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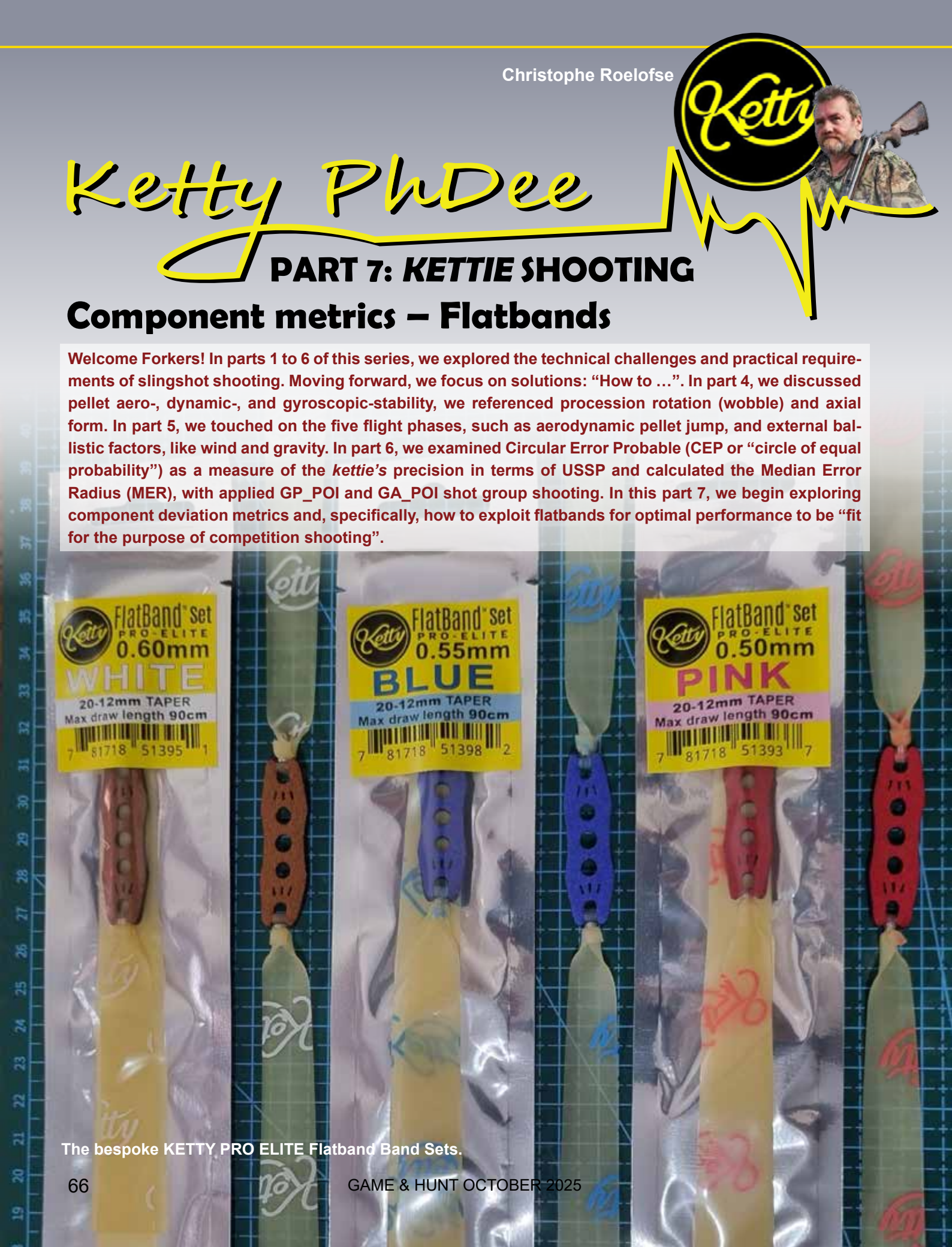
Ketty PhDee

