College of Policing

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T7 Supplementary accuracy testing report

[redacted]

Version 1.0

Contents

Taser 7 Supplementary accuracy testing

Testing by Dstl[1] highlighted some concerns in relation to the Taser 7 (T7) conducted energy device (CED) compared to the Taser X2. In summary this was:

- Accuracy of close quarter cartridge. This was found primarily in an exercise where the user was firing single handed at 3m (Exercise 1) with the close quarter (CQ) 12 degree cartridge.
- A high proportion of users reporting a shot fall to one side.
- Influence of compact battery on accuracy.
- Trapped ejectors.
- Detaching probes at full extension.
- Stiff action of trigger and safety.

On the first two issues, further testing was recommended to understand the problem in more detail.

Executive summary – key findings

Testing was conducted at Hendon, using 12 competent Taser users from both the Metropolitan Police Service (MPS) and National Crime Agency (NCA). In summary, the following key findings of this trial have been made (see also caveats and limitations):

Key finding 1 - Any bias to either the left or right for both weapon systems (T7 and X2) is negligible in this test. All other exercises broadly supported this conclusion.

Key finding 2- The results broadly support Dstl's finding that the X2 has greater practical accuracy than the T7, however the T7 remains an accurate weapon system in the hands of a competent user.

Key finding 3- Trigger finger position has negligible influence on accuracy for either weapon system at 3m when fired with both hands supporting the CED.

Key finding 4- The compact battery had little influence on accuracy in this test.

Key finding 5- The T7 with a close quarter cartridge is marginally more accurate than an X2 for a given probe spread.

Key finding 6- Male and female officers and left and right handed officers achieve similar standards of accuracy in both weapon systems.

Key finding 7- Incidence of pierced ejectors were almost identical to that of the Dstl trial. Overall reliability is a concern, however, this may be largely be confined to one CED that operationally would not have been put into service.

Key finding 8- Almost every participant commented on the stiffness of safety and trigger.

Key finding 9- Training cannot eliminate the risk associated with detaching probes but may assist in its management.

[1] Dstl T7 Interim report presentation from trial and testing, January 2020

Accuracy testing

First, we should consider the definition of 'accuracy'. It is commonly considered as '*the difference between the point of aim (POA) and point of impact (POI)*'. There are two further sub-definitions this report will consider *'intrinsic accuracy'*- the inherent accuracy of the weapon system (usually tested by firing from a clamp or jig) and *'practical accuracy'*- the accuracy in the hands of a competent user.

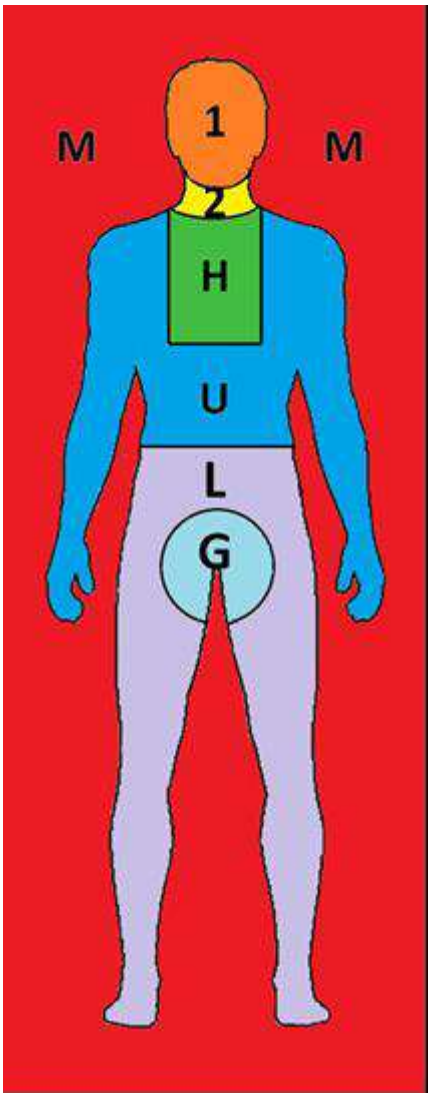


Figure 1

In Dstl's 'lab based' tests, the intrinsic accuracy of Taser 7 was found to be comparable to the X2[2]. Dstl (2020)[3] state "*… the intrinsic accuracy of the device is not the reason for the degradation in user accuracy."* However, during exercise 1 and other exercises of the Dstl handling trial it was found to be less accurate.

In examining the two types of tests, we need to be clear in the methodology of recording accuracy. In the lab based testing, the position of the point of impact was measured in the horizontal and vertical axis, allowing direct comparison with the point of aim produced by the lasers. In the handling trial a simpler method was used, just recording the zone of the target the probe hit (see figure 1), misses were only recorded as a miss[4]. Point of aim was not recorded, the officer was asked to achieve probe placement above and below the belt line. This is the method that has been used on previous trials. With the benefit of hindsight, this does not produce detailed results allowing examination against the primary definition of accuracy as above. It reduces it to a rather polarised 'hit' vs 'miss', where the difference between POA and POI cannot be measured. One could contend in the real world 'hit vs miss' is clearly relevant but it does not allow a measure of accuracy and for the issue to be quantified or explored. However, by measuring the point of impact the latter 'hit vs miss' could be subsequently extrapolated by overlaying the data on a suitable model, such as the target used for qualification purposes.

Next, we need to consider the differences in the X2 and Taser 7 systems. One of the key features of the Taser 7 is introduction of the 'close quarter' cartridge, which has a probe spread of 12 degrees, radically different to 7 degrees of the Taser X2. When fired at a person shaped target, even if the same top probe location is maintained, the lower probe of the Taser 7 will inevitably hit the target significantly lower than the X2.

