



KAIZEN...

The science & art of continuous improvement

Philip Watson, Senior Coach

Plan for the session

Part-1

Kaizen theory

- When did Kaizen originate?
- Where was Kaizen developed?
- What is Kaizen all about?
- How is Kaizen applied in Sport?

Short comfort break

Part-2

Kaizen in practice

- Applying Kaizen principles to arrow nocks

Who am I?

ARM

Marconi



VLSI

Avant!



SYNOPSYS®



Scouts 



What is tonight about?



A (very) short history lesson... (1940-45)

- Training Within Industry Service (TWI)
- War Manpower Commission (Washington DC)

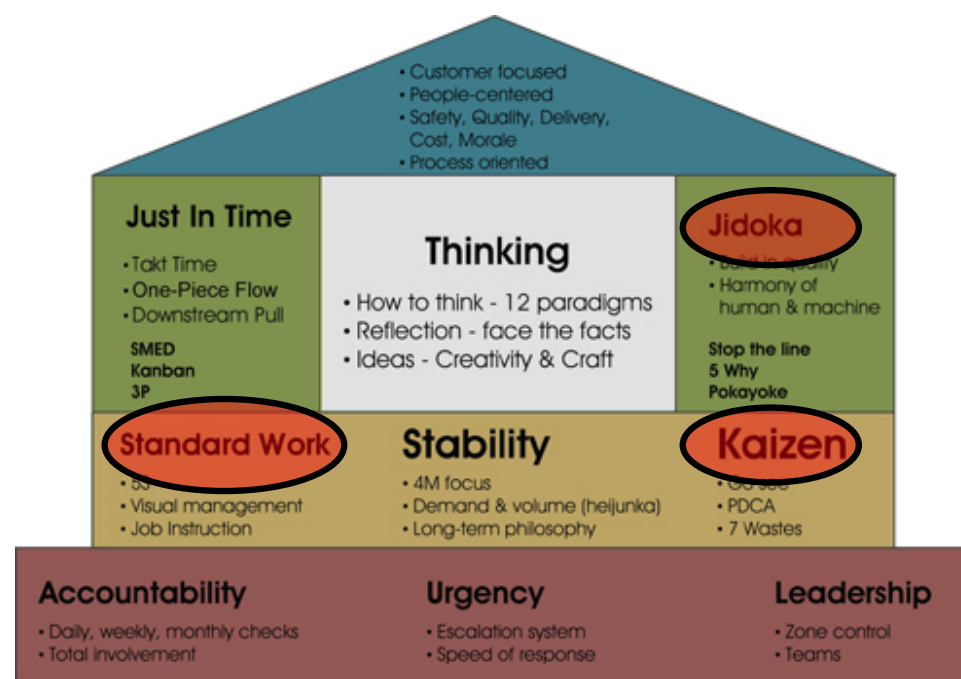
The Common Goal

We all want to meet the demands of war—maximum production through best use of our facilities and talents. But we can also build for the future in meeting the present challenge. The training we give the worker to do a good job *now* for war production can be more than an expedient means of getting the job done. It can be suitable to the individual and in line with his native talent and aspiration. Then it becomes education because the worker placed in the line of work he desires, and trained in accordance with his talent and aspiration, is a growing individual—mentally, morally, and spiritually, as well as technically. Training done from this point of view promotes production now and builds better citizens for a greater national stability afterwards.



A (very) short history lesson (1945-55)

- Post War reconstruction
 - Gen. McArthur
- Taiichi Ohno
- Toyota Production System (TPS)
 - *Standard Work*
 - TWI principles
 - *Kaizen*
 - Plan/Do/Check/Action cycle
 - *Jidoka*
 - The 5 Why's



So what is Kaizen?



Courtesy BBC ©
2018

The PDCA cycle

Toyota Production System



AGB L2 Resource Manual

Level 2

Resource Manual



1.2 Coaching Delivery

This section covers the **coaching process** itself, various aspects of coaching and the scope of a Level 2 coach's activity.

The Plan, Do and Review cycle introduced in Level 1 is critical for both coaches and archers. Including all three phases in coaching practice provides direction, motivation and a clear path for any archer to reach their goals.

The Plan, Do, Review cycle

The foundation of the coaching process is the cycle of Plan, Do, Review. In practice the review step comes first, followed by the plan and then the 'do', and so on as the process is repeated. Integral to the Plan, Do, Review cycle is Goal Setting. The plan, do, review cycle and goal setting form the framework for coaching. Goal setting will be dealt with in more detail in section 1.3. It is important to recognise that this is a cycle and is therefore dynamic in that the plan will always be subject to change as progress is made and goals are achieved.



