

Combat Arrow Test Plan

The item under test is the most recent design version of "Baldar Blunts". The following terms have all referenced this style of blunt: Baldar Blunt, CUBB Style Blunt, and the Fathead. Previous versions of the Baldar Blunt will be referred to as the Original Baldar Blunt.

For clarity and continuity purposes I will only refer to the item under test as either the "Test Blunt", meaning only the head, or the "Test Combat Arrow", meaning the entire assembled Combat Arrow under test.

"Head" (Test Blunt) Data

Original Baldar Blunt kit was purchased from Northstar Archery (Distributor), May of 2008.

Length = 2.25 Inches

Diameter = 1.5 Inches (38mm)

Shaft insertion depth = 1.125 Inches

Head weight approximately = 27 grams

Due to the design change, Duke Baldar sent the updated (Fathead) Combat Test Blunt, August of 2009.

Length = 2.25 Inches

Diameter = 1.5 Inches (38mm)

Shaft insertion depth = 1.125 Inches

Head weight approximately = 35 grams

Combat Arrow (Test Combat Arrow) Data

Assembly glue = Goop Brand adhesive (plumbing) 3.7 FL. OZ

Assembly instructions per the Northstar Web site

http://www.northstararchery.com/kit_assembly.html

Total Length = 30.25 Inches (measured from the nock groove to the tip of the fully assembled head)

Total Weight = 86 grams

Draw Length = 28 inches

Solid Fiberglass shaft = 45 grams, (not required for the currently approved combat blunt, but they are what came with the combat blunts Kit)

Bow Specs.

Manufacturer: PSE archery

Model: Buckeye 62"

35 lbs@28"

8" Brace Height

Additional Test Equipment

Lufkin HI-VIZ measuring Tape 100'

Model L1706N

Plastic Slide Ruler

Manufacturer Name Not Marked on Ruler

1/28th" Increments

Made in Taiwan

Taylor Digital Nutritional Scale
Model 3833
Tillering Tree (to to draw bow to full draw for measurement purposes)
Manufactured by me to make bows.
Bow Scale (Used to Measure Bow Weight at full draw on the Tillering Tree)
Manufacturer Name Not Marked on Scale (Luggage Scale)
Model # none
Range 0-80 lbs
Swanson Angle finder
Magnetic Base (no model Number)
Sheet steel, 16 Ga.,
12"x12", Mild Steel Purchased From Home Depot

The Test Combat Arrows were tested using the same equipment standards and methods as our currently approved Combat Arrows. The Test Combat Arrows were assembled per the distributors instructions, which can be found at: http://www.northstararchery.com/kit_assembly.html .

A couple of notable differences are:

The Test Combat Arrow shafts were not taped with strapping tape along them lengthwise and the Anti-Penetration Device was not used in place of the fletching. Reason being that neither of these are factors considered in our currently approved Combat Arrows.

General information

The following are some factors that will have a dramatic effect on the efficiency and the transfer of a bows "energy". I have listed them in order of greatest effect to least effect.

- Bow limb (Elastic) Hysteresis
- Arrow mass
- Arrow (Elastic) Hysteresis. A.k.a. "Archers Paradox"
<http://www.youtube.com/watch?v=WzWrcpzuAp8&feature=related>
- Arrow Drag
- String mass
- String drag

The physics and mechanics involved with the release of an arrow can be viewed as an argument between the bow, the string and the arrow. The harder the string pushes against the arrow, the harder the arrow pushes back.

When the bow string is released, the potential energy stored in the bows limbs begins to transfer to the arrow through the string. As the string begins to move, the nock of the arrow also begins to move and the transfer of energy forces the nock of the arrow to travel faster than the head of the arrow, causing the arrow to "flex" (Archers Paradox). This flex is where some of the energy is lost.

If all things were equal with two identical arrows, the only difference being the weight of the heads. The lighter arrow will flex less, requiring less energy to propel the arrow forward causing a net effect of increased speed when compared to the heavier arrowhead. The heavier arrow will require more energy from the bow in the cushion effect of the flex and much more of the energy will be needed to propel the arrow forward. The net effect will be reduced speed when compared to the lighter arrowhead.

