[redacted]

Physical Assessment of TASER 7™

[redacted], [redacted], [redacted], [redacted]

Dstl/TR117685 v1.0
13 March 2020

Dstl
Counter Terrorism and Security
Porton Down
Salisbury
Wilts
SP4 0JQ

[redacted]

[redacted]

Release Conditions

This document, which was produced by Dstl for Home Office Science under the Crime and Policing Services SLA, is approved for public release.

Authorisation		
Role	**Name**	**Date**
Project Manager	[redacted]	12 March 2020
Technical Reviewer	[redacted]	12 March 2020
Project Technical Authority	[redacted]	12 March 2020
Author	[redacted]	13 March 2020

[redacted]

[redacted]

Executive summary

The UK Home Office and National Police Chiefs' Council (NPCC) have a requirement for a Conducted Energy Device suitable for covert carriage to replace the TASER X26™. The TASER 7™ was identified by the NPCC as a potential candidate. Dstl were tasked by the Home Office Commissioning Hub to conduct an assessment of the TASER 7™ to evaluate the compliance of the TASER 7™ with the Police Operational Requirements, which were subsequently extended to include both covert and overt police roles.

This report describes the physical assessment of the TASER 7™ for technical and user handling performance. The results from this assessment will also inform the independent Scientific Advisory Committee on the Medical Implications of Less-Lethal weapons (SACMILL) to aid their understanding of the TASER 7™ system as well as informing the Home Office, Police and College of Policing of the system's performance.

The TASER 7™ is a two shot device that has two types of operational cartridge: Standoff and Close Quarter. The Standoff cartridge fires a pair of probes at an angle of 3.5°, while the Close Quarter cartridge fires a pair of probes at an angle of 12°. Hook and Loop Training (HALT™) versions of both the Standoff and Close Quarter cartridges are also available.

TASER 7™ beneficial aspects

- The TASER 7™ Adaptive cross-connect feature, if it operates in the way that the manufacturer claims, is an improvement over the current devices and would provide an improved tactical option by increasing the likelihood of achieving neuromuscular incapacitation (NMI) in instances where three or four probes are in contact with the subject.

- The pulse charge delivered by the TASER 7™ is said by the manufacturer to be similar to that delivered by the TASER X2™, however, the TASER 7™ reportedly delivers these pulses at a slightly higher pulse rate, which may improve the robustness of NMI. The claimed electrical output characteristics of the TASER 7™ are currently being independently confirmed by Defence Research and Development Canada (DRDC).

- The TASER 7™ is likely to be effective delivering a wider probe separation at shorter ranges and in confined spaces when using the Close Quarter cartridge than the current devices, hence improving effectiveness at close ranges compared with the currently authorised devices.

- The TASER 7™ has a two shot capability while the TASER X26™ requires reloading in order to take a second shot.

- The accuracy and consistency of the Standoff cartridge is better than current devices giving better capability at longer ranges and extending the maximum effective range.

[redacted]

[redacted]

- The TASER 7™ has a dual laser sight, with the top probe sight being green and the bottom probe sight being red. The green laser is likely to be more visible than the red laser used in earlier devices to sight the top probe.
- The TASER 7™ has a rechargeable battery, which is one of the Police Operational Requirements.
- The training cartridges are representative of the operational cartridges in terms of their accuracy and consistency.
- Drop testing of the system does not reveal any robustness concerns.
- The user groups expressed predominantly positive comments on the TASER 7™ and stated in the main that the device was likely to be suitable for use in their current roles, although there were a small number who disagreed.

Performance observations from the assessment

- At a firing distance of 3 m, the TASER 7™ fitted with the Close Quarter cartridge showed a higher miss rate than the X2™. This was in part due to the increased probe separation of the TASER 7™ increasing the likelihood of the lower probe missing the legs of the target. Without mitigation, this could reduce the effective operational range, particularly around 3 m.
- A high proportion of users reported accuracy issues where the bottom probe did not impact the laser point of aim. It was established that this was not due to the intrinsic accuracy of the devices and is therefore likely to be due to the interface between the firer and the weapon.
- Trapped ejectors result in the potential of disconnection/obstruction problems (this was observed at least 1 in every 42 firings or 2.4%).
- Probes detaching from the wire at full extension producing an additional risk to bystanders (including other officers), a risk that is not present with the X2™ or X26™. It is difficult to quantify this risk using data from the trial and injury potential will be affected by a number of factors such as where the probe hits on the body and the probe's kinetic energy.
- The safety lever was observed to be difficult to operate in some cases.

System reliability

Dstl procured 20 TASER 7™ handles. Over the course of the assessment faults with five of the handles were detected. Three of these showed faults at the start of the assessment, another handle showed a fault in the data download in the second week of the user handling trial which cleared later. The fifth unit was drop tested and test-fired successfully with no faults recorded but later developed a fault that showed in the data download.

[redacted]

[redacted]

During the Dstl assessment a total of 1,981 cartridges were fired. Eight cartridges (0.4%) were faulty and failed to fire. This has operational implications that should be considered before acceptance.

During the assessment it was observed that if the TASER 7™ cartridges were not loaded in a positive manner prior to the trigger being pulled, a failure to fire could occur. This fault was not indicated on the CID. The implications of this operationally need to be considered.

Additional observations

The TASER 7™ manual states that after five minutes of inactivity the armed TASER 7™ will enter low power mode, dimming both the laser and LED flashlight. This was found to be incorrect from the units tested where the laser and flashlight turn off after five minutes of inactivity. Axon® report they are currently in the process of updating the manuals to display the correct information.

There is some discrepancy between the firmware version advertised on the Axon® web page and the latest available version. Immediately before acceptance into service, a review of firmware changes made since the technical assessments should be undertaken and any implications of the firmware changes on these assessments should be considered.

The TASER 7™ laser warning label is incorrect. This needs to be amended before procurement of any devices. This should be noted in any contracts.

During the finalisation of this report additional work was undertaken by the College of Policing to examine some of the issues raised in this report. Dstl's review of this additional testing is provided in DSTL/LR122033 18 March 2020[1].

[1] TASER 7™ Assessment: Comments on performance observations DSTL/LR122033 18 March 2020 [OS-COMM]

[redacted]

[redacted]

Table of contents

[redacted]

[redacted]

List of tables

[redacted]

List of figures

[redacted]

1 Introduction

1.1 The Dstl Resilient Law Enforcement and Emergency Services Project was established to enable the delivery of the elements of the Home Office Security, Science and Innovation strategy. Dstl Policing and Security Group was tasked by the Home Office Commissioning Hub [1] to conduct an assessment of the TASER 7™ system on behalf of the UK Home Office and National Police Chiefs' Council (NPCC).

1.2 The NPCC had a requirement for a Conducted Energy Device (CED) that is suitable to be carried discreetly for covert roles [2]. Currently the TASER X26™ is the option employed in this role but, as it is no longer manufactured, an alternative needed to be identified. While the TASER X2™ is in service with UK police, covert users consider this device to be too large. The NPCC set up a Covert CED sub-group to oversee this project and produce a police operational requirement. The TASER 7™ was identified as a potential replacement. At the NPCC Less Lethal Weapons Working Group meeting on 01 November 2018, it was decided to add the TASER 7™ as a potential replacement for mainstream policing in addition to covert roles [3]. Subsequently, the NPCC Lead for the Less Lethal Weapons (LLW) Portfolio decided to broaden the remit of the Operational Requirement to include both covert and overt roles and modified the Operational Requirement to reflect this [2]. A copy of this is provided in APPENDIX A.

1.3 The trial and assessment of the TASER 7™ reported here followed a similar procedure to the assessment of the X2™ that was completed by the then Home Office Centre for Applied Science and Technology (CAST) in 2016. This gathered data on the handling characteristics and technical assessment of the X2™. This work was documented in reference [5], which partly informed the then Home Secretary's decision, in March 2017, to authorise the TASER X2™ for use by the police [3].

1.4 It is intended that this report will inform the independent Scientific Advisory Committee on the Medical Implications of Less-Lethal weapons (SACMILL) to aid their understanding of the TASER 7™ system and performance. Additionally, the findings will assist the College of Policing to help develop their training and guidelines.

1.5 The assessment was separated into two stages: a user handling trial and a technical assessment. Where appropriate, comparisons were made between the performance of the TASER 7™ with the TASER X26™ and TASER X2™ devices.

1.6 This report will be delivered to the Home Office and the NPCC LLW Portfolio Lead to assist in their assessment of the TASER 7™ to meet the current operational requirement.

[redacted]

[redacted]

2 The TASER 7™ system

2.1 Overview

2.1.1 The TASER 7™ is a Conducted Energy Device (CED) designed and manufactured by Axon® Enterprise, Inc. The TASER 7™ is similar to the X2™ in that it is a two shot device with laser sights to assist placement of the upper and lower probes. The main components are the handle, battery and cartridges. The TASER 7™ handle with one of the two battery options inserted is shown in Figure 1.

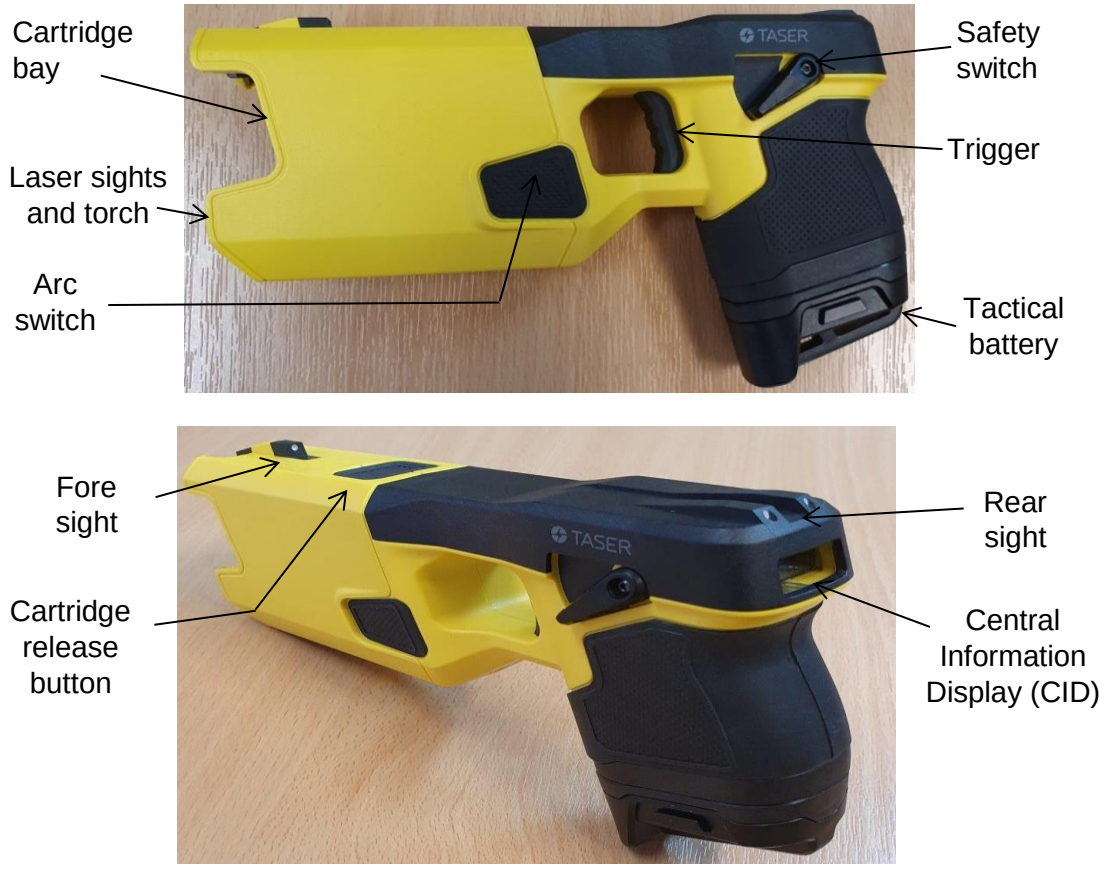


Figure 1: TASER 7™ handle with tactical battery inserted

2.1.2 The two TASER 7™ cartridge bays are referred to as bay one (the left-hand bay from the user's perspective) and bay two (the right-hand bay). Further details on the cartridges are provided in Section 2.11.

2.1.3 Activating the trigger fires the first cartridge (from bay one); activating the trigger again will fire the second cartridge (from bay two). Bay one always fires first, which differs to the X2™ where the first bay to fire can be selected by the user.

2.1.4 Axon® specify [17] the following environmental operating parameters for the TASER 7™:

- Operating Temperature range -20 °C to +50 °C
- IPX3 water ingress rating with cartridges and battery fitted.

[redacted]

[redacted]

2.1.5 A comparison of the dimensions of the X26™, X2™ and TASER 7™ devices is given in Table 1.

2.1.6 The TASER 7™ when fitted with the compact battery option, is slightly longer (by about 0.5 cm) and slightly wider (by about 0.4 cm) than the X26™ when fitted with the Extended Digital Power Magazine (XDPM) battery pack and cartridge loaded. In the latter configuration, however, the X26™ height is slightly more (about 0.8 cm) than the height of the TASER 7™ (with compact battery fitted). The mass of the TASER 7™ (with compact battery and cartridges fitted) is about 130 g more than that of X26™ fitted with the XDPM and cartridge. This should provide NPCC with sufficient information to determine whether this meets their requirement for size and weight in a covert role.

[redacted]

[redacted]

TASER® model	Physical dimensions and mass	
X26™ 	Length with Extended Digital Power Magazine (XDPM) fitted	15.5 cm without cartridge; 18.5 cm with cartridge loaded
	Width (widest)	3.8 cm
	Height with XDPM fitted	10.3 cm
	Mass (body only)	186 g
	Total mass with XDPM fitted and one cartridge loaded	295 g
X2™ 	Length with Automatic Shut-Down Performance Power Magazine (APPM) fitted	19.8 cm with cartridges loaded
	Width (widest)	4.4 cm
	Height with APPM fitted	11.0 cm
	Mass (body only)	284 g
	Total mass with APPM fitted and two cartridges loaded	437 g
TASER 7™ 	Length with compact battery fitted	18.9 cm with cartridges loaded
	Width (widest)	4.19 cm
	Height with compact battery fitted	9.5 cm
	Mass (body only)	270 g
	Total mass with compact battery fitted and two cartridges loaded	424 g

Table 1: Dimensions of the TASER® devices

[redacted]

[redacted]

2.2 Safety switch

2.2.1 This is an ambidextrous switch that can be operated on either side of the TASER 7™.

2.2.2 When the safety switch is in the down position, the TASER 7™ is safe: when the safety switch is in the up position, the TASER 7™ is armed.

2.2.3 If the safety switch is left in the armed position for five minutes with no activity, the TASER 7™ automatically turns off the lasers and Light Emitting Diode (LED) flashlight to preserve battery life. Cycling the safety switch to the safe position then back to the armed position will turn the device back on. This differs from the information in the TASER 7™ user guide [6], which states that after five minutes of inactivity the armed TASER 7™ will enter low power mode, dimming both the laser and LED flashlight. Axon® report they are in the process of updating the manuals to display the correct information [19].

2.2.4 If the safety switch is moved to the safe position during the five second firing cycle the discharge will immediately cease.

2.3 Trigger

2.3.1 When the TASER 7™ is loaded with two cartridges, the safety switch moved to the armed position, and the trigger pulled, the left bay (from the firer's perspective) will fire first. The next trigger pull will fire the cartridge in the right bay, the exception being if there is a previously fired or faulty cartridge loaded into the left bay in which case the right bay will fire.

2.3.2 To re-energise the deployed cartridge the operator must first remove their finger from the trigger and then press the arc switch.

2.4 Arc switch

2.4.1 The arc switch is a switch fitted to both sides of the TASER 7™ and has a number of functions:

- Pressing and holding either arc switch will generate a warning arc. The warning arc can be generated with the cartridges loaded. For the UK police the mode of operation of the TASER 7™ is configured to "arc switch override" which is the same as the X2™ (see Section 2.13). The setting of arc switch override is configured using Evidence.com™ by the user with the appropriate administrative access.

- If one or both cartridges have been fired, a sustained press of the arc switch will re-energise both bays until the switch has been released. This is the same as the X2™.

- Pressing both arc switches and holding for three seconds will put the TASER 7™ into stealth mode (see Section 2.16) temporarily switching off the laser sights and torch. This function is specific to the TASER 7™.

- Momentary simultaneous pressing of both the left and right arc switches will put the TASER 7™ in function test mode and the Central Information Display (CID)

[redacted]

[redacted]

will show the battery percentage and the firmware version installed. This function is specific to the TASER 7™.

2.5 Cartridge release button

2.5.1 The cartridge release button is a push button located on the top of the TASER 7™ near to the front of the device (as shown in Figure 1) and operated to unload the cartridges. The X2™ release button is located on the underneath of the body of the device. It is understood that users will be trained to use only one model of device, therefore consistency between devices is not believed to be an issue. If users will have access to more than one device, this may require mitigation.

2.6 Laser sights

2.6.1 The TASER 7™ has three lasers that are used for sighting and to indicate where the probes will impact. The top laser is green and the two bottom lasers are red (there are two bottom lasers – one for each cartridge type). When the TASER 7™ is loaded and the safety switch is moved to armed, the green and one of the red laser sights will activate. The bottom laser selection is automatic and dependent on the cartridge type fitted to ensure that the correct aim points are projected. Additionally:

- The top laser of the TASER 7™ is green and is continuously on (i.e. it does not flash). The top laser is intended to provide an indication of the top probe point of impact.
- The TASER 7™ has two bottom lasers that are red and flash. The bottom laser is intended to provide an indication of the bottom probe point of impact.
- If the TASER 7™ is not loaded, or loaded with two deployed cartridges, the bottom laser will turn off but the top green laser will be on.
- Similarly, if one faulty cartridge is detected and one deployed cartridge is loaded only the top green laser is displayed.
- There is an option to change the configuration of the lasers; both lasers on solid, top laser solid and bottom blinking or both lasers off. These settings are made through Evidence.com™ by the user with the appropriate administrative access.
- The manufacturer states that the top and bottom lasers are set to intersect the probe impact points at 4.6 m (15 ft).

[redacted]

[redacted]

2.7 Fixed (mechanical) sights

2.7.1 The TASER 7™ has a moulded sighting system integral to the handle (front sight and rear alignment trough – see Figure 1). Axon® states that the top laser and the mechanical sights intersect within a 3 inch (7.6 cm) circle at 15 ft (4.6 m) [6].

2.8 Light emitting diode (LED) flashlight

2.8.1 The TASER 7™ has a built-in flashlight to assist the user in low light environments. The flashlight has three settings (high, low and off) selected through Evidence.com™ by the user with the appropriate administrative access.

2.9 Central information display (CID)

2.9.1 The CID is a display on the back of the TASER 7™ that provides information about the TASER 7™ [6]. When the safety switch is in the up (armed) position, the CID will display the cartridge bays and battery status. The CID is shown in Figure 2 (left).

2.9.2 Pressing both arc switches together will put the TASER 7™ into function test mode and the CID displays the version of firmware installed and the battery level as a percentage shown in Figure 2 (right).

2.9.3 The CID for the TASER 7™ is simplified compared with the X2™ and only displays icons to show if the cartridge is loaded or has been deployed. It does not display the cartridge type loaded, unlike the X2™.

2.9.4 The unfired cartridge loaded icon is shown on the CID as a yellow square. A deployed cartridge icon is shown as a black square with a yellow border. If no cartridge is loaded the icon will be blank. If a fault is detected with the cartridge the icon is a yellow cross and will blink [6].

Figure 2: CID display showing two cartridges loaded, battery percentage and version of firmware installed

[redacted]

[redacted]

2.10 Battery pack

2.10.1 The battery pack is a rechargeable lithium-ion cell that powers the TASER 7™. The battery pack acts as a power source, contains data from the TASER 7™ (event logs, fault data, etc.) and is used to update the TASER 7™ firmware.

2.10.2 The data from the TASER 7™ is accessed when the battery is inserted into the Axon® battery dock linked to the Evidence.com™ application. This feature is described in more detail in Section 2.17. The battery has two press-buttons that must be depressed simultaneously to release the battery from the TASER 7™ grip.

2.10.3 The TASER 7™ has two battery options, tactical and compact (Figure 3), which perform in the same way. They differ in size, with the compact battery being 11.5 mm shorter than the tactical battery.

Figure 3: TASER 7™ battery options (tactical on the left and compact on the right)

2.10.4 From fully charged, the battery should provide sufficient power for approximately 150 five-second trigger activated firings [6] [7] from a single bay (22 pulses per second). Arc switch/trigger activations, such as generating a warning arc, activates both bays (44 pulses per second) [6] [7] and the battery should provide approximately 75 five-second activations. The manufacturer's specification sheet states "Lithium-Ion batteries continue to slowly discharge (self-discharge) when not in use or while in storage. In storage, the battery may lose up to 10 % of its capacity in the first month and 3 % of its capacity for each additional month, so should be routinely checked [7]. The X2™ APPM battery will provide approximately 500 five-second discharges [20] but is not rechargeable.

2.10.5 Axon® advise that battery packs should be stored charged to 30–50 % capacity and may lose up to 10 % capacity in the first month and then 3 % capacity for additional months. Loss of charge is dependent on storage temperature and the state of the charge [7].

2.10.6 Similar to the X2™, the battery types contain the signal functionality to trigger Axon® body worn cameras.

[redacted]

[redacted]

2.11 Cartridges and probes

2.11.1 The cartridges for the TASER 7™ are currently available in two angle configurations:

- Standoff cartridge 3.5° (Figure 4)
- Close Quarter cartridge 12° (Figure 5).

Figure 4: 3.5° cartridge (Axon®)

Figure 5: 12° cartridge (Axon®)

2.11.2 The cartridges can be loaded as a pair of Close Quarter or Standoff cartridges, or one of each. As noted earlier, the CID does not indicate which type of cartridge is loaded in each bay.

2.11.3 The Standoff (3.5°) cartridge is designed for targets at up to a range of 7.6 m (25 ft) whereas the Close Quarter (12°) cartridge is intended to deliver a wider probe separation for closer target subjects. The probe separation is an important factor in delivering a neuromuscular incapacitation (NMI) effect to the subject. SACMILL has noted in their 2016 medical statement that a minimum separation of the probes of about 23 cm (9 inches) is understood to be required to induce NMI [8], based on research by Ho et al [9].

2.11.4 Different cartridge types are available for operational and training use and are available for each cartridge angle configuration. Figure 6 shows the operational probe and Figure 7 shows the HALT™ probe for training. Further information regarding TASER 7™ cartridges can be found in Table 2.

Figure 6: TASER 7™ operational probe

[redacted]

Figure 7: TASER 7™ Hook and Loop Training (HALT™) probe

2.11.5 The TASER 7™ operational cartridge design differs significantly from that of the TASER X2™. The wire for the TASER 7™ is wound inside the probe body and not stored inside the cartridge like the X26™ and X2™. When the TASER 7™, cartridge is fired the probe is propelled down-range and the wire is drawn out from the rear of the probe, (Figure 8). This design results in the TASER 7™ probe reducing in mass as it travels down-range towards the target. The mass of the different probes is contained in APPENDIX B. All TASER 7™ cartridges have a wire length of 7.6 m (25 ft).

2.11.6 Figure 8 shows two of the operational probes. The upper image shows the break-away probe design. On impact, the design of the probe is intended to allow the barb and front portion of the probe to attach to the subject. The rear portion contains the mass of the unexpended wire spool and is designed to detach from the front portion. The intention of this design feature is to be prevent the barb being ripped out of the subject by mitigating the kinetic impact of the probe in the event of an angled impact.

Figure 8: Operational probe showing the wire spooled inside the probe body and the break-away probe design (top)

2.11.7 The probes are propelled from the cartridge by compressed nitrogen.

[redacted]

Cartridge type	TASER 7™ Operational 3.5° (Standoff)	TASER 7™ Operational 12° (Close Quarter)	TASER 7™ Training (HALT™) 3.5° (Standoff)	TASER 7™ Training (HALT™) 12° (Close Quarter)	TASER 7™ Inert Drill 3.5° and 12°
Image					
Length of wire	7.6 m (25 ft)	7.6 m (25 ft)	7.6 m (25 ft)	7.6 m (25 ft)	N/A
Probes	Barb length 11.5 mm		N/A		N/A
Propellant	Compressed Nitrogen				N/A
Colour	Body: Grey Doors: Black	Body: Black Doors: Black	Body 3.5°: Grey Doors 3.5°: Blue	Body 12°: Black Doors 12°: Blue	Body 3.5°: Grey Body 12°: Black Doors (both): Red
Cartridge dimensions	81 mm long, 19.9 mm wide, 34 mm high				
Cartridge weight	33 g	33 g	31 g	31 g	17 g

Table 2: TASER 7™ cartridge options

[redacted]

The TASER 7™ cartridges are delivered in pairs in a cartridge safety clip (Figure 9). The cartridge safety clip is used as a tool to extract the TASER 7™ operational barbs, see Figure 10.

Figure 9: Pair of TASER 7™ cartridges in cartridge safety clip

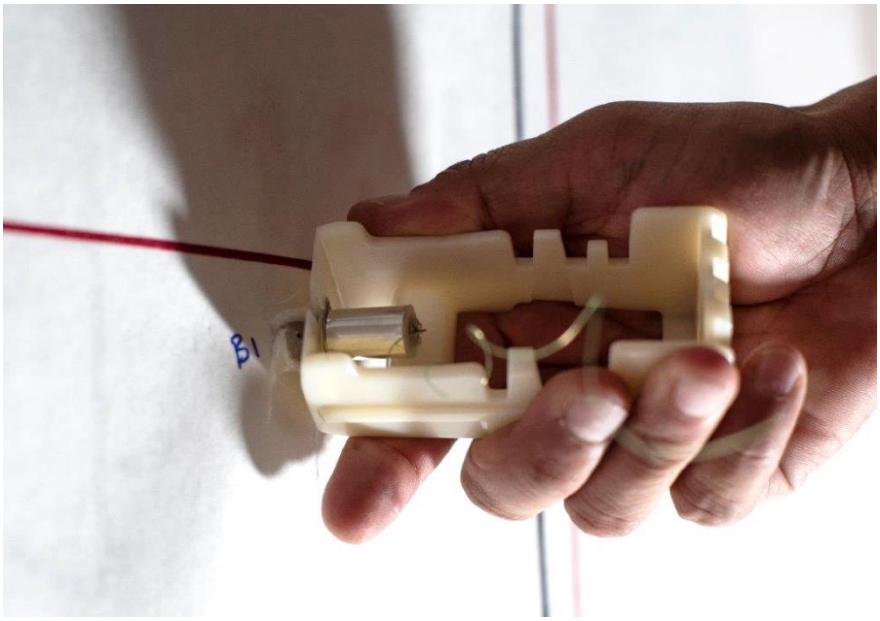


Figure 10: Removal of TASER 7™ operational barb using cartridge safety clip

[redacted]

2.11.8 The TASER 7™ handle, battery and each cartridge are marked with unique identifying serial numbers. When used, these serial numbers are recorded in Evidence.com™ log.

2.12 Configuration of test items

2.12.1 Axon® provided an assurance that the TASER 7™ items delivered to Dstl for the assessment were all full production standard. The items were marked with the following revision designations:

- TASER 7™ handles: Revisions B and C
- Cartridges: Revision X56 and Revision A
- Tactical and compact batteries: Revision X23.

2.12.2 Axon® introduced a minor process improvement to improve the functionality of the handles in a high humidity environment. This revised the handles from Revision B to Revision C [10].

2.12.3 Dstl only assessed the versions listed above. At the time of writing this report, Axon® notified Dstl that the TASER 7™ handles are now at Revision F, the cartridges are at Revision B (12°) and Revision C (3.5°) and batteries (compact and tactical) are at Revision C. Axon® state that the changes made from those assessed will have "no discernible effect to the customer" [10], although this has not been independently verified.

2.12.4 The Axon® website advertises that latest firmware is version 1.3.10 released 14 March, 2019. However, on the 7 May 2019, Axon® released training bulletin 21-03 version 1.0 [18] notifying the release of updated firmware version 1.3.13, which was installed on the TASER 7™ devices used for the assessment. The user with the appropriate administrative access should ensure the correct version of the firmware is installed on TASER 7™.