Ask the 5 Why's

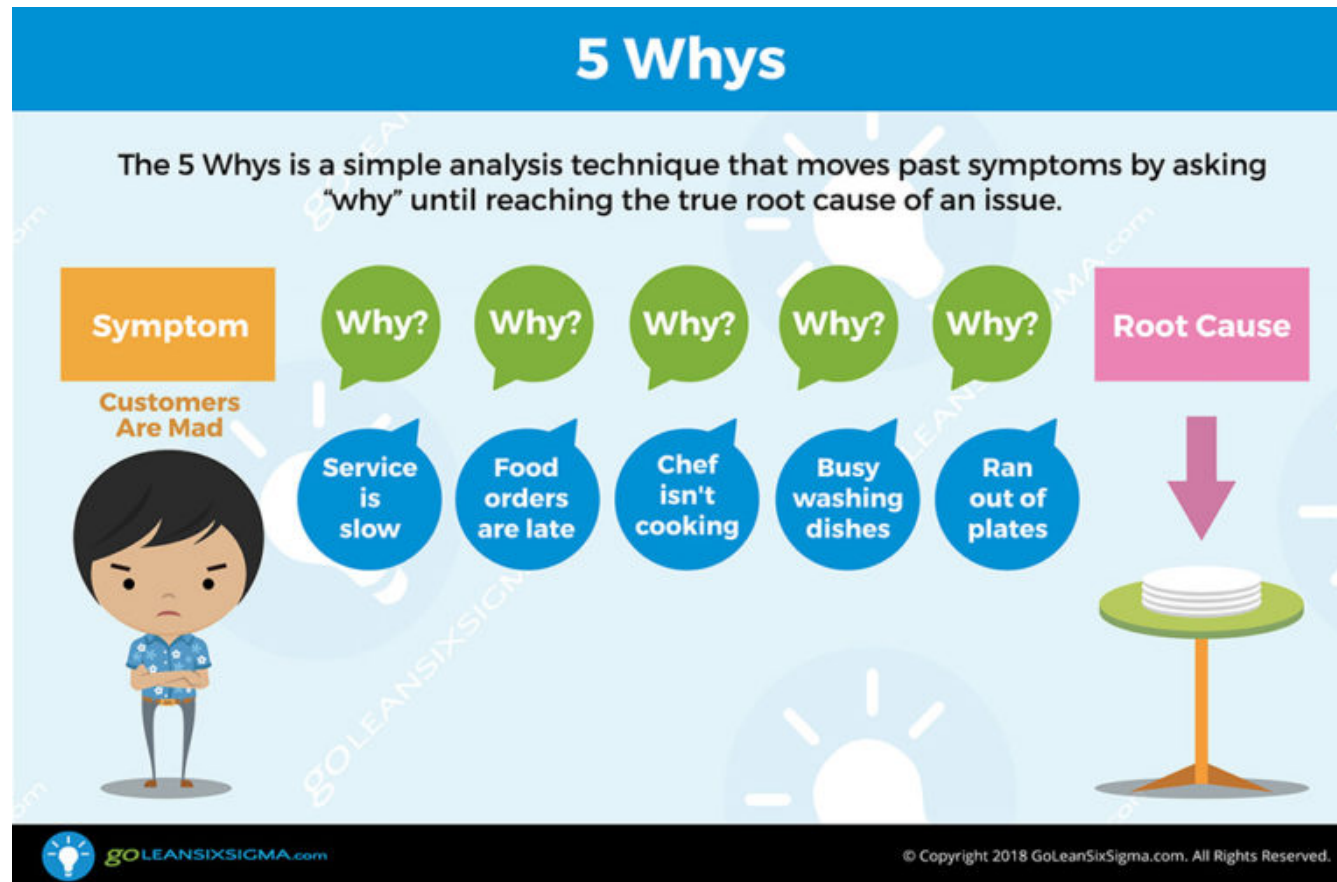
1. Define the problem

2. Ask why

- Repeat until you reach the root cause

3. Determine & implement corrective actions

5 Why's in action...



Kaizen in sport (David Brailsford & the 1% factor)



THE SEARCH FOR OPTIMAL NOCK FIT

An example of kaizen

What is nock fit & why do we care



Courtesy Lancaster Archery © 2016

Let's Kaizen an example...



First let's use the 5-Why's technique.

1) Why does my arrow keep falling off my string?

- *Because the nock fit is too loose*

2) Why is the nock fit too loose?

- *Because the nock is the wrong size for the string*

3) Why is the nock the wrong size for the string?

- *Because the serving is too thin, there's too few strands in the string or it's the wrong nock*