[2] Dstl T7 Interim report presentation from trial and testing, January 2020

[3] [redacted] (2020), *Physical Assessment of TASER 7™*, Dstl, Page 66, para 6.8.7

[4] [redacted] (2020), *Physical Assessment of TASER 7™*, Dstl, Page 24, para 3.1.16

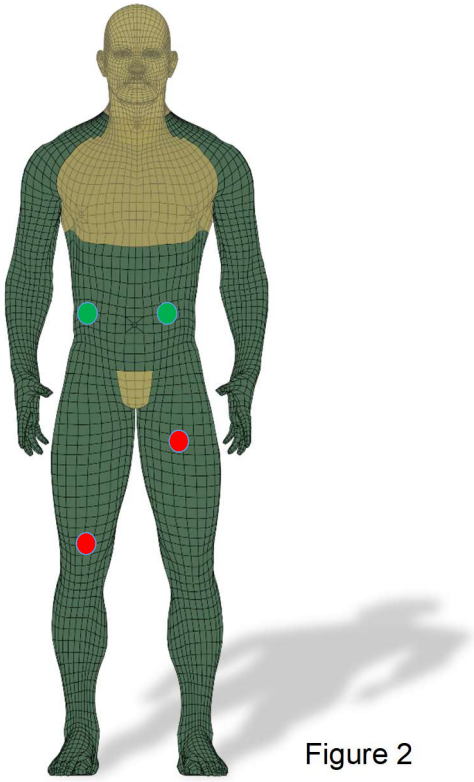


Figure 2

Consider figure 2 (not to scale). The points indicated on the left would be preferred probe placement (above and below the beltline) for a Taser 7. One can see the lower probe is approximately 70cm below the upper probe and is therefore has to engage a much narrower target area. The shot on the right shows an X2 probe spread at the same distance. One can see the lower probe has a much wider target area to hit. Therefore, any lateral inaccuracy induced by the user is likely to have a far greater impact on the Taser 7 than the X2 for a given distance.

One could contend to make a comparison of accuracy between a Taser 7 and an X2 at a given distance has its limitations, as the user has to deliver a radically different probe spread. An additional evaluation of the system may be to compare the accuracy of a given probe spread. For example, the probe spread at 3m for a Taser 7 and CQ cartridge (70-75cm) is comparable to the probe spread of an X2 at approximately 5.7m to 6m.

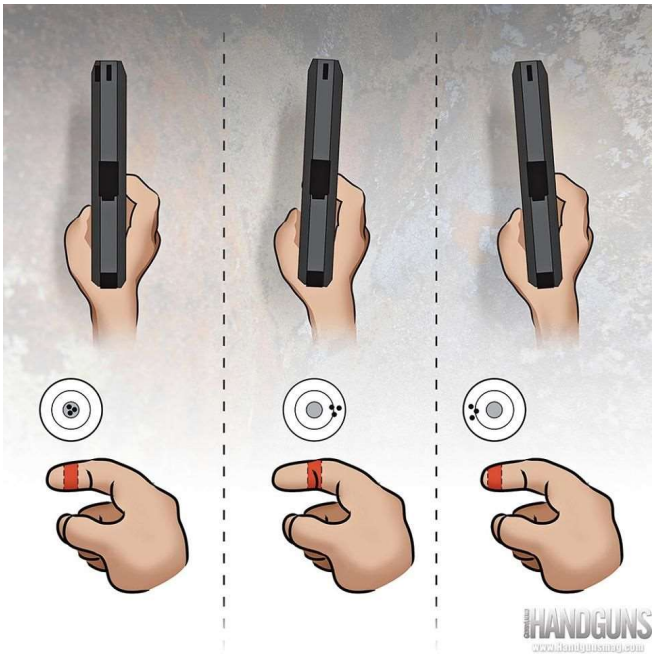


Figure 3

Feedback from earlier adopters of the T7 in the United States ([redacted] 2020[5]) highlights that trigger finger placement may be a contributing factor. This is a recognised issue in pistol shooting, for which a number of articles and publications exist. An example can be seen in figure 3[6] that illustrates the point.

It should be noted in the pistol example given they are only dealing with a single shot (equivalent to the upper probe only). The lower probe may produce different results.

[5] [redacted] (2020), *Taser T7 – US Police Department User Feedback,* Dstl, Page 3 Accuracy – User Impact

[6] www.handgunsmag.com

Further testing

To examine the above hypotheses a further trial was developed. This testing blended the accurate recording of probe position with the handling and firing conducted by competent users. The horizontal and vertical position of each probe was recorded, similar to the lab based testing, and the user was directed as to their point of aim, at the centre of the cross with lower laser on the vertical line (figure 4). This allowed measurement of the difference between POA and POI.

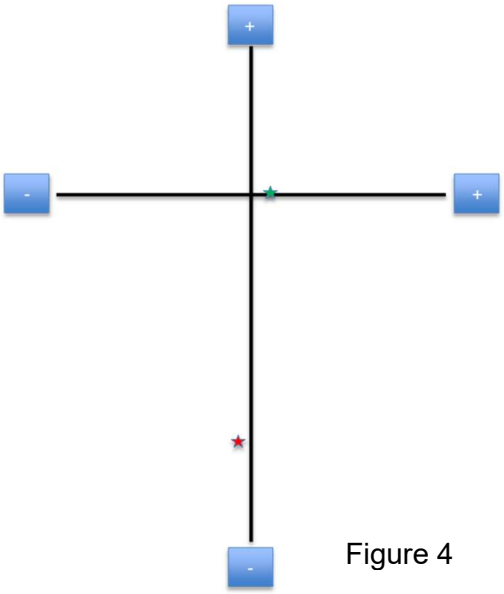


Figure 4

Eight exercises were developed.

1. Taser 7 at 3m, two handed with the users default trigger finger placement.
2. Taser 7 at 3m, two handed with user directed to use ‘crook of finger’.
3. Taser 7 at 3m, two handed with user directed to use ‘pad of finger’.
4. Taser 7 repeat of exercise 3 with compact battery.
5. Taser X2, as per exercise 1
6. Taser X2, as per exercise 2
7. Taser X2, as per exercise 3
8. Taser X2, as per exercise 3 but at probe spread equivalent distance of 5.7m.

Each exercise was repeated three times by 12 users. The users were divided into groups of three. Groups (1) and (3) conducted the exercises in order as above. Groups (2) and (4) conducted the exercises in the following order 1-3-2-4-5-7-6-8. The order of exercises 2 and 3 and 6 and 7 were switched to balance out any ‘learning effect’ that may have an effect on improved performance.

The purpose of the above exercises was to:

- allow the level of accuracy to be quantified allowing a direct comparison of practical accuracy between the two weapon systems. (Ex 1 vs 5)
- remove the ‘single handed shooting’, which may also be a contributing factor and something we would not encourage with large probe spreads and/or increased distance. (All exercises)
- allow examination of trigger finger placement contributing to inaccuracy. (Comparison of Ex 1 to 3 and Ex 5 to 7)
- allow examination of whether the compact battery has an impact on accuracy. (Ex 3 vs 4)
- allow comparison of the two weapon systems at an equivalent probe spread. (Ex 3 vs 8)

The scope of these exercises were intentionally limited to the identified issues. These tests are supplementary to the more extensive Dstl testing and have not been designed as a replacement.

