

## Sigma 500mm f/4 DG OS HSM Sport Lens Review

by E.J. Peiker



The Japanese lens manufacturer Sigma has been around since 1961 and for much of its history it has been known as a company that makes budget lenses for Nikon and Canon cameras (and others at times). In late 2012, Sigma went public with a desire to no longer be seen only as a budget third party lens maker. They came up with the Global Vision line of lenses, new state of the art manufacturing processes and a vastly upgraded quality control process. The Global Vision lenses are part of three different distinct product lines. The Contemporary line stays true to the original Sigma concept - consumer grade lenses made of lighter materials at prices significantly below the camera manufacturer's lenses. The Art line of lenses was conceived to make the finest prime and short zoom lenses, lenses that meet or exceed the very best that the OEM's and even specialty lens companies make regardless of cost. And finally a Sport telephoto line that makes high end long lenses equal in performance to what the likes of Canon and Nikon make. These three lines have become unmitigated success stories and has moved Sigma from the realm of cheap knock-off lens maker to an innovative high end lens maker that produces lenses as good or better than anything on the market. Art lenses are even on par with specialty lens makers like Zeiss and often exceed the image quality of similar Canon and Nikon lenses. As an example, their latest 85mm is considered an equal to the ultra high end Zeiss 85mm Otus lens at a drastically lower cost, and it has autofocus which the Zeiss does not.

On the Sport lens front, Sigma made a huge splash with their 150-600mm Sport lens which I wrote about nearly 2 years ago (<http://www.ejphoto.com/Quack%20PDF/Sigma%20150-600.pdf>). Last year at Photokina they announced the first Sport series prime lens designed to compete with the latest super-telephoto lenses from Canon and Nikon. The new Sigma 500mm f/4 lens is nearly a lightweight as it's Canon and Nikon 500mm siblings, with superb weather

sealing, very rugged magnesium alloy construction, and a new AF motor that has 33% more torque resulting in AF acquisition speeds equal to the very best. In the past, despite excellent optics, Sigma lenses have been slower for initial focus acquisition. Both the Canon and Nikon mount versions of the Sigma lens use fully electronic aperture control - while this is not new for Canon it is something new on the Nikon side. It will increase reliability due to no longer needing a spring-loaded mechanical aperture stop down tab in the mount. The mechanical part of Nikon lens aperture control has long been a failure point on Nikon and third party lenses made for Nikon cameras - especially if the lenses that are subjected to a high frequency of lens changes. When first looking at this lens, it is easy to get overwhelmed as it has taken the number of buttons and switches to new levels. There is even a switch on the lens collar! Among the switches you will find an AF/MF switch, a three position focus limiter switch, an OS mode switch, a custom function switch, a beep on/off switch, an AF function switch, a memory set button to program the 4 lens barrel buttons and a collar detent click on/off switch. Add knobs to loosen or tighten lens collar rotation and another to insert or retract rear element filter and you have a very complex lens. Sigma has gone to the trouble of labeling the switches and buttons in Canonese or Nikonese depending on which lens mount model you buy, therefore, the labels will have somewhat different names if you use a Canon mount or Nikon mount lens keeping consistency with the labeling of lenses by the camera manufacturers. The customization switch allows for three different lens behaviors, one the Sigma standard and two other customizations of AF and OS behaviors. A button activated feature on the new Sigma 500mm f/4 that is not available on Nikon and Canon 500mm lenses is that each of the four lens barrel buttons can be programmed for a different focus distance pre-set. This is extremely useful for bird photographers sitting in a blind with multiple perches. Each button can be programmed for focus on a different perch making it much more likely to obtain AF when moving quickly from one perch to another. The user simply programs the buttons from left to right with the left most button being for the leftmost perch and then programming each button from there as one moves to the rightmost perch. The lens ships with a soft shroud type lens-cap, carbon fiber lens hood and large soft case with backpack shoulder straps. It even leaves room for an attached camera! This is infinitely more useful than the big bulky hard cases that never leave the storage closet after the lens is initially unpacked.