Definition of hysteresis The word hysteresis is of the Greek origin and means etymologically 'coming behind'. It was introduced into scientific vocabulary about 120 years ago by the Scottish physicist, Alfred Ewing, as follows. "When there are two quantities M and N , such that cyclic variations of N cause cyclic variation of M , then if the changes of M lag behind those of N , we may say that there is hysteresis in the relation of M and N "

The potential of stored energy in a bow can be expressed in inch-pound of force. It is calculated by multiplying the distance the string travels from "at rest" to "full draw" by the draw weight. The SCA uses this calculation to determine the Power of their crossbows. I have included it here for reference use: 35# X (28" draw - 8" brace) = 700 inch-pounds at 100% efficiency. Unfortunately it is not possible to achieve 100% efficiency (not even an Olympic Recurve is 100%!).

Testing Timeline

May 2008

Received the Original Baldar Blunt Combat Arrow Kit from Northstar Archery. Arrows were assembled as instructed by the distributor. Testing began and continued until it was stopped due to rumors of a bad batch of Blunts being produced by the manufacturer.

August of 2009

The Manufacturer sent replacement Test Blunts of the new design. I contacted the Imperial Crown with the news, However the Imperial Crown wanted to verify they were in fact the new style Test Blunts and not the Original Baldar Blunts that were pulled from the market. Once the Test Blunts were verified, testing began of the new Test Blunts.

Measurements were taken of the new Test Blunts (Figures 1 through 11). The physical dimensions were virtually the same, with the only outstanding variation being, the new Test Blunt is 8 grams heavier likely due to the added rubber behind the midpoint of the head. The Original Baldar Blunts were removed from the Fiberglass Shafts, the shafts were then cleaned with Acetone and the new Test Blunts were installed following the instructions on the distributors website.

Note The heads are very difficult to remove from the shaft. It takes quite some time, a little swearing, and a lot of work.

September 2009

Imperial War (non Contested)
Held in Miami.

The Test Combat Arrows were used and no injuries reported from them. I do not believe the Test Combat Arrows were able to be tested in all Combat scenarios because all scenarios did not allow missile weapons. I reported the results of the testing to His Imperial Majesty Sir L'Bet'.

May 2010

Banner war (non Contested)
Held in Miami.

Imperial Minister of Joust and War specifically stated that they were not allowed to be used.
"The Balder Blunts will not be allowed for two reasons

- 1) *There are some safety concerns with the Balder Blunts and I would prefer to see additional testing done at the local level before these would be allowed at an Imperial War.*
- 2) *Since they are being play tested in only some of the subdivisions, not everyone has them and I do not believe this would be fair."*

We brought them along but they were not tested in any scenario during that war.

August of 2010

Play Testing time line expired.

September 2010

Imperial Crown War (non Contested)

Quiet Waters Park.

The Test Combat Arrows were not tested and an extension of the testing time was not requested because the Imperial Minister of Joust and War specifically stated that he would not permit them to be used.

March 2011

As agreed with Their Imperial Majesties at the March 2011 Imperial Estates Meeting, His Imperial Highness Sir L'Bet' and myself are to conduct further testing outside of Adria on our own personal time and produce a report to the Estates in July. The testing could continue at the leisure of Sir L'Bet' and myself outside of Adrian Events.

Unfortunately, Sir L'Bet' has informed me that, to date, he has been unable to attain the solid shafts and only has wooden shafts affixed. Sir L'Bet' stated that the distributor has been unresponsive when he questioned about additional shaft use. So Sir L'Bet' has not done any further testing.