The tests were conducted by the College of Policing and NPCC with support from the Metropolitan Police. Members of SACMILL were invited to observe.

All T7s devices were revision E and had firmware version 1.3.14. The laser warning label indicated the laser was class 3R (figure 5). This appears to address the concern raised by Dstl[7]. Only ten T7s were available with four officers sharing two weapons, the other eight having a T7 each. Each officer used the same allocated weapon throughout the trial.

Figure 5

Other issues

All shots were monitored for pierced ejectors and occurrences noted. Any other faults were noted and recorded.

At the conclusion of the trial, the participants were invited to complete a questionnaire in the same format as the Dstl trial. Any questions relating to matters the participants had not experienced were removed. However, the question relating to the safety lever and trigger remain, allowing officer's observations to be captured.

The trial

The trial was conducted at the MPS training facility Hendon. The cohort of twelve officers from both the MPS and NCA, were all existing competent Taser users. There were six female and six male officers, of which four were left handed and eight right handed. Their key hand dimensions were also recorded along with key data relating to their service and experience with a CED. (See Appendix 2)

The results

Accuracy

The full results can be found in appendix 1. For the purpose of this report, they are summarised in tables below (all data is shown in centimetres, unless otherwise stated). Examination of these results will primarily focus on the horizontal axis, which is likely to have a far greater impact on accuracy. However, data is also available for the vertical axis.

Table 1 – accuracy using default trigger finger placement

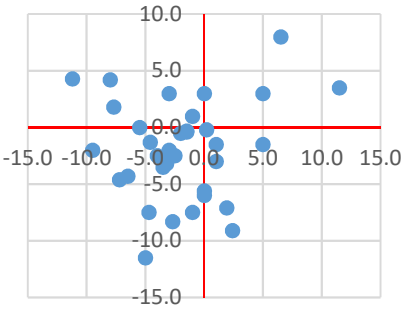
	Exercise	Mean	Median	Left range	Right range	Range	Mean horizontal deviation
Default trigger finger	**Ex 1 top (T7)**	-1.92	-2.5	-11.2	11.5	22.7	3.9
	Ex 5 top (X2)	1.25	1.0	-3.5	6.4	9.9	1.8
	Ex 1 bottom	0.15	0.4	-9.5	9.5	19	3.0
	Ex 5 bottom	0.21	0.0	-4.0	4.5	8.5	1.4

[7] [redacted] (2020), *Physical Assessment of TASER 7™*, Dstl, Page 76, para 6.13.5

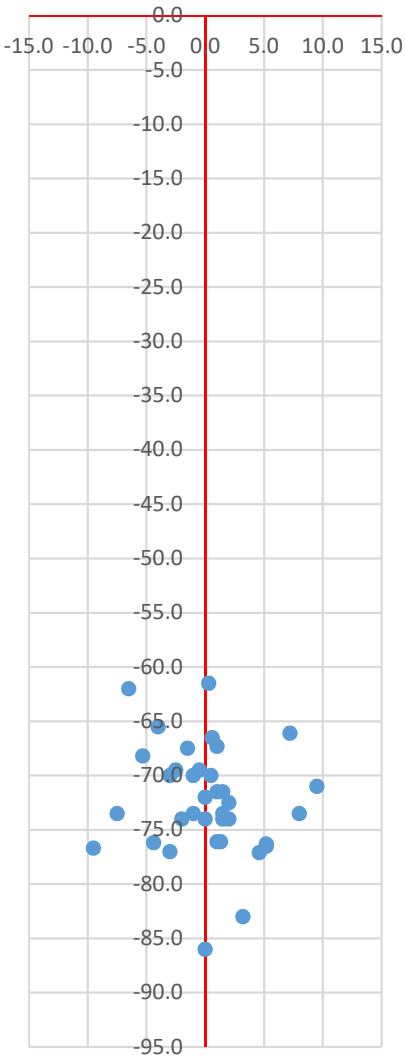
From the results, the mean deviation from the central axis could be calculated. In exercise 1 (T7) the mean deviation of the top probe was 1.9cm to the left in comparison to 1.3cm to the right for the X2 in exercise 5. For the bottom probe, it was 0.2cm to the right for the T7 and 0.2cm to the right for the X2.

When the positions of the x and y coordinates of the probes in exercise 1 (T7) and exercise 5 (X2) are plotted no distinct left or right bias is observed. (See graphs 1 and 2 below)

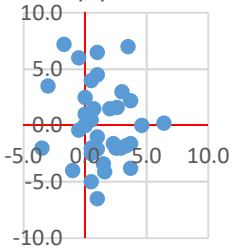
Graph 1- Ex 1 Top probe



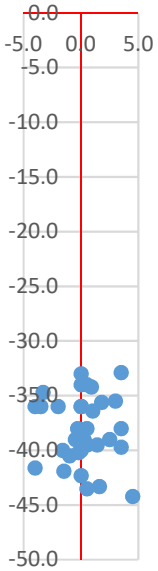
Graph 2- Ex 1 bottom probe



Graph 3- Ex 5 Top probe



Graph 4- Ex 5 bottom probe



Note graphs may not be exactly to scale.

Key finding 1 - Any bias to either the left or right for both weapon systems is negligible in this test. All other exercises broadly supported this conclusion.

Whilst the above will highlight any right or left bias, examining the mean deviation may not give an accurate picture of accuracy, as an inaccurate shot to the left would 'balance out' an inaccurate shot to the right. Therefore two further parameters were calculated, the horizontal range (i.e. total distance from shot furthest to the left to furthest to the right) and the mean horizontal deviation, irrespective of it being to the left or right (Table 1, last column). Clearly the lower the number the greater the practical accuracy. One can observe in table 1, above, that the X2 clearly produced better results than the T7, as the range was greater, as was the mean horizontal deviation for the T7. However, the mean horizontal deviation was 1.8cm (top probe) and 1.4cm (bottom probe) for the X2 in comparison to 3.9cm/3.0cm respectively for the Taser 7. In essence barely a 2cm difference. All other exercises produced broadly similar results. One should remember the officers participating in the trial are far more familiar with the X2 than the T7.