The Sigma 500mm f/4 lens utilizes 16 elements in 11 groups and uses rounded aperture blades for smooth out of focus highlights (bokeh). It uses the most effective Optical Image stabilization in any Sigma to date and has positions for normal use and for panning. It is compatible with the Sigma USB Dock which allows the user to fine tune AF at 4 different AF zone distance settings (compared to just one for Canon and Nikon) and also allows one to fine tune AF speed, acquisition, re-acquisition, stabilization behavior, focus limit range sizes, and update the lens firmware. The new Sigma 500mm f/4 uses a 46mm rear filter which is part of the optical formula and is required for optimal performance. Similar to the other 500mm designs from the camera manufacturers, a clear filter is included and a polarizer is optional. The front element has a coating that beads off water and resists oil making it very easy to clean. The lens is only compatible with Sigma's TC-1401 1.4x and TC-2001 2x teleconverters which are specifically designed to optimize performance with this lens. It will not work with a Canon or Nikon teleconverter. Despite this world class level of features and construction, the manufacturer's suggested retail price in the USA is \$6000 which is over \$4300 less than the Nikon lens and \$3000 less than the Canon lens at this writing. If this lens performs, it is a steal (in relative terms). Sigma pre-sales vastly outstripped their ability to manufacture the lens so many are betting on it to be worthy of the Sport moniker. If it does live up to the promise of the Sport lens line, then it could corner the market for 500mm f/4 lenses or at least force some price reductions from Canon and especially Nikon.



Lesser Goldfinch (D500, Sigma 500mm f/4)

**Build Quality:** Sigma has stepped it up notch with this lens compared to their previous long telephoto offerings! The build quality is every bit as good as the latest Nikon 500mm f/4E lens and actually feels like it might be a bit stronger with more metal which is backed up by the additional half pound of. The days of Sigma making lenses with tripod mounting lens feet that have too much flex seem to be completely a thing of the past. This foot is beefy although a bit on the short side for a 500mm lens but the Sigma replacement foot with integrated Arca Swiss dovetail is much longer and even stronger but does add about 6 more ounces - of course you would be adding that anyway with a third party lens plate. This is the same optional lens foot as is available for the 150-600mm Sport lens - be aware that the dimension of the dovetail is a couple of millimeters narrower than all other Arca Swiss style feet. This can be problematic for lever clamp type of attachments but there is absolutely no problem with the normal knob style quick releases. . I find the Jobu replacement foot for the 150-600mm Sport lens to be the perfect foot for this lens - it adds virtually no weight and has the precise dimensions of an Arca Swiss style foot, unlike the Sigma foot.

**Size and Weight:** A slight drawback of the Sigma 500mm f/4 lens is that it weighs a few ounces more than it's Nikon and Canon competitors although it is a bit lighter than the insanely overpriced Sony 500mm f/4 lens. Overall physical size of the lens is similar enough to the competition that it isn't even worth mentioning.

**Image Stabilization:** Sigma calls their stabilization system by the moniker of OS for Optical Stabilization. The nice thing about Sigma Sport lenses is that you can customize how the OS system reacts with the Sigma Dock and its lens tuning software - an additional option that I recommend for anyone owning high end Sigma lenses. The lens offers three OS modes:

- Dynamic View Mode – This is a very aggressive mode that feels a bit overly aggressive similar to very old IS systems where the image in the viewfinder can really jump around (similar to the original Canon 300mm f/4 IS lens)
- Standard – This is the default setting. According to Sigma, the OS effect is well-balanced and suitable for various scenes.
- Moderate View Mode – This mode offers an excellent compensation of camera shake and achieves very smooth transition of the image in the viewfinder.

After experimenting quite a bit and doing some online research as well as communicating with other early adopters of this lens, I have found that customizing the OS system with a setting of Moderate View Mode gives good performance for Wildlife and Sports photography without creating a jumpy viewfinder - note that this is not the default setting that the lens ships with. With this customization, I find that the Sigma 500mm lens behaves very much like the Nikon 500mm f/4E lens or the Canon 500mm f/4L II lens and I can hand hold the lens and shoot at least 3 stops slower than I could with OS off. Even though Sigma has always said to turn OS off on a tripod, they also state that it is simply to reduce battery consumption. They have always been vague about whether or not there is any other detriment, I find that the lens behaves similar to

Nikon VR lenses - namely that if your shutter speed starts to get up towards 1/1000 second, you will get slightly better resolution if you turn OS off but it is really minimal and it requires some pixel peeping to really see any difference. If you do forget to turn it off when it's bright out, it really isn't a big deal. Similar to Canon and Nikon, Sigma says you should turn off the OS prior to a lens change even though few people actually ever do that!