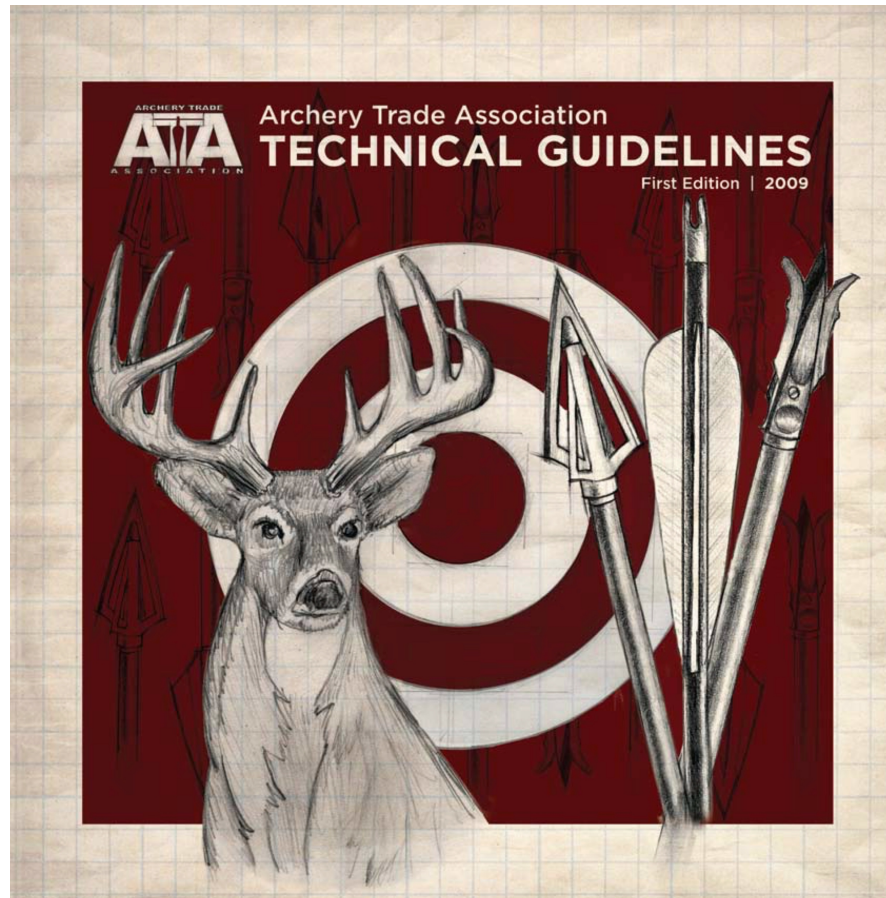
4) Why is the serving too thin, too few strands or the wrong nock?

- *Because you don't know what the centre serving diameter should be*

5) Why don't I know what the centre serving diameter should be?

- *Because you didn't know there was a specification for that (ATA Technical Guidelines)*

ATA Technical Guidelines



ATA Technical Guidelines

Guideline for ATA String Center Serving Diameter Specification

Designation: ATA/BOW-111-2008

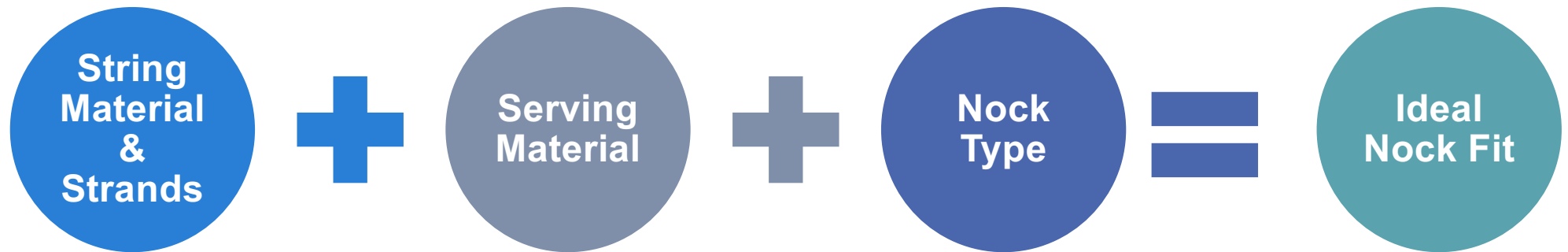
Summary:

To define and promote the standardization of Archery bowstrings center serving diameter specifications. Though there are many individual preferences of archers in how tight or snug an arrow nock should fit to the bowstring, it is generally accepted that the proper fit of arrow nocks to the bowstring should allow for a nocked arrow to fit the string in a manner that holds the nocked arrow in place during the draw cycle of the bow, and allows the arrow to launch with accuracy and consistent velocity. These guidelines are based on an analysis of currently used materials for the manufacture of bowstrings and the strength requirements of a bowstring dictated by archery bows with up to 80 pounds of Peak Draw Force. For “Low Peak Weight” bows, Archery Bows with Peak Draw Force values **under 30 pounds**, the bowstring center serving diameter specification is **0.102 inches (±0.004 inches)**. For Archery Bows with Peak Draw Force values of **30 pounds up to 80 pounds**, the bowstring center serving diameter specification is **0.112 inches (±0.004 inches)**. No recommendations are made for bows with Peak Draw Force values over 80 pounds.