Test Photographs



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



Figure 12, ID Label



Figure 13, ID Label



Figure 14, Pre-Test Photo, 16 Gauge Sheet



Figure 15, Pre-Test Photo



Figure 16, Powdered Tip



Figure 17, 1st Shot



Figure 18, 1st Shot



Figure 19, 2nd Shot



Figure 20, 2nd Shot



Figure 21, 2nd Shot



Figure 22, 3rd Shot



Figure 23, 3rd Shot



Figure 24, 3rd Shot



Figure 25, 3rd Shot



Figure 26, Post Combat Arrow Test Front Side

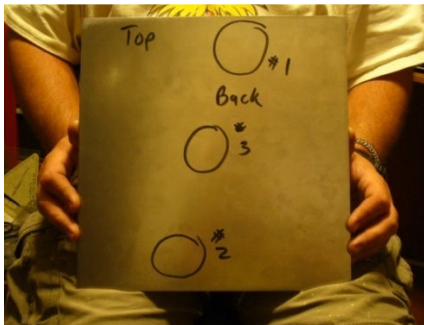


Figure 27, Post Combat Arrow Test Back Side



Figure 28, Spear



Figure 29, After Spear Front Side

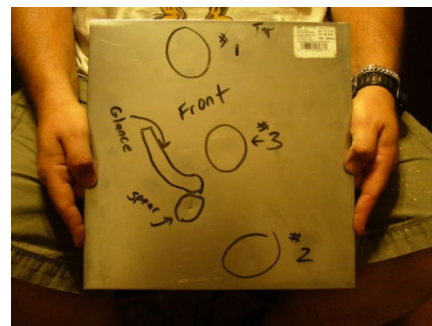


Figure 30, Post Spear Impact Front Side



Figure 31, Post Spear Impact Front Side



Figure 32, Post Spear Impact Front Side



Figure 33, Post Spear Impact Front Side

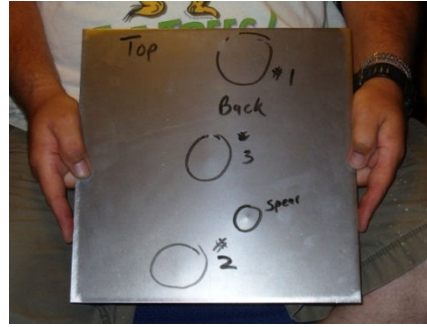


Figure 34, Post Spear Impact Back Side



Figure 35, Post Spear Impact Back Side

Test Summary

1. Safety

To my knowledge there have been no documented cases of injuries to spectators or combatants, related to the Test Combat Arrows in any of our combat lists. It is my suggestion however, that when determining the boundaries of the combat field, safety must be kept in mind at all times, and the boundaries should be established accordingly when this missile weapon is to be used, by including a buffer zone between combat and spectators. This is an issue that is not clearly addressed in our manuals regarding missile weapons, but has become common practice in our region. In addition to bystanders being kept at safe distances, it is still the duty of the Archer to know what is beyond their target. If there is an unarmored individual or spectator behind the target the Archer is about to shoot at, the Archer must not take the shot until the shot is safe.

The manufacturer recommends the use of solid Fiberglass shafts. I am unable to locate any reference Requiring the use of "hollow shafts" or "hollow safety shafts" in our Combat Missile Weapon Construction Manual. It only states "Combat arrows are fiberglass shafts with a thick amount of foam on the tip" however I agree with the manufacturer and recommend solid shafts be used with the Test Blunts.

Questions have been raised asking if the Test Combat Arrow passes the "Eye Socket Test". I have been unable to find any Eye Socket Test requirements or test parameters in our manuals or bylaws, and additionally, I cannot find any test data from the currently approved combat arrows for comparative analysis. The only closely related information is in the Missile Weapons Construction Manual. It suggests that combat arrows not have a head diameter less than 40mm. Since the Test Blunts are approximately 38mm, I recommend that the Test Blunt be wrapped in thick electrical tape sufficiently enough to at least meet this minimum standard.

From my experience, the eye socket test seemed to be based on opinions of what may and may not cause harm to the human eye however, there were no indications of expertise in the field of medicine or other relevant backgrounds in the statements.

Some people have asked the hypothetical situation of, what if Test Combat Arrow hits an innocent bystander in the eye. It is my recommendation that all combat scenarios that include the use of this missile weapon should also include a buffer distance of at least 35 feet between combat and spectators (Much like the list field in combat where we have ropes and distance between combat and spectators).

There are several things that can go wrong using our currently approved weapons, and the same risk concerns can be made regarding the use of virtually all of them. Recently I have heard of combatants holding steel swords at the pommel and using this style of grip to swing the sword at their opponent. I have heard of thrusting swords breaking during combat due to improper tempering. I have seen steel swords break and pieces fly into the crowd of spectators. I have seen spearheads break from being struck by another weapon or from improper attacking. I have seen combatants have their weapon yanked out of their hands during a tournament by their opponent. A combatant can lose their grip on the weapon, it could slip, the tang could break, the blade could

break, etc. leaving the combatant no control over the weapon. The only protection available to bystanders at that point, hopefully, would be they are at a safe distance to limit the chances of being injured. I know it sounds really harsh, but these are some of the reasons the Adrian Empire maintains liability insurance coverage.

2. Implementation or viability issues including procedures

The usage procedures are the same as our current combat arrow with the exception that, the distributor recommends that the Blunts be used with Solid fiberglass shafts.

The Test Combat Arrows performed as well as and in some cases better than the currently approved Combat Arrow.