PART 7: *KETTIE* SHOOTING

Component metrics – Flatbands

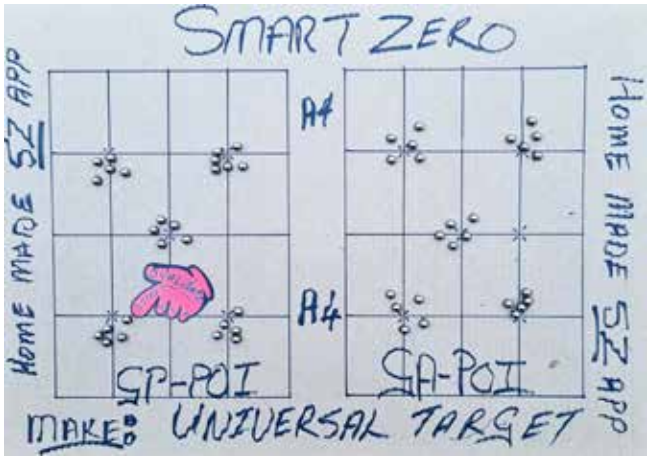
Welcome Forkers! In parts 1 to 6 of this series, we explored the technical challenges and practical requirements of slingshot shooting. Moving forward, we focus on solutions: "How to …". In part 4, we discussed pellet aero-, dynamic-, and gyroscopic-stability, we referenced procession rotation (wobble) and axial form. In part 5, we touched on the five flight phases, such as aerodynamic pellet jump, and external ballistic factors, like wind and gravity. In part 6, we examined Circular Error Probable (CEP or "circle of equal probability") as a measure of the *kettie's* precision in terms of USSP and calculated the Median Error Radius (MER), with applied GP_POI and GA_POI shot group shooting. In this part 7, we begin exploring component deviation metrics and, specifically, how to exploit flatbands for optimal performance to be "fit for the purpose of competition shooting".



The bespoke KETTY PRO ELITE Flatband Band Sets.

Just a quick reminder! This is not a lecture, and in an effort to keep every part of this series a substantive and entertaining article, I typically have to refer to various subjects in oversight in every part of the series to provide context and handy guidance. As the series progresses, we revisit these individual subjects in more detail where relevant in various sections. Note, the aim of this series is to get you, as a *kettie* athlete, to the 10 m standard discipline shooting-range line, equipped with (a) core knowledge (technical understanding) and (b) critical equipment. However, you must keep an open mind and be prepared for an expedient (c) elective knowledge learning curve (self-discovery) to become a competitive athlete within one season.

In part 6, we did some "bench" shooting for precision, and the question raised was, what to do if the *kettie* GP-POI was not on par with the CEP (circle of equal probability) expectation? This "expectation" or requirement is based on the (precision) necessity for the specific sling shot discipline (match play) you participate in, or measured and compared in terms of the USSP (Universal Standard of Slingshot Precision), reference parts 5 and 6 of Ketty PHDee. Firstly, caveat all, and let us assume that the actual shooting test method and the calculations are scientifically correct, then it would stand to reason that the *kettie* platform is not on standard (to expectation) and should thus be improved. For the purpose of this series, I suggested in part 1 that you obtain a good quality UK (Utility *Kettie*) and therefore all our discussions relate to a typical good all-round modern general-purpose *kettie* (slingshot).



Applied GP_POI and GA_POI shot group shooting.

The Frame

The first metric (element) in the P.A.M (Precision and Accuracy Matrix) is *Kettie FRAME,* of which the obvious element (metric) is geometry. Is the bow (fork/prongs) symmetric? Second, is "frame flex". Although theoretically, all types of materials are energy and in a state of some movement, tension, or flex – exaggerated by machining, casting, injection, etc, the tolerances are insignificant for our purpose, provided the frame and fork (bow/prongs (post) are made of metal alloys, etc. Thirdly, the torsion (twisting, rotation, torque) of the handle (grip) in your hand could be very significant, influenced or amplified by your actual grip method (technique) and the slingshot frame design.