Figure 6

Of greater note was the increased 'range' 9.9cm/8.5cm for the X2 and 22.7cm/19cm for the T7. It should be remembered that officers undertake robust assessment in relation to accuracy via a qualification shoot. Consider figure 6, which shows a standard target used for qualification purposes, it being approximately 16cm across where the T7 lower probe would be likely to hit. Any officer that could not fire the weapon accurately would not be authorised to carry it.

Key finding 2- The results broadly support Dstl's finding that the X2 has greater practical accuracy than the T7, however the T7 remains an accurate weapon system in the hands of a competent user.

Influence of trigger finger position

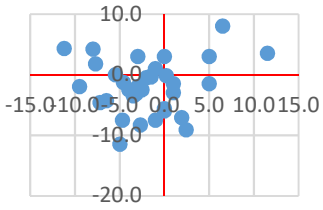
The trial compared various trigger finger placements and their impact on accuracy. As can be seen from table 2 below, their impact was negligible on both weapon systems. This is highlighted by the mean horizontal deviation, which for the T7 was 3.9cm, 3.7cm, and 3,4cm for the top probe and 3.0cm, 3.4cm and 2.9cm for the bottom. In other words, for the T7, trigger finger placement produced differences of approximately 5mm. Similar results can be observed for the X2 with differences in the order of 4 to 7mm. These differences are negligible given the nature of the test.

Table 2 – accuracy comparing trigger finger placement

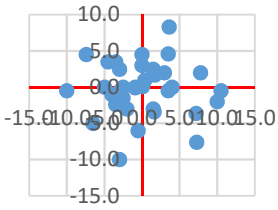
	Exercise	mean	median	Left range	Right range	Range	Mean Horizontal Deviation
Default trigger finger	**Ex 1 top**	-1.92	-2.5	-11.2	11.5	22.7	3.9
	Ex 5 top	1.25	1.0	-3.5	6.4	9.9	1.8
	Ex 1 bottom	0.15	0.4	-9.5	9.5	19	3.0
	Ex 5 bottom	.21	0	-4.0	4.5	8.5	1.4
Crook trigger finger	**Ex 2 top**	0.0	-0.3	-10	10.5	20.5	3.7
	Ex 6 top	0.4	0.5	-5.2	5.5	10.7	2.0
	Ex 2 bottom	0.5	0.8	-11	11.5	22.5	3.4
	Ex 6 bottom	0.0	0.1	-5.5	5.0	10.5	2.1
Pad trigger finger	**Ex 3 top**	-1.1	-1.4	-8.7	10	18.7	3.4
	Ex 7 top	0.8	0.5	-5.0	6.5	11.5	2.2
	Ex 3 bottom	-0.8	-0.6	-10.5	11.0	21.5	2.9
	Ex 7 bottom	-0.2	0.5	-4	4.5	8.5	1.9

When plotted as a scatter graph the shot distribution can be observed. Graphs 5 and 6 below show shot distribution for default trigger finger placement, graphs 7 and 8 crook of finger and graphs 9 and 10 pad of finger. The mean point of impact appears central or very close to central point of aim, further supporting the finding that trigger finger position had little influence in this test.

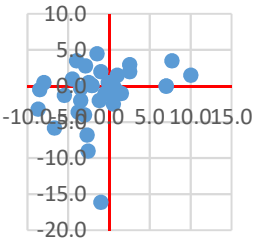
Graph 5- Ex 1 Top probe



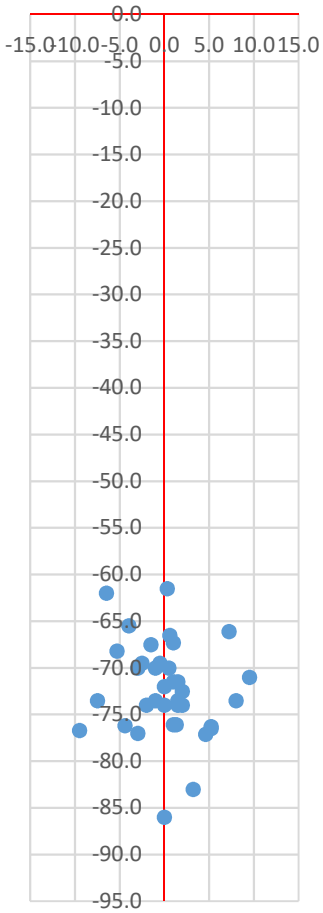
Graph 7 - Ex 2 Top probe



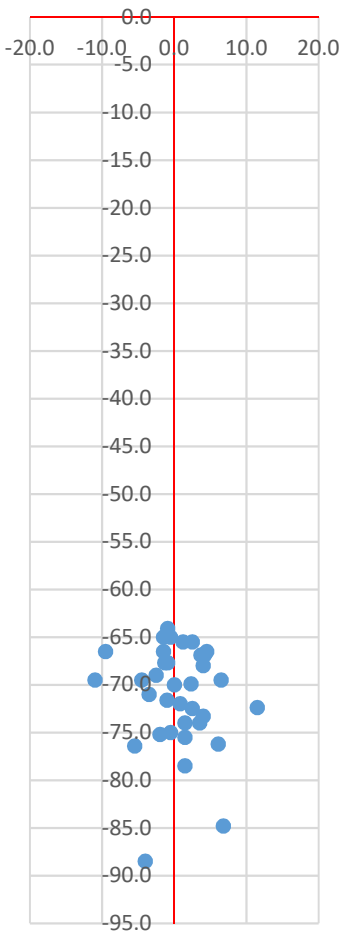
Graph 9 - Ex 3 Top Probe



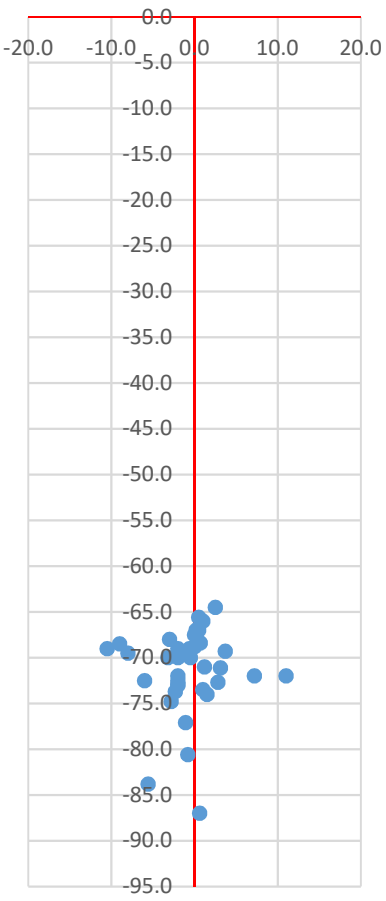
Graph 6- Ex 1 bottom probe



Graph 8 - Ex 2 Bottom probe



Graph 10- Ex 3 bottom probe



Graphs may not be exactly to scale.