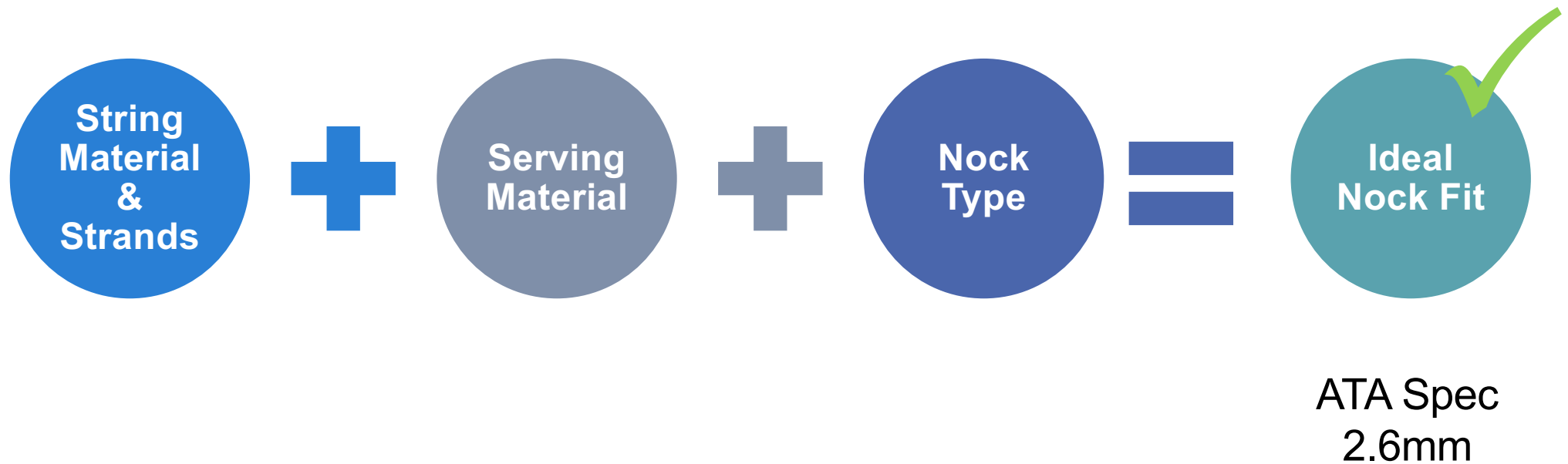
Note: $0.102'' \pm 0.004'' = 2.5908\text{mm} \pm 0.1016\text{mm}$ / $0.112'' \pm 0.004'' = 2.8448\text{mm} \pm 0.1016\text{mm}$

Courtesy Archery Trade Association

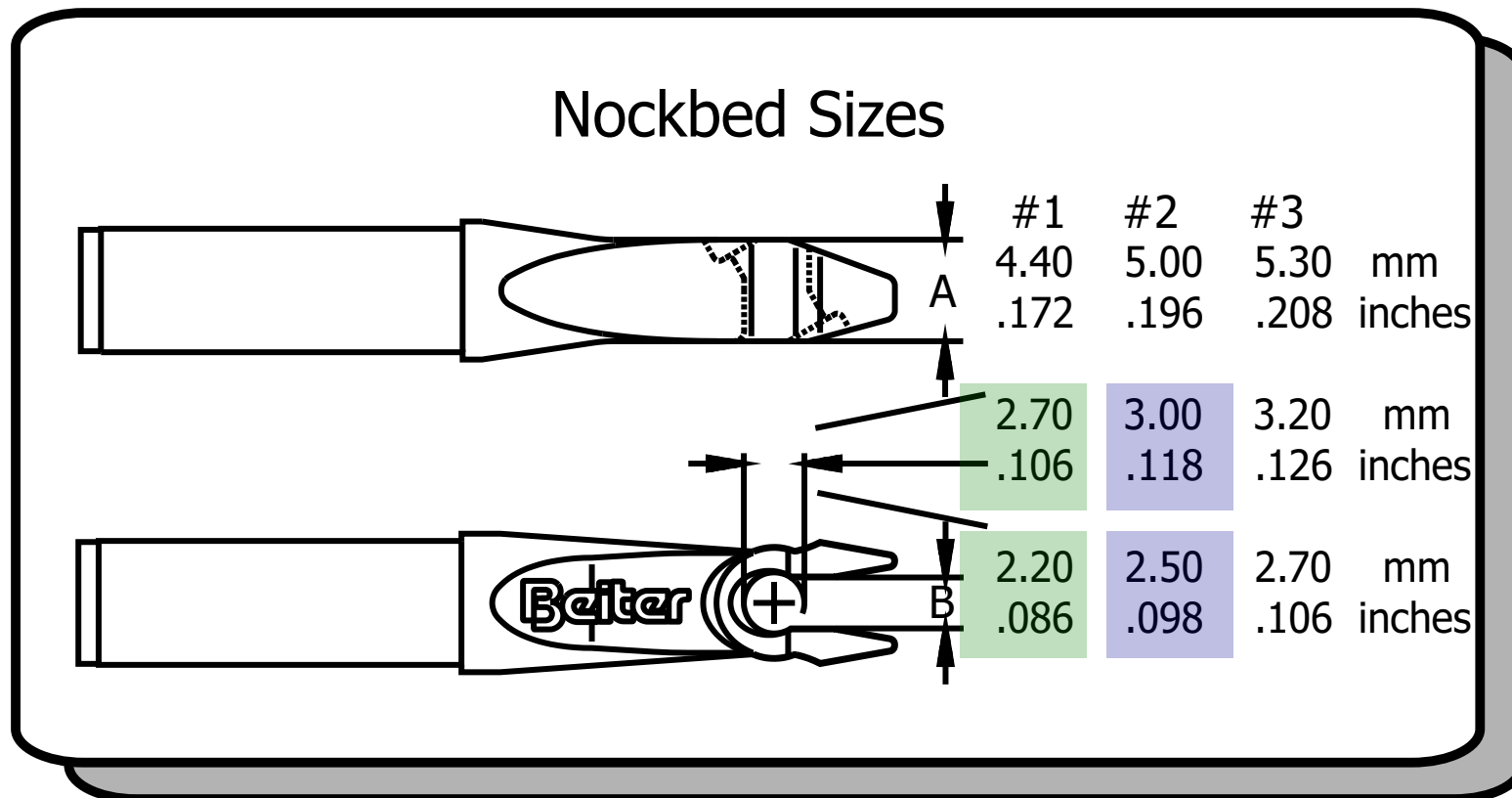
What would we like?...