Rock Squirrel (D500, Sigma 500mm f/4)

Auto-focus: Most people really only care about three things when it comes to super-teles - does it have world class AF, is it sharp and what is its weight? Lets tackle the AF question first! Once I customized the internal AF settings to Fast AF Priority for Custom Switch Setting 1 with the Sigma Dock, I found this lens to be the fastest focusing 500mm lens I have used. In repeated tries, I saw an ever so slightly faster initial acquisition, especially when the lens is focusing from very far to very near. The cost of using Fast priority, according to Sigma, is that there may be a slight decrease in first shot focus accuracy but in all honesty, I did not experience this in my use of the lens so far. In Standard AF mode the difference to the Nikon and Canon 500mm f/4 lenses is too small to notice but there might be a very slight edge to the Nikon lens over the Canon and Sigma, I would call it a near tie. There is also a Smooth AF Priority setting that can be assigned to a Custom switch setting which provides for smoother focus transitions and is designed primarily for video shooting. I see virtually no difference in focus tracking after acquisition between the lenses in normal or fast AF mode using a D500 with its fantastic focusing system. This is the first third party long lens I have used where I can say without reservation that the AF is as good as the OEM lenses that cost much more. There is a focus accuracy caveat though! In my opinion, based on extensive testing and focus calibration of hundreds of Sigma lenses over the years, no Sigma lens should ever be used on any camera without at minimum an in-body focus calibration using the Canon Micro-adjust feature or the Nikon AF Fine Tune feature and ideally using the optional Sigma Dock to finely tune the lens to the body. All Sigma lenses require some calibration to the body. Most Nikon users are no stranger to this because virtually no Nikon lens is at its sharpest without some AF Fine Tune but in the Canon world, if you own one of the bodies and lenses introduced in the last 5 years, there is at least a 50/50 chance that the camera/lens combination you are shooting with will be very near its sharpest even without adjustment; however, you still can't customize the AF for different focus distances with either the Canon or Nikon lenses. Even though there is a more involved procedure to focus tune a Sigma lens with the dock, it also will end up being more accurate through the entire focus range rather than just at the single distance you used to do your focus tuning. Below is the focus fine tuning table for the Sigma 500 f/4 lens that I used for this review - note that this is only for illustrative purposes and that your lens will have different values and these. They are only valid on my camera/lens combination. You can see that one is able to enter different focus offsets for different shooting distances and the lens then interpolates for in-between distances - this is not possible on Canon and Nikon lenses:



One thing that I noticed while doing the lens calibrations is that this lens exhibits more focus shift than is normal for a lens like this. Focus shift is a phenomenon where the focus point shifts when the aperture is changed. This phenomenon is prevalent in very fast primes like 35mm f/1.4 lenses but it is not usually even measurable in super-telephoto lenses. Since the lens is always at f/4 during AF operations, focus shift could cause slightly out of focus shots if you shot at anything other than f/4. I found that there is a 2-3 point lens calibration offset at virtually all shooting distances between f/4 and smaller apertures. Unless you plan on always shooting this lens wide open at f/4, I would recommend doing the focus calibration at f/5.6. A message for Sigma: If you are going to build lenses with focus shift and provide a USB dock solution to calibrating lenses, then give us the opportunity to also calibrate focus at different apertures! While this would vastly increase the focus calibration complexity, Sigma could make it an optional mode for advanced users that would allow us to dial in any Sigma lens with an extreme level of precision for all distances and apertures. As you can see from the graphic above, minimum focus distance on this lens is the best in class at just 11.5 feet, about a foot closer than you can get to your subject than with the best selling lens in the category, the Canon 500mm f/4L II. Focus breathing (the reduction in actual focal length as the lens is focused to minimum focus distance) is well controlled and on par with the others resulting in a magnification ratio of about 1:6.5.