2.12.5 The Evidence.com™ version used during the assessment was 2019.10.0.

2.12.6 The TASER 7™ electrical output characteristics and associated footnotes from Axon®'s specification document [17] are reproduced in Table 3.

[redacted]

[redacted]

Parameter	Test Condition	Minimum	Typical	Maximum	Unit
Delivered Parameters[1]					
Pulse Charge[4]	250–1000 Ω	59	63	67	µC (microcoulomb)
Pulse Rate[2,3]	Single Bay	21	22	23	PPS (pulses per second)
	Two Bay	43	44	45	
Pulse Duration	600 Ω[7]	35	45	55	µs (microseconds)
Total Discharge Time ("on" time)	22 pps into 600 Ω[7]	0.00077		0.0012	seconds
Aggregate Current[5]	22 pps into 600 Ω[7]	0.0013		0.0015	A (amperes)
Energy per Pulse	500 Ω[6]	0.063	0.081	0.104	J (joules)
Peak Loaded Voltage	600 Ω[7]	1500		2600	V (volts)
Adaptive Cross Connect					
Adaptive Cross Connect Pulse[3,7,8]	Two bays, 2 to 4 probes in load[9]	21		45	PPS (Pulses per second)

[1] A delivered parameter represents an amount that is expected to enter a subject's body when a circuit is completed, and electrical current is delivered from the TASER CED. Data obtained by connecting resistive loads to the dart spears on a spent cartridge.
[2] Pulse rate may vary over operating temperature and battery conditions.
[3] Note: This limit applies to probe pairs and not to individual probes. For example, in a triangular output (system of three probes where the fourth probe is not making an electrical connection) one probe will be the common return for the other two probes. In a triangular output the Adaptive Cross Connect technology will limit the pulse rate on each good connection to around 17.6 PPS, resulting in as many as 44 ± PPS on the common probe.
[4] Non-inductive resistor. Duration measured from −100 mA to 100 mA per American National Standards Institute Crane Power Lines Standards Organisation-17.
[5] Aggregate current is the flow of charge per second. Equals pulse rate time pulse charge.
[6] Standard load: consisting of a non-inductive resistor of 500 ± 2.5 Ω resistor. International Electrotechnical Commission, Household and Similar Electrical Appliances—Safety—Part 2—76: Particular Requirements for Electric Fence Energizers IEC 60335-2-76, Ed 2.1, 2006, Geneva: IEC.
[7] Pulse rate may vary over operating temperature and battery conditions.
[8] Adaptive Cross Connect pulse rate per connection will vary dynamically based on the quality of the connection. Good connections will have higher PPS (up to 22 nominal), poor connections fewer PPS (down to 4 nominal).
[9] Two probes of opposite polarity (top and bottom) are required to deliver electrical pulses to the load.

Table 3: TASER 7™ electrical output characteristics [17]

[redacted]

[redacted]

2.13 Automatic shutdown

2.13.1 Using Evidence.com™, the TASER 7™ devices were configured to the UK settings as defined by the College of Policing [21][22]. These are the same settings used for the X2™.

2.13.2 When the TASER 7™ is correctly configured to auto shutdown enabled, with arc switch override mode, the operation is as follows:

- When the trigger is pulled and released, the TASER 7™ will emit an audible beep for the last two seconds and the cycle will stop at the end of the five second cycle.
- When the trigger is pulled and kept activated, the TASER 7™ will emit an audible beep for the last two seconds and the cycle will stop at the end of the five second cycle. The audible beep will continue until the trigger is released.
- To re-energise the deployed cartridge the operator must remove their finger from the trigger and then press the arc switch.
- Pressing the trigger again will deploy the second cartridge.
- When the arc switch is pressed the TASER 7™ will continue to cycle while the arc switch remains depressed. When the arc switch is released the cycle will stop.
- When set to Arc Switch Override mode, pressing and holding the arc switch before the five-second trigger-initiated cycle has ended will cause the cycle to continue past the five second auto-shutdown point.

2.14 Adaptive cross connect

2.14.1 Adaptive cross connect is described in the TASER 7™ user manual [6]. When both cartridges have been deployed, TASER 7™ will deliver a cross connect across all available positive and negative electrode paths to all four possible connections across both bays. The electrical pulses are delivered to the four connections in a sequence of up to 44 pulses per second with 22 pps for an individual connection [6][17], between all positive and negative probe combinations as illustrated in Figure 11 shown from the perspective of the firer:

- Probe 1 to probe 2
- Probe 1 to probe 4
- Probe 3 to probe 4
- Probe 3 to probe 2.

[redacted]

2.14.2 Adaptive cross connect is reportedly designed to still deliver an effective connection even if some probes do not hit the target. A charge is directed to all of the contacts to maximise the impact of the probe deployment and to compensate for close probe separation or clothing disconnects.

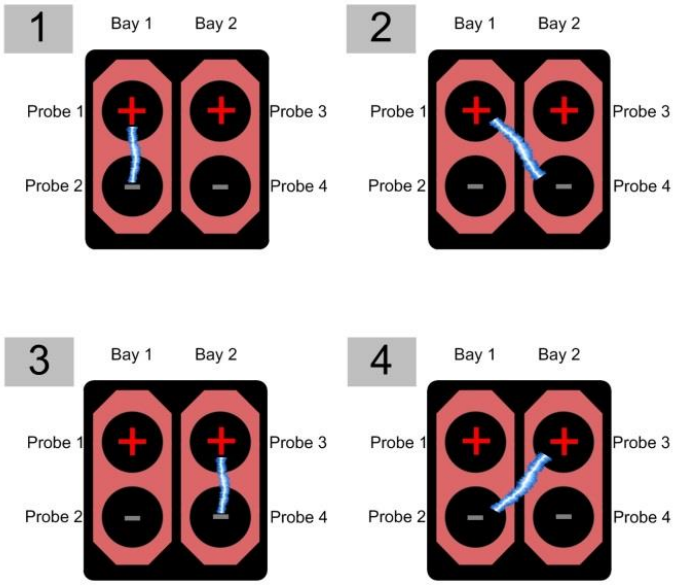


Figure 11: TASER 7™ Adaptive Cross Connect from the position of the firer

2.14.3 The TASER 7™ adaptive cross connect differs to the X2™ cross connect because the TASER 7™ has built-in controls that will attempt all four possible connections and determines which one (or ones) has a path, while periodically attempting the other paths to check if the situation has changed. It was anticipated that a report on testing undertaken by Defence Research and Development Canada would have contributed to this assessment, but the testing has not been reported at the time of writing.

2.15 Charge metering

2.15.1 The charge metering, described in the TASER 7™ user manual, [6] is designed to optimise the charge output depending on load conditions e.g. good connection, partial connection, arcing to skin etc. The amount of charge applied reduces as the connection improves with an aim to apply 63 µC per pulse. This technology is also employed in the X2™.

[redacted]

2.16 Stealth mode

2.16.1 TASER 7™ has a stealth mode that turns off the flashlight and laser sights temporarily. This is activated by pressing and holding both arc switches for a period of three seconds. When the TASER 7™ is armed the flashlight and laser sights will not illuminate. Moving the safety switch to the safe position will deactivate stealth mode. The lasers and flashlight can be turned off through settings in Evidence.com. The user can activate or deactivate stealth mode for the X26™ and X2™ by using the selector switch on the device.

2.17 Evidence.com™ and docking station

2.17.1 TASER 7™ uses the online Evidence.com™ cloud-based software application. This online method is used for TASER 7™ to undertake tasks such as downloading the firing data or installing any updates. This data transfer is carried out via the TASER 7™ battery and the docking station (see Figure 12). The TASER 7™ does not have the capability to conduct this task offline unlike the X26™ and X2™. When the docking station is not connected to the internet, but still connected to mains power, it will only serve as a battery charger.

Figure 12: TASER 7™ docking station

[redacted]

[redacted]

2.17.2 The data includes an event log and any technical faults detected. The event log records the following information:

- Movement of the safety switch to the armed position
- Movement of the safety switch to the safe position
- Details of the cartridges loaded in both bays
- Trigger pull
- Operation of the arc switch
- Cartridge deployment
- Time, date, start and duration of electrical discharge.

2.17.3 Axon® report that a time drift tolerance of plus or minus two minutes per month applies to the firing data recorded by TASER 7™ [23].

2.18 Device registration

2.18.1 To manage the TASER 7™ and batteries, the serial numbers are registered into Evidence.com™. This can be carried out either by using the battery and docking station or the Axon® device manager application. This would typically be carried out by the user with the appropriate administrative access.

[redacted]

[redacted]

3 User handling trial

3.1 Overview

3.1.1 This user handling trial was based upon the previous X2™ assessment [5] and, where possible, the TASER 7™ was compared to the X26™ and X2™.

3.1.2 At the request of the NPCC LLW Secretariat, West Midlands Police offered their training facility to Dstl to conduct the user handling trial over two separate weeks commencing 10 June 2019 and 24 June 2019.

3.1.3 The aim of the trial was for volunteer police officers in both covert and overt roles to participate in a series of scenario exercises where they compared the TASER 7™ to the X2™ or X26™ to achieve the following objectives:

- Provide the participants with an opportunity to use the TASER 7™ including using the Close Quarter and Standoff cartridges.
- Provide an opportunity for the participants to comment on the suitability of the TASER 7™ in both covert and overt roles.
- Capture comments and feedback from the officers who participated in the trial using a questionnaire to inform procurement decisions and training.
- Inform the next stage of the technical assessment.
- Provide an indication of reliability in use.

3.1.4 The trial was solely a user handling trial from users and did not involve the assessment of individual subject performance; therefore this did not require ethical approval from the MOD Research Ethics Committee in accordance with Joint Service Publication (JSP) 536 Ministry of Defence Policy for Research Involving Human Participants [11]. Testing of the inherent accuracy of the device was conducted in a separate technical assessment (see Section 6).

3.1.5 Twenty four volunteer officers from both covert and overt roles were identified by the NPCC to participate in the trial based on their operational availability and experience:

- Twelve covert users compared the TASER 7™ to the X26™
- Twelve overt users compared the TASER 7™ to the X2™.

3.1.6 In consultation with the College of Policing, the appropriate roles for covert and overt users were identified. These roles are:

Covert roles

- Armed Surveillance Officer (ASO)
- Close Protection Officer (CPO)
- Counter Terrorism Specialist Firearms Officer (CTSFO)

[redacted]

[redacted]

- Surveillance Officer (SO).

Overt roles

- Armed Response Vehicle Officer (ARV)
- Specially Trained Officers (STO).

3.1.7 The breakdown of officer roles is shown in Table 4.

Group	Role	Devices to compare in trial	Number of officers
Week 1	SO (covert)	X26™ v TASER 7™	3
	CTSFO (covert)	X26™ v TASER 7™	3
	CPO (covert)	X26™ v TASER 7™	3
	ASO (covert)	X26™ v TASER 7™	3
			Total 12
Week 2	STO (overt)	X2™ v TASER 7™	9
	ARV (overt)	X2™ v TASER 7™	3
			Total 12

Table 4: Breakdown of officers vs devices compared

[redacted]

[redacted]

3.1.8 The characteristics of officers who participated in the user handling trial is shown in Table 5.

X26™ covert participant	No.	X2™ overt participant	No.
Male	10	Male	12
Female	2	Female	0
Right hand dominant	11	Right hand dominant	10
Left hand dominant	1	Left hand dominant	2
Right eye dominant	9	Right eye dominant	9
Left eye dominant	2	Left eye dominant	3
Both eyes equal	1		
Length of service	**No.**	**Length of service**	**No.**
15+ years	7	15+ years	6
10-15 years	3	10-15 years	2
5-10 years	0	5-10 years	3
0-5 years	2	0-5 years	1
Experience as TASER® trained	**No.**	**Experience as TASER® trained**	**No.**
10+ years	5	10+ years	2
5-10 years	2	5-10 years	5
0-5 years	5	0-5 years	5

Table 5: Breakdown of participant information

[redacted]

[redacted]

3.1.9 The scenario exercises were developed in consultation with the NPCC LLW Secretariat, College of Policing, police practitioners and the Dstl Police Adviser.

3.1.10 College of Policing CED training instructors were responsible for issuing instructions to the officers and supervising the safety of the activity. The scenario exercises involved the officer firing the CED probes at a target board or an individual wearing the HALT™ training suit.

3.1.11 Before starting the trial all of the participants were given initial training on the TASER 7™ by the College of Policing. This consisted of classroom training followed by practical drills.

3.1.12 Before starting the exercises all participants tried both battery types (compact and tactical) in the TASER 7™. Each selected the battery type they felt was most appropriate for them and their role. Once selected, this was the battery type they used for the duration of the trial. Dstl understands the selection of battery for operational use will be a local force decision.

3.1.13 Of the twenty four participants, four users (covert) selected the compact battery. The remaining twenty officers selected the tactical battery. The comment on the battery type selected by the officers is shown in Table 6.

Battery-type selected	Number of covert users	Number of overt users	General comments
Tactical	8	12	• More comfortable grip • Increased gripping surface • More secure feel with increased leverage • Ability to attach a lanyard • Easier distinction between a firearm and a TASER® grip
Compact	4	0	• Preferential grip • Less irritation to torso while holstered in seated position • Better suited to a covert role

Table 6: Battery selection breakdown table

3.1.14 Officers were not permitted to select the cartridge type (unless this was part of the test): the cartridge type was a test variable. Paired Standoff or paired Close Quarter cartridges were used because this was understood to be the proposed configuration for use in the UK (i.e. not mixed standoff/close quarter sets).

[redacted]

[redacted]

3.1.15 The exercises addressed the operational requirement and were aligned with College of Policing CED training. Each officer conducted each exercise three times using both devices. An outline description of each exercise is in Table 7. More detail of the exercises can be found in APPENDIX C.

Exercise Number	Description	Laser sights on/off	Cartridge type
Exercise 1	Standard upright two shot	ON	12° cartridge
Exercise 2	Iron sights one shot	OFF	3.5° cartridge
Exercise 3	Target laying horizontal one shot	OFF	12° cartridge
Exercise 4	Target laying horizontal one shot	ON	3.5° cartridge
Exercise 5	Target too close	ON	12° cartridge
Exercise 6	Three shot	ON	12° cartridge 2 inert cartridges then 1 operational
Exercise 7	Shield	ON	12° cartridge
Exercise 8	Show of strength	ON	12° cartridge
Exercise 9	Static target	ON	Either pair of 3.5° or 12° - User to decide
Exercise 10	Target moving sideways	ON	12° HALT™ cartridge
Exercise 11	Target moving sideways	ON	3.5° HALT™ cartridge
Exercise 12	Target moving forwards	ON	12° HALT™ cartridge
Exercise 13	Target moving forwards	ON	3.5° HALT™ cartridge (TASER 7™ only)
Exercise 14	Torch and in low light	ON	12° cartridge

Table 7: User handling trial – outline of the exercises

[redacted]

[redacted]

3.1.16 For the user handling trial a flat body-shaped target was divided into areas of interest as shown in Figure 13.

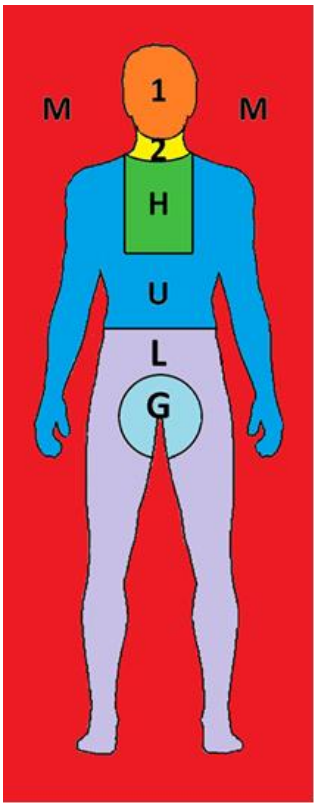


Figure 13: Target zones (M = Miss)

3.1.17 During CED training the College of Policing guidance instructs users to attempt to "split the beltline" with the impact points of the top and bottom probes. Instances where the top-probe impacted upper areas and the bottom-probe impacted lower areas were recorded as "splits".

3.1.18 Impact points that did not split the beltline (e.g. both probes impact either the upper or lower target areas) were recorded as a "no-split" however they were considered to be hits.

3.1.19 Potential high risk areas with possible medical implications and of interest to SACMILL were recorded where the probes have impacted the head, neck, heart and groin.

3.1.20 Instances where one probe missed the target or both probes missed the target were also recorded.

3.1.21 The majority of exercises used a fixed target as detailed above. However for the exercises that featured a moving target, HALT™ cartridges were used against an individual wearing the HALT™ training suit (see Figure 14).

[redacted]

Figure 14: Moving target scenario exercise

3.1.22 During the exercises Dstl staff recorded the following measurements to compare the TASER 7™ with the X2™ and X26™. Result spreadsheets were created in advance to enable the Dstl staff to save all data. The following data was recorded:

- Impact location zones
- Distance measurement between the cartridge bay and the target subject
- Time taken from instruction to fire.

3.1.23 At the end of each week the firing data logs from each TASER 7™ used in the handling trial were downloaded to Evidence.com™.

3.1.24 After completing the exercises all the participants provided feedback via a joint stakeholder designed questionnaire on the features, characteristics and whether they felt the TASER 7™ was suitable for their role(s).

3.1.25 Twelve officers from the covert group responded to the questions comparing the TASER 7™ with the X26™. Twelve officers from the overt group responded to the questions comparing the TASER 7™ with the X2™. Each of the questions were answered with an opportunity to enter additional comments. The responses to each of the questions are shown in Figure 15 to Figure 54 and summarised in the following sections. A summary of the feedback provided by all the officers can be found at APPENDIX D.

3.2 Q1. The device is accurate.

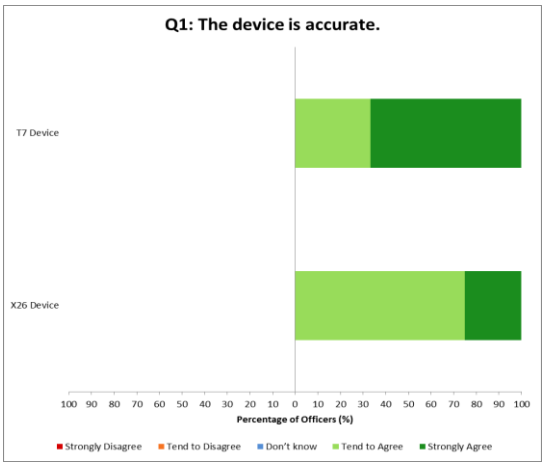


Figure 15: Q1 The device is accurate (TASER 7™ vs X26™)

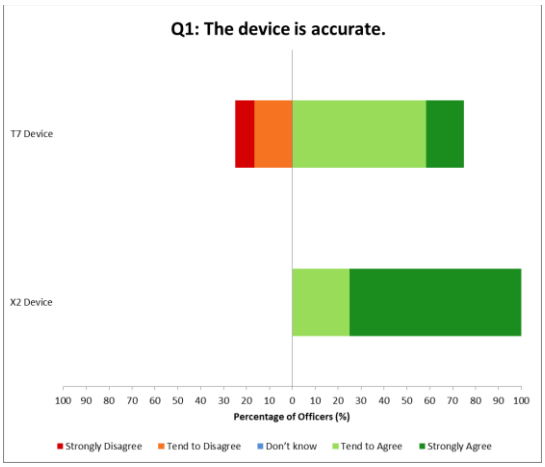


Figure 16: Q1 The device is accurate (TASER7™vs X2™)

100% of X26™ trained officers strongly agreed, or tended to agree, that both the TASER 7™ and X26™ devices are accurate. Twelve officers from each group responded.

- X2™ trained officers either strongly agreed, or tended to agree that the X2™ was accurate.
- 25% of the X2™ trained officers strongly disagreed, or tended to disagree that the TASER 7™ device was accurate. This is a result of feedback from officers who commented that they felt the bottom probe impact point was to the left of the laser aim position (Section 6.8).

[redacted]

3.3 Q2. The device could be used to target an individual within a group.

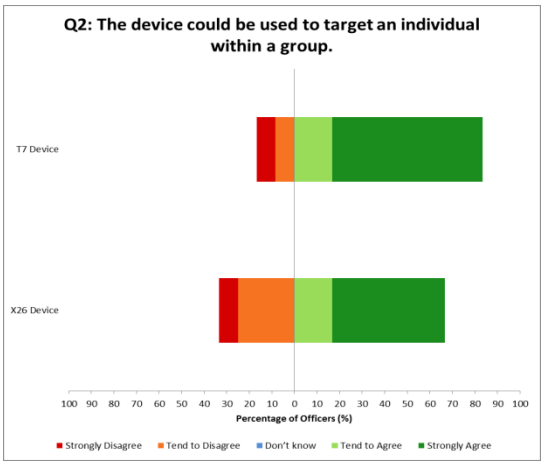


Figure 17: Q2 The device could be used to target an individual in a group (TASER 7™ vs X26™)

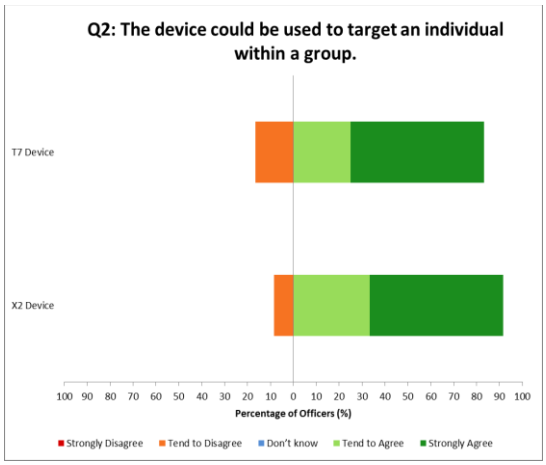


Figure 18: Q2 The device could be used to target an individual within a group (TASER 7™ vs X2™)

Comparing TASER 7™ to the X26™, more officers agreed or strongly agreed that TASER 7™ could be used to target an individual within a group because of the dual laser sights. Twelve officers from each group responded.

- A CPO officer believed that TASER 7™ would only target an individual at very close range.
- Users of X2™ commented that the bottom probe impact point was to the left of the laser position.
- An ARV officer who tended to disagree with the statement commented that the TASER 7™ seemed to consistently achieve a probe placement left of the laser sights, but overall believes the TASER 7™ to be superior to X2™.

[redacted]

[redacted]

3.4 Q3. The device could be used effectively against a moving target at various ranges.

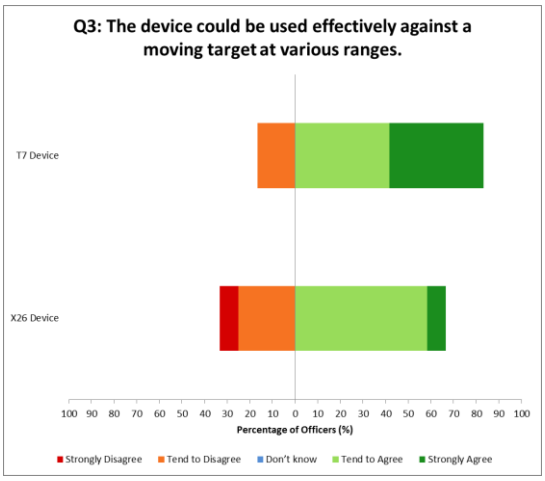


Figure 19: Q3 The device could be used effectively against a moving target at various ranges (TASER 7™ vs X26™)

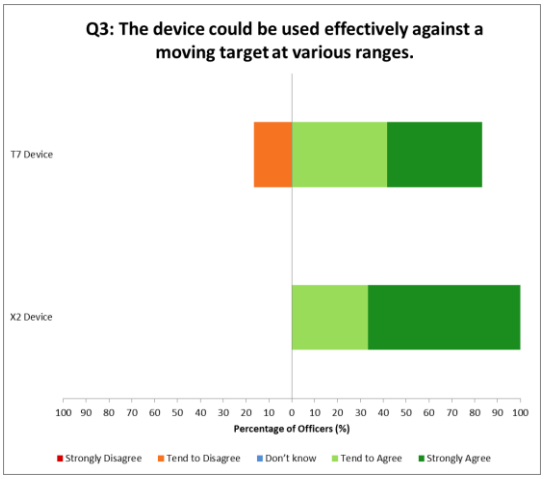


Figure 20: Q3 The device could be used effectively against a moving target at various ranges (TASER 7™ vs X2™)

The X26™ trained officers tended to agree, or strongly agreed that the TASER 7™ could be used more effectively when used against a moving target at various ranges. Twelve officers from each group responded.

- An ASO who tended to disagree with the statement with regards to the TASER 7™ further commented they did not believe the device would be effective against a target “of substantial velocity”.
- The majority of X2™ trained officers strongly agreed, or tended to agree that the TASER 7™ could be used effectively when used against a moving target at various ranges.
- Two ARV officers tended to disagree regarding the TASER 7™ because they felt that the bottom probe impact point was to the left of the laser position.

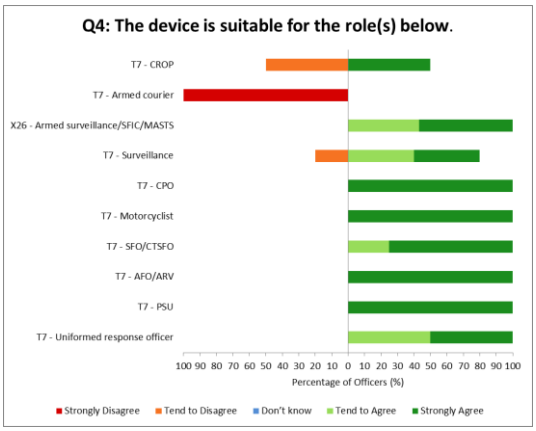
[redacted]

[redacted]

- Additional comments included possible limitations of the TASER 7™ against moving targets depending on which cartridge type was loaded.

[redacted]

3.5 Q4. The device is suitable for certain roles?



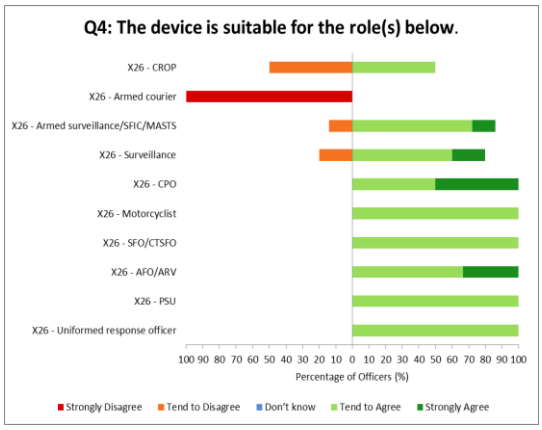
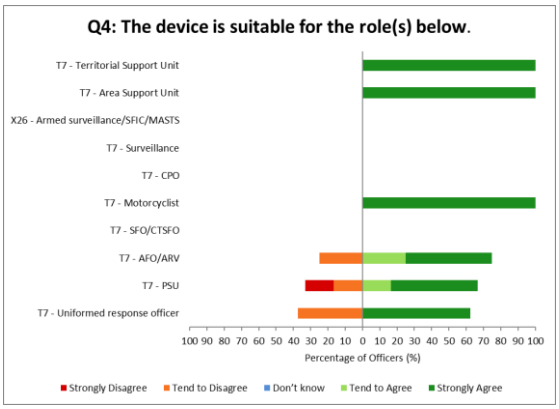


Figure 21: Q4 The device is suitable for the roles below (TASER 7™ vs X26™)



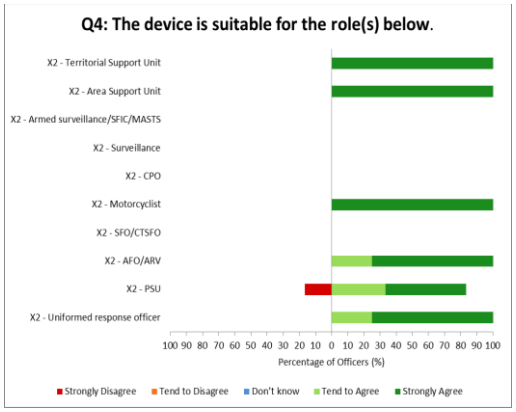


Figure 22: Q4 The device is suitable for the roles below (TASER 7™ vs X2™)

Those officers who had experience in roles made a comment on the suitability of the devices. Officers without experience in the roles did not comment. Twelve officers from each group responded.