We deliberately eliminate the actual steel round balls as a source of the poor shot group pattern, for the purpose of this conversation, based on what we already learned in part 5, and accept the steel balls are of high quality, consistent density and near a perfectly concentric axial form. If all is secured, and the draw and grip of the pouch, alignments is perfectly repeated, the culprit is more often than not, the Flatbands. Hence, the focus of this article is on flatbands (the elastic propulsion system), which is a major component in the precision equation (precision chain)/PAM (precision accuracy matrix).

Natural latex – for Slingshots

The elastic bands on your *kettie* are the heart of the propulsion system, it is the engine, and the most critical component (metric) of the slingshot performance, and there should be no compromise! Let's summarise and highlight the key features regarding natural latex material composition for slingshots. Latex (rubber) has various applications in various industries, from water and gas airtight seals to protective coatings, medical tubes and gym equipment to slingshot bands and tubes. Each application requires a specific set of properties, such as tensile strength (MPa) for the specific application – for example, hard but brittle, or soft and playable, which is obtained by mixing (blending/formulating) natural tree latex with natural and chemical additives.

Natural latex compounds are ideal for slingshot bands due to their high tensile strength and super elasticity. Raw natural latex typically has a tensile strength of 20-30 MPa, which can be increased to 30-35 MPa with vulcanisation using sulphur and accelerators like ZMBT (zinc mercaptobenzothiazole). Additives such as antioxidants (e.g., BHT) and UV stabilisers

No.	Substance name	CAS no.	RL (%)
1	4,4'-Diaminodiphenylmethane (MDA)	101-77-9	0.100
2	5-tert-butyl-2,3,4-trinitro-m-xylene (musk xylene)	81-15-2	0.100
3	Alkanes, C10-13, chloro (Short chain chlorinated paraffins)	85535-84-8	0.100
4	Anthracene	120-12-7	0.100
V	V	V	V
201	Tris (4-nonylphenyl, branched and linear) phosphite (TNPP)	–	0.100
202	2-benzyl-2-dimethylamino-4'-morpholinobutyrophenone	119313-12-1	0.100
203	2-methyl-1-(4-methylthiophenyl) -2-morpholinopropan-1-one	71868-10-5	0.100

The special compound for the bespoke KETTY PRO ELITE Flatbands formula has 203 identifiable elements in the avant-garde product.

(e.g., Tinuvin 770) are often included to extend material life under sunlight and oxidation. These compounds enable rapid elastic recoil, crucial for projectile velocity. While natural latex degrades faster than synthetics, it offers superior energy return and biodegradability, making it a preferred choice for high-performance slingshots. Ketty Pro (general purpose/hunting) and Kety Pro Elite (competition) bands, with a scientific laboratory certification, the special compound, hand-laid, and eco-friendly, are some of the finest in the world at a premium but guarantee top consistent performance.

Flatband metrics

The obvious metric is the actual compound (material composition/formula) ensuring base performance fit for purpose, and from the above discussion and information, it is very complicated. In practice, as a Forker (user/consumer) lets buy the best and work with the actual geometrics (physical appearance) of the bands itself (reference part 2), on two technical levels – (A) the size (A1) width and (A2) length, the (A3) gauge (thickness) and (A3i) gauge taper, if any, and (B) the shape or so-called aspect ratio (B1) straight, or (B2) taper. We assume and accept for this discussion that the bands in use are – Ketty Pro Elite: Natural Latex, bands specifically developed and manufactured for use in slingshots. *www.ketty.co.za*

Gauge

The thickness of the flatband is measured in millimetres (mm). I find it very interesting that the universally accepted gauge (measuring system) for flatbands is metric (in mm), even in staunch imperial countries like the USA, UK, etc. Unlike firearms, which are" (inch-based) like a Cal. 45", meaning 0.45 of 1 inch. Dedicated *kettie* (slingshot) competition flatbands are 0.4 mm to 0.60 mm, whilst 0.7 mm to 1 mm is considered heavy gauge, for outdoor/hunting purposes. The basic technical mechanical explanation is – the more latex material (the thicker the band), the more torques (ability to move/propel heavier pellets), but the slower the velocity (condensing/contracting speed), and the less material (thinner the latex), the faster the retraction speed, but with less torques, thus with lighter pellets.