**Image Quality:** There are a number of things that define image quality including Sharpness, distortion, chromatic aberration, and bokeh. I tested the lens both in the field and on test charts. For sharpness, the lens outresolved the sensors of the Nikon cameras that I tested it on which includes the D7200 which has the smallest pixel pitch of any Nikon camera on the market and therefore would be the most likely to show any problems within the DX (APS-C) crop of the lens' image circle. The lens outresolved the sensor even at f/4. I then attached the Sony a7R Mk II with a 42 megapixel sensor via a Novoflex adapter to measure corner resolution. Again the lens outresolved the sensor since it reproduced the 4000 line per inch portion of the ISO 12233 test chart which is the highest that my chart goes. In fact, at f/4 this is tied with the Canon as the sharpest 500mm lens I have tested at moderate and long shooting. Visual sharpness improved at f/5.6 where all of the current crop of 500mm lenses are equal. This is the first 500mm lens that I would have little reservation mounting on a Nikon body and shooting it wide open if necessary and most certainly having zero reservations stopped down one stop to f/5.6. The sharpness/resolution conclusion then is that the lens outresolves any sensor on the market and is approximately on par with the Canon or Nikon 500mm f/4 lenses. One thing I did notice though is that both the Nikon and Canon lenses have somewhat higher contrast - not something that would matter much to me since I shoot 100% in RAW which requires processing of the files anyway. Next I tested linear distortion. Super teles rarely have notable linear distortion and in most cases, since these lenses aren't used to shoot architecture, it generally would never be noticed even if there was significant distortion. The lens had virtually no linear distortion as expected. Chromatic aberration (CA) can be a problem with color fringing on very high contrast edges especially in the corners. Of the three lenses, the Canon 500mm f/4L II has essentially zero CA throughout the frame. Both the Nikon and Sigma have a very slight amount of CA that is almost too small to see and it is inconsequential. Finally on the subject of out of focus highlights, or bokeh, the Sigma's nearly perfectly round aperture produces absolutely beautiful out of focus highlights without the scalloping, or bageling as some call it, which has always been the only real weakness of Canon super teles. One area that the Sigma is a bit weaker in than it's more expensive 500mm competitors is in corner light roll-off (sometimes referred to as vignetting). On a full frame sensor at f/4 the Sigma displays about a half stop more of this than the others, by f/5.6 it is similar to the Canon and Nikon lenses and by f/8 it is gone. As this lens gets added to RAW conversion software databases, this will be automatically corrected and if

you are shooting with an APS-C camera like a Nikon D500, you will never see this at all even without software correction.

Finally, I put the lens to the test with the Sigma TC-1401 1.4x teleconverter. Performance was very similar to the Nikon 500mm with the latest TC-14E III for focus and sharpness. A slight increase in chromatic aberration is present with the 1.4x converter. I do not recommend shooting this lens (or any lens for that matter) with a teleconverter wide open. Stopping down 2/3 to 1 stop to f/7.1 or f/8 optimizes sharpness. Canon, as has always been the case, does have slightly higher acuity, especially wide open with its latest 1.4x teleconverter, but the difference isn't as big as it used to be in years past. AF performance with the 1.4x, while degraded somewhat was still excellent and on par with the Canon and Nikon lenses and their respective teleconverters. Surprisingly, the focus shift noticed on the lens without a teleconverter is reduced with the TC-1401 teleconverter attached. I did not test the Sigma TC-2001 2x converter as I have never found 2x teleconverter images satisfactory on modern high resolution sensors and generally do not recommend them.



White-crowned Sparrow (D500, Sigma 500mm+TC-1401)

Below is a comparison table of the four 500mm f/4 lenses currently on the market. It is important to note that, in real world, performance between all of these lenses is essentially equal. Even though one lens may be ranked above another in the table, these are largely derived from test charts utilizing a single sample of the lens - actual photos taken will be essentially identical and are more heavily influenced by the sensor of the camera that is attached than they are of the lens since these lenses outresolve any sensor you can attach to them.