- The majority of covert officers agreed or strongly agreed that both the X26™ and TASER 7™ devices are suitable for their roles. However, noticeably less suitable for armed courier and Covert Rural Observation Post (CROP) roles.
- Comparably the covert users did not consider the X26™ to be suitable for armed courier and CROP roles either.
- Comparing the TASER 7™ with the X2™ the responses indicate the X2™ is marginally more suitable than the TASER 7™ for the roles specified.
- Additional comments made included possible limitations of the TASER 7™ against moving targets depending on which cartridge type was loaded.

[redacted]

- Comments suggested that switching between the TASER 7™cartridge types (Close Quarter and Standoff) for the uniformed response role could prove difficult.
- The majority of covert officers agreed or strongly agreed that both the X26™ and TASER 7™ devices are suitable for their roles.

[redacted]

[redacted]

3.6 Q5. The device is easy to point and aim.

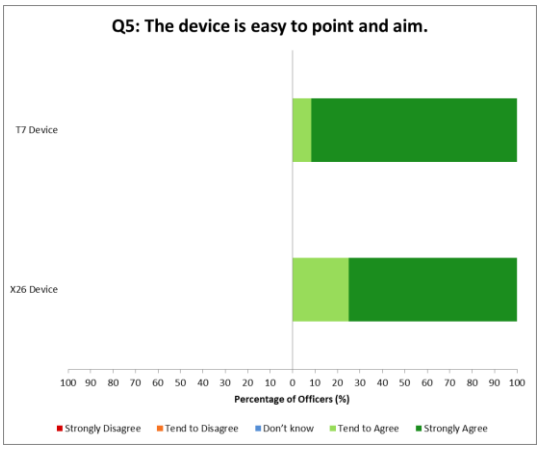


Figure 23: Q5 The device is easy to point and aim (TASER 7™ vs X26™)

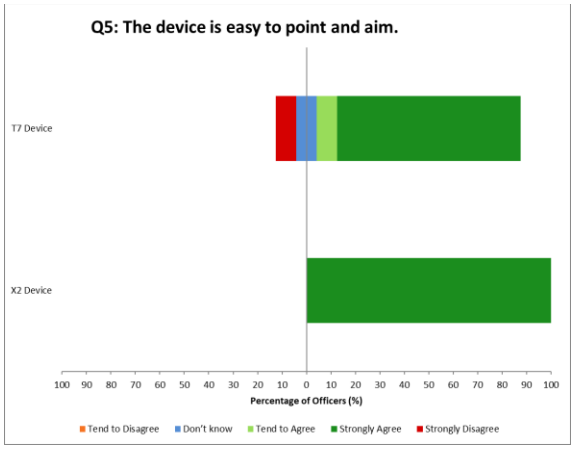


Figure 24: Q5 The device is easy to point and aim (TASER 7™ vs X2™)

The majority of TASER 7™ and X26™ users tended to agree or strongly agreed that the X26™ and TASER 7™ are easy to point and aim. Twelve officers from each group responded.

- One STO strongly disagreed and cited the TASER 7™ safety switch as too small and difficult to operate easily.
- One officer indicated in their response that they did not know how to answer this question.
- Two officers (CPO) from the covert user group commented that the green laser made the sights easier to see.
- Three officers (CTSFO) from the overt user group commented on the potential conflict of the green laser sighting systems with those fitted to lethal weapons.

[redacted]

[redacted]

3.7 Q6. The device cartridges are easy to load and unload.

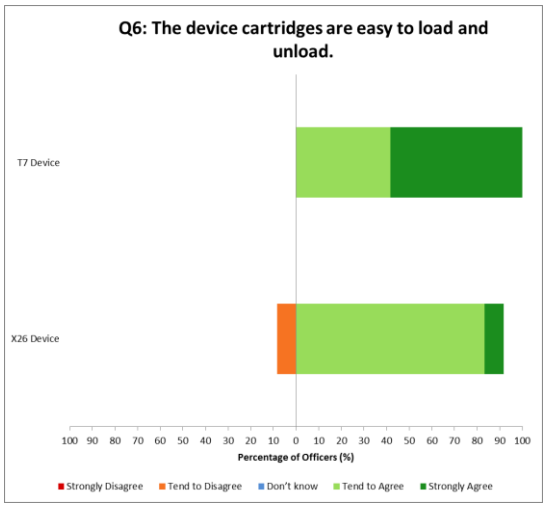


Figure 25: Q6 The device cartridges are easy to load & unload (TASER 7™ vs X26™)

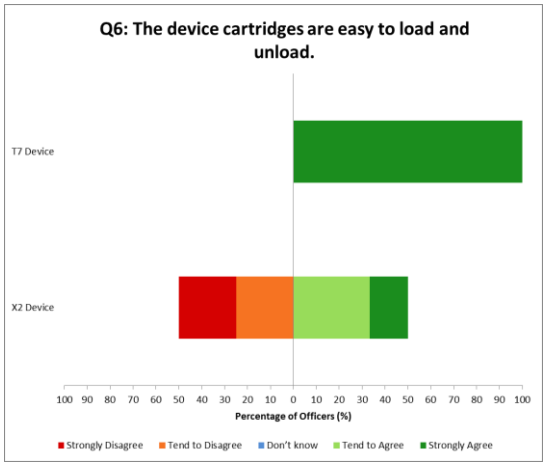


Figure 26: Q6 The device cartridges are easy to load and unload (TASER 7™ vs X2™)

All but one officer from the covert user group tended to agree, or strongly agree that both the X26™ and TASER 7™ cartridges are easy to load and unload. Twelve officers from each group responded.

- 50% of officers from the overt user group tended to disagree or strongly disagree that the X2™ is easy to load and unload.
- There was a comment from this group that the TASER 7™ cartridges felt were an improvement compared to the X2™ cartridges and that the TASER 7™ tapered design aided improved ease of loading and unloading in comparison with the X2™.

[redacted]

[redacted]

3.8 Q7. The battery is easy to fit and remove.

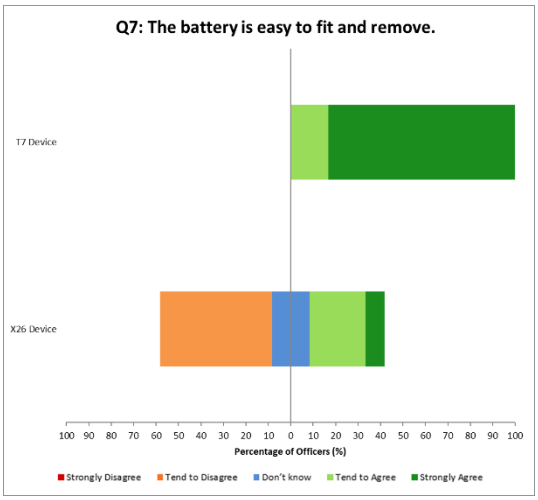


Figure 27: Q7 The battery is easy to fit and remove (TASER 7™ vs X26™)

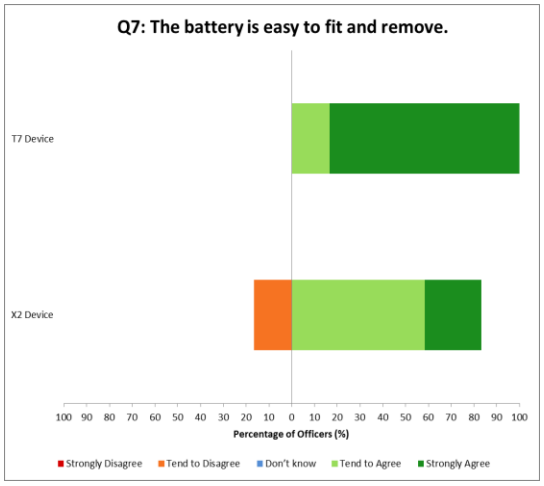


Figure 28: Q7 The battery is easy to fit and remove (TASER 7™ vs X2™)

From the covert group there was a preference that the TASER 7™ battery was easier to fit and remove compared to the X26™. Twelve officers from each group responded.

- One officer did not know how to respond and did not provide any further comment.
- The response from the overt users for both devices were similar. Two officers disagreed that the X2™ battery was easy to fit and remove.

[redacted]

[redacted]

3.9 Q8. The device is easy to operate, including the safety switch and trigger.

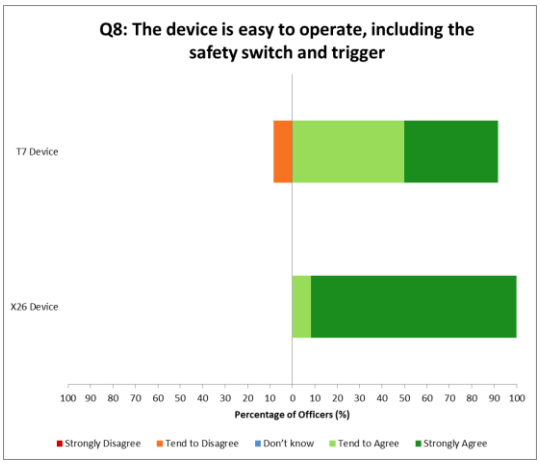


Figure 29: Q8 The device is easy to operate including the safety switch and trigger (TASER 7™ vs X26™)

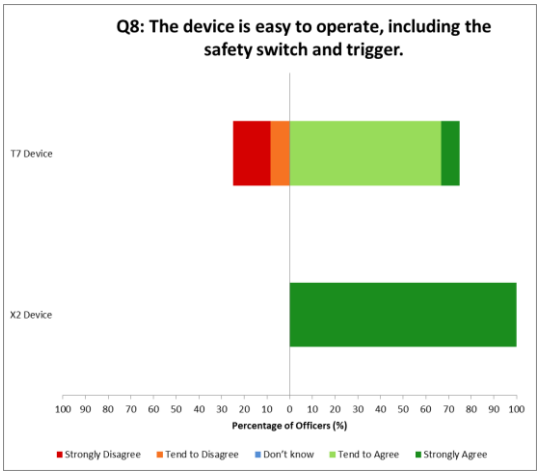


Figure 30: Q8 The device is easy to operate including the safety switch and trigger (TASER 7™ vs X2™)

The majority of the covert user group tended to agree or strongly agreed that both the TASER 7™ and X26™ were easy to operate. Twelve officers from each group responded.

- One officer tended to disagree that the TASER 7™ was easy to operate giving the reason that they considered the safety switch stiff to operate.

- The majority of the overt user group tended to agree or strongly agreed that both the TASER 7™ and X2™ were easy to operate. However three officers disagreed or strongly disagree that TASER 7™ was easy to operate and cited the stiffness of the safety switch and difficulty in operating it repeatedly.

[redacted]

[redacted]

3.10 Q9. It is easy to perform an arc display with this device.

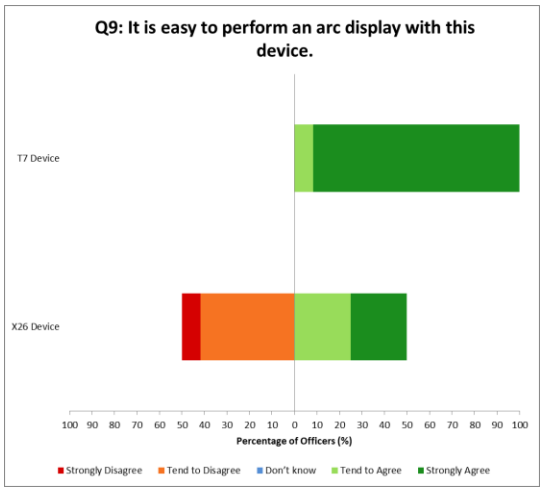


Figure 31: Q9 It is easy to perform an arc display with this device (TASER 7™ vs X26™)

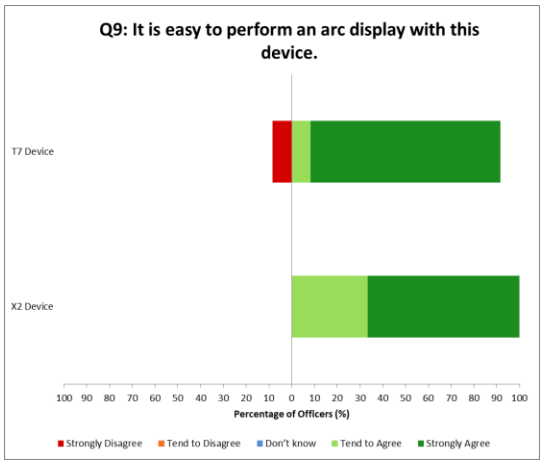


Figure 32: Q9 It is easy to perform an arc display with this device (TASER 7™ vs X2™)

Similar to the X2™, an arc display can be generated on the TASER 7™ without having to unload the cartridges. Twelve officers from each group responded.

- 50% of the covert user group disagreed or strongly disagreed that the X26™ is easy to perform an arc display. This was not surprisingly reflected in the comments since the X26™ cartridge must be unloaded before performing an arc display.

- All but one of the overt user group gave positive responses comparing the TASER 7™ and X2™. The one officer who strongly disagreed did not comment further.

[redacted]

[redacted]

3.11 Q10. The device can be used accurately without the use of laser sights.

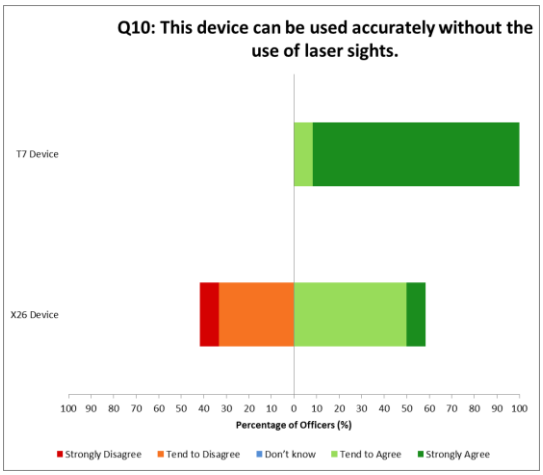


Figure 33: Q10 This device can be used accurately without the use of laser sights (TASER 7™ vs X26™)

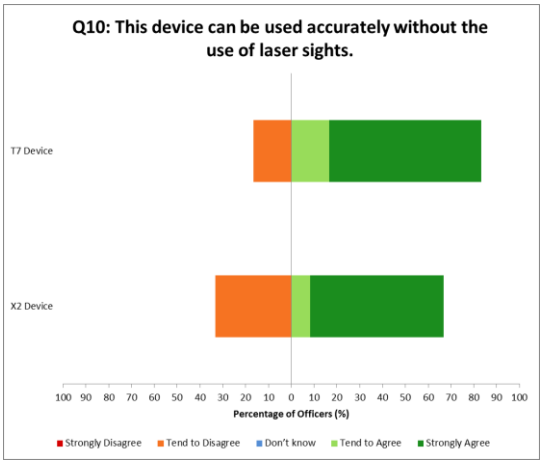


Figure 34: Q10 This device can be used accurately without the use of laser sights (TASER 7™ vs X2™)

Fixed sights would be used when the X26™ and X2™ laser sights are turned off or when the TASER 7™ is the stealth mode. Twelve officers from each group responded.

- The responses from the covert user group clearly indicated an improvement in the fixed sights of the TASER 7™ compared to the X26™ when using the devices without the laser sights.
- The overt user group had a similar response with a preference for the TASER 7™ compared to the X2™. This was supported with comments regarding the improvement in the TASER 7™ fixed sights.

[redacted]

[redacted]

3.12 Q11. The device is safe to use without risk of electric shock to the officer

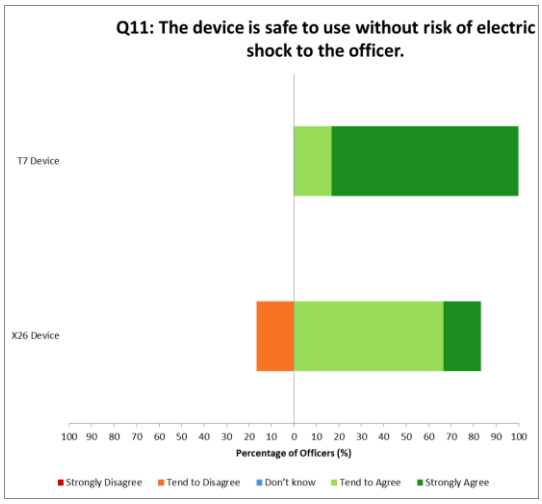


Figure 35: Q11 The device is safe to use without risk of electric shock to the officer (TASER 7™ vs X26™)

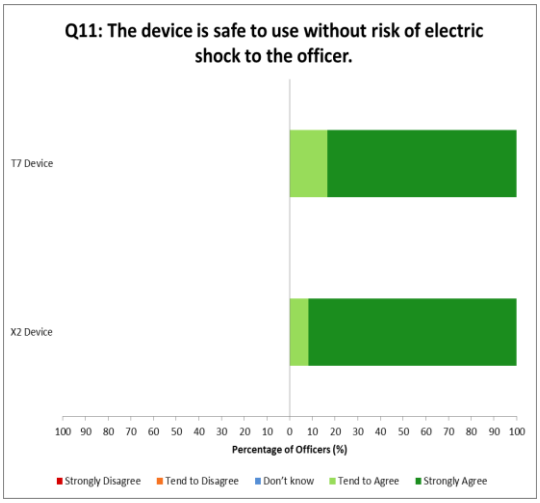


Figure 36: Q11 The device is safe to use without risk of electric shock to the officer (TASER 7™ vs X2™)

The responses from both groups for all devices was mainly positive with the exception of two officers from the covert group who tended to disagree that the X26™ was safe to operate. The X2™ and TASER 7™ were considered to be safe to operate. Twelve officers from each group responded.

[redacted]

[redacted]

3.13 Q12. The device could be used in confined spaces when the subject is too close.

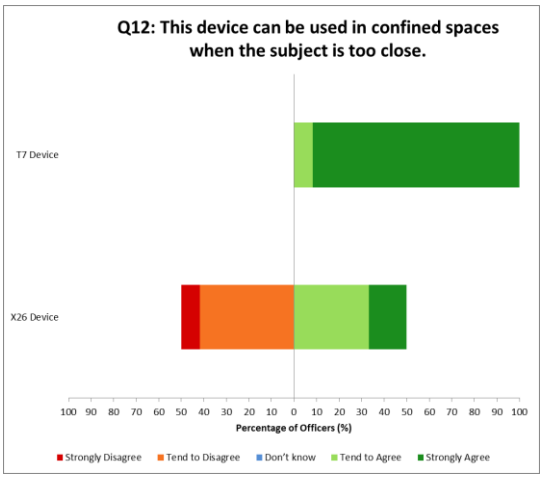


Figure 37: Q12 This device can be used in confined spaces when the subject is too close (TASER 7™ vs X26™)

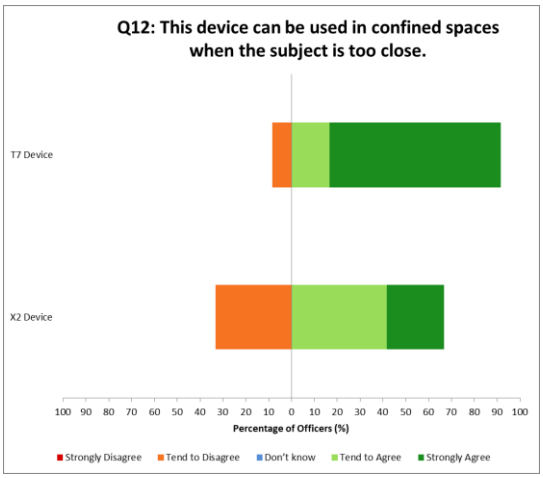


Figure 38: Q12 This device can be used in confined spaces when the subject is too close (TASER 7™ vs X2™)

From the covert user group all of the officers tended to agree or strongly agree that the TASER 7™ can be used in a confined space when the subject is too close. Twelve officers from each group responded.

- Only 50% of the X26™ users agreed or strongly agreed with this statement.
- The overt user group gave similar responses to the covert group.
- This can be reflected in the following comment “really like the 12°, as in most incidents I attend are close quarters, houses, room clearances, etc.”.

[redacted]

[redacted]

3.14 Q13. After completion of the exercises, I felt confident in handling and using the device.

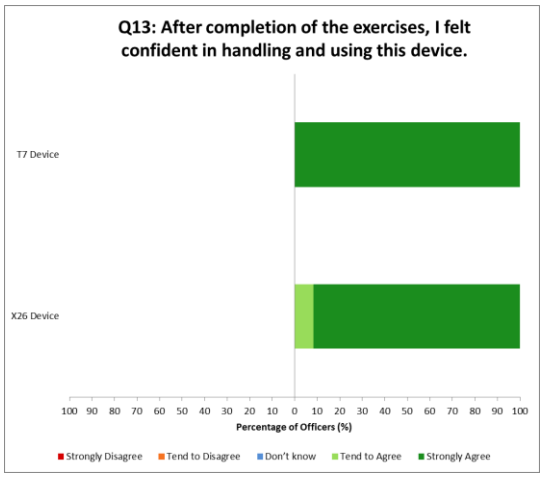


Figure 39: Q13 After completion of the exercises, I felt confident in handling and using this device (TASER 7™ vs X26™)

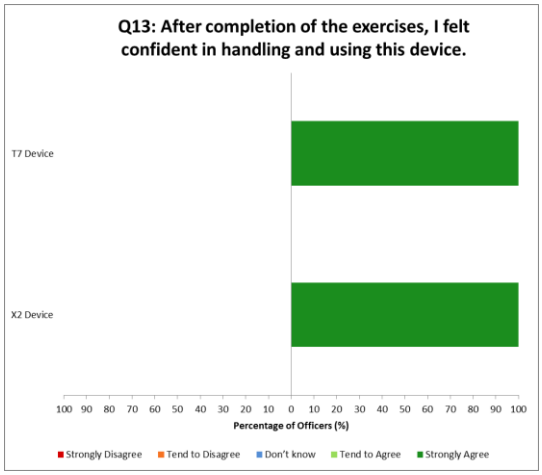


Figure 40: Q13 After completion of the exercises I felt confident in handling and using this device (TASER 7™ vs X2™)

Responses from the covert and overt user groups showed that 100% of the officers tended to agree or strongly agreed that they felt equally confident handling the TASER 7™, the X26™ and the X2™. Twelve officers from each group responded.

[redacted]

[redacted]

3.15 Q14. The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle.

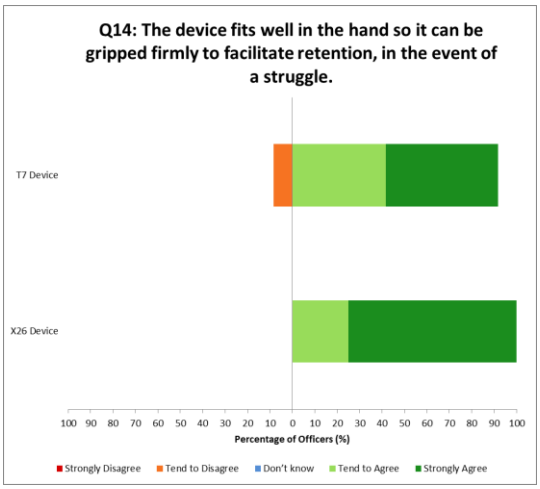


Figure 41: Q14 The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle (TASER 7™ vs X26™)

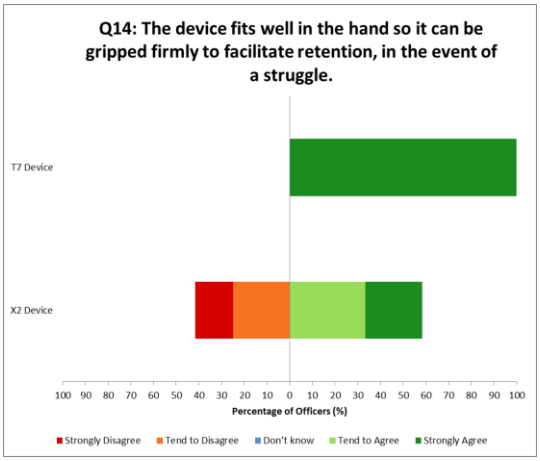


Figure 42: Q14 The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle (TASER 7™ vs X2™)

The majority of X26™ trained officers strongly agreed, or tended to agree that both X26™ and TASER 7™ devices fit well in the hand, and therefore aids retention. Twelve officers from each group responded.

- One officer from the covert user group tended to disagree commenting that the TASER 7™ grip was undersized to the point where their smallest finger could not fit on the grip. Before the start of the trial the officer had the opportunity to choose between the compact and tactical battery types and selected the compact battery to use for the trial. After the trial the officer commented this may be remedied with an elongated battery. Battery selection may require consideration by the procurement agencies and suitable information should be available to officers to aid selection of the correct battery. It is recommended that this selection is covered in training.

[redacted]

[redacted]

- All of the X2™ trained officers strongly agreed that the TASER 7™ fits well in the hand and can be gripped firmly to facilitate retention.

[redacted]

[redacted]

3.16 Q15. The device would be suitable for use in the dark or subdued lighting conditions.

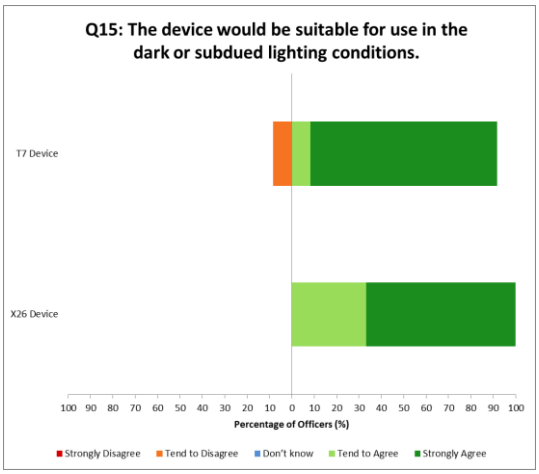


Figure 43: Q15 The device would be suitable for use in the dark or subdued lighting conditions (TASER 7™ vs X26™)

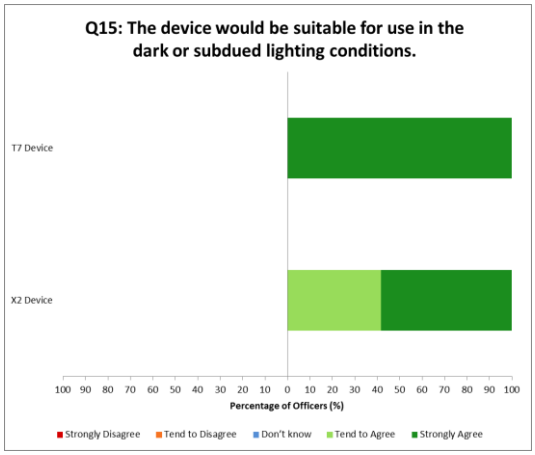


Figure 44: Q15 The device would be suitable for use in the dark or subdued lighting conditions (TASER 7™ vs X2™)

The majority of officers from the covert user group tended to agree, or strongly agreed that both the X26™ and TASER 7™ are suitable to use in dark or subdued lighting conditions. Twelve officers from each group responded.

- One officer from the covert user group tended to disagree that the TASER 7™ could be used in these conditions. The officer felt that a function test could prove difficult in these conditions with cartridge loaded in the bays. As an X26™ user, they would be familiar with conducting a function test on the X26™ with the cartridge unloaded.

- 100% of the X2™ overt user group officers strongly agreed that the TASER 7™ would be suitable for use in low light conditions.

[redacted]

[redacted]

- The X2™ officers either tended to agree or strongly agreed that the X2™ was suitable to use in the dark or subdued lighting conditions.
- From all the officers that participated, eight commented that the TASER 7™ torch was brighter than the X26™ or X2™.