Examining this point further, this seems a logical conclusion. Whilst the trigger finger position may produce an angular deflection of the weapon as it is fired, given the close range its impact on accuracy is limited. Therefore, whilst a pistol fired at much greater range may

exhibit this phenomenon, when the sub-tension[8] of the angle is considered at 3m it is unlikely to be observed. For example, a 1 degree angle subtends to 5cm at 3m, 9cm at 5m and 17cm at 10m. For the mean horizontal deviation observed in exercise 1, this means the angular deflection of the weapon is approximately 0.745°[9] for the top probe and 0.573°[10] for the bottom probe.

Knowing that, if trigger finger placement were an issue we would also expect it to be present in the discharge of stand-off cartridges at increased distance, as distance would magnify the error. According to the Dstl report (2020)[11], *"…the TASER 7™ 3.5° operational cartridge top probe miss rate to be comparable with the X2™",* therefore this was not observed in the Dstl trial.

Whilst a left bias may have been reported by participants in the earlier trial, it was not observed in this trial. Nor did participants make similar observations. Whilst trigger finger placement remains a plausible theory, it may be the use of double-handed firing largely eliminated any effect.

Key finding 3- Trigger finger position has negligible influence on accuracy for either weapon system at 3m when fired with both hands supporting the CED.

Compact battery

A test was included to examine the influence of a compact battery on accuracy. In examining the results from exercises 3 and 4, one can see they are broadly similar, with one centimetre or less difference in range and mean horizontal deviation.

Table 3 – accuracy using compact battery vs tactical battery

	Exercise	mean	median	Left range	Right range	Range	Mean Horizontal Deviation
Compact battery	**Ex 3 top**	-1.1	-1.4	-8.7	10	18.7	3.4
	Ex 4 top	-0.1	-0.5	-9.0	10.5	19.5	3.0
	Ex 3 bottom	-0.8	-0.6	-10.5	11.0	21.5	2.9
	Ex 4 bottom	-0.7	-0.8	-10.5	10.0	20.5	3.7

Key finding 4- The compact battery had little influence on accuracy in this test.

[8] **Subtension** refers to the length between two points on a target, and is usually given in either centimetres, millimetres or inches. The **subtension** covered by a given angle increases with distance to the target.

[9] Given a=3.9cm (deviation) and b=300cm (distance to target), ∠α = 0.745°

[10] Given a=3.0cm (deviation and b=300cm (distance to target, ∠α = 0.573°

[11] [redacted](2020), *Physical Assessment of TASER 7™*, Dstl, Page 52, para 4.3.1

Equivalent probe spread

The accuracy of the T7 was examined against the X2 for a given probe spread (T7 at 3m vs. X2 at 5.7m). Again, the horizontal results could be examined as a guide to accuracy. As can be seen from the results below the T7 was slightly more accurate than X2 for an equivalent probe spread.

Table 4 – accuracy at equivalent probe spread

	Exercise	mean	median	Left range	Right range	Range	Mean Horizontal Deviation
Equivalent probe spread	**Ex 3 top**	-1.1	-1.4	-8.7	10	18.7	3.4
	Ex 8 top	2.4	2.5	-13.9	10.4	24.3	4.3
	Ex 3 bottom	-0.8	-0.6	-10.5	11.0	21.5	2.9
	Ex 8 bottom	0.0	0.0	-8.7	7.5	16.2	3.8

Key finding 5- The T7 with a close quarter cartridge is marginally more accurate than an X2 for a given probe spread.

Officer characteristics

The trial had an equal number of male and female officers, and eight right-handed and four left-handed officers, more than the commonly accepted 10% by population. It is important that any weapon system is accessible to as many officers as possible and sex and dominant hand should not be a limitation. Examination of the results across all exercises show that male and female officers produced very similar results, suggesting the officer's sex has no influence on accuracy. Women were marginally more accurate than men, but not by a significant amount. Interestingly the difference in accuracy between the two weapons was less marked for women than it was for men, although by only a small margin.

Table 5 - Mean horizontal deviation by exercise and sex

		Female (T7)	Male (T7)			Female (X2)	Male (X2)
Exercise 1	**Top**	3.8	4.0	**Exercise 5**	**Top**	2.0	1.6
	Bottom	2.7	3.4		**Bottom**	1.0	1.9
Exercise 2	**Top**	3.1	4.3	**Exercise 6**	**Top**	2.3	1.7
	Bottom	2.6	4.2		**Bottom**	2.3	1.8
Exercise 3	**Top**	2.5	4.2	**Exercise 7**	**Top**	2.0	2.4
	Bottom	1.7	4.0		**Bottom**	1.6	2.3
Exercise 4	**Top**	2.2	3.8	**Exercise 8**	**Top**	4.1	4.4

	Bottom	2.9	4.5		**Bottom**	4.0	3.7
Mean top		2.9	4.1	**Mean top**		2.6	2.5
Mean bottom		2.5	4.0	**Mean bottom**		2.2	2.4

When the shots with the greatest deviation to the left or right were identified for each exercise, eight of these 'worst shots' were produced by men and eight by women on the X2 and two worst shots were produced by women and 14 by men on the T7.

Similarly, the left-handed vs right-handed produced broadly similar results supporting the conclusion the weapon is ambidextrous.

Table 6 - Mean horizontal deviation by exercise and dominant hand

		Right (T7)	**Left (T7)**			**Right (X2)**	**Left (X2)**
Exercise 1	**Top**	4.0	3.8	**Exercise 5**	**Top**	1.7	2.1
	Bottom	2.7	4.0		**Bottom**	1.1	2.2
Exercise 2	**Top**	2.9	4.5	**Exercise 6**	**Top**	2.2	1.6
	Bottom	2.8	3.9		**Bottom**	1.9	2.5
Exercise 3	**Top**	2.7	4.5	**Exercise 7**	**Top**	2.1	2.3
	Bottom	1.7	4.4		**Bottom**	1.5	2.7
Exercise 4	**Top**	2.0	4.3	**Exercise 8**	**Top**	4.2	4.5
	Bottom	3.0	4.4		**Bottom**	3.9	3.7
Mean top		2.9	4.3	**Mean top**		2.6	2.6
Mean bottom		2.6	4.2	**Mean bottom**		2.1	2.8

When the shots with the greatest deviation to the left or right were identified for each exercise, six of these 'worst shots' were produced by left handed firers and ten by right handed firers on the X2 and 11 worst shots were produced by left handed firers and five by right handed firers on the T7.