So we now know...



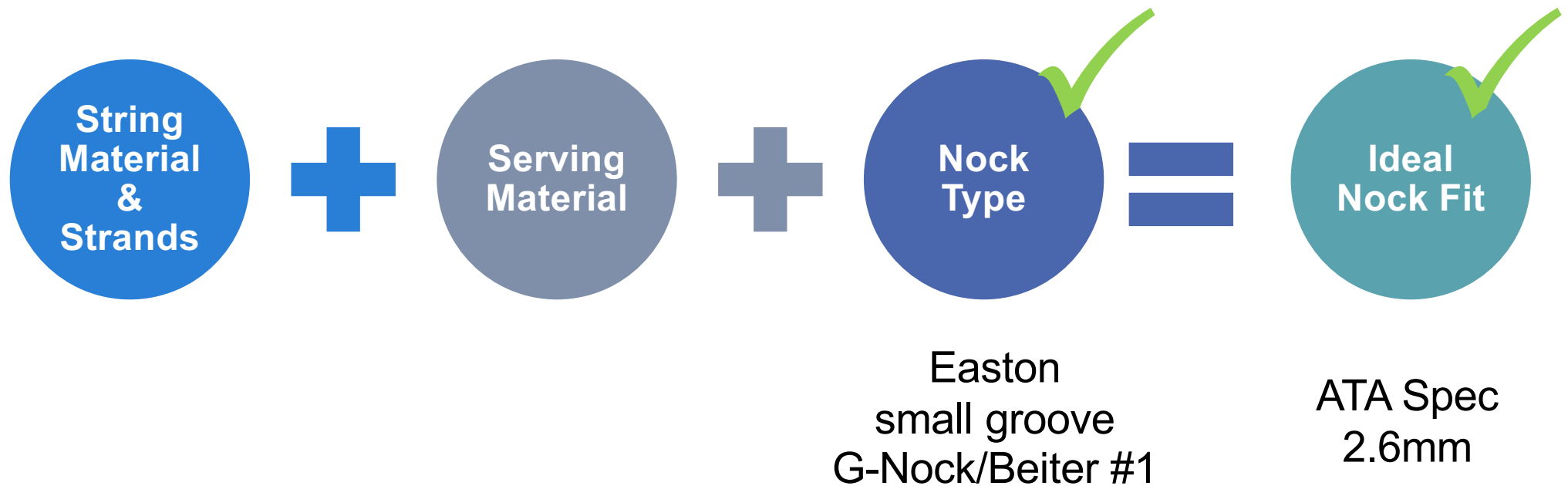
Beiter Nocks



Wait! What was that?

	Easton		Beiter		ATA Specification	
Model name	Small Groove	Large Groove	#1	#2	<30lb draw-weight	>=30lb draw-weight
Throat size	0.088" 2.2mm	0.098" 2.5mm	0.086" 2.2mm	0.098" 2.5mm		
Nock bed size			0.106" 2.69mm	0.118" 2.99mm	0.102" 2.6mm	0.112" 2.8mm

Remember, we would like...



String & Serving Materials

Quote from BCY...

“In textiles we size by Denier.”

“We can’t really get a diameter on flat bowstring material.”