[redacted]

[redacted]

3.17 Q16. The device could not easily be discharged unintentionally.

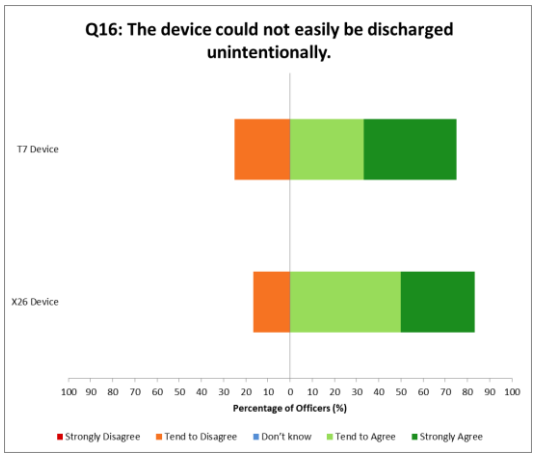


Figure 45: Q16 The device could not easily be discharged unintentionally (TASER 7™ vs X26™)

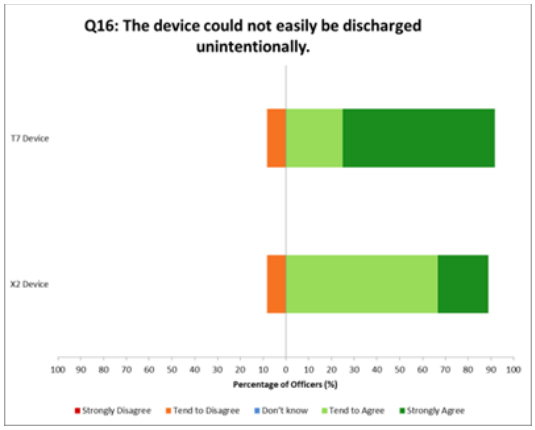


Figure 46: Q16 The device could not easily be discharged unintentionally (TASER 7™ vs X2™)

The majority of officers from the covert user group tended to agree or strongly agreed that both X26™ and TASER 7™ devices could not be discharged unintentionally. Twelve officers from each group responded.

- Three officers (ASO and CTSFOs) from the covert user group tended to disagree that the TASER 7™ could not be discharged unintentionally. Further comments from the two CTSFOs stated they believe an unintentional discharge may be possible from TASER 7™. One officer (STO) tended to disagree with the statement for both the X2™ and TASER 7™, but did not comment further.

- The majority of officers from the overt user group tended to agree or strongly agreed that both X2™ and TASER 7™ devices could not be discharged unintentionally.

[redacted]

[redacted]

3.18 Q17. The device was easy to reset after the auto shut-off.

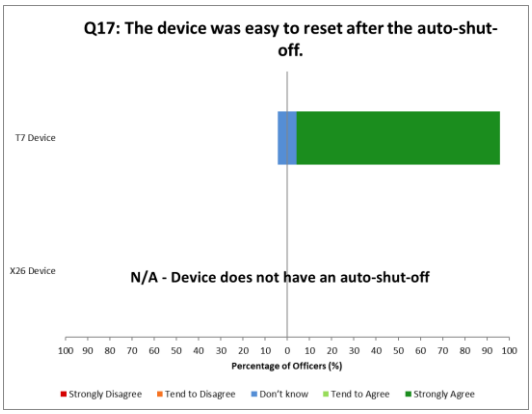


Figure 47: Q17 The device was easy to reset after the auto shut-off (TASER 7™ vs X26™)

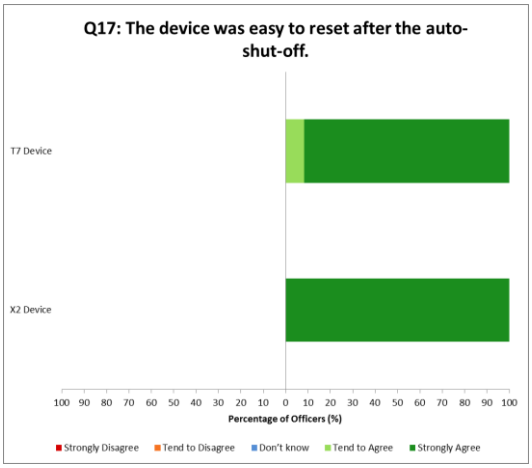


Figure 48: Q17 The device was easy to reset after the auto shut-off (TASER 7™ vs X2™)

The X26™ does not have an auto shut-off, hence this question is not applicable. Twelve officers from each group responded.

- The majority of the X26™ covert user group found the TASER 7™, easy to reset following an auto shut-off. One X26™ trained officer (SO) did not know how to respond, and did not comment further.

- The overt user group agreed or strongly agreed that both the X2™ and TASER 7™ was easy to reset after auto shut-off.

[redacted]

[redacted]

3.19 Q18. The training cartridges (used against the subject in suit) were a good simulation of the operational cartridge and performed in a similar manner.

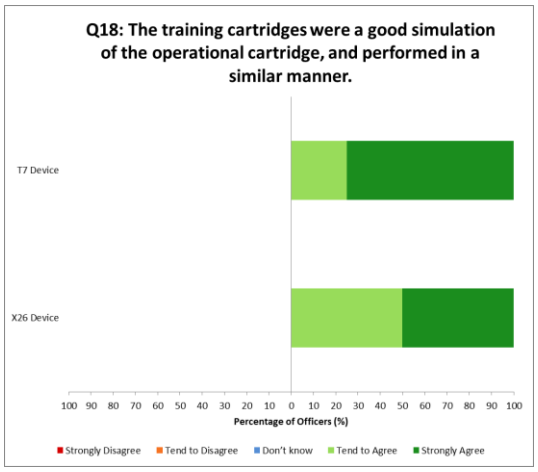


Figure 49: Q18 The training cartridges were a good simulation of the operational cartridge and performed in a similar manner (TASER 7™ vs X26™)

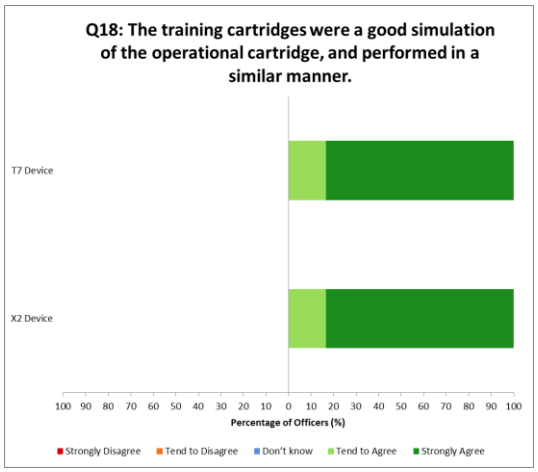


Figure 50: Q18 The training cartridges were a good simulation of the operational cartridge and performed in a similar manner (TASER 7™ vs X2™)

All of the officers from both covert and overt groups tended to agree, or strongly agreed that the training cartridges (HALT™) for the X26™, X2™ and TASER 7™ were a good simulation of the operational cartridge and performed similarly. Twelve officers from each group responded.

[redacted]

[redacted]

3.20 Q19. Operational and training cartridge types were readily distinguishable from each other.

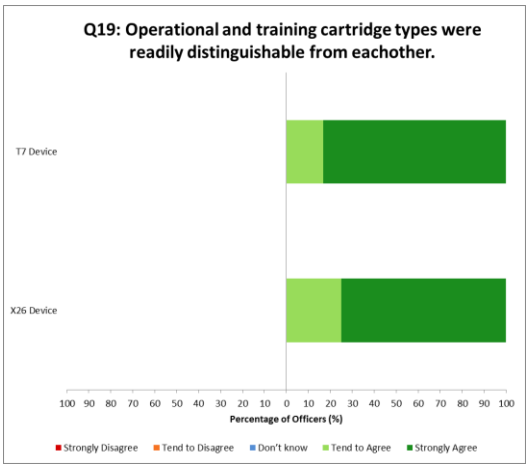


Figure 51: Q19 Operational and training cartridge types were readily distinguishable from each other (TASER 7™ vs X26™)

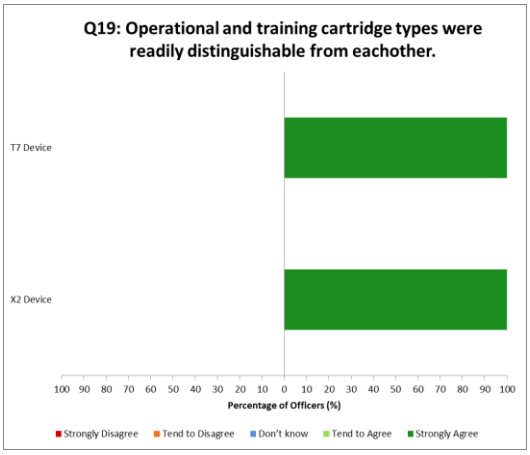


Figure 52: Q19 Operational and training cartridges types were readily distinguishable from each other (TASER 7™ vs X2™)

All of the officers from both covert and overt groups tended to agree, or strongly agreed that the training cartridges (HALT™) for the X26™, X2™ and TASER 7™ were readily distinguishable from the operational cartridges. Twelve officers from each group responded.

[redacted]

[redacted]

3.21 Q20. The device could be discreetly carried in accordance with your role

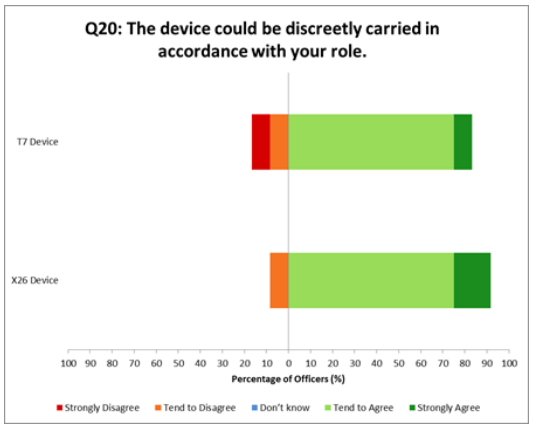


Figure 53: Q20 The device could be discreetly carried in accordance with your role (TASER 7™ vs X26™)

Only the covert user group of twelve officers answered this question carrying the device discreetly in accordance with their role:

- The majority of the covert user group tended to agree, with some strongly agreeing, that both X26™ and TASER 7™ devices could be carried discreetly in their role.
- Two officers (ASO and CTSFO) from the covert user group tended to disagree and strongly disagreed that the TASER 7™ could be discreetly carried. The officers commented on the colour of the device and stated they would prefer a reduction in the overall size of the device.
- 50% of this covert user group stated they would prefer a more covert colour (e.g. non-yellow) version for covert carriage.

[redacted]

[redacted]

3.22 Q21. The device is compatible with your method of carriage.

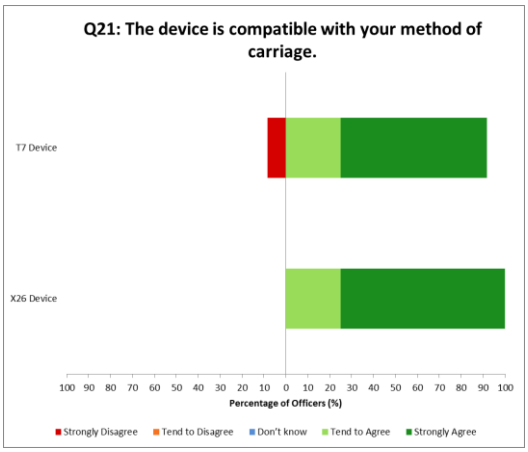


Figure 54: Q21 The device is compatible with your method of carriage (TASER 7™ vs X26™)

Only the twelve officers in the covert user group answered this question in accordance with their role.

- The majority of officers from this user group tended to agree or strongly agreed that both X26™ and TASER 7™ were compatible with the officers' method of carriage.
- One officer (ASO) strongly disagreed with this statement and commented that TASER 7™ requires a safety clip to keep the safety switch in the safe position while using their preferred carriage method. A safety clip is currently available for the X26™ and when fitted prevents the safety switch from inadvertently being activated and arming the X26™ when carried in a bag or rucksack.

[redacted]

[redacted]

4 User handling trial – accuracy

4.1 Background

4.1.1 This section summarises the impact location, distance to target and the time to fire results for some of the exercises carried out during the user handling trial where comparisons and observations can be made. The charts show the average results for the groups and the devices. A description of the exercises can be found in APPENDIX C. The breakdown of the impact locations of all the exercises can be found in APPENDIX E.

4.1.2 The exercises for the 12° cartridges were generally conducted at a shorter range than the 3.5° exercises.

4.2 Probe impact summary

4.2.1 Table 8 shows a summary of shots fired and area of probe impact with the results separated by user group. Head, neck and one hit correspond to single probes. Head and neck shots are classed as hits. The impact locations for all the exercises, all devices and all cartridge types are shown as percentages in APPENDIX E.

TASER® model	User group	Total shots fired	Both hit (%)	Head	Neck	One hit	Both miss
X26™	Covert	509	472 (92.7%)	2 (Ex 2)	32	35	2
TASER 7™	Covert	574	471 (82.1%)	1 (Ex 7)	25	99	4
X2™	Overt	538	507 (94.2%)	0	0	28	3
TASER 7™	Overt	576	456 (79.2%)	0	15	114	4

Table 8: Summary of the number of shots and probe impacts for all devices and all cartridge types by user group (exercises during which head shots occurred shown in parentheses)

4.2.2 The results shown in Table 8 highlight a lower proportion of both probe hits for the TASER 7™ compared to the TASER X26™ and TASER X2™. Further analysis was conducted on the data to investigate the TASER 7™ miss rate. The first step was to separate the miss rates between the 3.5° and 12° cartridges.

[redacted]

[redacted]

4.2.3 The results shown in Table 8 highlight a lower proportion of both probe hits for the TASER 7™ compared to the TASER X26™ and TASER X2™. Further analysis was conducted on the data to investigate the TASER 7™ miss rate. The first step was to separate the miss rates between the 3.5° and 12° cartridges.

4.3 Investigation of the miss rate trends

4.3.1 A review of all the firings from APPENDIX E was conducted and the data for the operational cartridges was extracted and analysed. The results are shown in Table 9. This showed the TASER 7™ 3.5° operational cartridge top probe miss rate to be comparable with the X2™, however less than the X26™. There were a greater number of bottom probe misses compared to the X2™ and X26™. The TASER 7™ 12° cartridge had a higher miss rate for both probes compared to the X2™ and X26™.

TASER® model	Quantity of Operational cartridges fired	Top probe miss %	Bottom probe miss %
X2™	430	0.5	4
X26™	401	2	5
TASER 7™ 3.5° cartridges	144	0.7	9.7
TASER 7™ 12° cartridges	430	2.3	15.8

Table 9: Percentage miss rate for operational cartridges only X2™, X26™ and the TASER 7™

4.3.2 As can be seen from Table 9 the highest proportion of misses from the user handling trial was observed from the TASER 7™ 12° cartridge and specifically from the bottom probe.

4.3.3 Table 9 included all of the exercises that used operational cartridges. In order to investigate the miss rate in more detail the exercises that used only the TASER 7™ operational 12° cartridge and fired at a range of 3 m were analysed in Section 4.4.

4.4 TASER 7™ 12° cartridges miss rate from comparative exercises

4.4.1 The results from following exercises using the TASER 7™ 12° operational cartridges fired at 3 m were analysed to compare the miss rate with the TASER X26™ and TASER X2™.

- Exercise 1: Standard upright two shot
- Exercise 6: Three shot
- Exercise 8: Show of strength
- Exercise 14: Torch on, low light.

[redacted]

[redacted]

4.4.2 Table 10 to Table 13 show the miss rate for the individual exercises. Table 14 shows the combined results summary of these exercises.

TASER® type	Top probe miss %	Bottom probe miss %	Both probe miss %
X26™	0	0	0
X2™	0	0	0
TASER 7™ 12° cartridges	4.2	17.5	1.4

Table 10: Exercise 1: Standard upright two shot (12° cartridge)

TASER® type	Top probe miss %	Bottom probe miss %	Both probe miss %
X26™	0	0	0
X2™	0	0	0
TASER 7™ 12° cartridges	1.4	23.6	0

Table 11: Exercise 6: Three shot (12° cartridge)

TASER® type	Top probe miss %	Bottom probe miss %	Both probe miss %
X26™	0	2.8	0
X2™	0	0	0
TASER 7™ 12° cartridges	0	8.5	0

Table 12: Exercise 8: Show of strength (12° cartridge)

TASER® type	Top probe miss %	Bottom probe miss %	Both probe miss %
X26™	0	0	0
X2™	0	0	0
TASER 7™ 12° cartridges	2	13.9	0

Table 13: Exercise 14: Torch and in low light (12° cartridge)

[redacted]

[redacted]

TASER® type	Top probe miss %	Bottom probe miss %	Both probe miss %
X26™	0	0.5	0
X2™	0	0	0
TASER 7™ 12° cartridges	2.3	15.8	0.47

Table 14: Collective summary of exercises 1, 6, 8, & 14

4.4.3 The results show a consistently higher miss rate for these four exercises from the bottom probe of the 12° operational cartridge when compared to the TASER X26™ and TASER X2™. It was hypothesised the probe separation coupled with a twisting of the device could be a contributing factor to the number of misses.

4.4.4 To further explore whether the misses could be attributed to probes bouncing out of the target following impact, the data from all the accuracy and consistency firings was examined (130 x 3.5° cartridges and 87 x 12° cartridges). A total of three probe bounce outs were recorded, all of which were from the 3.5° cartridges.

4.4.5 To summarise the results of Table 9 to Table 14:

- The TASER 7™ 3.5° cartridge recorded a slightly higher miss rate than the X26™ and X2™
- The TASER 7™ 12° cartridge recorded a greater miss rate than the X26™ and X2™
- The highest rate of misses was recorded from the bottom probe of the 12° cartridge at a range of 3.0 m (10 ft). This indicates that there may be operational consequences from these miss rates.

4.5 Torch on low light (Exercise 14)

4.5.1 Exercise 14 involved the officers using the TASER® devices to engage a stationary target at a range of 3 m in low light conditions to determine the effectiveness of the torch and laser sight system. Table 15 shows the results.

[redacted]

[redacted]

TASER® type	% hits							
	Covert users				Overt users			
	Split belt	No split	1 probe miss	Both miss	Split belt	No split	1 probe miss	Both miss
X26™	97.6	2.4	0	0	N/A	N/A	N/A	N/A
X2™	N/A	N/A	N/A	N/A	97.2	2.8	0	0
TASER 7™	87.5	0	12.5	0	80.6	0	19.4	0

Table 15: Summary of Exercise 14 percentage shot distribution

4.5.2 The data from Table 15 shows that both user groups attained 100% hit rate with the X26™ and X2™ devices. With the TASER 7™, a similar number of one probe misses were observed from both user groups. However in response to Question 15 of the survey – “The device would be suitable for use in the dark or subdued lighting conditions”, the majority of officers from both user groups responded positively regarding the performance of the TASER 7™ in such conditions. Four officers did comment positively on the brightness of the TASER 7™ LED torch.

[redacted]

5 User handling trial – other results

5.1 Two shot exercise (Exercise 1)

5.1.1 Exercise 1 was carried out using the laser sight and taking two shots at an upright stationary target. The X26™ requires reloading, whereas both the X2™ and TASER 7™ have two cartridge bays, which can be fired one after another.

5.1.2 The results show the difference in timings between the X26™, X2™ and TASER 7™ Figure 55.

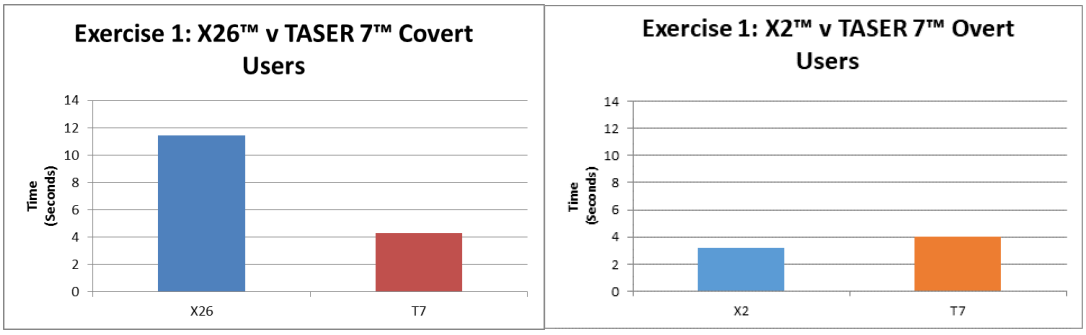


Figure 55: Exercise 1 - times to fire two shots X26™ vs TASER 7™ and X2™ vs TASER 7™

The average time was approximately three times quicker using TASER 7™ than the X26™. The times for the X2™ and TASER 7™ were comparable.

5.1.3 Breaking the user groups into their role profiles, the timings to take two shots with X26™, X2™ and TASER 7™ are shown in Figure 56 and Figure 57.

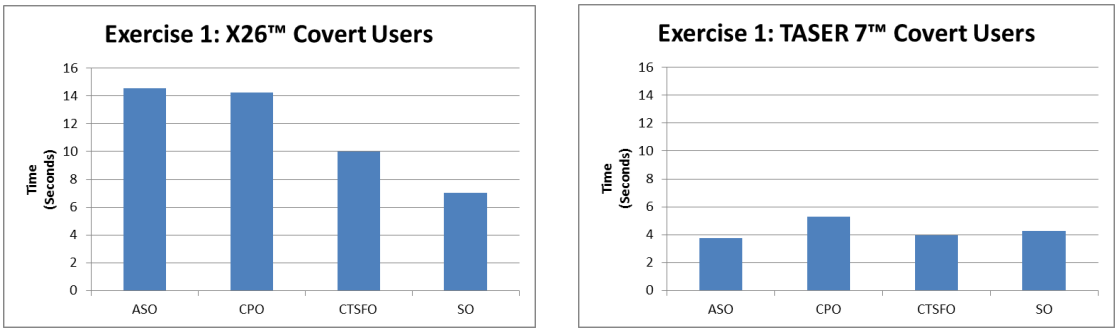
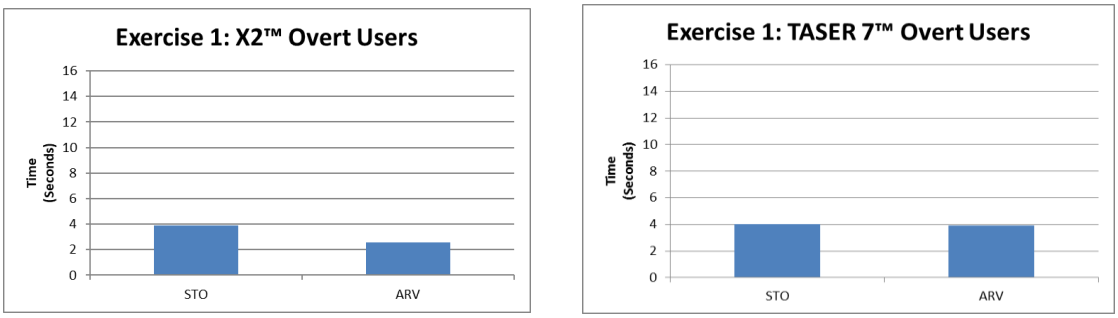


Figure 56: Exercise 1 - times to fire two shots X26™ vs TASER 7™ for the covert user group



[redacted]

Figure 57: Exercise 1 - times to fire two shots X2™ vs TASER 7™ for the overt user group

5.1.4 Figure 56 shows that there was a greater variation (approximately 8 seconds) in times between the covert user group to fire two shots from the X26™ compared to the TASER 7™. This is partly explained by one user in each covert group taking over 20s to reload. Comparing the same roles using the TASER 7™, the timings to fire two shots are similar (within approximately 1.5 seconds). Figure 57 shows that the overt user group fired two shots with the TASER 7™ and X2™ in a similar time.

5.2 Target too close (Exercise 5)

5.2.1 Officers from both groups stood at a distance of 1 m from the target. For TASER 7™ the 12° cartridges were used. The average probe separation was measured and is shown in Figure 58.

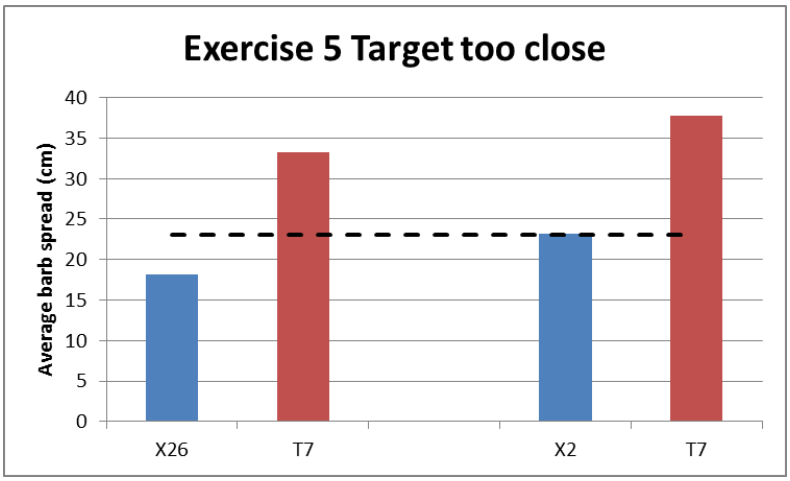


Figure 58: Exercise 5 - target too close, average probe separation (dashed line represents 23 cm probe separation (reported minimum to induce NMI))

5.2.2 The exercise showed that when the officers engaged with a target that was too close, the TASER 7™ with the 12° cartridges, delivered an average probe separation in excess of the 23 cm (9 inches) that is reported to be required to be the minimum required to induce NMI. Figure 58 shows the wider probe separation of the TASER 7™ 12° cartridge compared to that of the X26™ or X2™.

[redacted]

[redacted]

5.3 Time to fire three shots (Exercise 6)

5.3.1 In Exercise 6 the officers had to fire three 12° cartridges (laser on) in quick succession – two inert, followed by one operational cartridge. The participating officers were instructed to not wait for the CED to finish cycling on the first two shots but reminded to engage the safety when reloading. For the X26™ this entailed firing the cartridge, unloading and reloading twice. The TASER 7™ and X2™, fired two inert cartridges and reloaded to fire a third cartridge. The results of the hit locations are shown in APPENDIX E.

5.3.2 The average, maximum and minimum times to fire three cartridges for the X26™, X2™ and TASER 7™ are shown in Figure 59.

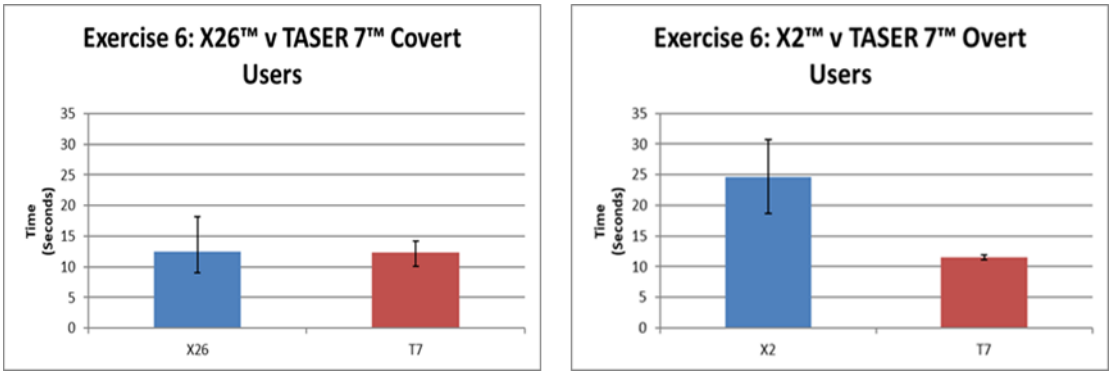


Figure 59: Times to fire three shots X26™ vs TASER 7™ and X2™ vs TASER 7™

5.3.3 The times to carry out three shots were similar between the X26™ and TASER 7™. The X2™ took the longest to fire three shots. This was explained in the questionnaire, where 50% of the users found the X2™ difficult to unload and reload the cartridges.

5.4 Static target through an open door at different ranges (Exercise 9)

5.4.1 For Exercise 9 all 24 officers engaged a target at three randomly selected distances that were unknown to the officer (1.5 m, 3.5 m and 6.0 m). Each officer began the exercise with the TASER 7™ loaded with a pair of 12° operational cartridges. Each officer also had a pair of 3.5° cartridges in a belt pouch. The officer stood behind a closed door. When the door was opened the officer had to decide if the loaded cartridge was the most suitable to use against the target at that range or decide whether to reload with the 3.5° cartridges.