The brands

There are plenty of slingshot band brand names and products, but actually only three leading brands worldwide. Buying a big brand name with a cheap product is counterproductive. The avant-garde KETTY brand – Ketty Pro Elite, should be on top of your list. Note the unique print pattern on the bands, which immediately identifies it as a handcrafted bespoke product. The band has no colour pigmentation to distort the unique molecular latex structure, and thus literally has a natural, semi-translucent appearance. The repetitive print of the bands is not embedded and wears off as an indicator of band state. The translucent eminence has the added advantage that when stretched, the material consistency can be inspected. Kind to the environment (eco-friendly), the material is UV sensitive. The bespoke Ketty Pro Elite bands are available in 0.45mm (yellow), the adult range: 0.5mm (pink), 0.55mm (blue) and 0.6mm (white). Note: The Yello Pro Elite (0.45mm), intended for youngsters outside recreational activities, is solid yellow and has higher UV protection.

Gauge taper

Sheet rubber, can be by design or due to poor quality management – sometimes be thicker on one end than the other end in width. If you cut bands from this type of "gauge taper" sheet, you can get a "double taper" thickness of the rubber plus the width, with the thin and narrow end at the pouch, thick and wide end at the forks. Sounds impressive, but it is very difficult to maintain the required performance repeatability (precision reprise) from one band set to the next. Rather look at it as a problem with lesser quality flatband products, than a performance enhancement solution, which is difficult to spot or measure. Imagine you cut a band set of which the bands' gauge tapers and are installed in opposite directions. Your accuracy would be compromised (point of impact would shift), you would be very frustrated and never find the root cause (origin) of the problem. Ketty Pro Elite bands are consistent and easy to inspect and gauge because it is translucent.

KETTY PROFESSIONAL ELITE Natural Latex Flatbands Taper Cut Guidelines					
Pro Elite	Pellet mm	Short Draw (Pull)		Medium (Middle) Draw	
		< 20°C	20°C >	< 20°C	20°C >
0.45 YELLO	7.0-7.5	16-10 @ 150	16-10 @ 155	16-10 @ 190	16-10 @ 205
0.45 YELLO	8	18-10 @150*	18-10 @ 155	16-10 @ 195	16-10 @ 210
0.50 Pink	7.0 - 7.5	16-10 @ 155	16-10 @ 160	16-10 @ 195	16-10 @ 210
0.50 Pink	8	17-10 @ 155	17-10 @ 160	17-10 @ 195	16-10 @ 210
0.55 Blue	7.0 - 7.5	16-10 @ 155	16-10 @ 160	16-10 @ 195	16-19 @ 210
0.55 Blue	8	18-10 @ 155	17-10 @ 160	17-10 @ 200	17-10 @ 215
0.60 White	8	18-10 @ 155	17-10 @ 160	18-10 @ 200	18-10 @ 215
0.60 White	8.5	20-10 @ 155	18-10 @ 160	20-10 @ 210	17-10 @ 220
0.60 White	9	20-12 @ 160	20-10 @ 165	20-12 @ 210	18-10 @ 220
Key: 18-10 @150* / 18 mm wide on the broad (post-) end – 10 mm narrow (pouch-) end / 150 mm length					

Taper cut

Where the band is cut from wide to narrow in length. Basic rule is – the more aggressive the taper, the more velocity (veracity of the contraction), but the lesser durability (lifespan). Straight cut bands, caveat all – have the best duration expectancy. You need to find the ideal performance parameters. The table below provides some tape cut guidelines:

