

Scientific Crossbow Test

By Jon Teater

Barnett is not new to the archery game, as you know from last issue's Cover Story. They have been designing products in both the international and domestic arena for years. In the United States Barnett is known for producing some of the most popular crossbows. The earlier products that were produced were inherently less sophisticated as compared to today, yet still capable of taking game with ease. Today's line is appealing, and has some major innovations as compared to the products of the past.

I was able to shoot the Predator at the Archery Trade Show this year. After talking with Barnett's engineering staff, they were quite pleased that *ArrowTrade* was interested in doing a technical review on their product. Barnett's staff was equipped to answer any technical questions I had during the show, which gave me more time to evaluate the "testability" of the product. In the end, I was able to determine that my test equipment could handle the Predator, which is sometimes my largest concern when doing these tests.

The Predator went through a standard and regimented performance test. The focus of these types of tests is to determine, for a specified product, the performance characteristics. Additionally, the goal is to provide those archers that enjoy shooting and/or hunting with appropriate objective information, as well as some subjective commentary, for aiding in the purchase process. With that said, this evaluation is by no means conclusive. Each archer should assess what is important to him or her and interpret the results within the context of this article. As always, I recommend that anyone who is considering a crossbow, shoot as many different makes and models as possible to determine what best suits their individual needs and desires.

Due to the lack of testing methods and procedures available publically for crossbows, testing guidelines were developed and published in 2009. These testing guidelines remain unchanged since 2009, and I continue to use these methods to evaluate crossbows.

Barnett Outdoors has been in business for half a century. Being an older company is something that makes this company stand out from the rest. Some

Predator

Contact Info Barnett

www.barnettcrossbows.com

MSRP (Predator package) \$699.99

Finish Realtree APG

String Material BCY DynaFlight 97

Stock GAM Composite

Limbs Gordon/Barnsdale Laminate

Performance at a Glance

Arrow	Speed	K.E.	Momentum
425 Grains	371.3	130.1	22.5
475 Grains	354.5	132.6	24.0
525 Grains	341.6	136.0	25.6

believe that getting old is fraught with negative implications. From my standpoint, this company defeats that inference and is just getting better with age.

Barnett is located in Tarpon Springs, Florida. At the Florida facility, the company has brought many technologies in-house, which provides a tremendous opportunity for the company to quickly design and produce components. Barnett has been able to maintain a production facility that is able to deal with the seasonal demand of its products. The company also remains focused on developing new products each year. Recently, the company publicized that they have sold over one million crossbows. That is an astonishing number, and certainly, something the company is proud about—as they should be.

Barnett offers products in both the low and mid price range. The products they design have a somewhat similar look, but their higher end crossbows have a few key differences. The high end products have many of the bells and whistles that archers prefer. These features are employed in the Predator, Barnett's flagship crossbow.

The Predator is one of the top of the line offerings from Barnett. With that said, the product is sold as a complete package at an affordable price. The package includes a quiver and attachment bracket, rope cocking device, telescopic sight (4X32) that includes rings/mounts and associated hardware including a lens cleaning cloth. The purchaser also receives Barnett crossbow bolts including field tips and crossbow lube wax. These components are all essential and key for a productive shooting experience.

The crossbow measured out of the box:

Dimensions

Model	Axle to Axle	Axle to Axle (full draw)	Powerstroke	Rail*	Overall Length	Mass Weight (including scope)	Mass Weight (without scope)
Predator	21.8125"	17.75"	15.125"	19.4375"	37.75"	10.1 lbs	9.4 lbs

Note: The "Rail" measurements were taken from the front of the rail to the front of the string at the full-draw position

Barnett Predator

shot	Weight (grains)	Chrono 1	Chrono 2	shot	Weight (grains)	Chrono 1	Chrono 2	shot	Weight (grains)	Chrono 1	Chrono 2
1	425	371.6	367	1	475	354.9	351	1	525	341.9	338
2		371.2	367	2		354.7	351	2		341.6	338
3		371.1	367	3		354.4	351	3		341.6	337
4		371.3	367	4		354.7	351	4		341.3	338
5		371.4	368	5		353.9	350	5		341.4	338
avg (fps)		371.3	367	avg (fps)		354.5	351	avg (fps)		341.6	338

	Weight	Speed Per Inch of PS
Speed per inch of Powerstroke	425 grains	24.5
	475 grains	23.4
	525 grains	22.6
Powerstroke	15.13	inches