5.4.2 A summary breakdown showing the number of officers that used either the 3.5° or 12° cartridge at the differing ranges is shown in Table 16. Also included are the average probe separation measurements from each range and cartridge type. The average probe separation value is calculated from shots that impacted the target. The full breakdown of the impact locations from these exercises can be found at APPENDIX E.

[redacted]

[redacted]

Target Distance (m)	Covert User Group			Overt User Group		
	No. of officers using 3.5°	No. of officers using 12°	Average probe separation (cm)	No. of officers using 3.5°	No. of officers using 12°	Average probe separation (cm)
1.5	N/A	12	38.2	N/A	12	47.7
3.5	N/A	12	83.9	1	11	46.0 87.5
6.0	12	N/A	57.9	12	N/A	62.1

Table 16: Exercise 9 - static target through an open door at different ranges

5.4.3 With the exception of one officer, all of the officers selected the 12° cartridge for the 1.5 m and 3.5 m ranges. The one officer who selected the 3.5° cartridges for the target at 3.5 m still achieved a probe separation of 46 cm (the officer may have been closer or further from the target when taking the shot due to their position when the door was opened). The remaining 23 officers achieved a mean probe separation of 87.5 cm when choosing the 12° cartridge at the 3.5 m range.

5.4.4 All of the officers selected the 3.5° cartridge for the 6 m range.

5.4.5 Examining the shots from Exercise 9 at different ranges (APPENDIX E, Figure 83 and Figure 84); it can be seen that the impact results at 1.5 m (Figure 82) for the TASER 7™ (12° cartridge) and the X26™ and X2™ are comparable with a high number of hits. At 3.5 m the miss rate for the TASER 7™ using the 12° cartridge (all except one officer who used the 3.5° cartridge) was seen to increase, while the X26™ and X2™ maintained 100% hit rate. This accords with the miss rate observed in the comparable exercises described in Section 3. At 6.0 m more hits were observed by all officers using the TASER 7™ 3.5° cartridge compared to the X26™ and X2™.

5.5 Target moving forwards 12° HALT™ cartridge (Exercise 12)

5.5.1 Exercise 12 measured the average time to fire and average distance to an advancing target while moving forwards using 12° HALT™ cartridges. A summary of the results is shown in Figure 60. The full breakdown of the impact locations from these exercises can be found at APPENDIX E.

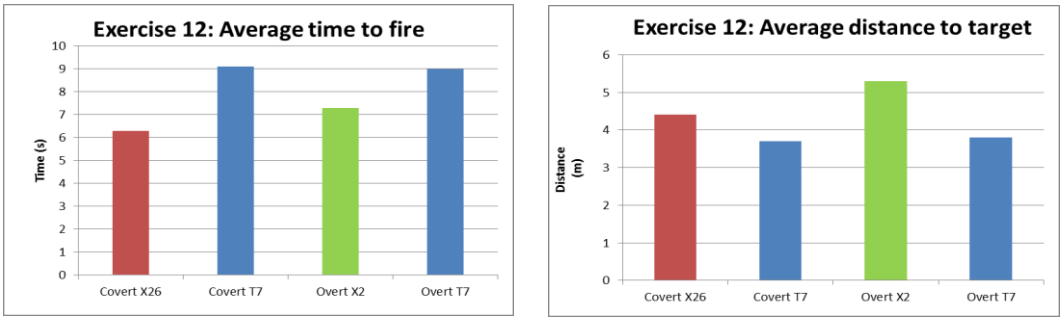


Figure 60: Target moving forwards (12° HALT™ cartridge)

[redacted]

The covert user group took the longest time to fire the TASER 7™. Both user groups took longer before firing the TASER 7™ compared with the X26™ and X2™. This corresponds to the target distance being closer to the officer for TASER 7™ before firing.

It may be hypothesised that the officer delayed firing to ensure that both probes impact the subject (because of the greater probe separation of the 12° cartridge). There are potential risks in allowing the subject to get closer to the officer before firing. Taking a shot too early and with the subject further away increases the risk of the bottom probe from the 12° cartridge impacting the ground. This should be reviewed for any training implications.

5.6 Target moving forwards 3.5° HALT™ cartridge (Exercise 13)

5.6.1 Exercise 13 measured the average time to fire and average distance to an advancing target using 3.5° cartridges. A summary showing the average, maximum and minimum results is shown in Figure 61. The full breakdown of the impact locations from these exercises can be found at APPENDIX E.

Figure 60 shows that the times and distances are comparable for both user groups.

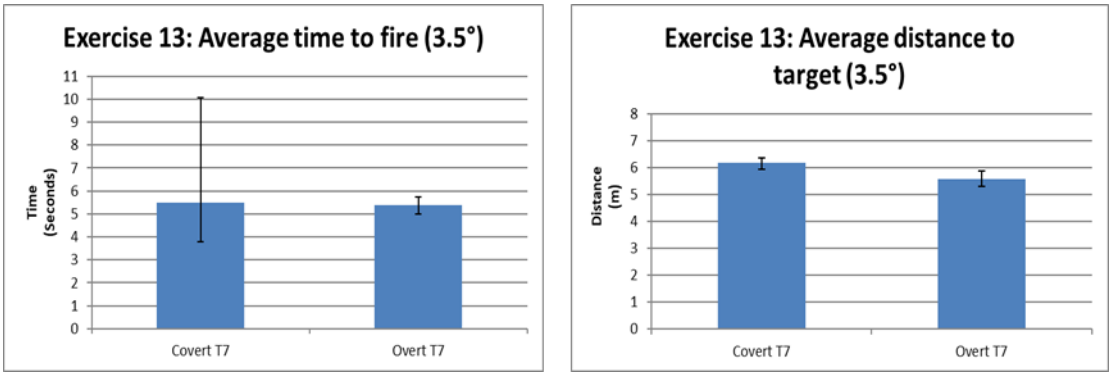


Figure 61: Target moving forwards 3.5° HALT™ cartridge

5.6.2 Figure 60 and Figure 61 show that both user groups took their shots quicker using the 3.5° cartridges compared with the 12° cartridges. This corresponds to a greater distance between the officer and the target.

[redacted]

6 Technical assessment

6.1 Background

6.1.1 The technical assessment of TASER 7™ followed a similar procedure to the assessment of the X2™ that was completed by the then HO CAST in 2016. This work was documented in report CED Replacement Project, Assessment of the TASER X2™ against the Police Operational Requirements, CAST Publication No.057/16 [5].

6.1.2 The aim of the trial was to conduct tests and record measurements to assess the performance of the TASER 7™ against the police operational requirement.

6.1.3 The TASER 7™ performance was assessed by conducting the following trial serials:

- Laser sight alignment checks
- Accuracy and consistency test
- Range tests
- Probe velocity measurement
- Laser output measurements
- Electromagnetic compatibility (EMC) testing (conducted by Axon®).
- Drop testing

6.2 Reliability

6.2.1 The TASER 7™ records data internally and was downloaded to the Axon® application, Evidence.com™ to check condition (when the TASER 7™ is downloaded to Evidence.com each device has an error status as ‘Good’ or ‘Major’). This log was checked for faults after each trial serial.

6.2.2 20 TASER 7™ devices were delivered for use during the assessment. Over all the tests issues were observed with five units, these are provided in Table 17. Of note:

- Only one of these units (serial number X410020KT) displayed a fault icon on the CID alerting the user to the fault and also logged a major fault as the error status in Evidence.com™.
- The remaining faults were not displayed on the CID and therefore may not be detected by the users until the device is downloaded and the data reviewed on Evidence.com™.by the person responsible for undertaking that task. This may result in a TASER 7™ with a major fault being deployed for operational duty and the fault only becoming evident after the device has been downloaded to Evidence.com™.

When these faults are shown, the device should be removed from service and the instruction from Evidence.com™ is to contact Axon®.

[redacted]

[redacted]

TASER 7™ Serial number	Fault shown in Evidence.com™	Fault details
X410020KT	Major fault	Intermittent arcing and fault icon was displayed in CID at the start of the assessment.
X410020A3	Major fault – then cleared	This device showed a major fault recorded in Evidence.com™ on 25 June 2019 at 13:52. When this device was reconnected to Evidence.com™ on 25 October 2019 the fault no longer showed. The Axon® TASER 7™ user manual states that "*Faults are rare. Shift the safety switch to the down (SAFE) position and then to the up (ARMED) position; the fault may clear.*"
X410020KM	No fault shown in Evidence.com	Appears to have a fault with the safety switch at the start of the assessment.
X410020KF	No fault shown in Evidence.com™	Following a cartridge malfunction the unit was inspected at the start of the assessment and found that a connection pin in bay 1 was missing or damaged. As shown in Figure 62.
X410020M4	Major fault	Unit used for drop test (armed) during the technical tests.

Table 17: TASER 7™ fault log

Figure 62: Image from inside the cartridge bay of TASER 7™. The image on the left can be compared to the image on the right where the pin (circled red) is missing or damaged (serial number K410020KF)

6.3 TASER 7™ cartridge faults

6.3.1 During the Dstl assessment a total of 1981 cartridges were fired:

- 1423 Operational cartridges
- 558 HALT™ cartridges

[redacted]

[redacted]

6.3.2 There were a total of eight cartridge failures that resulted in the cartridge failing to fire (six operational cartridges and two HALT™ cartridges).

6.3.3 During the assessment it was observed that when the TASER 7™ cartridges were not loaded in a positive manner prior to the trigger being pulled, a failure to fire could occur. This was not indicated as a fault on the CID. This should be monitored by those involved in managing training to monitor and mitigate this issue.

6.4 TASER 7™ battery faults

6.4.1 During the assessment there was one unexplained instance where a TASER 7™ battery charge dropped from 51% to zero overnight. After the battery was re-charged in the dock it operated correctly and maintained the charge.

6.5 Laser sight check

6.5.1 During the user handling trial, several officers commented on the accuracy and/or that they found the TASER 7™ bottom probe had a tendency to impact the target to the left of the point of aim. The comments from the officers are reproduced below.

'I did hit low left of the point of aim consistently at first, more time with the device and more training did address this.' STO1

'I found on the T7 the lower red dot was not as accurate as it could be.' STO2

'I was finding the accuracy of the T7 was drifting left on some shots.' STO3

'Found that the lower probe on T7 would hit left of where the device was aimed at (i.e. aim at lower left leg and would hit left of targets missing subject). Not clear whether this was due to later placement.' STO4

'T7 - seems to fire to the left of the lasers. This may be due to the safety switch or trigger being different to the X2.' STO5

'I am 100% confident that the T7 is not accurate. I have fired this many times with a steady aim using laser sights and the probe was around 6 inches to the left of where I aimed.' STO6

'The accuracy of the probes has been an issue for me. One or two misplaced probes can be blamed on user error but I had a considerable amount, the majority of which were going to the left.' ARV1

'I noticed is quite inaccurate with regard to the lower laser dot. Especially with the 12 degree cartridge. The lower probe on most occasions would always strike left of where the laser sight is. This could be very problematic when sighting on a lower leg as this could result in a miss.' ARV3

'Both are very good, the X2 is very accurate and consistently functions well. T7 is let down by its safety and on a few occasions bottom barb misses.' ARV2

'T7 shot at a distance it was noted the bottom red dot on a 3.5 degree cartridge did slightly move left.' STO8

[redacted]

To investigate this the following tests were undertaken:

- TASER 7™ fixture check
- Laser sight comparison test
- Laser verification live firing test.

6.6 TASER 7™ fixture check

6.6.1 To check the consistency of the TASER 7™ fixture (Figure 63) a functional TASER 7™ (Serial No. X410020KK) was used as a reference device. This was secured in the TASER 7™ fixture and loaded with a pair of 12° inert cartridges. The positions of the laser sights were marked on a target at a range of 3 m (10 ft). To verify the repeatability and consistency of the fixture, the TASER 7™ was removed and refitted ten times and the position of the laser sights was marked each time.

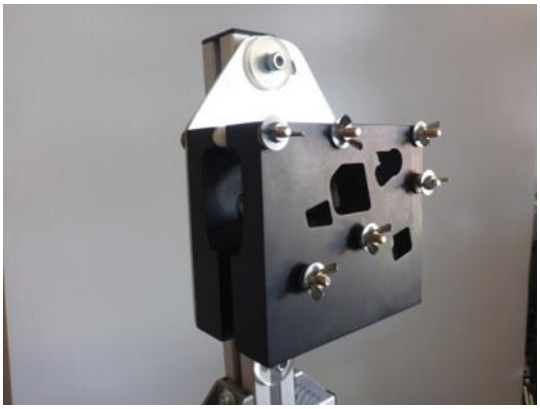


Figure 63: TASER 7™ fixture

6.6.2 The test concluded that the TASER 7™ fixture was reliable for checking the consistency of the laser sights. The laser sights of the remaining 17 functional TASER 7™s were then checked between devices using the method described in Section 6.7.

6.7 Laser sight comparison test

6.7.1 The sight comparison test was conducted to identify any variation in the laser sights between the Dstl stock of working TASER 7™ units. Each device was individually mounted in the TASER 7™ fixture and loaded with a pair of 12° inert cartridges. The position of the top and bottom lasers from bay one was marked, measured and recorded on a target, set at a range of 3 m (10 ft). This process was conducted three times for each TASER 7™.

6.7.2 The sight comparison test was then repeated using the 3.5° inert cartridges to ensure that the bottom laser associated with this cartridge remained consistent between all the TASER 7™ devices.

[redacted]

6.7.3 The laser sight comparison test showed that there was variation between the 17 TASER 7™ devices that were checked. It was identified that TASER 7™ Serial No. X410020CD was the worst case being the furthest away from the point of reference (bottom laser average 3.9 cm at a range of 10 ft with 3.5° cartridge) compared to the reference device (Serial No. X410020KK). The device (Serial No. X410020CD) was then included in the laser verification live firing test explained in Section 6.8.

6.8 Laser verification live firing test

6.8.1 Eight TASER 7™ devices associated with adverse comments about accuracy with the laser sight position were identified for this test. Also included in this test was the worst case device (Serial No. X410020CD) as identified in Section 6.7.3. A total of nine devices were then live fired from the TASER 7™ fixture to check the accuracy and consistency of the probe impact locations compared to the laser point of aim.

6.8.2 TASER 7™ device (Serial No. X410020KK) was used as a reference device to set up the TASER 7™ trial fixture. The device was loaded with 12° inert cartridges to provide the largest probe separation. The top and bottom laser locations were then marked on the target at a range of 3.0 m (10 ft).

6.8.3 Each device was loaded with 12° operational cartridges in bay 1 and the top and bottom laser positions marked. After each shot, the measurements from the point of impact to the point of aim were recorded. A tolerance of +/- 0.5 cm was deemed acceptable for target measurements. Five shots were taken from each device and the mean results are shown in Table 18:

TASER 7™ Serial No.	Test range	Top probe POA to MPI top laser (cm)		Bottom probe POA to MPI bottom laser (cm)	
		X	Y	X	Y
X410020CD	3 m (10 ft)	2.7	3.7	-3.2	1.4
X4100204H	3 m (10 ft)	2.3	3.0	-2.9	1.1
X410020C7	3 m (10 ft)	0.5	1.6	-1.9	-0.5
X410020M2	3 m (10 ft)	-1.6	1.8	-4.0	0.4
X410020M5	3 m (10 ft)	-4.3	0.7	-3.4	2.8
X410020MC	3 m (10 ft)	-1.7	2.0	-6.9	-2.1
X410020KV	3 m (10 ft)	-0.2	1.7	-4.0	2.2
X410020KP	3 m (10 ft)	-4.8	0.5	-4.7	1.6
X410020M3	3 m (10 ft)	-4.8	1.2	-5.8	2.5

Table 18: Laser verification TASER 7™ top and bottom laser mean point of impact (MPI)

[redacted]

[redacted]

6.8.4 The data shown in Table 18 shows the maximum distance from the mean results for the bottom probe impact point to be 6.9 cm to the left of the point of aim.

6.8.5 The results for all devices show the bottom probe to be between 1.9 cm to 6.9 cm left from the point of aim. This data is from a fixed mount.

6.8.6 The shot dispersion for each device is shown graphically in APPENDIX F.

6.8.7 The average displacement MPI for the nine units tested for the bottom probe when fired from the fixed mount at 3.0 m (10 ft) was approximately 4 cm to the left and 1 cm above the POA. The results of this test do not reflect the deviation in shot for the 12° cartridge bottom probe that was reported by some of the users in the handling trial. Therefore the intrinsic accuracy of the device is not the reason for the degradation in user accuracy.

6.9 Accuracy and consistency

6.9.1 These tests determine the accuracy and consistency of the TASER 7™ cartridges when fired from a fixed mount (Figure 63) at different ranges. The following measurements were recorded:

- Point of aim (POA) from top laser to the point of impact (POI) of the top probe (X and Y coordinates and radial distance)
- POA from bottom laser to the POI of the bottom probe (X and Y coordinates and radial distance)
- Probe separation (the measured distance between the POI of the top and bottom probes).

6.9.2 A tolerance of ± 0.5 cm was deemed acceptable for target measurements. The test results were not intended to replicate the accuracy from hand-firing but to give an objective comparison of intrinsic consistency.

6.9.3 The test involved firing TASER 7™ cartridges at a fixed POA marked on a TASER 7™ target from different test ranges as shown in Table 19 and Table 20.

6.9.4 The tests included the 3.5° and 12° operational cartridges. The 3.5° and 12° Hook and Loop Training (HALT™) cartridges were fired and their performance was compared to the operational cartridges.

6.9.5 The left cartridge bay of the TASER 7™ was the primary firing bay for measurements. Ten 3.5° and ten 12° operational cartridges were fired from the right bay at each range to enable a comparison to be made between the firing bays.

6.9.6 This test format enables the comparison of the accuracy and consistency of the TASER 7™ system compared with the X26™ and X2™ as documented in Reference [5].

[redacted]

[redacted]

Test Range	12° operational cartridge		12°HALT training cartridge
	Left bay	Right bay	
1.5 m (5 ft)	10	10	10
3.0 m (10 ft)	20	10	10
4.6 m (15 ft)	20	10	10
6.1 m (20 ft)	20	10	10
7.6 m (25 ft)	10	10	10

Table 19: TASER 7™ test ranges and numbers of 12° cartridges tested

Test Range	3.5° operational cartridge		3.5° HALT training cartridge
	Left bay	Right bay	
1.5 m (5 ft)	10	10	10
3.0 m (10 ft)	20	10	10
4.6 m (15 ft)	20	10	10
6.1 m (20 ft)	20	10	10
7.6 m (25 ft)	10	10	10

Table 20: TASER 7™ test ranges and numbers of 3.5° cartridges tested

[redacted]

[redacted]

6.9.7 The TASER 7™ was clamped in the TASER 7™ fixture on a tripod and checked with an inclinometer to ensure it was level and upright to within ±0.2°. The TASER 7™ target board was secured at the set test range from the front of the TASER 7™ and marked with cross hairs at a height of 1.4 metres from the ground. The centre of the cross hairs was designated the POA and the origin (coordinate X0, Y0 position) from where the measurements were taken. The TASER 7™ laser sight was turned on and the top laser aligned with the cross hairs. For every shot the top laser was always sighted at X0, Y0. This is a test set-up and not the operational POA.

6.9.8 The position of the bottom laser location was marked, measured and recorded for each cartridge type with reference to the origin. For every shot the bottom laser was always sighted at this point of aim for the bottom probe.

6.9.9 The battery level for the TASER 7™ was recorded before and after firings at each test range.

6.9.10 A summary of the mean accuracy and consistency data for X26™, X2™ [5] and TASER 7™ can be seen in Table 21 and Table 22. The data for the X26™ and X2™ is taken from previous work [5]. There is no data for the 12° cartridges past 5.8 m (19 ft) due to the bottom probe striking the ground beyond this range, therefore is shown for information only.

6.9.11 The accuracy and consistency data for X26™, X2™ and TASER 7™ at different ranges is presented pictorially in the following appendices:

- APPENDIX G: X26™ operational cartridge probe displacement relative to point of aim
- APPENDIX H: X2™ operational cartridge probe displacement relative to point of aim
- APPENDIX I: TASER 7TM operational 3.5 cartridge probe displacement relative to point of aim
- APPENDIX J: TASER 7TM operational 12° cartridge probe displacement relative to point of aim
- APPENDIX K : Comparison between TASER 7™ left bay and right bay firing operational 3.5° cartridge
- APPENDIX L: Comparison between TASER 7™ left bay and right bay firing operational 12° cartridge
- APPENDIX M: Comparison between TASER 7™ operational 3.5° cartridge and HALT™ training 3.5° cartridges fired from left bay
- APPENDIX N: Comparison between TASER 7™ operational 12° cartridge and HALT™ training 12° cartridge fired from left bay.

[redacted]

[redacted]

TASER® model	Test range	Top probe POA to MPI (top laser) (cm)		Bottom probe POA to MPI (bottom laser) (cm)		Probe separation (cm)			
		X	Y	X	Y	Min	Max	Range	Mean
TASER X26™ (2015 test)	1.5 m (5 ft)	-0.2	3.6	n/a	n/a	19.3	24	4.7	20.9
	3.0 m (10 ft)	-1.2	2.0	n/a	n/a	33.4	44.5	11.1	40.3
	4.6 m (15 ft)	-3.1	-4.4	n/a	n/a	50.5	65	14.5	58.2
	6.1 m (20 ft)	-2.2	-14.0	n/a	n/a	66.4	85.5	19.1	76
TASER X2™ (left bay)	1.5 m (5 ft)	-0.1	2.7	-2.2	0.9	18.7	22.0	3.3	20.4
	3.0 m (10 ft)	-0.6	-0.7	-2.2	-1.8	30.3	44.5	14.2	37.6
	4.6 m (15 ft)	0.3	-7.0	-2.2	-4.2	39.6	64.7	25.1	51.0
	6.1 m (20 ft)	0.3	-16.5	-2.5	-14.0	59.3	83.2	23.9	69.2
	7.6 m (25 ft)	0.35	-28.2	-1.0	-25.1	77.0	105.0	28.0	86.2

Table 21: Summary data table for probe impact for X26™ and X2™

TASER 7™	Test range	Top probe POA top laser to MPI (cm)		Bottom probe POA bottom laser to MPI (cm)		Probe separation (cm)			
		X	Y	X	Y	Min	Max	Range	Mean
3.5°	1.5 m (5 ft)	-0.7	3.5	-1.8	1.6	13.0	19.2	6.2	15.9
	3.0 m (10 ft)	-0.4	3.2	-2.3	1.8	17.7	39.4	21.7	28.5
	4.6 m (15 ft)	-0.8	1.9	-5.4	-1.3	33.6	54.3	20.7	43.6
	6.1 m (20 ft)	0	-1.2	-4.0	-3.9	43.3	81.0	37.7	56.3
	7.6 m (25 ft)	0	-5.5	-1.6	-6.0	48.1	81.5	33.4	67.0
12°	1.5 m (5 ft)	-0.7	2.2	-2.6	2.5	31.4	39.2	7.8	36.1
	3.0 m (10 ft)	-0.4	2.0	-2.5	3.2	62.7	75.8	13.1	70.4
	4.6 m (15 ft)	-1.4	-3.0	-3.7	2.0	92.4	111.2	19.6	102.4
Information	5.8 m (19 ft)	0	-5.6	-4.6	3.1	122.0	130.5	8.5	126.2

Table 22: Summary data table for probe impact for TASER 7™

[redacted]

[redacted]

6.9.12 The summary observations from the accuracy and consistency test using the TASER 7™ fired from a fixed mount are:

- For TASER 7™ 3.5° and 12° cartridges at ranges between 1.5 m (5 ft), 3.0 m (10 ft) and 4.6 m (15 ft) the top probe is clustered around the POA.
- There is noticeably less drop of the TASER 7™ top probe compared to the X2™ at 6.1 m and 7 m (20 and 25 ft).
- For the TASER 7™ 12° cartridge there was a probe separation of 102 cm at 4.6 m (15 ft), which is double the 51 cm separation of the X2™ when the devices are compared at the same range.
- At its 25 ft maximum range, the TASER 7™ 3.5° cartridge delivers a probe separation of 67 cm.
- The minimum probe separation to produce NMI is understood to be 23 cm. At a range of 3 m (10 ft) the probe separation for the 3.5° TASER 7™ cartridge is between 17.7 cm to 39.4 cm. Given this is not reliably above the 23 cm reportedly required to achieve reliable NMI, consideration should be given to the definition of operational ranges for training.
- The 12° Close Quarter cartridge delivers an average probe separation of 36.1 cm at a range of 1.5 m (5 ft) (the minimum separation is 31.4 cm).
- When comparing the left and right bays for both TASER 7™ cartridge types, the top probe fired from the right bay had a tendency to impact slightly to the right of the POA.
- The TASER 7™ bottom laser aim point was found to be offset slightly to the right of the vertical centre line from the top laser point of aim from the firer's position. For example, the 3.5° cartridge at a range of 3 m (10 ft) and 4.6 m (15 ft) had an offset to the right of the centre line between 0.9 cm and 2.0 cm respectively. For the 12° cartridge at the same ranges the laser point of aim offset was between 1.8 cm and 3.0 cm.
- The results of the fixed mount firing do not reflect the deviation in shot for the 12° cartridge bottom probe that was reported by some of the users when hand fired in the handling trial. There may be other contributing factors to this finding.
- Two outlier shots were observed from the bottom probe of the TASER 7™ 3.5° cartridge at 6.1 m (20 ft) and 7.6 m (25 ft), these are shown at APPENDIX I.

[redacted]

[redacted]

6.9.13 The circles drawn on the hit diagrams (APPENDIX G to APPENDIX N) represent the mean and maximum radius around the upper probe mean point of impact for the group of shots. It is recognised that there may be some movement of the TASER 7™ when fired from the TASER 7™ test fixture, however, there were significant differences between the reported user accuracy from the user handling trials and the results from technical test assessment. These aspects should be considered by the police and the College of Policing for any training implications for officers. This dispersion information should be used to provide guidance on the recommended operational ranges of the cartridges. This should be undertaken given the findings in Ho [9] and [redacted] [12].

6.10 Effective range test

6.10.1 The user requirement states: “The effective range of the CED will be commensurate with the maximum distance a subject would cover in an officer’s reaction time of 21 ft” (6.4 m). This requirement was checked as part of the 7.6 m (25 ft) range accuracy and consistency test.

6.10.2 All of the TASER 7™ 3.5° cartridges impacted the target at 7.6 m (25 ft) during the accuracy and consistency tests meeting the effective range requirement.

6.10.3 This 21 ft requirement would not be met by the TASER 7™ 12° cartridges that are not designed for use at this range.

6.11 Extended range test

6.11.1 The aim of this test was to assess how well the wire is secured to the probe. Five live cartridges and five HALT™ cartridges were fired at a target at a distance of greater than 9.1 m (30 ft). The TASER 7™ was fired through a safety screen to protect the user from any bounce back from the cartridges.

6.11.2 All probes (both top and bottom) from the fired TASER 7™ operational cartridges became detached from the wires and impacted the target. In the event of a missed shot this may cause a hazard from an un-tethered flying probe.

6.11.3 All the HALT™ cartridges fired remained attached to their tethering wires. If a shot misses the target there is a potential hazard from probes bouncing back towards the firer.

[redacted]

[redacted]

6.12 Probe velocity

6.12.1 The objective of this test was to measure the velocity and calculate the momentum and kinetic energy of the operational top probe from the X26™, X2™ and TASER 7™. The probe velocity was measured using a calibrated high speed camera (Fastcam SA1.1 Model 675K-C1, Serial Number 355911089, calibration certificate number RMA 33719). The trial set-up is shown at Figure 64. Three shots were fired at each of the following ranges:

- Muzzle (first 0.03 m)
- 1.5 m (5 ft)
- 3.0 m (10 ft)
- 4.6 m (15 ft)
- 6.1 m (20 ft)
- 7.6 m (25 ft) X2™ and TASER 7™ only.