I suggest that the blunt be wrapped in thick electrical tape sufficiently enough to at least meet the 40mm diameter minimum standard.

3. Usage rules and regulations

All other combat rules and regulations should apply and be followed as outlined in the Adrian Empire Combat Manual.

After shooting, the Archer MUST inspect them. Even if someone else has inspected them after a battle, you need to re-inspect your own arrows again. Do not shoot them again if you find any kind of damage, or if the Blunt is not seated or taped correctly. Arrows, like other weapons, need attention and up-keep. You will need to fix and re-tape them occasionally. Inspect them between battles and when you get them home. Don't store your arrows in a shed or car where the temperature is uncontrolled. Extreme temperatures will make the tape come loose.

4. Assembly instructions

The Test Combat Arrows were assembled as follows. They can also be found on the distributors web site.

http://www.northstararchery.com/kit_assembly.html

Assembly Glue used was Goop Brand adhesive (plumbing).

Tape used was ½" electrical tape (I chose Red). The distributor recommend that at least ½" wide tape be used.

Instructions followed:

1. The hole of the blunt has already been roughened for better adhesion. Place a mark on the shaft 1 1/4-inch from the end of the arrow.
2. Put a blob of glue over the shaft hole of the blunt.
3. Push the Baldar Blunt onto the end of the shaft until it bottoms out and covers the 1 1/4-inch mark. Push it on straight and do NOT let the Baldar Blunt twist to the side or you will split the collar. If you split the collar, the Baldar Blunt may not be used.
4. Pull the shaft out and repeat the gluing procedure. Push hard to get any trapped air out of the shaft hole. Set the freshly glued blunt and shaft aside for a minute. Watch the mark to

make sure it is not sliding back off. If so, push it back on. You may need to push it back on more than once.

5. Allow the glue in the blunts to thoroughly dry before taping.
6. While drying, put your arrows/bolts someplace safe where they won't be disturbed.
7. The taping of the shaft portion of the assembly was omitted because it is not required for our currently approved Combat Arrows.
8. Using one continuous piece of electrical tape, Stretch the tape slightly as you wrap it three times around the shaft BELOW the collar of the Blunt.
9. stretch the electrical tape up to the collar of the Blunt and wrap the tape three times around the collar. Now stretch the tape back down to the shaft, and make three more wraps around the shaft below the Blunt. Do not stretch the tape too much or it will slide off the collar of the blunt.
10. Place another piece of electrical tape (8 to 10 inches) over the top of the blunt and down the sides of the shaft followed by a second piece of Tape (8 to 10 inches) 90 degrees to the first one over the top of the blunt and down the sides of the shaft. (You will see a + when looking directly at the tip as if it were flying towards you).
11. One last piece of electrical tape needs to go around the shaft to cover the ends of the tape that went over the head of the blunt.

5. Anything else needed to allow members to completely understand and implement the Play test.

Other organizations like the SCA have been using this blunt for light weapons use:

http://www.sca.org/officers/marshal/docs/marshal_handbook.pdf

pg. 6 of the SCA Marshal's Handbook. VII. Weapons Standards G.6.e.ii. Baldar Blunts

And also for Heavy Weapons use:

http://www.sca.org/officers/marshal/docs/marshal_handbook.pdf

pg. 7 of the SCA Marshal's Handbook. VII. Weapons Standards 7.b.iii.2. Baldar Blunts

The Test Combat Arrows have been used on Armored, Rapier, and Shinai armor, at wars and during practices.

For long distance shots, the combatant seemed to have the advantage over the archer. The loft of the Test Combat Arrow makes them somewhat predictable and allows the combatant time to side step the Test Combat Arrow.

The Test Combat Arrow shafts were not taped with strapping tape along them lengthwise and the APD was not used in place of the fletching. Neither of these are factors considered in our current Combat Arrow Construction.

I would recommend using high quality electrical tape like 3M brand or similar. It seems to hold up to wear and tear a little better

6. Individuals have reported the following:

- They did not think they noticed a huge difference between the Test Combat Arrow or the current approved Combat Arrow.
- The Test Combat Arrows seems to hit a little bit harder when compared to the currently approved combat arrow.
- They have been hit harder with Shinai weapons than the Test Combat Arrows.
- This is a contact sport and felt the impact of the Test Combat Arrow was not excessive.
- I have observed some combatants, uncertain if they were hit with the Test Combat Arrow or the currently approved Combat Arrow, while other combatants seemed to not notice they were even struck at all.
- They thought the Test Combat Arrow would have hit harder than it did, solely based on how the Test Combat Arrows felt in their hands, but later commented that it wasn't that bad.

