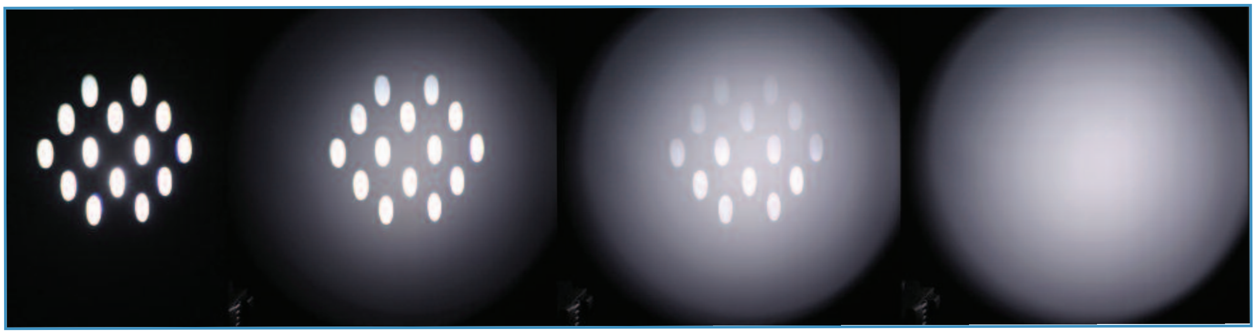

Figure 12: Frost.

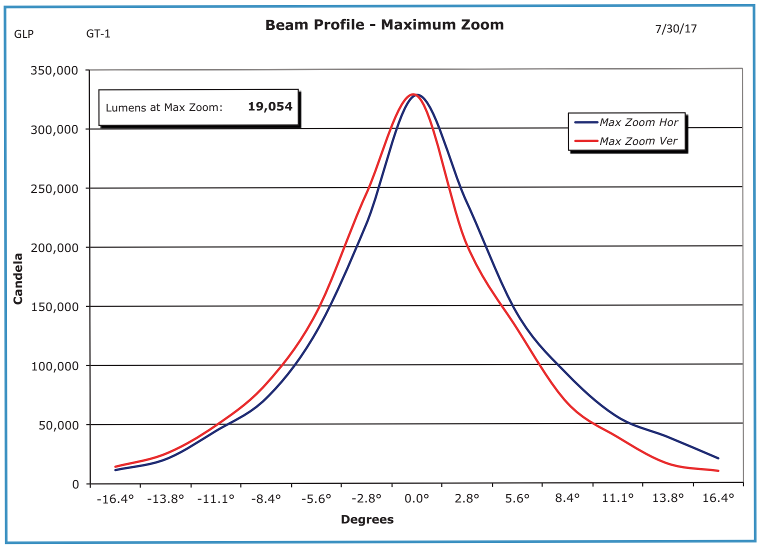

Figure 13: Output at maximum zoom.

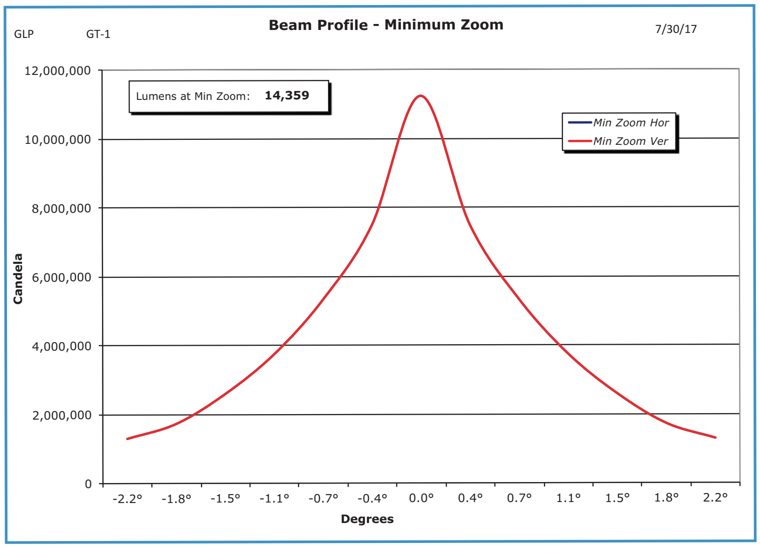

Figure 14: Output at minimum zoom.

beams. In wide angle, I measured the output at just over 19,000lm at a field angle of 33°. In narrow angle, the output dropped to 14,000lm at a field angle of 4.4° (Figures 13 and 14). This is a zoom range of about 7.5:1.

Note: The 19,000lm output measured at a wide angle makes me think that the lamp is producing significantly more than the rated 22,800lm; I'd guess more like 30,000lm. GLP may be running it at more than the nominal 440W, which is fine with a discharge lamp as long as the cooling is similarly increased.

Figure 16 shows a rotating gobo at maximum and minimum beam angles, side-by-side for comparison.

Notice that the profile is very peaky; this is deliberate, I'm sure, so that the small gobos needed for aerial beams are as bright as possible. I took all measurements without the diffusing filter on the fixed color wheel in place. Adding this filter flattened the gobo image significantly, with a consequent reduction in output down to about 64%.