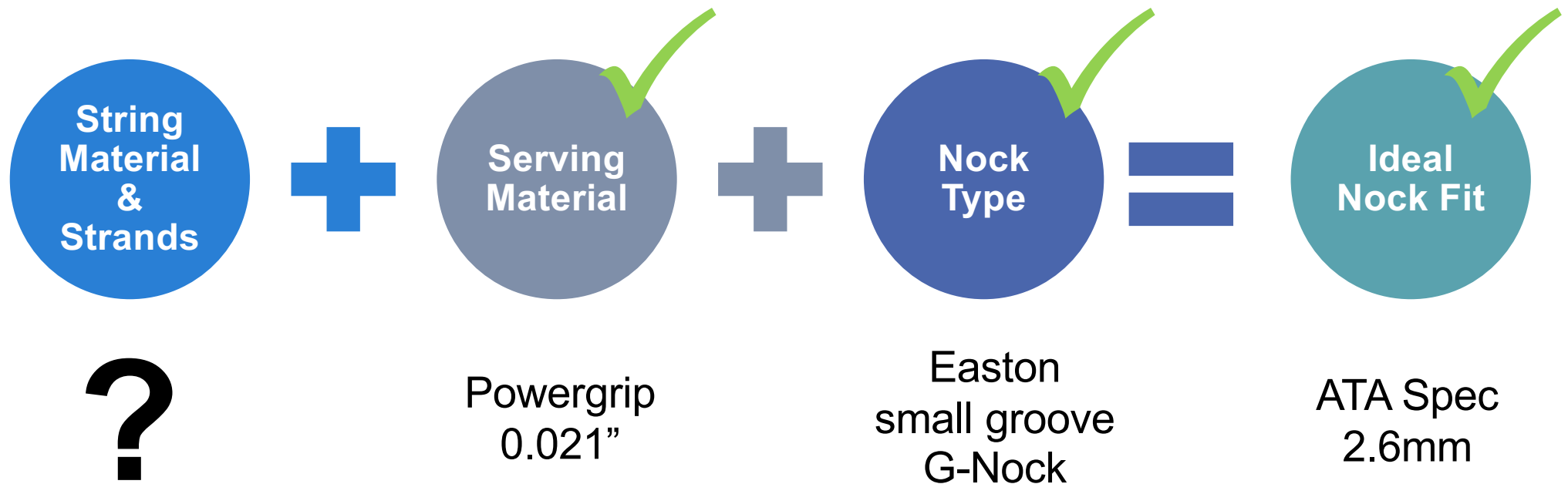


“If you take a look at our website www.bcyfibers.com.

We recommend strand count for each material.

“This is suggested with 0.021” diameter center serving, which will fit most nocks.”

Remember, we would like...