Figure 64: TASER 7™ probe velocity measurement trial set-up

[redacted]

[redacted]

6.12.2 The test set up took into account the potential separation in the x-axis and associated variation in the velocity measured by the high speed camera. The camera is calibrated and the calibration certificate states a frame rate accuracy of +/-0.01%. To estimate the variation in velocity due to parallax, calibration measurements were taken on the centre line and 10 cm either side of the expected centre line of the probe trajectory. This provided a predicted maximum and minimum for each shot. When averaged, the variation was approximately +/-3 m/s.

6.12.3 The probes from TASER 7™ were recovered after firing at each range and weighed. Figure 65 to Figure 68 compare the mass, velocity, kinetic energy and momentum of X26™, X2™ and TASER 7™ probes. Full details of the mass, velocity, kinetic energy and momentum can be found at APPENDIX B.

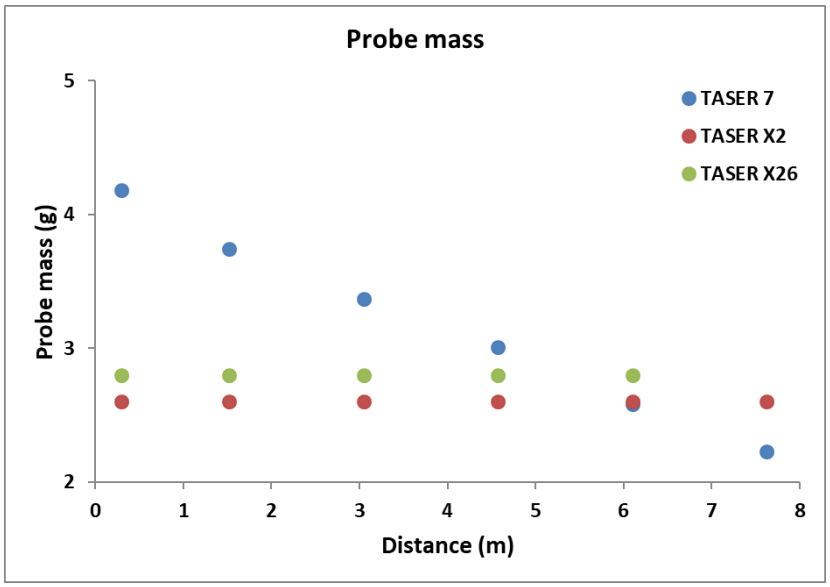


Figure 65: TASER™ probe average mass

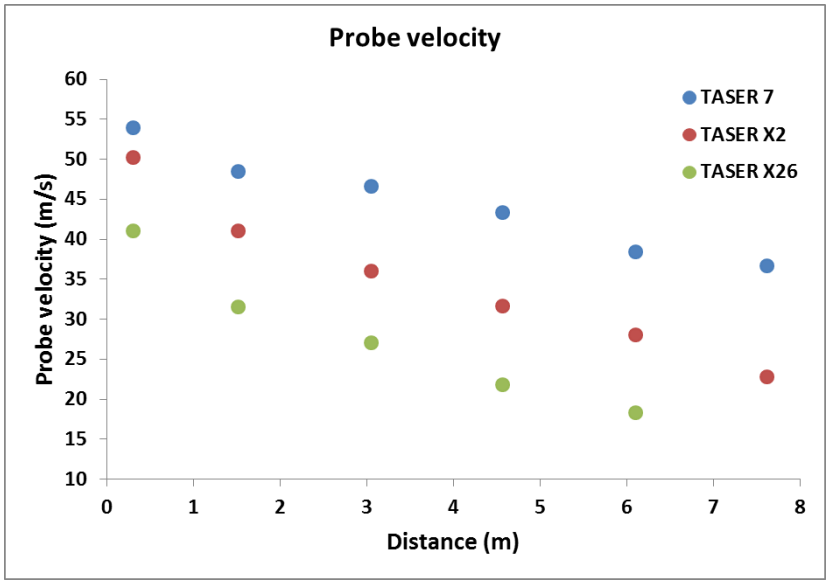


Figure 66: TASER™ probe average velocity

[redacted]

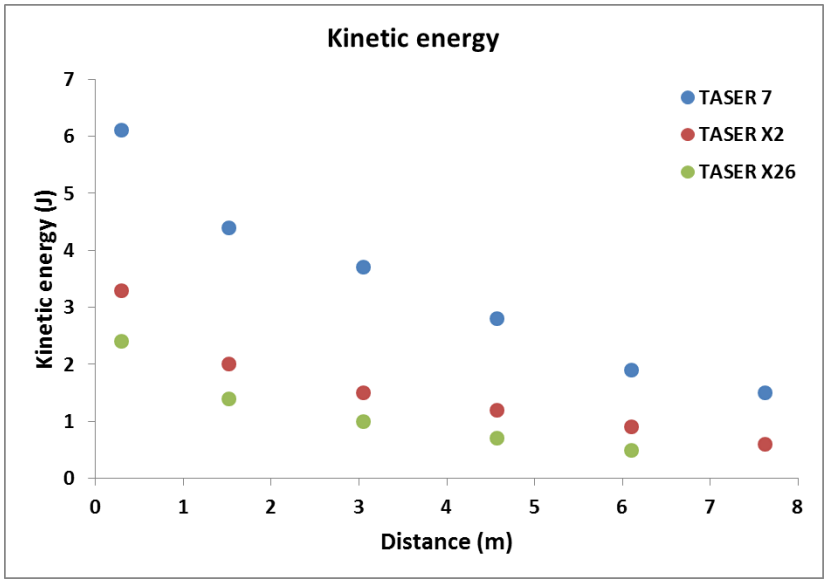


Figure 67: TASER™ probe kinetic energy

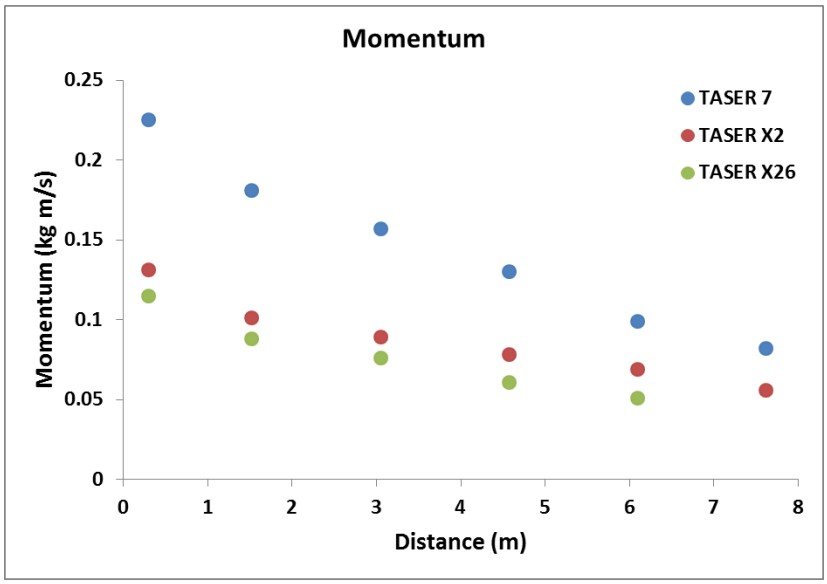


Figure 68: TASER™ probe momentum

6.13 Laser safety testing

6.13.1 The Dstl Laser Safety Adviser conducted an assessment of the TASER 7™ laser sight system [13]. Ten devices were chosen at random and measured at a distance of 60 cm from the laser aperture. The laser power was measured and recorded using a THOR labs power meter specifically for the wavelength range 400-1400 nm.

6.13.2 The data was collected, collated and the average for each device at each setting was calculated and shown graphically for ease of comparison. This was done for each TASER 7™ laser.

6.13.3 The average power measurements for each TASER 7™ laser found are shown in Table 23; all power levels are at the Class 3R level. This class is above the limit set in the laser safety recommendations, so exposure to the beam is in breach of regulation, in spite of there being no evidence of harm at these power levels. Even if operated at the optimum distance, with both beams overlapping, the combined power would be a maximum of 3.86 mW, still within the Class 3R band [13].

Laser	Degree	Power measured	Class
Green	All	2.1457 mW	3R
Red	3.5°	1.645 mW	3R
Red	12°	1.7154 mW	3R

Table 23: TASER 7™ laser power measurement

6.13.4 Figure 69 shows the green laser is fairly consistent across the devices. However the two red lasers are more erratic with a greater deviation.

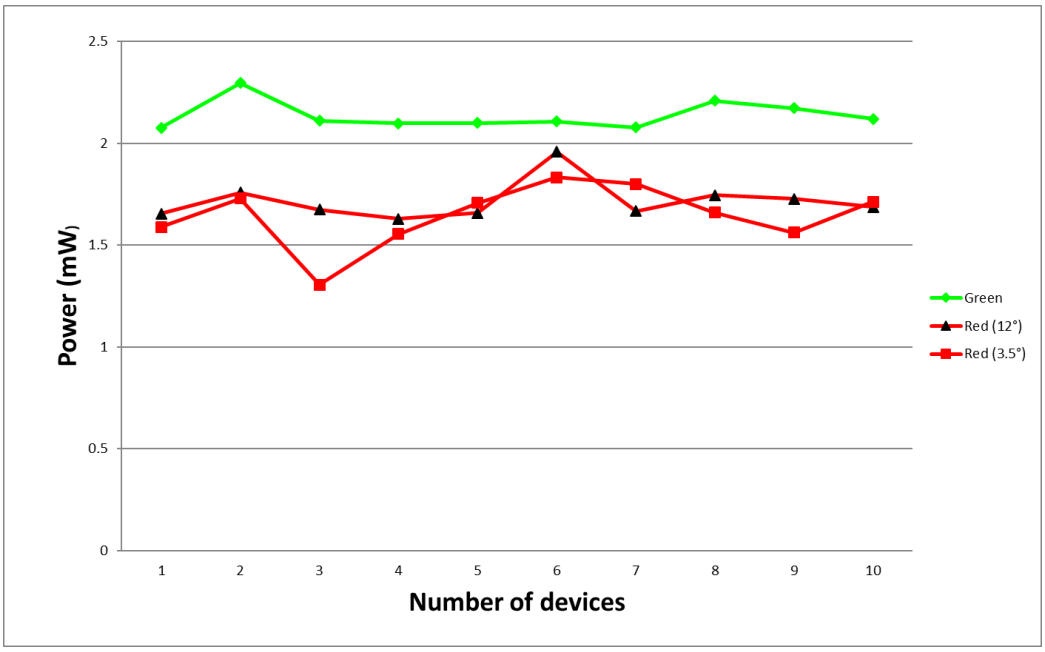


Figure 69: TASER 7™ laser characteristics

[redacted]

6.13.5 The warning label on the TASER 7™ devices supplied for the assessment is shown in Figure 70. When measured [13] all of the lasers within the TASER 7™ are Class 3R. Even if the red and green lasers combine, the total is still within the Class 3R band. The X26™ and X2™ are also classified as 3R. The TASER 7™ device is therefore incorrectly labelled as Class 2. The procurement agencies should ensure that any devices are correctly labelled, and training authorities should ensure that the training material is correct and hazards from Class 3R lasers are correctly taught.

Figure 70: Laser warning label on TASER 7™

6.14 EMC testing

6.14.1 Axon® contracted an independent test house to conduct RF emissions and susceptibility testing on the TASER 7™ between 12 June 2019 and 10 July 2019 [14].

6.14.2 The EMC test plan, drafted in consultation with Dstl, prescribed two test standards with bespoke test parameters:

- Home Office CAST Publication 010/18 (RF susceptibility test requirement - first edition) [15]
- CISPR 25:2016 (Limits and methods of measurement for the protection of on-board receivers) [16]

6.14.3 The results demonstrated that the TASER 7™ was unlikely to interfere with, or experience interference from, nearby radio transceivers such as Terrestrial Trunked Radio (TETRA), Emergency Services Network, mobile phones, Wi-Fi and Bluetooth. It is recommended that users avoid arming the TASER 7™ when inside a vehicle and with TETRA portable radios present. The operational implications of this recommendation should be considered by the NPCC and the College of Policing.

[redacted]

7 Drop Tests

7.1 TASER 7™ unit

The objective of this test was to assess the general robustness of TASER 7™ and also whether it is likely to discharge when dropped. Two TASER 7™ units (Serial Numbers. X410020KP and X410020M4) were selected for the drop test. The TASER 7™ was dropped in ten different orientations (Table 24) from a height of 2 m onto a metal plate using the Dstl TASER 7™ drop test rig (Figure 71). The drop test was conducted with the TASER 7™ in the unarmed state (safety on- X410020KP) and then repeated in the armed state (safety off-X410020M4). This is the same methodology used in the CAST assessment of the X2 TASER® [5].

7.1.1 Prior to drop testing, a competent Axon® trained TASER 7™ operator visually inspected the TASER 7™, inserted a fully charged battery and conducted a function test. A data download was then carried out and checked to ensure there were no prior faults present with the device.

7.1.2 To replicate operational carriage, the TASER 7™ was loaded with a pair of inert 12° cartridges. The TASER 7™ was mounted in the TASER 7™ fixture. The laser points of aim were marked on a target board set at a range of 4.6 m (15 ft). The TASER 7™ was subsequently loaded with 12° operational cartridges and secured in the TASER 7™ drop test rig (Figure 71). The TASER 7™ was held in the positions shown in Table 24 to present each planar surface and the four vertical corners of the unit towards the ground. The drop rig mechanism was operated remotely from behind a protective screen to release the TASER 7™ to free fall onto the metal plate. After each drop the TASER 7™ was visually inspected, the CID was checked and the TASER 7™ was test fired. The TASER 7™ was then re-mounted in the fixture and the alignment of the dual laser sights was checked. A data download was carried out after the full set of drop tests to check for any faults.

Drop Position	Impact Point
1	Bottom
2	Front
3	Top
4	Back
5	Right-hand side
6	Left-hand side
7	Front bottom corner
8	Top back corner
9	Back bottom corner
10	Front top corner

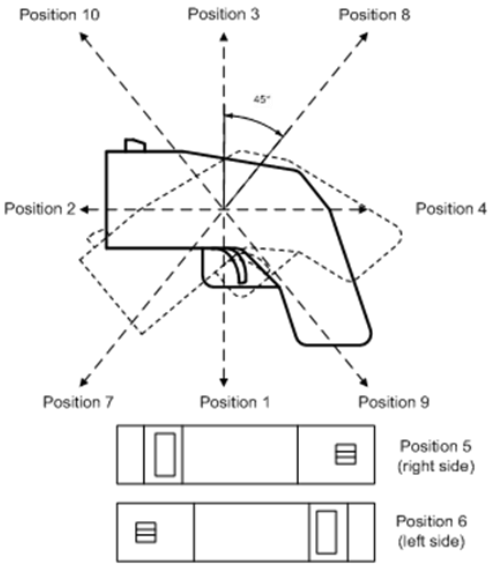


Table 24: TASER 7™ drop positions

Figure 71: TASER 7™ drop test rig

7.2 TASER 7™ single cartridge

7.2.1 The objective of this test was to determine how robust the TASER 7™ operational and HALT™ training cartridges are to being dropped and to ascertain any subsequent level of damage. The cartridge safety clips were removed from a pair of 3.5° and a pair of 12° operational and training cartridges. The cartridges were separated and dropped individually from a height of 2 m on to a metal plate in the following orientations:

- Blast doors upwards
- Blast doors downwards
- Largest flat side facing down.

The cartridges were dropped from behind a protective screen. After being dropped, any damage to the cartridges was recorded and the device test fired.

7.3 Pair of TASER 7™ cartridges

7.3.1 The cartridge drop test was repeated as described in Section 7.2.1, but with the cartridges clipped together as pairs.

7.4 Summary of drop test results - TASER 7™

7.4.1 After the TASER 7™ handle (X410020KP) was dropped with the safety switch in the safe position there was no visible damage to the handle, the CID operated correctly and the test fire was successful. The laser sight alignment was re-checked by mounting the unit in the test fixture and found to be within 0.5 cm of the pre-drop laser position. The download showed no faults in the handle. The results for the TASER 7™ drop test (unarmed) can be found at APPENDIX O

[redacted]

7.4.2 After the TASER 7™ handle (X410020M4) was dropped with the safety switch in the armed position there was no visible damage to the handle, the CID operated correctly and the test fire was successful. The laser sight alignment was re-checked by mounting the unit in the test fixture and found to be within 1.2 cm of the pre-drop laser position. The download showed no faults in the handle when synchronised with Evidence.com™ after the test. Subsequently after firing a further two cartridges whilst setting up for another test, this unit logged a major fault in Evidence.com™. The complete results for the TASER 7™ drop test (armed) can be found at APPENDIX P.

7.5 Summary of drop test results - cartridges

7.5.1 After the TASER 7™ cartridges were dropped singularly and in pairs there was no visible damage and all test firings were successful. When the cartridges were dropped in pairs there were instances where they were displaced from the TASER 7™ loading bay and separated. Full details are can be found in APPENDIX Q.

[redacted]

8 TASER 7™ ejectors

The ejector is a yellow plastic component that sits ahead of the probes within the cartridge and pushes the blast doors clear when firing. During the testing a number of cases of the plastic ejector being trapped in front of the probe body were noted. Figure 72 shows the TASER 7™ operational probe and ejector. Figure 73 shows a TASER 7™ operational probe that has trapped the ejector in the target.

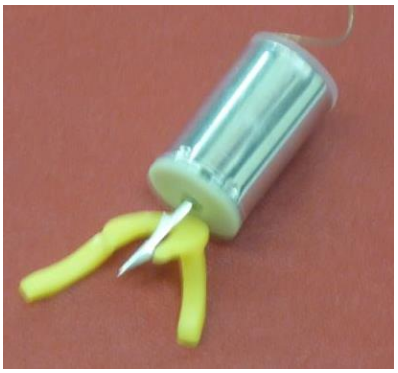


Figure 72: TASER 7™ operational probe with trapped ejector

Figure 73: TASER 7™ operational probe embedded in target with a trapped ejector

In total, 1332 cartridges operational cartridges were fired at the target board. There were 36 instances of trapped ejectors, including four where both the top and bottom probes trapped the ejector on impact. There were other instances where the probe did not lodge in the target: a trapped ejector could have been a contributory factor. These instances will reduce the contact, although there may still be sufficient contact to allow charge delivery.

Given that trapped ejectors were noted in 32 firings out of 1332 (and may be contributory in other cases) a minimum trapped ejector rate of 1 in every 42 firings can be expected, unless the design changes from that tested (Axon® have not informed Dstl of any design changes).

[redacted]

9 Conclusions

9.1 Reliability

Dstl procured 20 TASER 7™ handles (production versions Rev B and Rev C). Five faults were detected:

- Major faults (two devices)
- Manufacturing/assembly faults (two devices)
- Major fault initially recorded on Evidence.com™, which subsequently cleared (1 device).

Only one of the major faults was shown on both the CID and recorded in Evidence.com™. When these faults are shown, the device should be removed from service and the instruction from Evidence.com™ is to contact the Axon® customer care service. The remaining faults identified were not shown on the CID and therefore may not be detected until the device is used operationally or downloaded to Evidence.com™.

During the Dstl assessment a total of 1981 cartridges were fired. Eight cartridges (0.4%) were faulty and failed to fire (6 out of 1423 operational cartridges (0.42%) and 2 out of 558 HALT™ training cartridges (0.36%)).

9.2 Trapped ejectors

The ejector is a yellow plastic component that sits within the operational cartridge and pushes the cartridge blast doors clear when firing. During the handling trial, accuracy test and laser alignment test 1332 operational cartridges were fired at the target board, there were 36 instances (in 32 firings) where the ejector was trapped between the probe and the target material. This could potentially obstruct the probe attachment to the subject. A minimum trapped ejector rate of 1 in 42 firings was observed and this is likely to persist unless the cartridge design is changed.

9.3 User handling trial

Both user groups expressed predominantly positive comments on the TASER 7™ and agreed that TASER 7™ is suitable for use in their current roles. The exception being that two officers from the covert user group disagreed when asked if they felt the TASER 7™ could be discreetly carried as part of their role. The officers commented on the colour of the device and stated they would prefer a reduction in the overall size of the device.

Positive feedback was received from the users regarding the suitability of the 12° Close Quarter cartridge for use in houses or undertaking room clearances.

Users were invited to select their own choice of battery for the user handling trials. Comments after the trials indicated that better information could assist with battery selection decisions.

[redacted]

[redacted]

Several officers commented that they found the safety switch stiff to operate.

The green laser sight was considered effective, however some officers noted the possible conflict with the sighting systems of conventional weapons.

In the target moving forward exercise officers took longer to fire the TASER 7™ Close Quarter cartridge to ensure barb placement on the target. Therefore the target is closer to the firer before taking the shot.

Several officers commented that they believed the TASER 7™ bottom barb had a tendency to impact the target to the left of the point of aim. The Dstl technical assessment firing from a fixed mount did not find any evidence to support this. Further work is required to understand the difference in the operational and technical assessments and whether this issue may manifest itself in operational use (for example, related to ergonomics, recoil or another reason) or whether alternative training is required.

Examining the percentage miss rate from the user handling trial concluded that:

- The TASER 7™ 3.5° cartridge and TASER 7™ 12° cartridge both recorded higher miss rates than the X26™ and X2™.
- The highest rate of misses was recorded from the bottom probe of the TASER 7™ 12° cartridge. This indicates that the wider probe separation delivered by this cartridge and the potential higher miss rate should be considered by the NPCC and College of Policing before acceptance.

9.4 Technical assessment

At all ranges, for both cartridge types, the TASER 7™ top probes are clustered around the point of aim and have a closer grouping than X26™ and X2™. The TASER 7™ top probes maintain their trajectory and drop less from the point of aim.

At a range of 3 m (10 ft), the displacement error of the bottom probe MPI relative to the POA was found to be about 4 cm on average for the TASER 7™ (range: -1.9 to -6.9 cm). The displacement error at other ranges was not tested and currently remains unknown. The bottom probe displacement may have implications for users when the POA for the lower probe is on a narrow target, such as the subject's leg, but may also have implications for other targeted regions. There is inconsistency between the accuracy during the user reporting from the handling trial and the technical testing.

Performance between the TASER 7™ operational cartridges and HALT™ cartridges was found to be comparable.

Comparing the performance of the TASER 7™ left bay to the right bay, the left bay is accurate and consistent around the point of aim. When fired from a clamped weapon the top probe fired from the right bay showed a tendency to impact to the right of the centre line point of aim (approximately 5 cm at 3 m (10 ft)). These observations are consistent between both operational cartridge types. In previous tests [5] the X2™ displayed a similar tendency.

[redacted]

[redacted]

The Standoff cartridges were tested at 7.6 m (25 ft) and hence met the operational requirement that the range should be at least 6.4 m (21 ft).

The Close Quarter cartridge is designed to deliver a greater probe separation at close range. However at longer ranges, the probe separation becomes excessive and the bottom probe is likely to strike the ground before reaching the target. Successful top and bottom probe placement will be dependent on the size of the target.

The Standoff cartridge is designed to deliver an effective probe separation at longer ranges. It was observed that the top probe maintained its trajectory at long ranges (6.1 m (20 ft) and 7.6 m (25 ft)).

The testing involving probe dispersion should be used to define the expected operational ranges of the TASER 7™ if it is introduced into service. This is likely to feed into training.

After drop testing, the TASER 7™ handles and cartridges were visually inspected. They showed no sign of damage and test fired successfully. The laser sights alignment was re-checked by mounting the unit in the test fixture and found to be within 1.2 cm of the pre-drop laser position.

The extended range test simulated a probe missing the target and travelling beyond the length of the wire. Five operational cartridges were fired and in each case, both probes became detached from the wire. In an operational scenario, this has the potential to cause injury to bystanders.

During the assessment it was observed that when the TASER 7™ cartridges were not loaded in a positive manner prior to the trigger being pulled, failure to fire could occur. This was not indicated on the CID. This requires review to ensure it is mitigated in training.

When measured, all of the lasers within the TASER 7™ were found to be Class 3R [12]. The TASER 7™ device is therefore incorrectly labelled as Class 2. The procurement agencies should ensure that any devices are correctly labelled, and training authorities should ensure that the training material is correct and teach the hazards of Class 3R lasers.

The results of EMC testing conducted by Axon® demonstrated that the TASER 7™ was unlikely to interfere with, or experience interference from, nearby radio transceivers such as Terrestrial Trunked Radio (TETRA), Emergency Services Network, mobile phones, Wi-Fi and Bluetooth. It is recommended that users avoid arming the TASER 7™ when inside a vehicle and with TETRA portable radios present. The operational implications of this recommendation should be considered by the NPCC and the College of Policing.

At the time of writing this report:

- The TASER 7™ manual states that after five minutes of inactivity the armed TASER 7™ will enter low power mode dimming both the laser and LED flashlight. This was found to be incorrect from the units tested where the laser

[redacted]

and flashlight turn off after five minutes of inactivity. Axon® are currently in the process of updating the manuals to display the correct information [19].

- There is some discrepancy between the firmware version advertised on the Axon® web page and the latest available version. Immediately before acceptance into service, a review of firmware changes made since the technical assessments should be undertaken and any implications on the outcome of these assessments should be considered.

[redacted]

10 Recommendations

Testing of the TASER 7™ has been undertaken against the NPCC requirement. It is recommended that NPCC review the results of this testing to establish whether the TASER 7™ system and performance meets the operational requirement. In particular, this review should consider the operational accuracy (particularly at around 3 m and over with the 12 degree cartridge), the fault rate of the devices and cartridges, the issue of trapped ejectors, the possible free-flight of the probes beyond the maximum tethered range and the labelling of the laser.

It is recommended that SACMILL review these results to establish the medical implications of TASER 7™.

It is recommended that the College of Policing review this report to determine whether the information it contains could contribute to the training requirements for TASER 7™.