I have performed Combat archery drills with the Test Combat Arrows. We shot at each other at various ranges while wearing everyday clothes and a three weapons masks. There were no complaints made as to how hard they hit and there were no injuries and no bruising. Some individuals have volunteered to have their unarmored bodies shot at point blank range (between 4-8 feet) with the Test Combat Arrows. Some reported that the Test Combat Arrows seemed to hit a little hard at those distances however, further added that had they been wearing appropriate armor at the proper distance it most likely wouldn't be a really big deal.

One of the last persons to participate with the testing was a thirteen year old combatant. She wasn't feeling well but still agreed to lend herself to testing. Clean contact was made with a couple of head shots, one of them at near point blank range, shifted the helmet upwards. The Grill made slight contact to her forehead which left a pattern of the grill approximately the size of a Nickel. The Helmet she was wearing was a size medium and likely should have been wearing the next size smaller. She had the following comments: The initial impact is surprising, but by the time you realize you were hit it is over, but the hit wasn't bad. On a scale of 1-10, 1 being nothing and 10 being the worst, she ranked it about a 4 (similar to a hard shinai hit).

7. Opinion and observations

Distance Measurements.

My bow string anchor point during the testing was at 5.2 feet as measured vertically from the ground. The maximum attainable distance with six Test Combat Arrows shot @ 45 degrees to the ground was 153.25'. When shot with the Test Combat Arrows @ 0 degrees horizontal to the ground the arrows dropped out of a killing zone at around 25-30 feet and skidded along the ground about 4.25'. The average distance the arrows traveled from the archer to the final resting place was around 48.5' (It should be noted that the maximum distance for a siege weapon is 80 yards (240 feet) for heavy weapons combat and 50 yards (150 feet) for light weapons combat).

When an approved Three Weapons Mask (Blue Gauntlet size medium) was struck, from point blank range there was no noticed denting from the Test Combat Arrow. Figures 12 and 13 show A 12"x12", 16 gauge sheet of mild steel purchased from Home Depot (Figures 12 and 13). A mark was measured 8 feet from the target, and my foot was positioned on the

mark placing the head of the Test Combat Arrow approximately 5.5-6 feet from the surface of the 12"x12", 16 gauge sheet.

The 16 gauge sheet of mild steel was struck with three Test Combat Arrows from the above distance. I used Baby powder on the Test Combat Arrow to help indicate the point of contact.

The first shot (Figures 17 and 18) hit on the Top center of the sheet. There was barely any evidence of cupping across the sheet and no apparent denting. The second shot (Figures 19, 20 and 21) landed near the bottom center of the sheet. It too barely showed evidence of cupping and no apparent denting. The Third shot (Figures 22, 23, 24 and 25) landed near center and had no evidence of cupping but showed a very small dent almost not visible. The 12"x12", 16 gauge sheet of mild steel was inspected and contact spots were marked and photographed (Figures 26 and 27).

The 12"x12", 16 gauge sheet of mild steel was finally subjected to a Combat legal, Steel Spear (Figure 28) thrust which inflicted the most damage. Slight cupping and denting was immediately apparent along with evidence of the follow-through noted by the glancing marks (Figures 29 through 35).

One notable opinion worth mentioning is that it was made clear, some combatants do not like the idea of spending so much time getting suited up, only to be killed by an archer from across the field, without ever even having the chance to swing a sword at someone. I felt the statement was a little disturbing however, the comment seemed aimed towards Combat Archery in general and not directly towards the Test Combat Arrows.

The general median opinion I have observed is that many combatants feel the Test Combat Arrow seems to hit a little bit harder, but not by a whole lot.

Some individuals have strong opinions regarding the test blunt and feel that the current design is far superior to any other blunt out there. Arguably however, the Test Combat Arrow flight seems to travel in a very consistent manner with little influence from strong side winds and can provide a safer field of combat through their uniform construction, and durability. I feel that the design of the blunt provides excellent protection against a shaft punch through and I feel that the durability is an appealing factor that has been demonstrated by showing no mechanical problems other than the occasional need to have the head re-wrapped in electrical tape due to everyday wear and tear. Opinions have ranged from "they are extremely dangerous", as was stated by an Estates holder at the March 2011 Imperial Estates Meeting, to people claiming they have been hit harder with Shinai weapons, than the Test Combat Arrow, and have no problem with the hit from the Test Combat Arrows.