Experimental Methodology

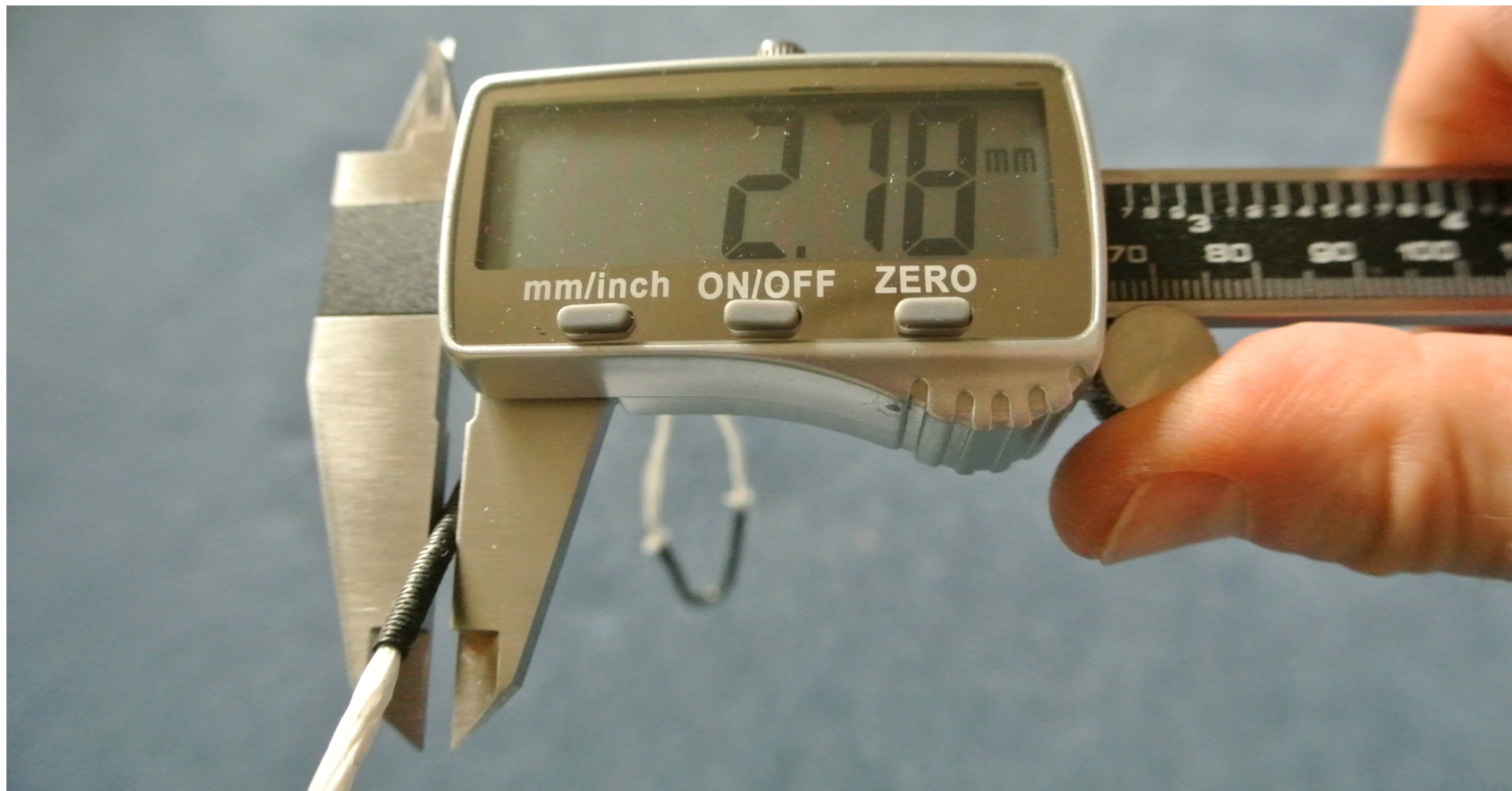


**Make lots of
recurve strings**

**Serve them as
consistently as
possible**

**Measure &
attempt to draw
conclusions**

Dimensionally



Results #1 (68" Recurve bow <30lb)

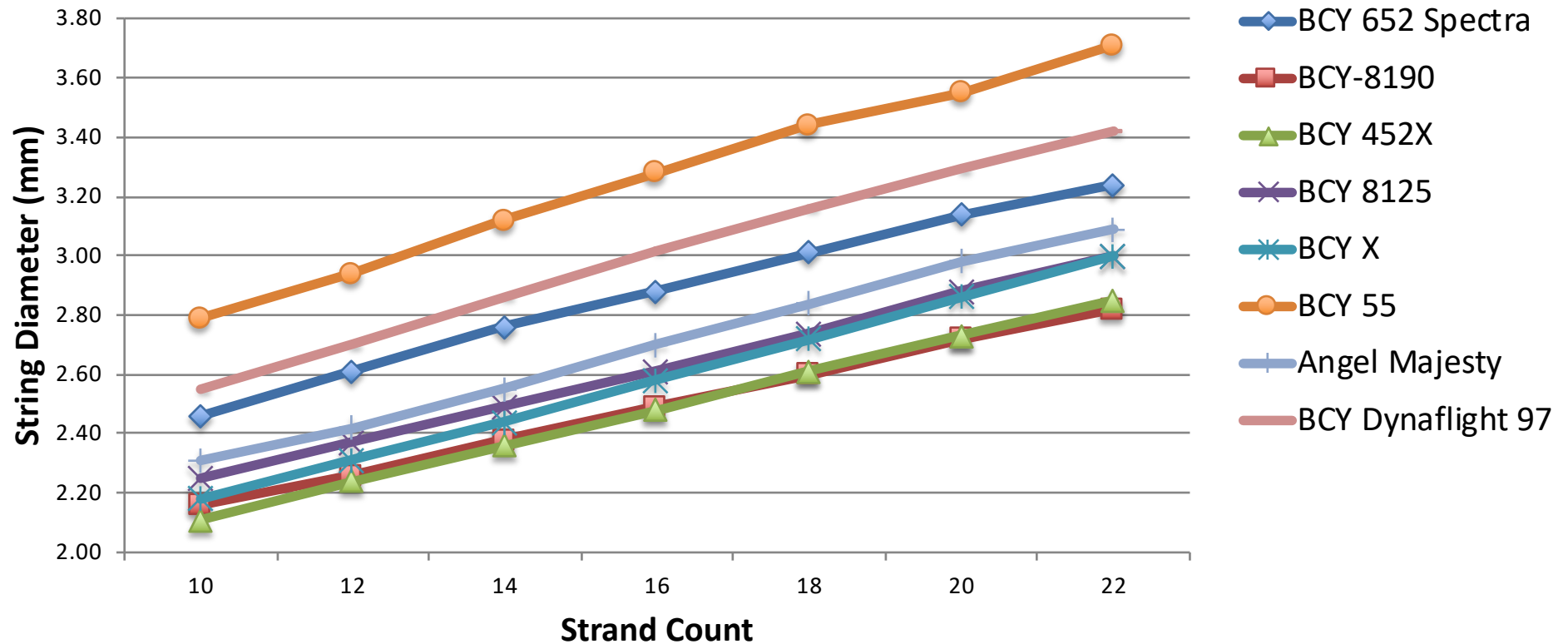
String Material	10 Str	12 Str	14 Str	16 Str	18 Str	20 Str	22 Str
BCY 452X	2.11	2.24	2.36	2.48	2.61	2.73	2.85
BCY 8190F	2.16	2.26	2.38	2.49	2.60	2.72	2.82
BCY X	2.18	2.31	2.44	2.58	2.72	2.86	3.00
BCY 8125G	2.25	2.37	2.49	2.61	2.74	2.88	3.00
Angel Majesty	2.31	2.42	2.55	2.70	2.84	2.98	3.09
BCY Spectra 652	2.46	2.61	2.76	2.88	3.01	3.14	3.24
BCY Dynaflight 97	2.55	2.70	2.86	3.02	3.16	3.29	3.42
BCY B55	2.79	2.94	3.12	3.28	3.44	3.55	3.71

Dimensions are in mm

Served with BCY Powergrip 0.021"

Results #2 (68" Recurve bow <30lb)

String Diameter vs. Strand Count



String material diameter

String Material	Effective diameter of an individual strand (mm)
BCY 452X	0.0904
BCY 8190F	0.0913
BCY X	0.0967
BCY 8125G	0.0995
Angel Majesty	0.1045
BCY Spectra 652	0.1161
BCY Dynaflight 97	0.1241
BCY B55	0.1414

What material / serving combinations?