Key finding 6- Male and female officers and left and right handed officers achieve similar standards of accuracy in both weapon systems.

Faults

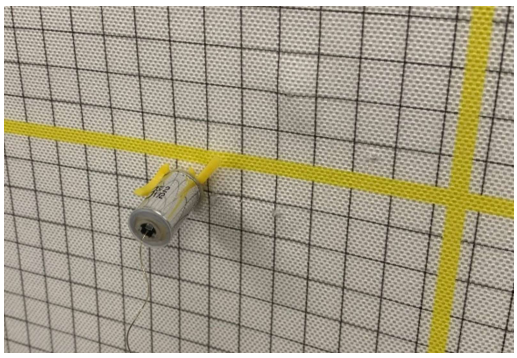


Figure 7

During the trial approximately 172 cartridges were fired.

Four pierced ejectors were observed, a ratio of 1:43. An example is shown in figure 7. This is consistent with the findings of the Dstl trial (1:42)[12]. Officers are trained to deal with contingencies where the first shot fails to incapacitate. This may include firing a second shot. The probability of encountering two consecutive pierced ejectors is 1:1849, based on probability of a single event being 1:43.

Twelve cartridges (1:14) failed to fire, despite repeated attempts including reseating. One of these cartridges was revision B, 11 were revision A. Of note is eight of these faults occurred with the same weapon.

One cartridge (Rev B) could not be fitted to the CED as the steel band at the rear of the cartridge was raised preventing it being inserted.

Key finding 7- Incidence of pierced ejectors were almost identical to that of the Dstl trial. Overall reliability is a concern, however, this may be largely be confined to one CED that operationally would not have been put into service.

A full list of faults can be found in table 8 below.

Table 8 – fault log

Time	Participant	CED SN	Cartridge SN	Description
15:45	3	X40005XIR	X4920D42Y Rev A	Pierced ejector – penetrated target
15:58	4	X40005YWY	X4920DNXA Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:02	4	X40005YWY	X4920DP0E Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:03	4	X40005YWY	N/K Rev A	Pierced ejector – bounced out
16:12	5	X40005YWA	X4920DFR0 Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:14	7	X40005YWH	X4920TDWW Rev B	Cartridge failed to fire. Re-seated, shows as spent.

[12] [redacted] (2020), Physical Assessment of TASER 7™, Dstl, Page 80

16:15	4	X40005YWY	X49200P19 Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:16	4	X40005YWY	X4920DNXF Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:28	9	X40005YWH	X4920TE6W Rev B	Pierced ejector – bounced out
16:34	4	X40005YWY	X49200DNWX Rev A	Pierced ejector – bounced out
16:41	5	X40005YWA	X4920DNV6 Rev A	Cartridge fault
16:43	5	X40005YWA	X4920DF9X Rev A	Cartridge fault
16:44	4	X40005YWY	X4920DC10 Rev A	Cartridge fault
16:46	4	X40005YWY	X4920DNTN Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:47	4	X40005YWY	X4920DHRV Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:50	4	X40005YWY	X4920DNK5 Rev A	Cartridge failed to fire. Re-seated, shows as spent.
16:50			X4920TE7X Rev B	Steel band at rear of cartridge raised, fouling on cartridge bay. Cannot be inserted.
16:52	12	X400061RW Rev E Battery X44004133 Rev X20		When loaded, torch and lasers flashing, blank CID. No faults show when unloaded. Fresh cartridges same fault. New battery cleared fault.

Questionnaire results

A summary of the questionnaire responses can be found in table 9 below.

Overall, most officers found the T7 to be accurate (Q1), easy to point and aim (Q2), easy to load and unload (Q3), easy to fit and remove the battery (Q4) and easy to use without risk of electric shock to the officer. None of them reported a left bias as per the Dstl trial.[13]

However, it is the responses to question 5 that require some consideration. The participants were asked whether they agreed/disagreed with the following statement:

> *"The device is easy to operate, including the safety switch and trigger."*

In the case of the T7, only three people tended to agree or strongly agreed with this statement, with six tending to disagree and three strongly disagreeing. By comparison, in the case of the X2, nine strongly agreed and three tended to agree, with none disagreeing.

The officers were also given opportunity to provided comments, examples of which are included below on this issue:

> *"In regards to turning the safety button off, it takes a lot longer to turn it off than the X2. It is possible to do but it is a lot harder and takes time and would be harder to use in the real world."*
>
> *"The T7 is a lot bigger in my hand than the X2 is. I found it more difficult to squeeze the trigger on the T7."*
>
> *"Trigger and safety stiff on T7."*
>
> *"T7 trigger is stiff and hard to use…"*
>
> *"The T7 trigger was more difficult to push…"*
>
> *"Didn't like the trigger, safety catch quite stiff…"*
>
> *"Trigger is more like a switch than a trigger…"*
>
> *"T7 safety slightly stiffer, may help prevent accidents."*
>
> *"T7 trigger grip good around handle- requires more pressure to shoot than X2. X2 very light and easy to 'ND' (negligent discharge).*
>
> *"I feel the safety switch is too stiff and find it difficult to use on the T7. The trigger switch is also incredibly stiff."*

Key finding 8 - Almost every participant commented on the stiffness of safety and trigger.

It should be noted the devices used in the trial were brand new, it is not known whether the action of the trigger and safety will ease with use. However, four members of the College of Policing team recently attended a Master Instructors' Course and used the T7 extensively. None of them noticed the trigger or safety being particularly stiff. This may be because the training was far more dynamic and scenario based, meaning there was less focus on such issues.