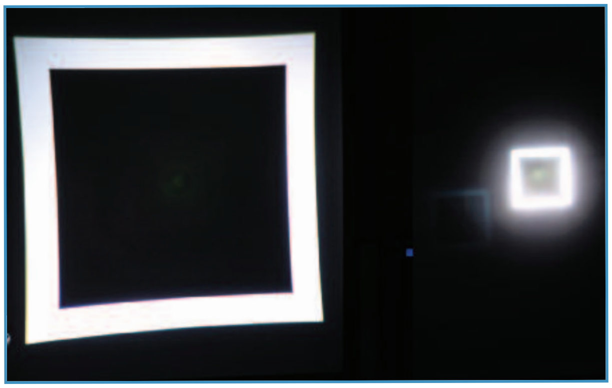

Figure 15: Zoom range on rotating gobo.

Pan and tilt

The GT-1 has a full pan range of 630° and tilt of 260°. Pan time at full speed over the pan range of 630° was 4.5 seconds and the time for a more normal 180° was 2.7 seconds. Corresponding times for tilt were 2.1 seconds for 260° and 1.9 seconds for 180°. Movement on both axes was very smooth, with very little stepping at slow speeds. Hysteresis on both axes was very small at 0.04°. This equates to 0.2" at a 20' throw (7mm at 10m). The low hysteresis shows the system is stiff, and this shows up as some wobble as the system comes to rest after a move.

Figure 16: Yoke arm 1.

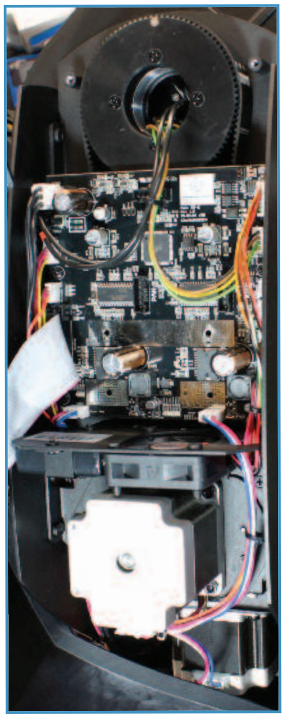

Figure 17: Yoke arm 2.

Noise

As is usually the case with arc units, the fan provides the bulk of the noise from the GT-1. I allowed the unit to heat up and stabilize for 30 minutes before taking these readings

SOUND LEVELS	
Ambient	<35 dBA at 1m
Stationary	51.4 dBA at 1m
Homing/Initialization	62.2 dBA at 1m
Pan	53.5 dBA at 1m
Tilt	53.2 dBA at 1m
Color	51.6 dBA at 1m
Effects	52.1 dBA at 1m
Gobo select	51.6 dBA at 1m
Gobo spin	51.6 dBA at 1m
Focus	53.0 dBA at 1m
Zoom	52.6 dBA at 1m
Strobe	52.1 dBA at 1m
Frost	51.4 dBA at 1m

Homing/initialization time

The GLP GT-1 took 101 seconds to complete a full initialization from either power on or from issuing a reset command through DMX512. The unit was well-behaved, as the lamp was dimmed out before movement started and didn't fade up again after all movement had finished.

Power, electronics, and control

Running on a 117V 60Hz supply, the GT-1 consumed 5.4A with a power consumption of 621W and power factor of 1.0.

GLP continues its design tradition of reducing the size of the top box to a minimum; this means that it contains little more than connectors, and everything else is in the yokes and head. The main motor control electronic boards are positioned behind the lenses in the head, with power supplies and other electronics found in the yoke arms. Figures 16 and 17 show the yoke arms. Figure 17 also shows the pan-and-tilt motors.

The GT-1 offers control through Art-Net via an etherCON connector as well as DMX-512 through five-pin and three-pin XLRs. I tested the RDM system using a City Theatrical DMXCat, and it performed well. As with other GLP units, the menu display system is also in a yoke arm. Figure 18 shows this in operation. This photo was taken during a homing cycle, when I had left the gobo module unplugged. (I might claim, as an alternative fact, that I did this on purpose to demonstrate the feature…) The default homing display shows this situation immediately, as none of the functions on the module are responding. Finally, the ignitor board is immediately behind the lamp, in the rear of the head (Figure 19).

Figure 18: Display.

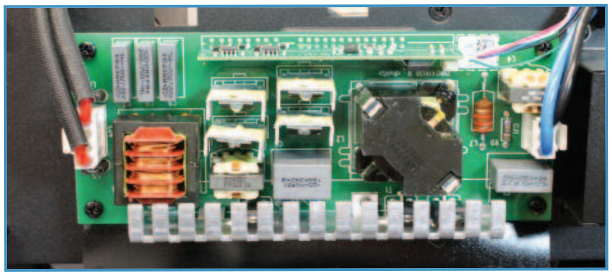

Figure 19: Ignitor.

Construction and serviceability

Leaving lamp change to one side, normal maintenance of the GT-1 looks straightforward. The gobo module came out and went back in easily, and it was possible to access lenses for cleaning.

So, there you have it: the GLP GT-1. A multi-purpose spot and aerial beam unit in a compact body. Does this combination of features appeal and could it have a spot on your rig? I've given you the data; now it's up to you to decide.

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