Material	Material diameter (mm)	No. of strands	String diameter with 0.014 Halo	String diameter with 0.017 Halo	String diameter with 0.019 Halo	String diameter with 0.021 Powergrip
BCY 452X	0.090	18	2.34	2.49	2.59	2.69
BCY-X	0.097	16	2.26	2.41	2.51	2.61
Angel Majesty Pro	0.105	18	2.59	2.74	2.85	2.95
BCY 8190F	0.0913	18	2.35	2.51	2.61	2.71
BCY Spectra 652	0.116	16	2.57	2.72	2.82	2.92
BCY 8125G	0.0995	16	2.30	2.46	2.56	2.66
BCY DynaFlight 97	0.124	14	2.45	2.60	2.70	2.80
BCY B-55	0.141	12	2.41	2.56	2.66	2.76
			Inch	mm	Nock fit (mm)	
Easton Small Groove G-Nock			0.088	2.235	2.6	
Easton Large Groove G-Nock			0.098	2.489	2.9	
		Beiter #1	0.086	2.184	2.6	
		Beiter #2	0.098	2.489	2.9	

Force required to detachnock



Claimed resolution 10g

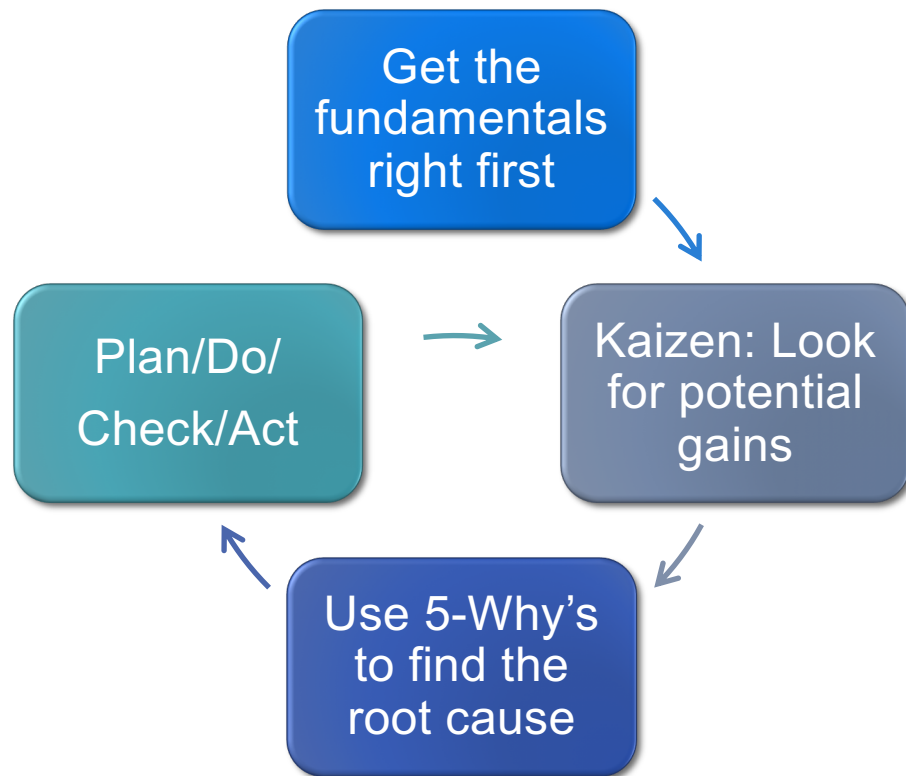
Consistent strand count / serving

String Material	Strand count	String Diameter (mm)	Nock detach force (lb)
BCY 452X	18	2.61	1.85
BCY X	16	2.58	1.74
Angel Majesty	14	2.55	1.74
BCY 8190F	18	2.61	1.94
BCY Spectra 652	12	2.61	1.81
BCY 8125G	16	2.66	1.96
BCY Dynaflight 97	10	2.55	1.74

Served with BCY Powergrip 0.021"

So where has this journey brought us?

Marginal Gains



Keizen for nock fit

BCY 8125

- 16 strand
- 0.021" serving
- 2.66mm diameter centre serving
- 2lb detach force

BCY 8190

- 18 strand
- 0.021" serving
- 2.61mm diameter centre serving
- 2lb detach force

A challenge for you



Strength

- Training schedule
- Warm-up



Technique

- Skills & Drills
- Progression



Equipment

- Basic set-up checklist
- Tackle-box



Mental

- Shot routine
- Goal setting