Whilst a 'light' trigger does aid accurate shooting, indeed target shooting firearms have very light triggers, they are easily fired accidentally, the literal 'hair trigger'. Conversely, a stiffer trigger is relatively more difficult to fire accurately but is less easily fired accidentally. It is for this reason police pistols have a minimum trigger 'weight' specified. This standard is often

[13] [redacted] (2020), *Physical Assessment of TASER 7™*, Dstl, Page 82

attributed to such incidents as the death of five year old John Shorthouse in 1985, when a police revolver was fired accidentally[14] during a search of his home.

The Taser 7 specification sheet states the trigger weight for a T7 to be 4.2lb[15] (1.91kg). Whilst the trigger weight for an X2 and X26 are not specified by Axon, Kroll (2017)[16] quotes them as "…only 2lbs" for the X26 and "…about 3lb" for the X2. So whilst the T7 has a higher trigger weight, it is not excessive and at the lower end of the scale of the equivalent specification for police pistols. (Circa: 2.3kg (5lb) to 6.8kg (15lb) depending on type).

Previous commentary on the X2 has observed it may be more prone to unintentional discharge therefore, one could speculate that a T7 may be less prone and that this may have been Axon's intention in its design.

It is also worthy of note that the safety on the X2 was originally (prior to introduction in the UK) considered too light and a 'positive safety lock' was retrofitted[17].

Changing to a new device can often be like a 'new pair of shoes', they feel uncomfortable and unfamiliar in the short term but the more one is exposed to a new device the more comfortable officers may become. The stiff safety lever and trigger of the T7 may be something officers simply get used to, but much beyond this, training can only familiarise officers with the CED's action and expedite this familiarisation process.

[14] https://www.birminghammail.co.uk/news/midlands-news/thirty-years-kings-norton-youngster-9903425

[15] *Taser 7, CEW Specifications*, 2019, V2.0 December 2018, Axon Ent. Inc

[16] Kroll, Mark, 2017, *Misunderstanding the Trigger-pull Download,* ResearchGate

[17] https://help.axon.com/hc/en-us/articles/115003581574-Installing-Positive-Safety-Locks-PSLs-

Table 9 – Questionnaire results

Question no. (Dstl trial Q no)		1 (Q1)		2 (Q5)		3 (Q6)		4 (Q7)		5 (Q8)		6 (Q11)		7 (Q14)	
	Participant number	The device is accurate		The device is easy to point and aim.		The device is easy to load and unload.		The battery is easy to fit and remove.		The device is easy to operate, including the safety switch and trigger.		The device is safe to use without risk of electric shock to the officer.		The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle.	
		T7	X2	T7	X2	T7	X2	T7	X2	T7	X2	T7	X2	T7	X2
Female	1	3	3	3	4	2	4	4	4	1	4	3	3	1	4
Female	2	3	3	3	4	2	4	4	4	2	4	4	3	2	3
Male	3	2	4	3	4	4	2	4	4	2	4	4	4	4	4
Female	4	4	4	3	4	3	3	3	3	3	3	3	3	3	3
Female	5	3	4	4	4	4	3	4	3	2	4	4	4	3	4
Male	6	3	4	4	4	4	3	4	4	4	4	4	4	4	4
Male	7	3	4	4	4	4	4	4	4	3	4	4	4	3	4
Male	9	4	3	4	4	2	3	4	3	2	3	2	3	2	3
Female	10	2	4	4	4	4	4	4	4	1	4	4	4	4	4
Female	12	4	3	4	3	3	2	3	1	2	3	4	4	4	4
Male	13	4	4	4	4	4	4	4	4	1	4	4	4	2	4
Male	14	4	3	3	4	4	3	4	4	2	4	4	4	3	4
	Totals	T7	X2	T7	X2	T7	X2	T7	X2	T7	X2	T7	X2	T7	X2
4	Strongly Agree	5	7	7	11	7	5	10	8	1	9	9	8	4	9
3	Tend to Agree	5	5	5	1	2	5	2	3	2	3	2	4	4	3
2	Tend to Disagree	2	0	0	0	3	2	0	0	6	0	1	0	3	0
1	Strongly Disagree	0	0	0	0	0	0	0	1	3	0	0	0	1	0
N	Don't Know	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Detaching probes

This is not an issue that has been encountered before with previous devices. If an officer misses with an X26 or X2 typically, the probes reach full extension of the wire and recoil landing somewhere near the officer. It is not unknown for them to strike the officer, however, by such time they have lost most of their kinetic energy so are unlikely to cause significant injury.

There has been some speculation that the probes detaching is a safety feature to prevent the recoiling probe hitting the officer given the increase in kinetic energy. I would not like to comment on the issue in the absence of any data or comment from Axon but on face value, it seems plausible.

Exploring this issue further, officers with existing devices already have to manage a 'backdrop' when firing the device, which is limited to the length of the wire. With a detaching probe, it is likely this backdrop is increased. As officers already have to manage a backdrop it is feasible that training could cover such issues, indeed officers manage much greater backdrops and greater injury potential with conventional firearms and other less lethal weapons. However, greater understanding is required of the probes trajectory, remaining kinetic energy and injury potential before any accommodation could be made in training. Data has been provided by Axon, who supplied the graph below (graph 11).

Graph 11

[redacted] However, it would be fair to conclude that the danger the probe may present decreases with distance, as the kinetic energy and height degrades, with the greater danger being in the first half of its flight.

[redacted]

In addition, further commentary has been provided by [redacted], after a visit to forces in the United States that have adopted the T7. He stated:

"…a test was carried out over 60 feet and a cartridge was fired at a target aiming both laser dots at the target; one was high, one was low. As expected both probes detached at around 25 feet and the barbs dropped 3 feet, with the upper probe embedding itself into the target at least 3 feet below the initial aim point. The probe embedded into the target up to the 1st barb indicating a significant loss of speed and velocity."

The upper probe is of primary concern as the lower probe's trajectory is such that it is likely to impact the ground far sooner than the upper.

Obviously, the injury potential to a bystander, which could include a police officer, cannot be overlooked. However, this is limited to the injury potential of the probe itself. Training cannot eliminate this risk but may assist in its management.

This issue does not currently appear in Axon's own training material, although I understand this is being addressed as a result of feedback from the UK.

Key finding 9 – Training cannot eliminate the risk associated with detaching probes but may assist in its management.