The taper cuts (angles) guidelines in the table indicate the optimum (most aggressive) cut angles for optimum flatland performance for a particular band model. Explore an example: Ketty Elite Pro 0.50 Pink with 8 mm Steel ball, 17-10 at 155 (as an example length), thus 17 mm at the wide end at the post and 10 mm at the pouch and the total (free draw/pull) length 155 mm. If you are confused by all of this, simply default to 20-18 mm – 12 mm for any Ketty Elite Pro bands, as a starting point. Remember, your band cut length depends on your actual draw length. Ketty Elite Pro ready-to-use band sets are available in taper cut 20 mm - 12 mm – for a max draw length of 90 cm.

Mistakes

Common errors made with cutting flatbands – example: (1) one side taper. The taper must run-in equally on both sides; in other words, both sides (in length) of the band must be of equal length. (2) The cut length– oversize (over reach) the draw length, in other words, the bands are marked out (stencilled/patterned) for the free draw length, but the taper is pinned (calculated) to the total length. Thus, especially on very short draws, the actual narrow (pouch) end of the band width is actually broader (wider) than intended. (3) Incorrect draw length conversion. The actual draw to stretch equation formula, which determines the actual cut length. As a rule of thumb, for performance bands, 4.5 X times stretch is the bottom limit and 5 X times the upper limit. In other words, if your draw is 50 cm, the free (active) band length is between 10 cm (shortest/5 X) and 11.1 cm (longest/4.5 X). (4) Cant Cutter – when the roller cutter is at an (extreme) angle, it creates uneven edges that originate tears.

Draw (pull) length

How long is your draw, and how do you measure it? There is the scientific method and the field method. **Scientific Method:** Take two pieces of string; affix each to a prong post in the centre of the usual band positions. Assume your active shooting stance, stake the two pieces of string in your rear hand close to the *kettie* frame, (I prefer with closed eyes), raise the *kettie* and hold it out to the shooting position and run your rear hand back, tensioning the strings under your thumb (pinch) and settle in the anchor position. Hold the string, pinch, and measure the length of each string. Use the average length if they differ. Very experienced shooters will have no or an insignificant variation, whereas beginners will have greater variation because of their inconsistent form (posture), with *kettie* cant, etc. It is important that you do not overreach your draw (which is easier to "feel" and see with a string than with elastic), because for various reasons (fatigue, complacency, etc), you will inevitably default to that "hold" (shooting position) in an event. **The Field method** is literally a "rough cut" option that I regularly use. It entails the slightly overestimation of the actual cut length. Already fit it with a pouch, and affix it to the bow, then pull it to max (comfortable) stretch length (past your intended anchor point), measure (estimate) the (extra) length of pull past the anchor point. Example: 3.5 cm extended pull, thus – 3.5 cm divided by 5 cm = 0.7 cm to shorter the bands, to shorten the free draw. It is a simple and easy method if you are in a crunch, but not scientifically correct (ideal). Near enough is not good enough in competition shooting.

Flatband Frame Affix metrics

Working into the flatbands performance equation is the – specific seating (affixing) method to the prongs (and pouch), such as: Matchstick, Double-slotted, Cuffing, Cocktails, Tabs, African wrap, Mummy wrap, Wrap & Tug, etc, (reference Part 2). The obvious significance of the affixing method and objective is to have everything symmetric (equal folds, length, etc)

of the bands to – and in combination with the various (correct) prongs (posts), to render the most consistent draws. In competition shooting and most modern *Utility Kettie*'s clamps or so-called clips is in common use. The fastener clip at the top of the prongs is secured with a fastener (bolt, screw) that clamps down the flatband in position. There are of cause *kettie* design that has mechanical band clips manipulated by pins or levers that makes band changes very easy. Of cause there is the very popular ocularus (oculus) type plug method to secure the bands like with the Yello Ketty Range, which provides agility in band positioning and configuration, from OTT, TTF to TTT (reference part 1). The takeaway is – to secure the bands with equal symmetric precision.