Sound Measurements			
Weight (grains)	425	475	525
Parameter	Peak A - Weighted Noise (dBA)		
1	95.0	93.8	92.2
2	95.0	93.8	92.2
3	95.1	93.8	92.1
4	95.3	93.9	92.3
5	95.1	93.7	92.2
6	95.0	93.8	92.3
7	95.0	93.8	92.3
8	95.1	93.9	92.2
9	95.3	94.2	92.5
10	95.0	93.7	92.7
Average	95.1	93.8	92.3
Total Avg Max	93.7		

Next, the crossbow went through a thorough inspection. The review focused on string/cables, eccentrics, limb and limb pockets, rail, stock, butt plate, trigger housing, trigger and trigger guard. After a thorough review of the Predator, I found a few blemishes. I noted a few minor nicks on the limb pockets and eccentric. Overall, I would rate the product slightly above average in the workmanship section.

Thereafter, I put the product through a 100-150 shot cycling to verify functionality. Some minor testing is performed, but the focus is to detect any issues or concerns with the product before starting the actual performance testing. The product performed flawlessly, I had no noticeable issues and was quite impressed each time I pulled the trigger.

The test crossbow is next evaluated on the five criteria outlined in the chart on the right hand page.

Trigger Analysis	
	Trigger Pull (lbs)
1	3.15
2	3.49
3	3.21
4	3.47
5	3.56
6	3.19
7	3.27
8	3.24
9	3.48
10	3.51
11	3.16
12	3.51
13	3.28
Average Trigger Pull (lbs)	3.35
Distance Traveled (inches)	0.4325



Detailed Test Results

Dynamic Efficiency: The dynamic efficiency portion of the test utilizes a Revere Load-Cell controlled by a winch device; the load-cell connects to the crossbow with a cocking aid. The crossbow is mounted in a shooting platform that controls any movement that might be experienced as Force-Draw curves are taken. The stored energy obtained from the Force-Draw curve, is used in conjunction with speed measurements to calculate dynamic efficiency.

Projectile Precision						
	Model/Brand	Arrow Weight	Distance (yards)	Spread 1 (inches)	Spread 2 (inches)	Average
Shooting by Hand	Easton Pwr Bolt	446	40	1.752	2.069	1.910
Shooting By Hand	Barnett	459	40	1.458	0.594	1.026

Scientific Crossbow Test



Barnett Predator

Peak Force		174.8	lbs
Stored Energy		171.1	lb-ft
Dynamic Efficiency	425 grains	76.1	percent
Dynamic Efficiency	475 grains	77.5	percent
Dynamic Efficiency	525 grains	79.5	percent

Trigger Force and we photographed the display after the eighth test shot.

Precision Measurements: This provides an indication of how close groups were shot together when shooting by hand from a bench rest or other supportive device. Extreme spread is the method used to calculate group size.

Test Category	Assessment
Dynamic Efficiency	Provides an indication of the amount of energy output by a crossbow relative to the energy expended through drawing the crossbow back. An assessment is made with multiple projectile weights.
Speed per inch of Powerstroke	Provides an indication of the amount of speed output by the crossbow over the distance from the full-draw position to the static brace height position. An assessment is made with multiple projectile weights.
Noise Output	Provides an indication of the noise output characteristics of a bow at the "point blank" range utilizing a series of shots with multiple projectile weights.
Trigger Force	Provides an indication of the amount of force required to discharge a given crossbow.
Precision Test	Provides an indication of how close groups are shot together by shooting from a bench rest or other supportive device.

The Initial Review

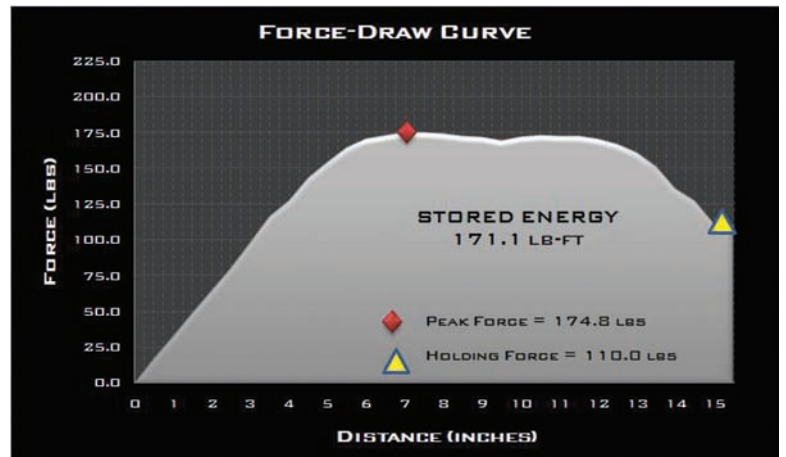
The Barnett Predator arrived during the same time I was testing a couple other products. I was able to set those aside for a few days to look over this product. I was quite pleased to open the box and see a quality inspection sticker right off the bat. Those little stickers let

Speed/ Performance Measurements: Speed measurements were taken with three projectiles. A 2009 Pact Chronograph XP and a Competition Electronics Pro-Chrono IR are set in tandem to record results. The average speed measurement is divided by the powerstroke to determine the speed per inch of powerstroke. Speed and speed per inch are on page 96.