Caveats and limitations

- This report is largely produced in response to Dstl findings.
- The scope of these exercises were intentionally limited to the identified issues. These tests are supplementary to the more extensive Dstl testing and have not been designed as replacement.
- The test was limited to a cohort of twelve officers. Every attempt was made to ensure they were a broad representation of a diverse work force.
- All measurements were made by hand using a tape measure. The same person took all the measurements in each lane for consistency. The target had a grid to ensure measurements were taken perpendicular to the relevant axis.
- Measurements are provided in centimetres and calculations are to one decimal place.
- The T7 devices and cartridges were provided by Axon, for the period of the test. The College does not have routine access to Taser 7 devices to explore any issues further.
- Axon were not present during any of the testing.
- The Taser X2 devices and cartridges were provided by the MPS.
- The scope and depth of this report has been limited to what is achievable within the time constraint provided.
- Data has not be subject to an analysis for statistical significance.
- Participants were given only limited training sufficient to undertake the trial.

Conclusion

This report set out to explore the following issues:

- Accuracy of close quarter cartridge.
- A high proportion of users reporting a shot fall to one side.
- Influence of compact battery on accuracy.
- Trapped ejectors.
- Detaching probes at full extension.
- Stiff action of trigger and safety.

In examining the above, the following key findings have been identified:

Key finding 1- Any bias to either the left or right for both weapon systems (T7 and X2) is negligible in this test. All other exercises broadly supported this conclusion.

Key finding 2- The results broadly support Dstl's finding that the X2 has greater practical accuracy than the T7, however the T7 remains an accurate weapon system in the hands of a competent user.

Key finding 3- Trigger finger position has negligible influence on accuracy for either weapon system at 3m when fired with both hands supporting the CED.

Key finding 4- The compact battery had little influence on accuracy in this test.

Key finding 5- The T7 with a close quarter cartridge is marginally more accurate than an X2 for a given probe spread.

Key finding 6- Male and female officers and left and right handed officers achieve similar standards of accuracy in both weapon systems.

Key finding 7- Incidence of pierced ejectors were almost identical to that of the Dstl trial. Overall reliability is a concern, however, this may be largely be confined to one CED that operationally would not have been put into service.

Key finding 8- Almost every participant commented on the stiffness of safety and trigger.

Key finding 9- Training cannot eliminate the risk associated with detaching probes but may assist in its management.

Response to findings

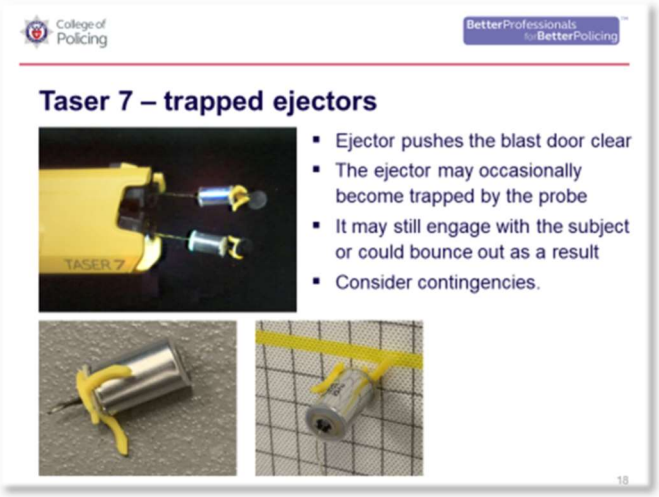
Accuracy- during assessment officers are required to demonstrate their proficiency and accuracy with a CED during a 'qualification shoot'. The proposed qualification shoot for the T7 demands the same standard of accuracy as for both the X26 and X2. Any officer that cannot achieve the required standard of accuracy will not be authorised to use the device.

Compact batteries- whilst the above testing demonstrated the compact battery has little influence on accuracy, the College accepts the Dstl recommendation *"…information should be available to officers to aid selection of the correct battery. It is recommended that this selection is covered in training."* (Dstl 2020)[18] Unit J4.5 (Carries and Uses a Taser Covertly) of the curriculum will be amended to include advice on battery selection.

[18] [redacted] (2020), *Physical Assessment of TASER 7™*, Dstl, Page 41

Pierced ejectors- for CED users training already includes suitable contingencies should the use of a CED not be effective. Additional training will be provided in the characteristics of this phenomenon, see figure 8. This slide has now been included in unit J2.3 as it relates to the Taser 7. Note more extensive trainer notes are also included with the slide.

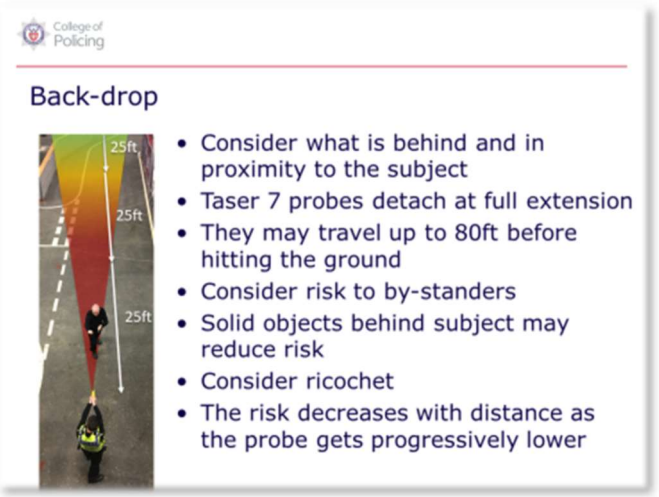
Figure 8



Trigger and safety stiffness- It should be recognised that the characteristics of the T7 are fundamentally different to that of previous devices, despite some similarities. It is essential officers are given sufficient time and exposure to the new device to become familiar with such characteristics. In this regard there is little substitute for repetition of drills in order for officers to develop the requisite 'muscle memory'. Therefore, the importance of such drill training cannot be over-emphasised and it must be a cornerstone of training for both existing and new users alike. This point will be given due prominence in the training implementation plan and training of Taser Lead Instructors in the Taser 7 device.

Detaching probes- Officers already have to manage the backdrop associated with a CED discharge with existing devices, albeit limited to the range of the device. As the probes for the T7 are highly likely to detach at full extension, training will include relevant information in the management of such a backdrop. A draft of the proposed PowerPoint slide is shown in figure 9.

Figure 9



Appendices

Appendix 1 – Excel spreadsheet containing all firing data and analysis. Note there are separate spreadsheets (see individual tabs) for:

- Each weapon (master)
- Each weapon by sex of officer
- Each weapon by dominant hand of officer

Appendix 2 – Excel spreadsheet containing questionnaire results.

Acknowledgments

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