	Canon 500 f/4L II	Nikon 500 f/4E	Sigma 500 f/4	Sony 500 f/4
<b>Minimum focus (MFD-ft)</b>	12.4	11.9	11.5	13.1
<b>F/range</b>	4-32	4-22	4-32	4-32
<b>Mag</b>	0.15x	0.14x	0.15x	0.135x
<b>Blades</b>	9	9	9	9
<b>Filter (mm)</b>	52	40.5	46	42
<b>Dimensions (in)</b>	5.75x15.1	5.5x15.25	5.7x14.97	5.5x14.5
<b>Weight (lb)</b>	7.03	6.81	7.3	7.6
<b>Price (USD)</b>	\$9000.00	\$10300.00	\$6000.00	\$13000.00
<b>500mm</b>				
<b>MFD sharpness (rank)*</b>	1	2	3	n/a
<b>10M sharpness (rank)*</b>	1	3	2	n/a
<b>Infinity sharpness (rank)</b>	1	3	2	n/a
<b>Chromatic Aberration*</b>	1	2	3	n/a
<b>Contrast</b>	2	1	3	n/a
<b>Bokeh</b>	3	2	1	n/a
<b>Vignetting</b>	2	1	3	n/a
<b>Focus acquisition*</b>	3	2	1	n/a
<b>Focus accuracy/tracking*</b>	2	1	2	
<b>500mm+1.4x</b>				
<b>MFD sharpness (rank)</b>	1	2	2	n/a
<b>10M sharpness (rank)</b>	1	2	2	n/a
<b>Infinity sharpness (rank)</b>	1	3	2	n/a
<b>Chromatic Aberration*</b>	2	1	3	n/a
<b>Contrast</b>	1	3	2	n/a
<b>Bokeh</b>	3	2	1	n/a
<b>* Differences negligible</b>				

In closing, several people have asked me to compare this lens vs. the very good Sigma 150-600 Sport. I look at the two as completely different lenses for different needs. Clearly the zoom lens wins on the versatility front by virtue of being a variable focal length lens and it can deliver outstanding results, especially when finely tuned across the zoom and focus distance range with the Sigma dock. The 500mm f/4 is, however, 1 1/3 stops brighter. The 500mm prime lens is also measurably sharper and can be extended to 750mm with the 1.4x TC-1401 and still be a faster lens (f/5.6) than the 150-600 is at 500 or 600mm (f/6.3). I would not recommend adding a TC to the 150-600mm zoom lens but I have no reservations to do so on the 500mm. Weight and size wise the zoom has an advantage although on the weight front that difference is only about a pound, however, the size difference is substantial. Usability of the 500mm lens on a gimbal head is a bit better as the center of gravity of the lens does not shift. The 150-600 on a gimbal can be tougher to handle due the shifting center of gravity as you zoom making it more likely to have lens flop. The extra 1 1/3 stop of light that the lens lets in makes it much easier to find your subject in low light. On a recent trip to Ecuador, we spent two mornings photographing the very reclusive Chestnut-crowned Antpita which lives deep in dark brush. Even though the bird was visible to the plain eye, I could barely see it in the dark viewfinder of an f/6.3 lens. Those with f/4 super-teles had no problem finding the bird. On the second day I actually used the f/2.8 70-200mm lens and got much closer just so that I could see and compose the bird in the viewfinder. Additionally, focus speed is simply faster when the camera's AF system is getting nearly 3 times more light. Add to that a new AF motor with 33% more torque and you have significantly faster AF performance with the 500mm f/4 Sport lens. So in the end, for convenience with excellent results, the Sigma 150-600 Sport is still a personal favorite but when fast AF in low light or a longer focal length is needed, the 500mm (with the TC-1401) is highly desirable.

The 500mm f/4 lenses represents some of the very finest telephoto glass on the planet and all of the lenses are more than capable of outperforming virtually any photographer on the planet. I have to highly recommend the Sigma 500 f/4 DG OS HSM lens given that it is dramatically less expensive while giving up virtually nothing on performance and adding customization features that the others don't have. It maintains the super high end build quality that we expect from lenses in this class. I see very little reason to buy the camera manufacturer's lenses unless a half pound is worth three or four thousand dollars to you!

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