Noise Output: Sound measurements were recorded with three projectiles. The measurements were averaged and the sound meter was set to take measurements with the A-weighted filter (which mimics the human ear). A CEL-430 sound level meter is used for this test. You can see the results at left.

Trigger Force: The Trigger Force measurements were recorded in pounds and averaged, with the results shown at far left. An Imada Digital Force Gauge is used to determine the

us know that the product went through a standard inspection before it left the manufacturer's facility. I was also provided with some speeds information and other data that the manufacturer felt would support my testing, which it certainly did.



The Predator was shipped in a small package and required little assembly upon arrival. The package included all necessary hardware to assemble the product. The scope had the rings pre-installed and only required mounting to the crossbow.

After I completed the assembly, I read the owner's manual. The manual identifies that the Predator should never be used with arrows that weigh less than 425 grains. In addition, the care and maintenance section of the manual requests that the archer should apply lube wax to the flight track every 5-10 shots. These two points are critical to the safety and longevity of the crossbow and associated components.

Barnett designs products that are "Built for the Hunt." All archers that hunt want products that work well in the field, this quote relates well to the company's intent for their products. The Predator is produced on a platform with numerous patented technologies. Barnett technologies include a Magnesium STR Riser, AVi-Anti Vibration Technology, AVi Bolt Retainer, AVi Foot Stirrup and AVi Limbs. These components combine to form a unique product with a ton of performance.

In The Field

I spent numerous days shooting the Predator. The key technologies mentioned, including some other features, allowed me to enjoy each shooting session. I tested the product outside my lab for several weeks on end. During that period, I was able to do some extensive field-testing. When stalking through the woods I focused on the product's maneuverability and the comfort I perceived when aiming at game. Maneuverability is a hard thing to quantify; however, I felt unhampered carrying the loaded crossbow through the woods as I looked for game. My feelings on the mobility relate to the overall size of the crossbow. The crossbow's dimensions seem to align well in comparison to some of the other products I tested. The axle-to-axle length seems somewhat compact and manageable in the field.

The crossbow sports a healthy weight, and most of the mass feels located toward the front of the crossbow; this remains an important item for archers that want good stabilization. The weight-forward design seems to be connected to the robust prod and stout limbs.

Next, I dealt with comfort and stability. When aiming at game I was able to move fluidly and aim precisely on my target without wobbling. Excellent shooting comes from good form, but to be proficient you still need features that will work with your shooting style. The forearm is one of those features on the Predator that just plain works. The crossbow makes the shooter grip the forearm at the center balance point. The forearm has channels for fingers and thumb, and underneath the forearm are grooves that aid in gripping the crossbow. The other feature that was enjoyable is the thumb-hole stock. The stock is designed with a cutout around the trigger that helps the archer have more control over the crossbow when aiming at game.

Digital calipers were used to measure the group size for the precision shooting test, using the extreme spread.



Unique Features

The stock has two features I have yet to see with any crossbow that I have tested thus far — an adjustment dial for fine-tuning the length of the rear stock and adjustable cheek piece. The adjustable dial allows for a multitude of length adjustment with just a turn of a dial and loosening/tightening of setscrews. The rear stock adjustment provides an opportunity for the archer to make minor or major adjustments to his/her "length of pull" (distance between the trigger and the butt of the stock). The adjustable cheek piece is a facet I really liked when I was shooting in the woods. It reminds me of what most expect to see on a trap gun. The cheek piece body can be adjusted by loosening retaining screws, and can be positioned in various angles and/or heights. This feature has two main purposes 1) to create better eye-scope alignment for the archer and 2) comfort. In the field, you cannot beat a feature like this. With that said, consistent shooting remains tied to features that promote consistency, which I think Barnett has accomplished with the Predator.