[redacted]

[redacted]

References

[1] TASER 7™ Statement of User Needs (SUN ref CH2019068) v1.0 30 April 2019

[2] [redacted]

[3] [redacted]

[4] New transparency measures for Taser use announced by Home Secretary. https://www.gov.uk/government/news/new-transparency-measures-for-taser-use-announced-by-home-secretary

[5] CED Replacement Project, Assessment of the TASER X2™ against the Police Operational Requirements, CAST Publication No.057/16 https://www.gov.uk/government/publications/cast-assessment-of-the-taser-x2

[6] TASER 7 Conducted Energy Weapon User Manual MMU0074 Rev: D March 2019

[7] Rechargeable TASER 7 Battery Pack specifications 11 December 2018 Rev:1.0

[8] SACMILL Statement on the Medical Implications of Use of the TASER X2™ Conducted Energy Device System, dated 30 Aug 2016, amended 12 Oct 2016

[9] Ho, J et al. 2012: Conducted electrical weapon incapacitation during a goal-directed task as a function of probe separation. Forensic Science, Medicine and Pathology, 18 May 2012, 8(4): 358-366

[10] Email from Axon® to Dstl T7 Project Lead X2 and T7 revision updates, 14 November 2019 \\rnet.dstl.gov.uk\Tech\Project_Technical\Standard\PJ100413\3.LLW\6.Comms\emails\20191114 X2 and T7 revision updates [OS].msg

[11] Joint Service Publication (JSP) 536 Ministry of Defence Policy for Research Involving Human Participants

[12] [redacted], [redacted], Review of the UK use of the TASER®X2™ conducted energy device after 16 months of operational service. DSTL/CR115459 v1.1, 28 June 2019

[redacted]

[13] Email 05 August 2019 from Dstl (Laser Safety Adviser) to Dstl T7 Project Lead, laser measurement data report \\rnet.dstl.gov.uk\Tech\Project_Technical\Standard\PJ100413\3.LLW\7. Ref docs\20190805 UK OFFICIAL T7 TASER LASER measurement data and very short report.msg

[14] Axon® EMC test results \\rnet.dstl.gov.uk\Tech\Project_Technical\Standard\PJ100413\3.LLW\7. Ref docs\20190725 Axon EMC test results and report (nested) [OS].msg

[15] Home Office CAST Publication 010/18 (RF susceptibility test requirement - first edition)

[16] CISPR 25:2016 (Limits and methods of measurement for the protection of on-board receivers)

[17] TASER 7™ Specifications Version 2.9 December 13, 2018

[18] Axon® Training Bulletin 21-03 version 1.0: TASER 7™ Firmware update 1.3.13

[19] Email from Axon® to Dstl Re low power mode \\rnet.dstl.gov.uk\Tech\Project_Technical\Standard\PJ100413\3.LLW\6. Comms\emails\20191108 Re UK OFFICIAL RE T7 low power mode.msg

[20] TASER® Automatic shut-down Performance Power Magazine (APPM) Specification version 4.0 12/6/2013

[21] College of Policing, Authorised Professional Practice (APP), Conducted Energy Devices https://www.app.college.police.uk/app-content/armed-policing/conducted-energy-devices-taser/#description

[22] National Police Firearms Training Curriculum (NPFTC) module J2 (Unit J2.5)

[23] Email 25 November 2019 from Axon® to Dstl reference TASER 7™ time drift \\RNET\Tech\Project_Technical\Standard\PJ100413\3.LLW\6. Comms\emails\20191125 AXON Response TASER 7 time drift OFFICIAL SENSITIVE.msg

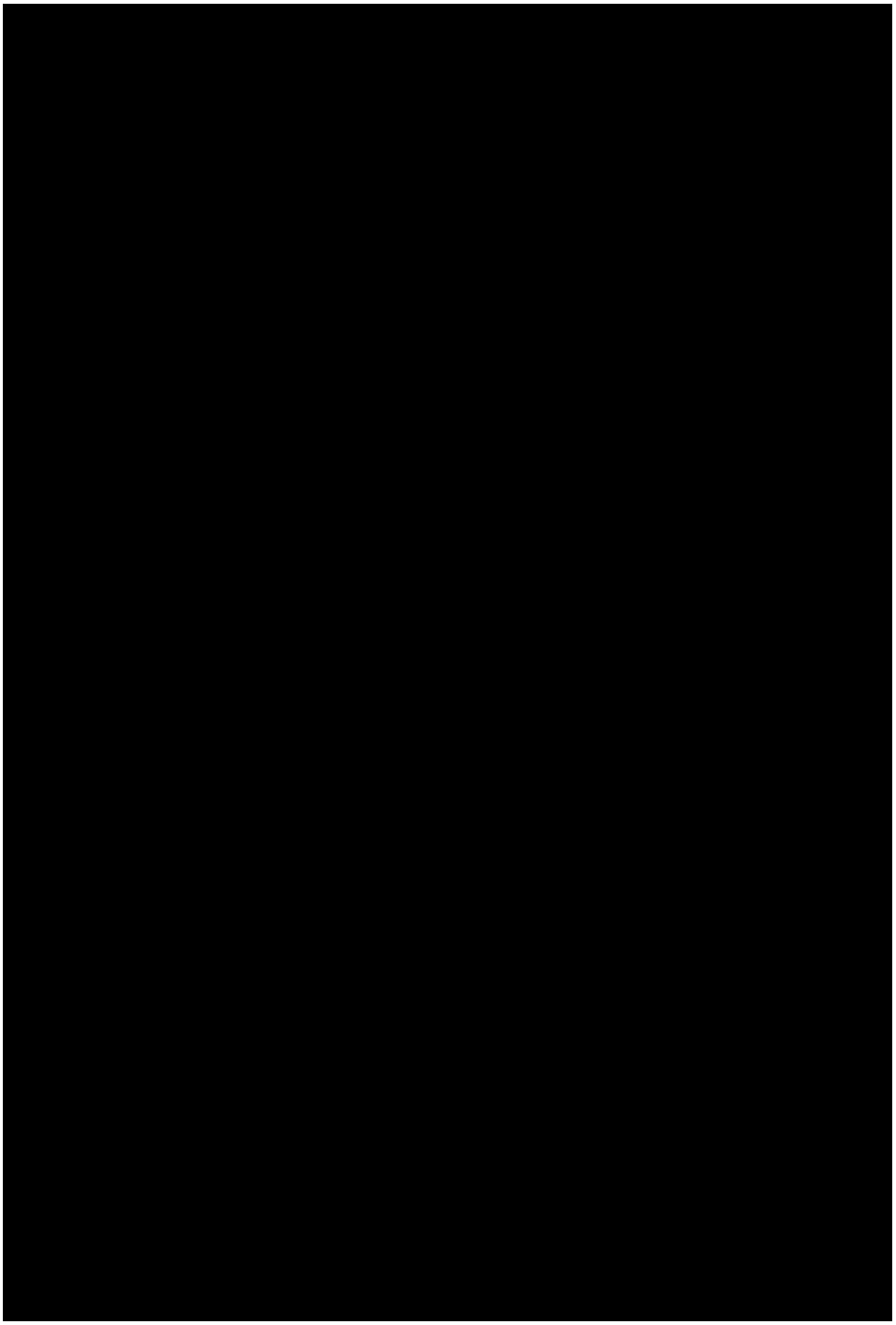
List of abbreviations

APPM	Automatic Shut-Down Performance Power Magazine
ARV	Armed Response Vehicle Officer
ASO	Armed Surveillance Officer
CAST	Home Office Centre for Applied Science and Technology
CED	Conducted Energy Device
CID	Central Information Display
CISPR	Comité International Spécial des Peturbations Radioélectrique
CPO	Close Protection Officer
CROP	Covert Rural Observation Post
CTSFO	Counter Terrorism Specialist Firearms Officer
EMC	Electromagnetic Compatibility
HALT™	Hook and Loop Training
IEC	International Electrotechnical Commission
LED	Light Emitting Diode
LLW	Less Lethal Weapons
MPI	Mean Point of Impact
NMI	Neuro-Muscular Incapacitation
NPCC	National Police Chiefs Council
POA	Point of Aim
POI	Point of Impact
PPS	Pulses Per Second
SACMILL	Scientific Advisory Committee on the Medical Implications of Less-Lethal weapons
SO	Surveillance Officer
STO	Specially Trained Officers
T7	TASER 7™
TETRA	Terrestrial Trunked Radio
XDPM	Extended Digital Power Magazine

[redacted]

APPENDIX A Overt/covert system requirements for NPCC Less Lethal Working Group

[redacted]



1

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

APPENDIX B TASER 7™ probe mass, probe velocity, momentum and kinetic energy vs distance

Cartridge type	Range in m (ft)	Probe mass (g)
X26™	N/A	2.8
X2™	N/A	2.6
TASER 7™	0	4.18
TASER 7™	1.5 m (5 ft)	3.74
TASER 7™	3 m (10 ft)	3.37
TASER 7™	4.6 m (15 ft)	3.01
TASER 7™ (3.5°)	6.1 m (20 ft)	2.58
TASER 7™ (3.5°)	7.6 m (25 ft)	2.23

Table 25: Probe mass

[redacted]

[redacted]

Cartridge Type	Range in m (ft)	Minimum velocity (m/s)	Maximum velocity (m/s)	Average velocity (m/s)	Average momentum (kg m/s)	Kinetic energy (J)
X26™	Muzzle	39.1	42.0	41.1	0.12	2.4
X26™	1.5 m (5 ft)	29.6	33.4	31.6	0.09	1.4
X26™	3 m (10 ft)	25.4	28.6	27.1	0.08	1.0
X26™	4.6 m (15ft)	20.5	23.1	21.8	0.06	0.7
X26™	6.1 m (20 ft)	17.2	19.3	18.3	0.05	0.5
X2™	Muzzle (within 300 mm)	47.8	52.1	50.2	0.13	3.3
X2™	1.5 m (5 ft)	36.5	41.1	38.9	0.10	2.0
X2™	3 m (10 ft)	32.0	36.0	34.1	0.09	1.5
X2™	4.6 m (15ft)	28.1	31.7	30.0	0.08	1.2
X2™	6.1 m (20 ft)	24.8	28.0	26.5	0.07	0.9
X2™	7.6 m (25 ft)	20.3	22.8	21.6	0.06	0.6
TASER 7™	Muzzle (within 300 mm)	51.4	56.0	53.9	0.23	6.1
TASER 7™	1.5 m (5 ft)	45.4	51.2	48.5	0.18	4.4
TASER 7™	3 m (10 ft)	43.7	49.2	46.6	0.16	3.7
TASER 7™	4.6 m (15ft)	40.6	45.8	43.3	0.13	2.8
TASER 7™ (3.5°)	6.1 m (20 ft)	36.0	40.6	38.4	0.10	1.9
TASER 7™ (3.5°)	7.6 m (25 ft)	34.5	38.8	36.7	0.08	1.5

Table 26: Probe velocity, momentum and kinetic energy

[redacted]

[redacted]

APPENDIX C TASER 7™ user handling trial - scenario exercises

Exercise Number	Exercise description	Position of firer	Position of target	Distance from target	Light	Status of TASER	Laser sights used?	No. of shots and bays	No. of times	Comment/ T7 cartridge type
1	Standard upright	Stationary, upright	Stationary, face on	3 m from muzzle	ON	Loaded, ready position single handed	YES	Two/both	Three times	12° only
2	Iron sights (laser off)	Stationary, upright	Stationary, face on	Muzzle at 5 m	ON	Loaded, ready position	NO	Single/ bay 1	Three times	3.5° user instructs to put into stealth mode.
3	Target laying horizontal – no laser	Stationary, upright	Stationary, laying on floor	3 m from muzzle	ON	Loaded, ready position	NO	Single/ bay 1	Three times	12°
4	Target laying horizontal	Stationary, upright	Stationary, laying on floor	3 m from muzzle	ON	Loaded, ready position	YES	Single/ bay 1	Three times	3.5°
5	Target too close	Stationary, upright, close up and step back, firing from the hip	Stationary, face on	1 m (front foot)	ON	Loaded, ready position	YES	Single/ bay 1	Three times	12°

[redacted]

[redacted]

6	3 shot	Stationary, upright	Stationary, face on	3 m from muzzle	ON	Loaded, ready position	YES	Three/ both, reload third from a bench	Three times	12° 2 x resettable cartridges 1 x live
7	Shield	Stationary, upright, behind officer holding and aiming around a long public order shield	Stationary, face on	Muzzle at 4.5 m	ON	Loaded, ready position, aimed	YES	Single/ bay 1	Three times, alternate R/H and L/H with reload strong hand first	12°

[redacted]

[redacted]

8	Show of strength	Show of strength	Stationary, face on	3 m from muzzle	ON	X26 loaded, ready position on aim red dot, unload cartridge, arc, reload, fire. X2 loaded, ready position on, aim red dot, arc, fire, extend and re-energise. T7 loaded, ready position on, aim red dot, arc, fire, extend and re-energise.	YES	Single/ bay 1	Three times	12° Exercise demonstrates the full functional aspects for each device.
9	Static target	Stationary, upright	Through an opened door	3 random distances unknown to firer 1.5 m, 3.5 m 6.0 m	ON	Loaded, ready	YES	Single/ bay 1	One shot at each distance (total 3 shots)	Live Loaded with pair 12° and pair 3.5° in pouch. User to decide.
10	Target moving sideways	Stationary, upright	Moving (sideways), face on	3 m from muzzle	ON	Loaded, ready position	YES	Single/ bay 1	Three times	12° HALT training cartridge

[redacted]

[redacted]

11	Target moving sideways	Stationary, upright	Moving (sideways), face on	4.5 m from muzzle	ON	Loaded, ready position	YES	Bay 1 T7 only	Three times	3.5° HALT training cartridge
12	Target moving forwards	Stationary, upright	Advancing, face on and re-energise if not incapacitated	9 m (start) from muzzle	ON	Loaded, in holster	YES	Single/ bay 1	Three times	12° HALT training cartridge
13	Target moving forwards	Stationary, upright	Advancing, face on and re-energise if not incapacitated	9 m (start) from muzzle	ON	Loaded, in holster	YES	Bay 1 T7 only	Three times	3.5° HALT training cartridge
14	Torch and in low light	Stationary, upright, reload in the dark	Stationary, face on	3 m from muzzle	OFF in low light	Loaded, ready position	YES	Two/both	Three times	12° only

Table 27: TASER 7™ user handling trial exercises

[redacted]

[redacted]

APPENDIX D TASER 7™ user feedback comments

Feedback comment
The safety switch is too stiff to operate comfortably
The probe placement did not match the laser positions
The moulded sights are far superior to previous models
The inclusion of a second laser increased overall accuracy
An intermediate (8º) cartridge would be preferred
The TASER 7™ felt more robust than previous models
The torch was significantly brighter (however this reduced the efficacy of arcing due to decreased visibility)
The grip felt more comfortable than the X2™ grip
The cartridges often required resitting or adjustment
A covert (non-yellow) version would be preferred
The TASER 7™ felt more compact than the X2
The grip was too small
Having the choice of a 12º and 3.5º cartridge was beneficial
12° Close Quarter cartridge would be useful when operating in houses or undertaking room clearances

Table 28: TASER 7™ user feedback comments

[redacted]

[redacted]

APPENDIX E TASER 7™ v X26™ v X2™ hit location data, user handling trial

During week one (10-14 June 19) of the user handling trial the covert user groups compared the TASER 7™ with the X26™.

During week two (24-28 June 19) of user handling trial the overt user groups compared the TASER 7™ with the X2™.

For the purpose of the trial, each area was allocated an identifying number. The target areas and corresponding numbers are shown in Table 29.

A compilation of all the impact locations for all the TASER® devices can be found in Table 30.

The hit location data, number of misses and split/no-split are shown in Figure 74 to Figure 89. An upper and lower hit was considered as splitting the belt buckle.

Target Area	Identifying Key
Head	1
Neck	2
Heart	3
Groin	G
Miss (one or more probe misses)	M
Above belt	U
Below belt	L
Split	Split
No-split	No-split

Table 29: Target area identification keys

[redacted]

TASER® type and user	Total shots fired	Both hit %	Split belt %	Not split belt %	Single probe miss %	Both probe miss %	1 (Head) %	2 (Neck) %	H (Heart) %	U (Upper) %	L (Lower) %	G (Groin) %	M (Miss) %
TASER 7™ Covert Users	574	82.0	80.9	1.2	17.3	0.7	**Top Probe**						
							0.2	5.6	23.5	67.8	0	0	3.0
							Bottom Probe						
							0	0	0	1.2	74.6	8.4	15.9
X26™ Covert Users	509	92.7	83.1	9.6	6.9	0.4	**Top Probe**						
							0.4	5.1	27.1	64.8	0.4	0	2.2
							Bottom Probe						
							0	0	0.2	9.4	69.0	15.9	5.5
TASER 7™ Overt Users	576	79.2	78.8	0.7	19.8	0.7	**Top Probe**						
							0	2.6	17.7	77.6	0.3	0	1.7
							Bottom Probe						
							0	0	0	0.5	74.0	6.1	19.4
X2™ Overt Users	538	94.2	87.0	1.1	5.2	0.6	**Top Probe**						
							0	0	3.5	94.2	1.7	0	0.6
							Bottom Probe						
							0	0	0	0.2	83.5	10.6	5.4

Table 30: Compilation of all impact locations for TASER 7™, X26™ and X2™

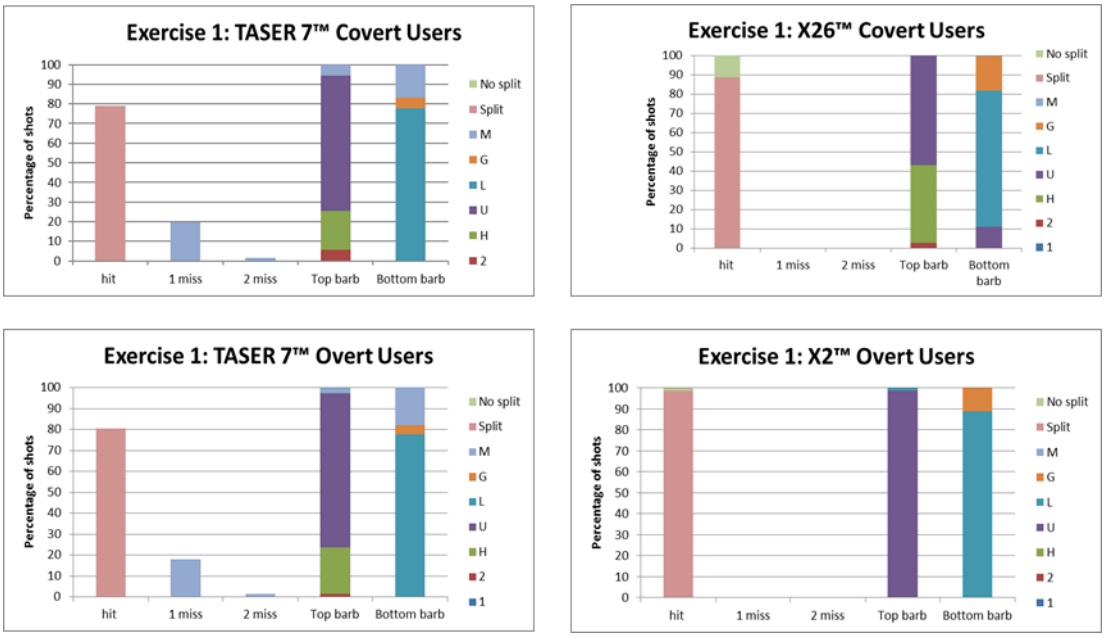


Figure 74: Exercise 1 – TASER 7™ vs X26™ and TASER 7™ vs X2™, standard upright

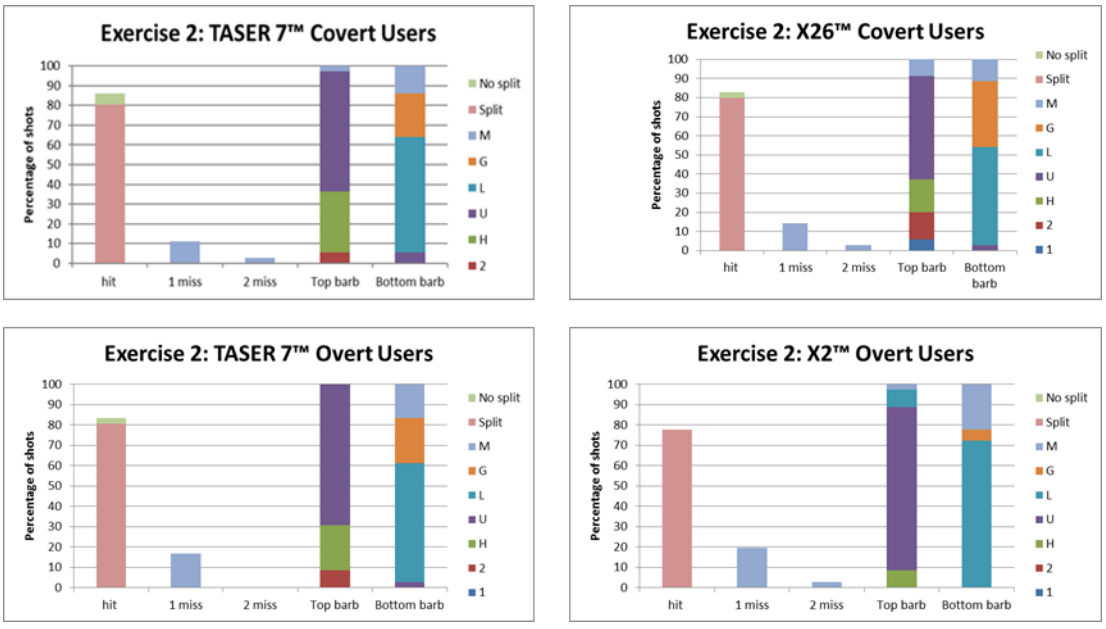


Figure 75: Exercise 2 - TASER 7™ vs X26™ and TASER 7™ vs X2™, iron sights (laser off)

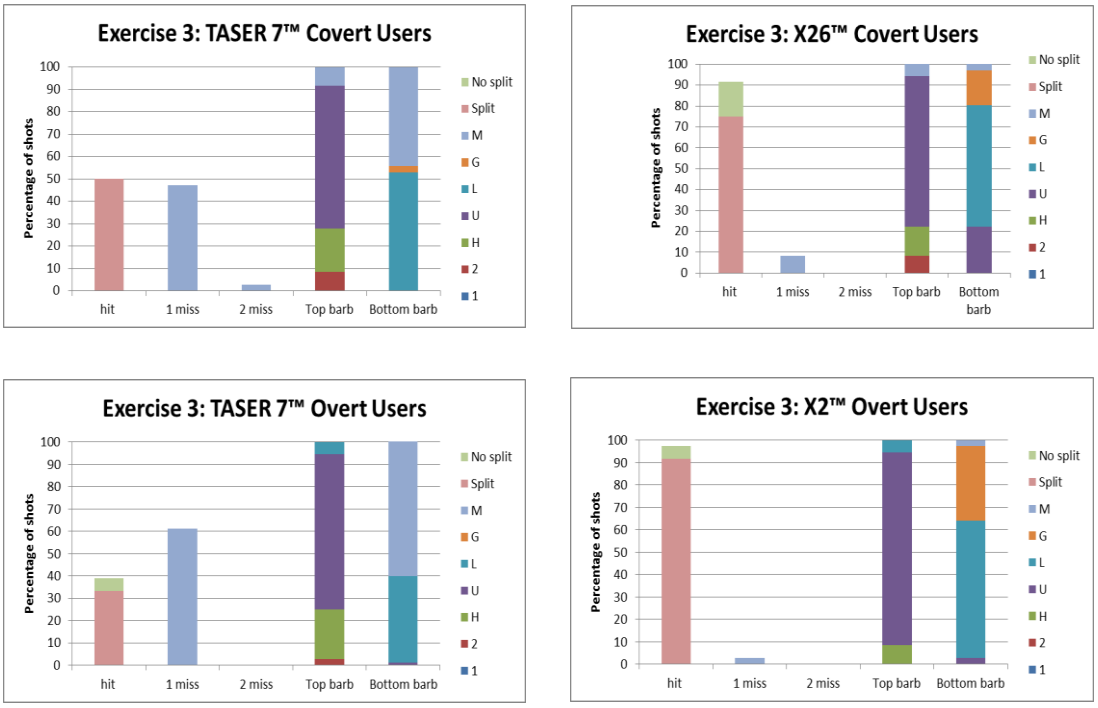


Figure 76: Exercise 3 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target laying horizontal – (laser sights off)

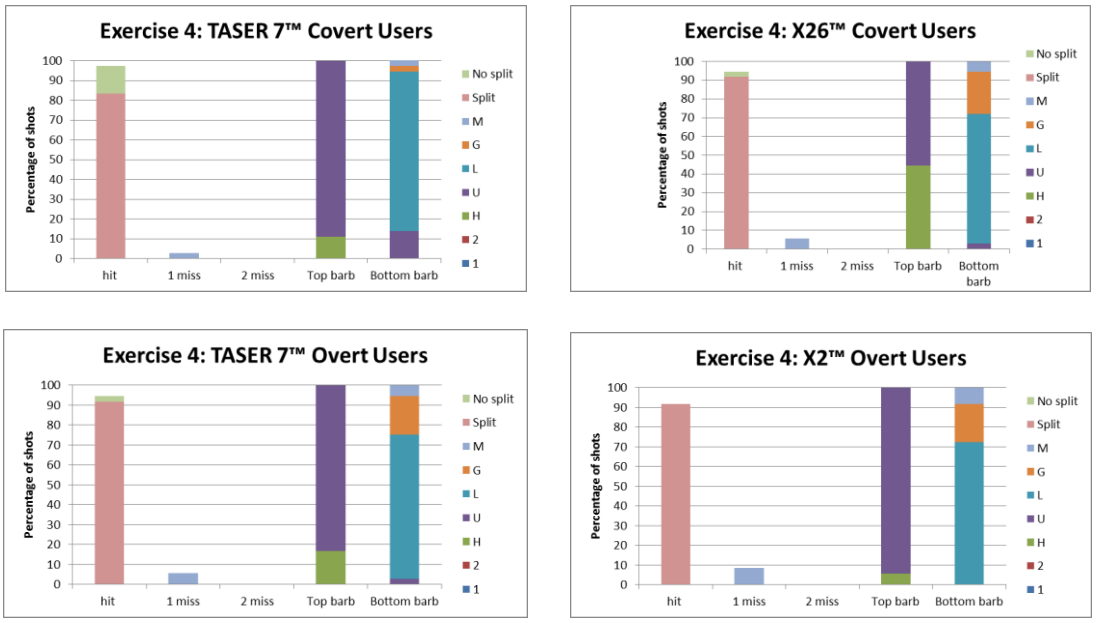


Figure 77: Exercise 4 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target laying horizontal (laser sights on)

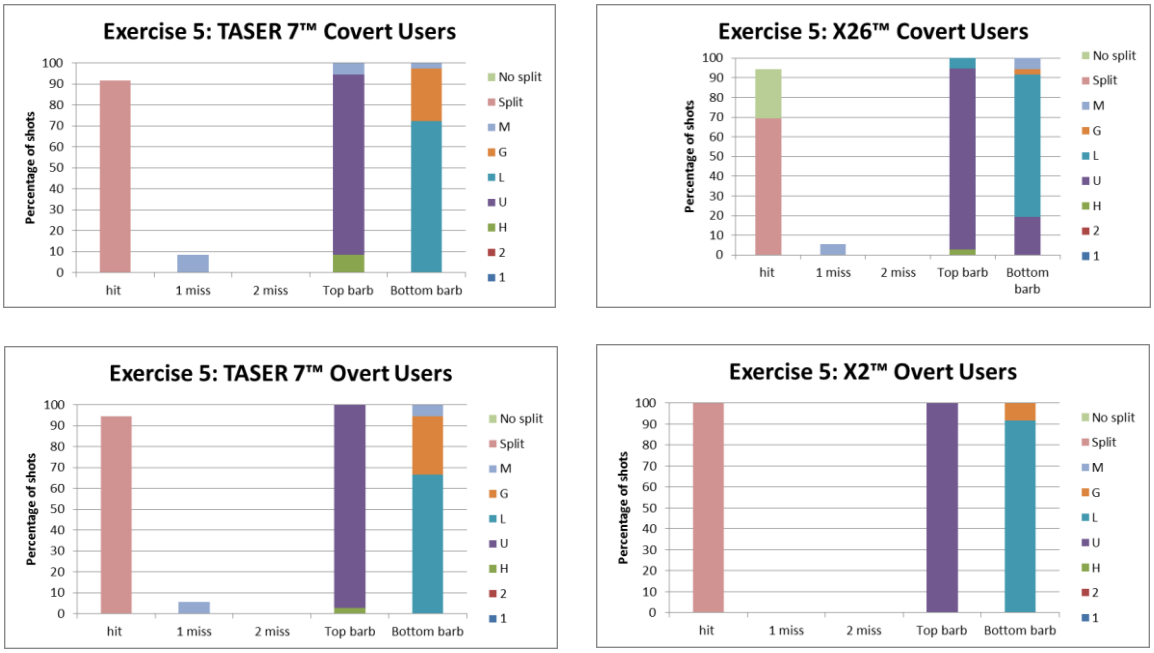


Figure 78: Exercise 5 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target too close