Flatband Pouch Affix metrics

Amongst the dazzling array of techniques to bind the bands to the pouch – I only use the "wrap and tug" method, period. Ketty (Pty) Ltd research has indicated a speculative insignificant difference between the so-called OTT (over the top) and TTF (through-the-fork) band tie options. I tie one universal method for all. What research clearly demonstrated was that the "ears" (the excessive bands' ends) must be on the outside of the pouch – the shorter the better. If you take the band at one pouch length on either side of the pouch and pull (stretch the band), the binding must be snug up against the pouch. If under tension, the binding moves with the stretch away from the pouch, the band was not optimally stretched during the binding process, and will slip and effectively lengthen the free draw. One should consider that 0.5 cm of band represents 2.5 cm of draw, and the loss of potential energy will have a lower POI (POI) that could be significant at 15 and 20 meter disciplines. It is noteworthy to mention the very neat and tidy exceptional wrap and tug method unique to the world Ketty Elite Pro commercial products (band sets). Note the absence of butterfly wings and restrictor knot nobs, absolutely world-class.

Band Tuning

Is a broad umbrella term to the effect of finding the "sweet spot" – a balance between the flatband's potential (draw length) and the pellet weight for optimal performance. In essence, if the band is too weak to power (trust) the pellet, the result will be dismal pellet speed and undesired drop. If the bands are overpowering, it will not result in exuberant speed, and the negative side effect of band slap.

Longevity V Performance

How long does (or should) a bandset last? If you want long-lasting bandsets, get artificial synthetic bands, but do not expect consistency and explosive performance. It is usually derived from the two common petroleum compounds, styrene and butadiene, produced into naphtha (a flammable oil) and combined with natural gas to create monomers, such as butadiene, styrene, isoprene, chloroprene, ethylene, and propylene. These compounds can then be polymerised using a catalyst and process steam, forming chains of polymers to create rubber. Unnecessary to say – it is more resistant to abrasion, grease, oil, water and heat when compared to natural latex. The truth is, it is great for toy *ketties* and hobbyist shooters, but for athletes concerned with precision in competition shooting, it is like using black powder instead of modern high-performance propellants in a rifle match. Bands are like car tyres that you don't use until they are unsafe or they burst. On a race track in a competition, you want exceptional, consistent, maximum performance. It is disposable consumer items, to be regularly changed in time for the best performance. If a Ketty Elite Pro Taper Cut band set exceeds 300 shots, it is probably not being used to full strength performance. A competition is 60 shots. I take consistency over longevity any day!

In conclusion

The bands are the easiest metric in the PAM (Precision and Accuracy Matrix) to discard by complacency or ignorance, but crucial to the accuracy chain. Precise repetitive band positioning when replacing or tying bands is crucial. It is important to eliminate the variables we have direct control over to ensure repetition and consistency. No detail is too insignificant.

"The Ketty Cut/The Ketty Seat"

This unique avant-garde method – that I use to affix the bands for OTT (over the top) at an angle to my *kettie* prongs for OTT will be discussed later in the series.

Band maintenance

By default, Natural Latex is susceptible to oil (hands) moisture (atmosphere) and UV (sunlight) and should be stored in a cool, dry place away from sunlight. While modern natural latex products are more resistant to environmental factors, my advice is – unless you have technical specifications or laboratory certification indicating otherwise – it is best to follow conventional wisdom.

Natural latex allergy

A very small percentage of people are allergic to the protein in natural latex, for example, evident when wearing latex gloves.

Thank you for joining me on this slingshot discovery journey. In the next part, we will take a look at some real-world band performance and discuss the significance of pouch metrics and circle back to pellet jump, leading on to shooting actual shooting techniques.