The Off-Shoot

Like with most products I review, I will comment on a few items that I felt could be improved upon. The weight of a crossbow is an important aspect for an archer. A 1/2 pound or 1 pound may not seem like much, but after lugging a crossbow around all day in the woods, one pound can make a big difference. I did not feel that the Predator was heavy during my field test, but the crossbow is somewhat heavier than a few of the competitor's products. The prod is designed from magnesium alloy, which does not weigh as much as some grades of aluminum. However, there is a good deal of beefiness to the prod, which I assume is for safety, and that may offset the lighter material that is used. The limbs may also factor into the weight. Archers should try out the Predator and see if the weight hinders or helps their shooting.

The trigger housing coloration is rather conspicuous. I

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am not one to nitpick, but I do not feel that this component's glossy coating works well with the product's aesthetics. I do like the fact that the housing is made from metal, as I have seen other products with a less rigid design.

The crossbow exhibits some impressive speed numbers. Although, I was slightly surprised that the potential energy and corresponding kinetic energy measurements revealed an average efficiency rating of approximately less than 80 percent. This number is not low by any means, but I felt the percentage could be higher. I would suspect that the engineering staff at Barnett has something in the works and will be focused on reducing hysteresis.

Overview

The Barnett Predator has some awesome attributes. AVi stands for Anti-Vibration Isolation. The AVi components play an integral part into the likability factor of the Predator. The AVi technology is located in strategic locations on the crossbow, but most importantly incorporated into the limbs. The engineering staff made the crucial decision to go through the design process of trying to encapsulate limbs with this material with a net outcome of reducing vibration. As you shoot the Predator, you will notice that the vibration lasts for a short time, which is attributable to the mentioned damping technology. In comparison to other products, the Predator seems to have less vibration and maintains a high level of performance.

The limb pocket is another feature that is important to this design. The purpose of the limb pockets is to control and align the split limbs. The magnesium prod also accommodates the limbs. The prod has precisely machined cutouts that work in cooperation with the limb pocket to support the limb throughout the drawing and shooting sequence. The deep cutouts in the prod create a pocket with ridges on both sides that the limbs are sandwiched between. The ridges provide additional lateral support. Both the limb pocket and prod work in conjunction to create almost perfect alignment, which will ensure better accuracy.



AVi models like the Predator tested here have limbs of Gordon Glass that are over-molded with the vibration killing polymer.

The Predator has several elements that are critically important to long shooting sessions. I put quite a few shots on this crossbow through my tests and adhered strictly to the Barnett's recommended instructions. Most strings, especially servings, will have significant wear after a few hundred shots. The serving on the Predator looks almost brand new after shooting more than a few hundred shots. In fact, the serving on the cables remained in excellent shape and showed no wear or separation throughout my shooting. The Predator has a few other items that contributed to the minimal wear on the strings and cables. The rail has a special coating applied that promotes frictionless travel. The coating creates little resistance on the string and subsequent projectile as they travel down the rail after the crossbow is shot. The results of the coating and use of lube wax, provides an extremely fast and unobstructed projectile. As mentioned, the lube wax is provided in the package and Barnett caps off the frictionless concept with Teflon tape underneath the rail to isolate the cables from the stock.

The engineering staff at Barnett has made some updates to the trigger for 2010. The trigger is unquestionably a highlight of the test. The trigger has reasonable amount of travel or "take-up" as it reaches the fire position. I have found many crossbow shooters, including myself, admire a trigger with some travel. After shooting the crossbow, it was very easy to understand what aspect of trigger has been the focal point for Barnett's engineering staff. The trigger's breaking point is critical to accurate shooting. The design team has worked on the breaking point and established a very sharp, crisp break. The outcome of a crisp trigger break is an instant release with a very clean feel. The other item to mention is the peak trigger weight. Many crossbow companies are trying to construct a reasonably light trigger at around 3-4 pounds. The Predator is right in the ballpark, and reaches a peak weight below 3.5 pounds.

As mentioned, the crossbow has some nice features that will aid the archer in the field and at the range. The shootability of the crossbow was proven with my tight groups at distances over 30 yards. The precision aspect of shooting is not just related to shooting style, but to the product itself. The Predator has excellent ergonomics, a comfortable feel and balance. Each element provides the archer with an added boost to stay on target.

When looking at the offerings of the Barnett line it is hard not to notice their products are less expensive. After evaluating the innovation and design features of the Predator, I consider the crossbow to have an abundant amount of value when considering the price. Therefore, I believe many consumers will be interested and eager to buy the Predator.

Special Thanks: I would like to thank the manufacturer and sponsor who supported this event; without them and their support, this evaluation would never have been possible. Scorpion Venom Archery Lubricants provided wax, lubricants and crossbow rail lube. The rail lube is stated to have the ability to increase speeds upward to 1-2 fps.