8. Areas of concern that were asked at the Imperial Estates Meeting in March 2011.

- **Can they leave bruises?** That depends on the individual. Medications, diet, vitamin and Mineral deficiencies along with overall personal health and natural body design are all factors that may

affect the ability for one to bruise. Some people bruise when bumping into everyday things, like an office desk at work for example, while others would remain unmarked.

- **Do they hurt?** That is a question that is based on personal judgment. Some will say they hurt while others will say that they don't hurt at all. Clothing and distance would also be contributing factors.
- **Can they be used on hollow fiberglass shafts?** The manufacturer recommends the use of solid Fiberglass shafts.
- **Are they Durable?** Yes they are very durable. They have withstood repeated **90 degree** angle and **45 degree** angle shots repeatedly into a solid cement surface without sacrificing the integrity of the head.
- **Are they cost effective?** That is up to the individual to decide.
- **What happens to a watermelon when struck?** Kind of strange question but the "Gallagher" inside of me just has to do it. I purchased the most ripe watermelon I could find from the grocery store. The melon was positioned with landscape timbers behind it and set up so that it would not move much and remained fully braced for the impact at near point blank range. Different individuals took turns shooting at it (it was really fun) in hopes to strike it. When the Test Combat Arrow eventually penetrated it. it went in approximately $\frac{3}{4}$ to 1 inch. The shots that followed seemed to penetrate easier and further as it eventually became mutilated. I did not eat the poor fruit nor did I send it to get mounted and stuffed to hang on the wall in my den, however I will seek out other unsuspecting fruits in which to hunt.
- **Safety in relation to being struck in the eye (innocent bystanders)?** As with all missile weapons, the field boundaries must be taken into account. It is my recommendation that the Minister, or whoever determines the boundaries of the combat field, must keep safety in mind at all times and establish the boundaries accordingly. It is also my recommendation that all combat scenarios that include the use of this missile weapon should also include a buffer distance of at least 35 feet between combat and spectators. The list field parameters doesn't mean that something can't happen, but shows due diligence in defining that we are making attempts to make sure they do not. In addition to bystanders being kept at safe distances, it is still the duty of the Archer to know what is beyond their target. If there is an unarmored individual or spectator behind the target you are about to shoot at, you must not take the shot until the shot is safe. It has been stated that "the eye socket test is not a valid argument due to the fact that an arrow may pass this test if held straight on yet still enter the socket cavity at various angles and velocities". If the eye socket test is to determine whether or not the arrow can make contact to the human eye at all, then even the currently approved arrow may fail.

There is always the possibility that a combat arrow may strike an unarmored individual. There is also the possibility that the arrow could strike someone in the eye. I cannot think of any Adrian approved missile weapon that is exempt from these possibilities.

The question was asked "Why change a combat arrow that works". I am not proposing to change the current Combat Arrow. I am only seeking an alternate choice. Some people may doubt their own mechanical abilities and may not feel comfortable constructing them.

To date I have heard that the Test Combat Arrow testing has to include being struck in the face at close range, and persons must be willing to take a shot in the face at a minimum of 10 yards to even be considered.

Unfortunately the possibility will always exist that any combination of mishaps can occur at any given time. I am uncomfortable with hearing the implications that the current Combat Arrow is so safe that you can shoot unarmored persons at point blank range and no one can get hurt. This type of claim can give the wrong impression and lead to very potentially harmful outcomes.

The Test Combat Arrow has been deliberately abused in an attempt to anticipate the "worst case scenario" and to accelerate the damage that may be caused by repeated hard use. The Test Combat Arrows performed well on the field and showed exceptional unanticipated durability against deliberate abuse.

Opinions of the Test Combat Arrow seem to be very polarized, ranging from "they are extremely dangerous", as was stated by an Estates holder at the March 2011 Imperial Estates Meeting, to people stating they have "been hit harder with Shinai weapons than the Test Combat Arrow and have no problem with the hit from the Test Combat Arrows".

I have seen arrows gleaned from the field and re-used in battles. In fact, during one particular battle, a spent arrow was gleaned and shot back into the opposing army. That arrow struck the opponent, the shaft had pierced the fore end of the Combat head and the unprotected shaft made contact with my body. My armor did its job and in the end there were no notable injuries. It was an obvious mistake, there were no injuries, and it was nothing more than simple equipment failure. It was at that time I began my search for an alternative.

Sir Nickademus Fiend