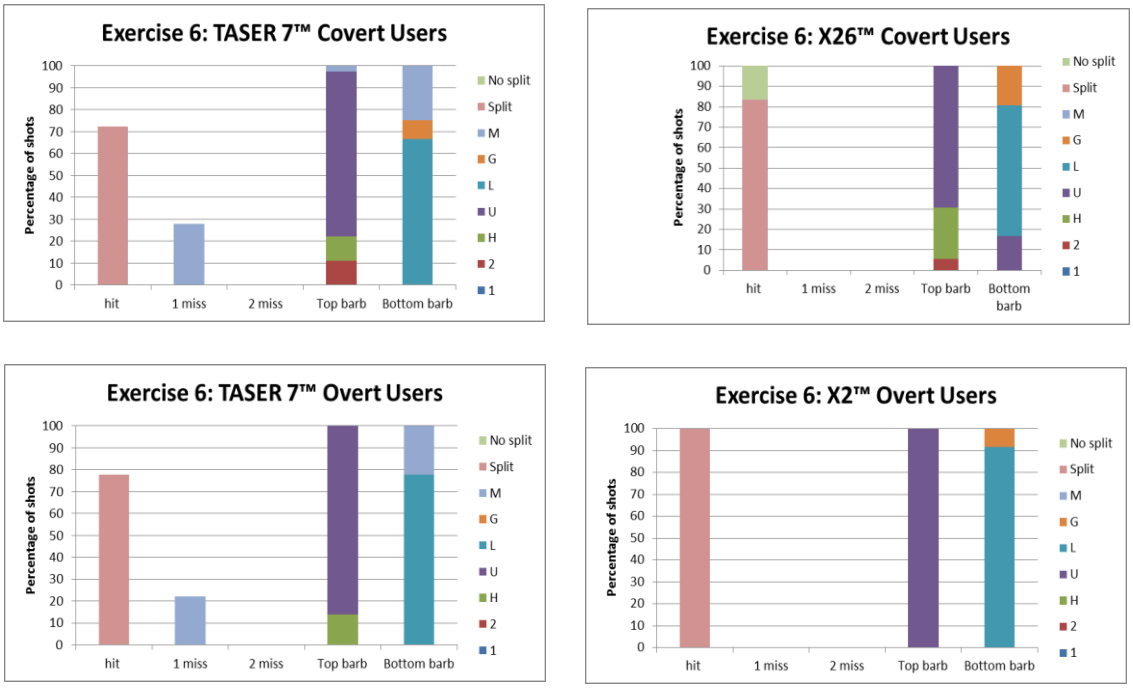


Figure 79: Exercise 6 - TASER 7™ vs X26™ and TASER 7™ vs X2™, 3 shot

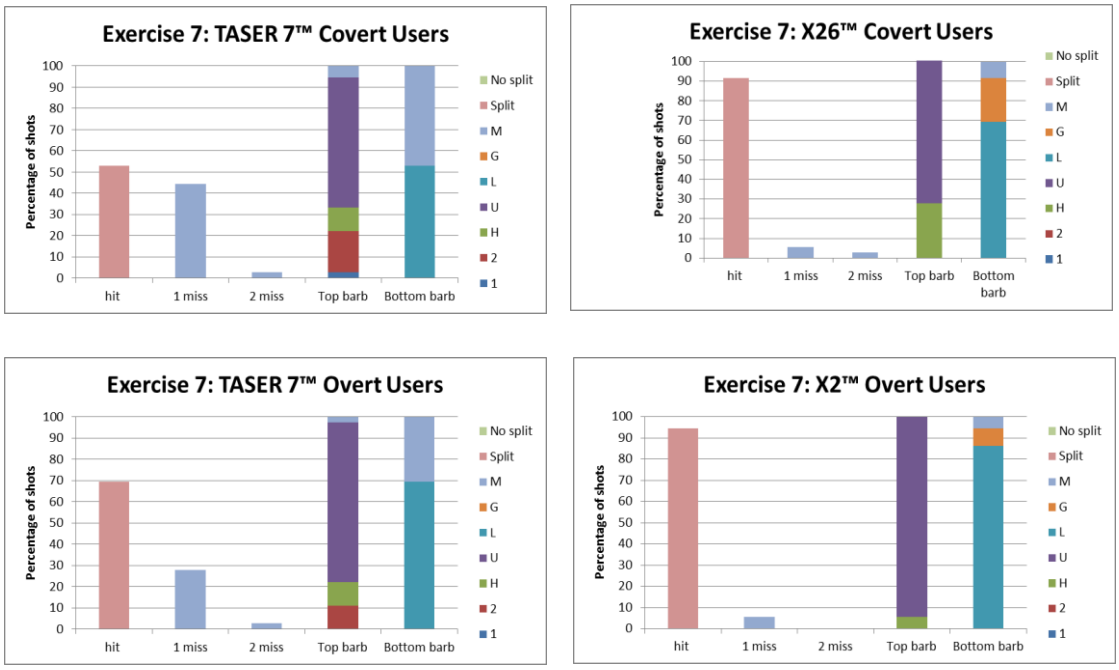


Figure 80: Exercise 7 - TASER 7™ vs X26™ and TASER 7™ vs X2™, shield

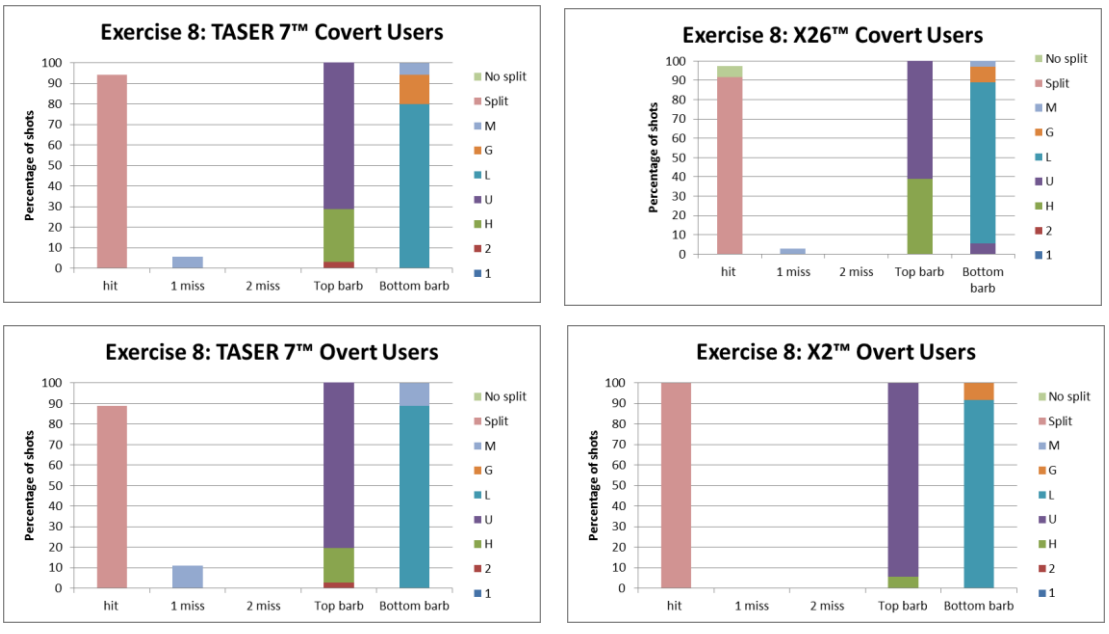


Figure 81: Exercise 8 - TASER 7™ vs X26™ and TASER 7™ vs X2™, show of strength

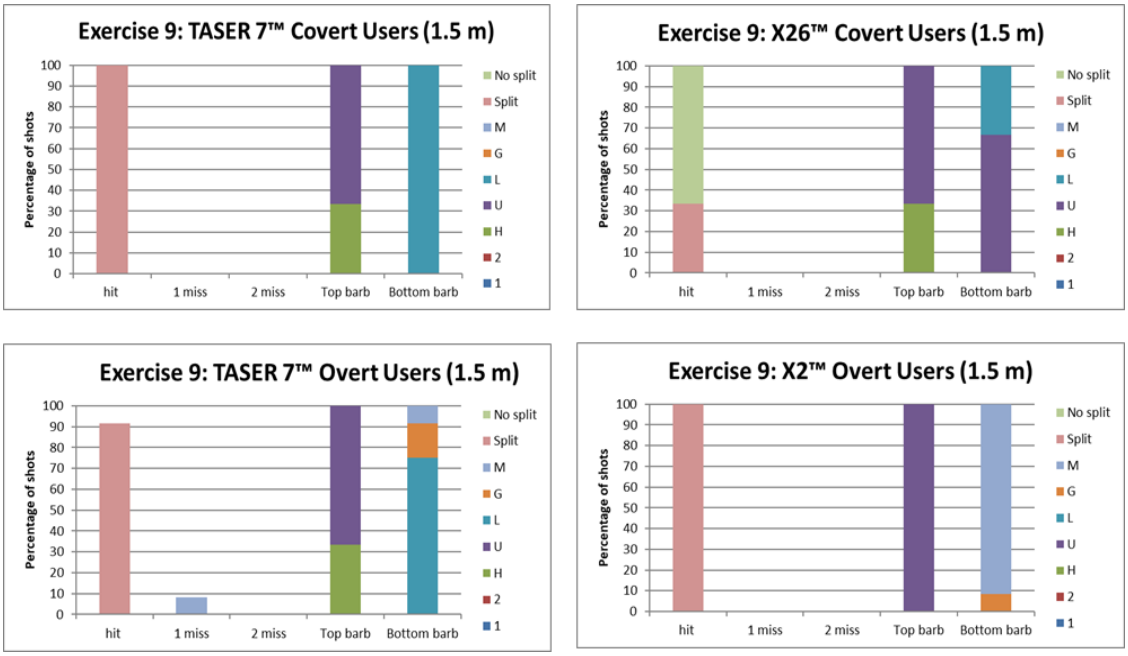


Figure 82: Exercise 9 - TASER 7™ vs X26™ and TASER 7™ vs X2™, static target at 1.5 m

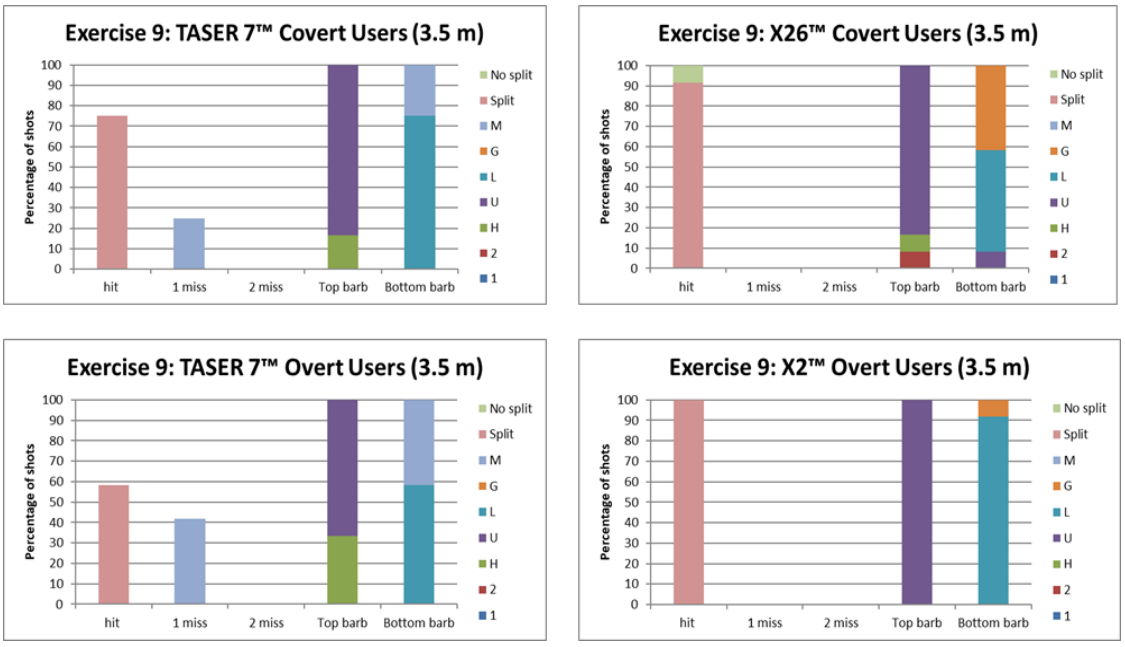


Figure 83: Exercise 9 - TASER 7™ vs X26™ and TASER 7™ vs X2™, static target at 3.5 m

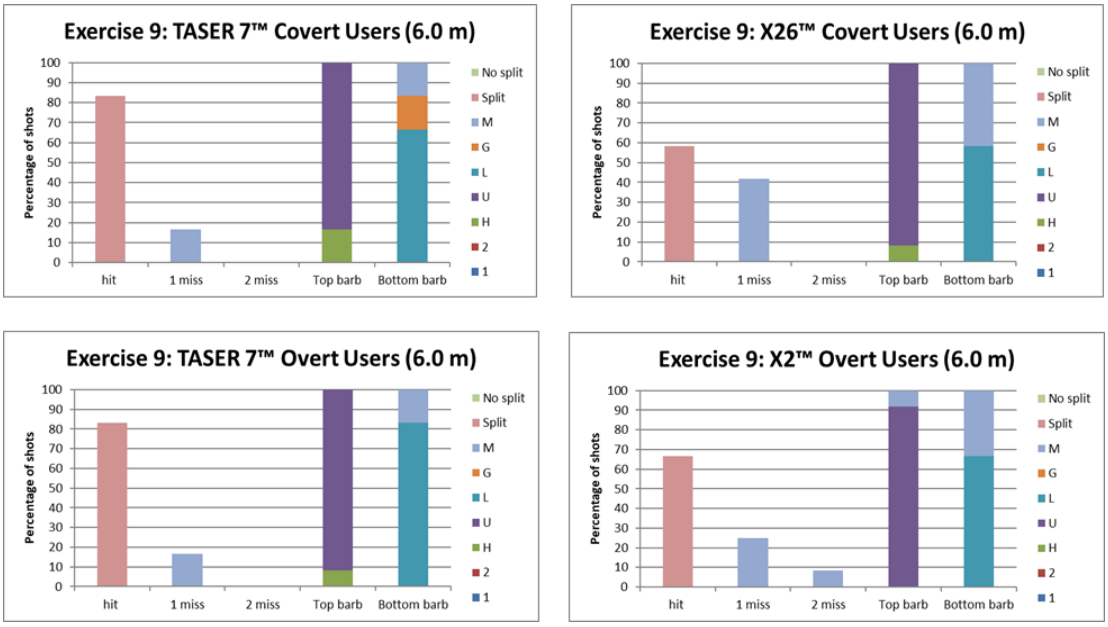


Figure 84: Exercise 9 - TASER 7™ vs X26™ and TASER 7™ vs X2™, static target at 6.0 m

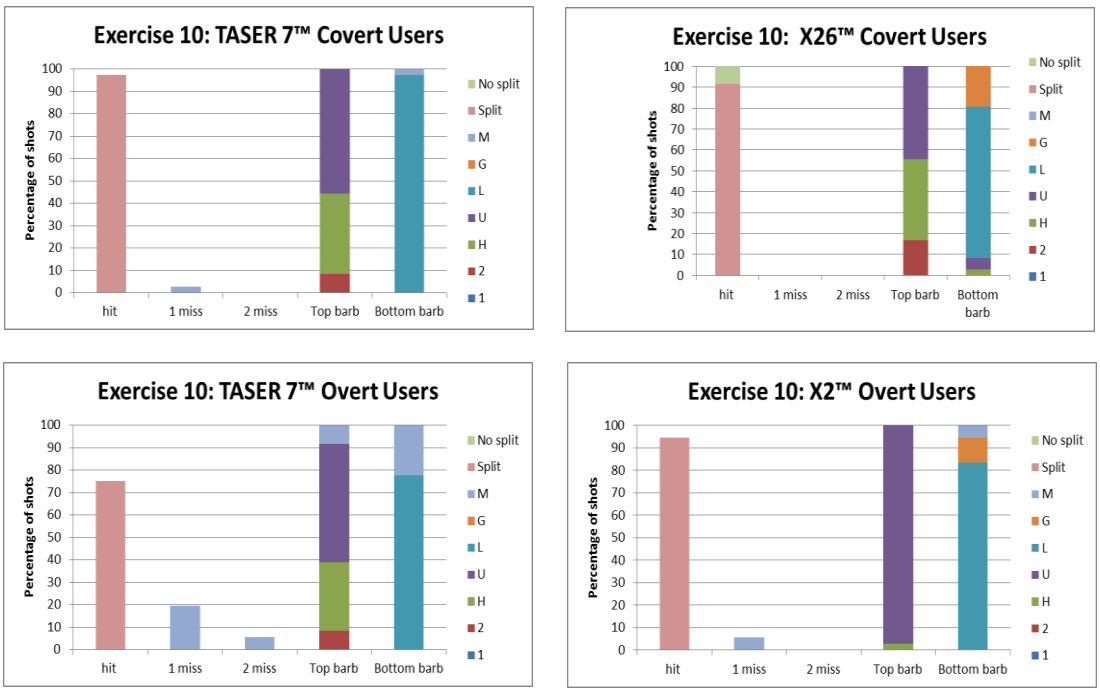


Figure 85: Exercise 10 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target moving sideways 12° HALT™ (3.0 m)

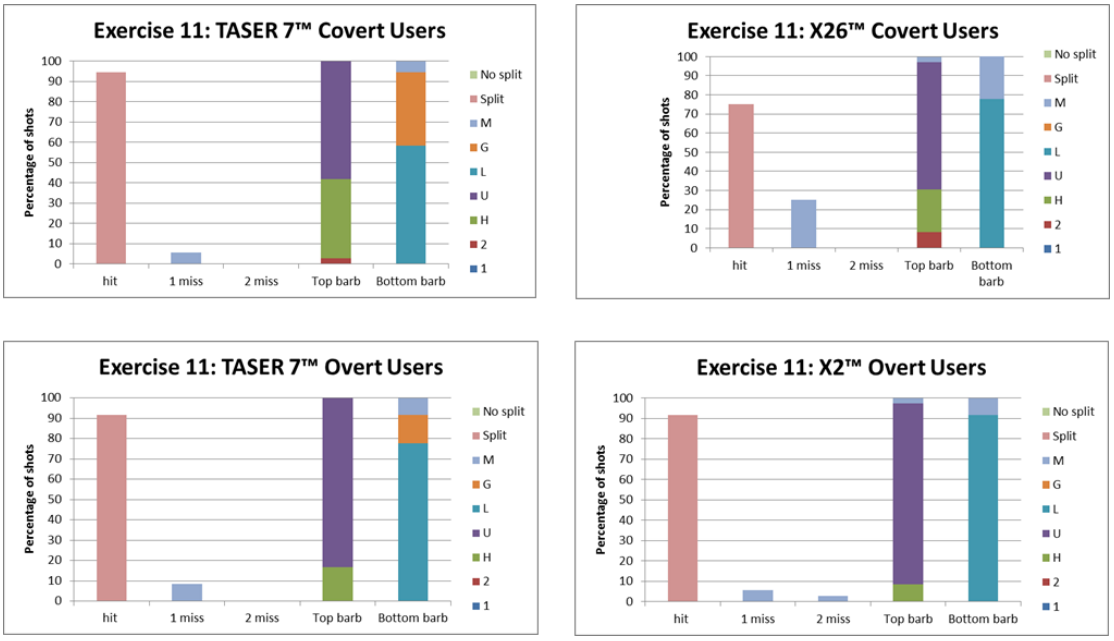


Figure 86: Exercise 11 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target moving sideways 3.5° HALT™ cartridge (4.5 m)

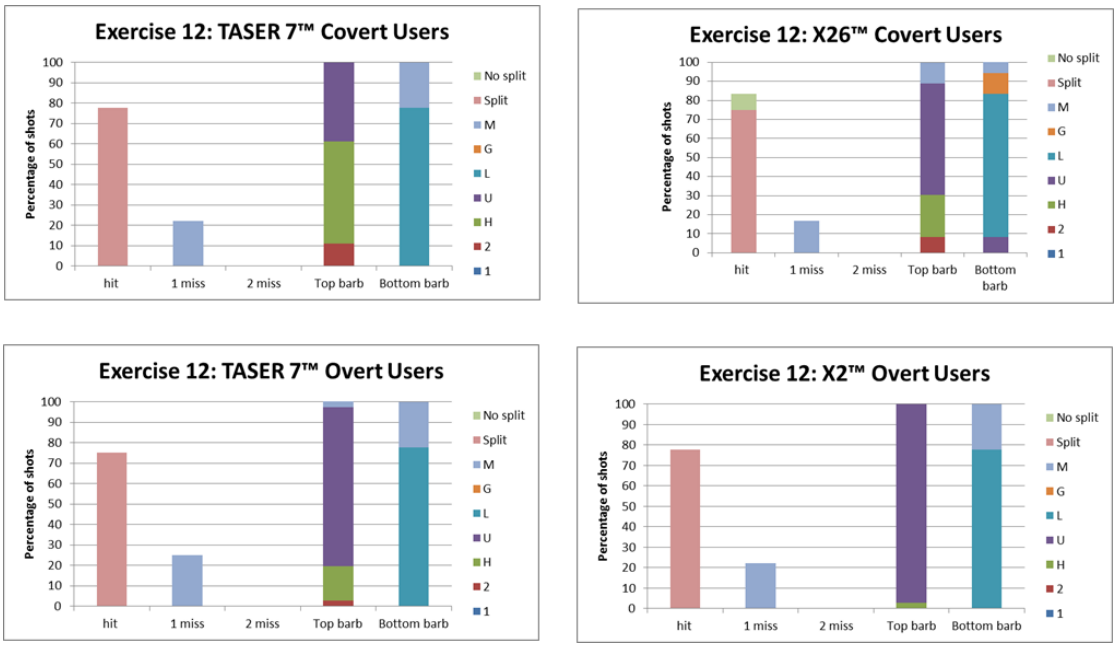
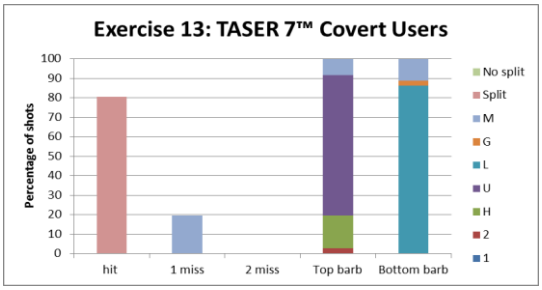


Figure 87: Exercise 12 - TASER 7™ vs X26™ and TASER 7™ vs X2™, target moving forwards (12° HALT™)



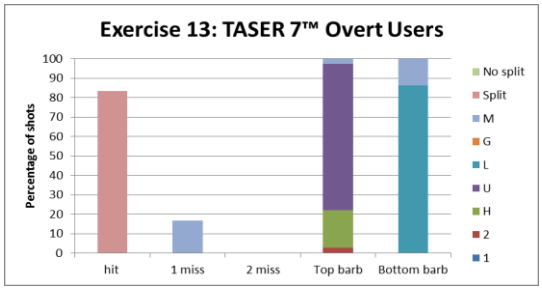
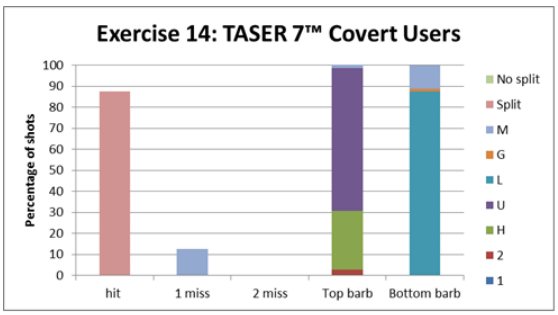
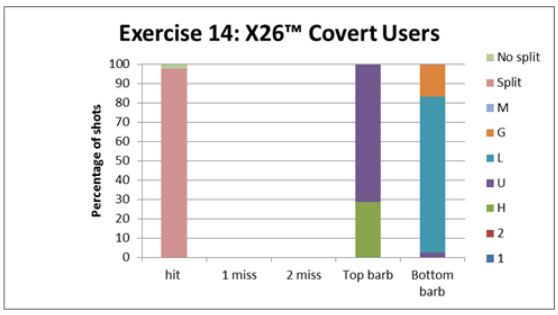
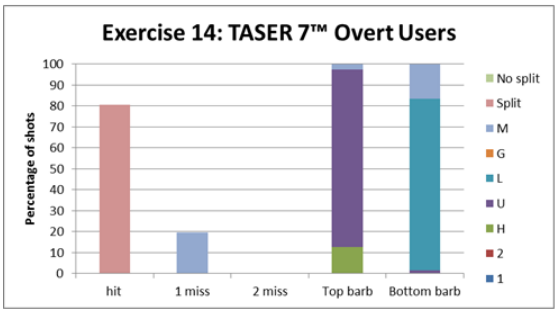


Figure 88: Exercise 13 - TASER 7™ only, target moving forwards 3.5° HALT™







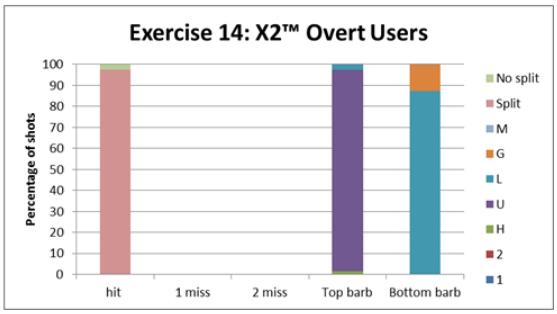


Figure 89: Exercise 14 - TASER 7™ vs X26™ and TASER 7™ vs X2™, torch and in low light

[redacted]

APPENDIX F Laser correlation live firing hit distribution

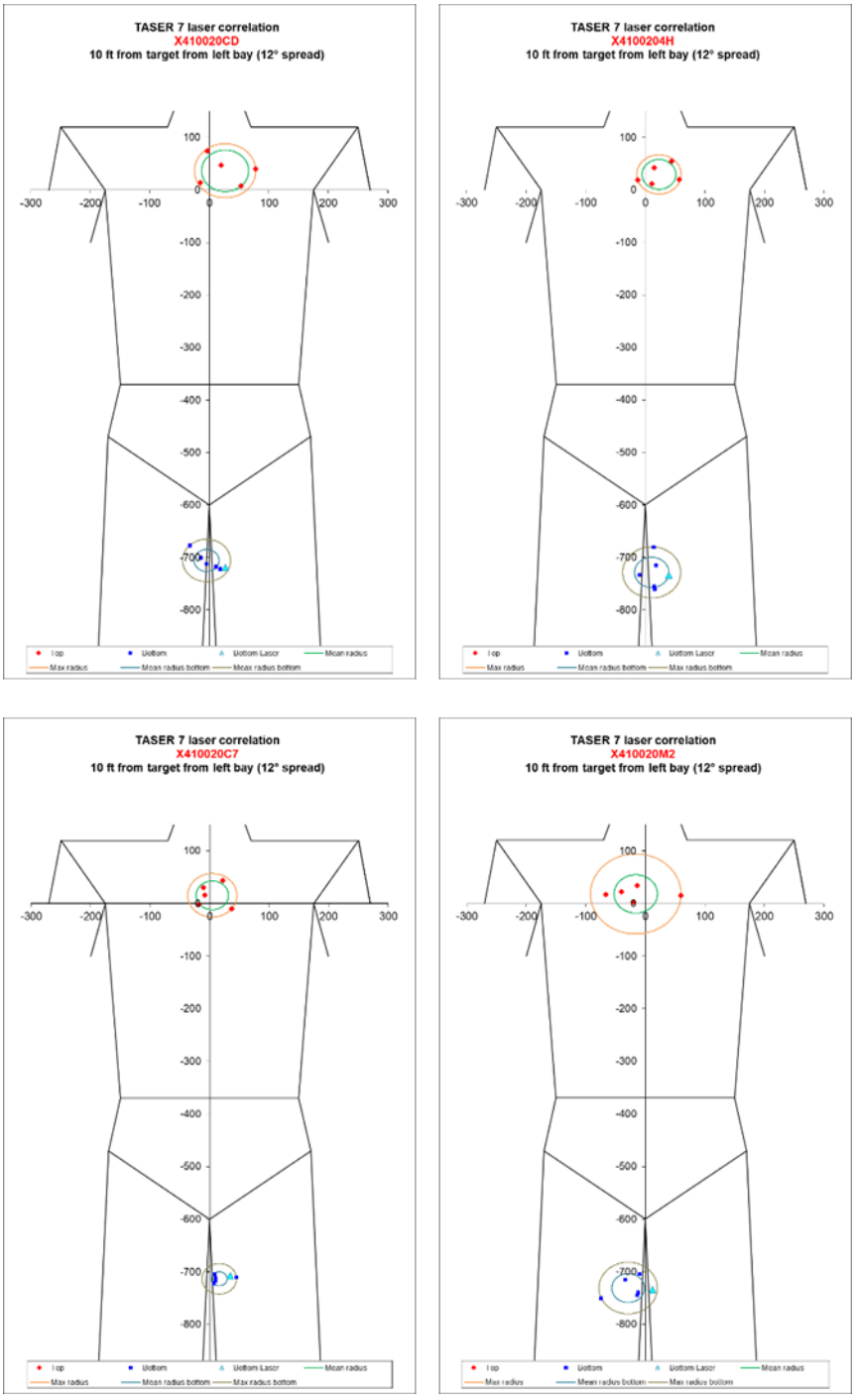


Figure 90: TASER 7™ serial numbers X410020CD, X4100204H, X410020C7, X410020M2 laser correlation target data (scale in mm)

[redacted]

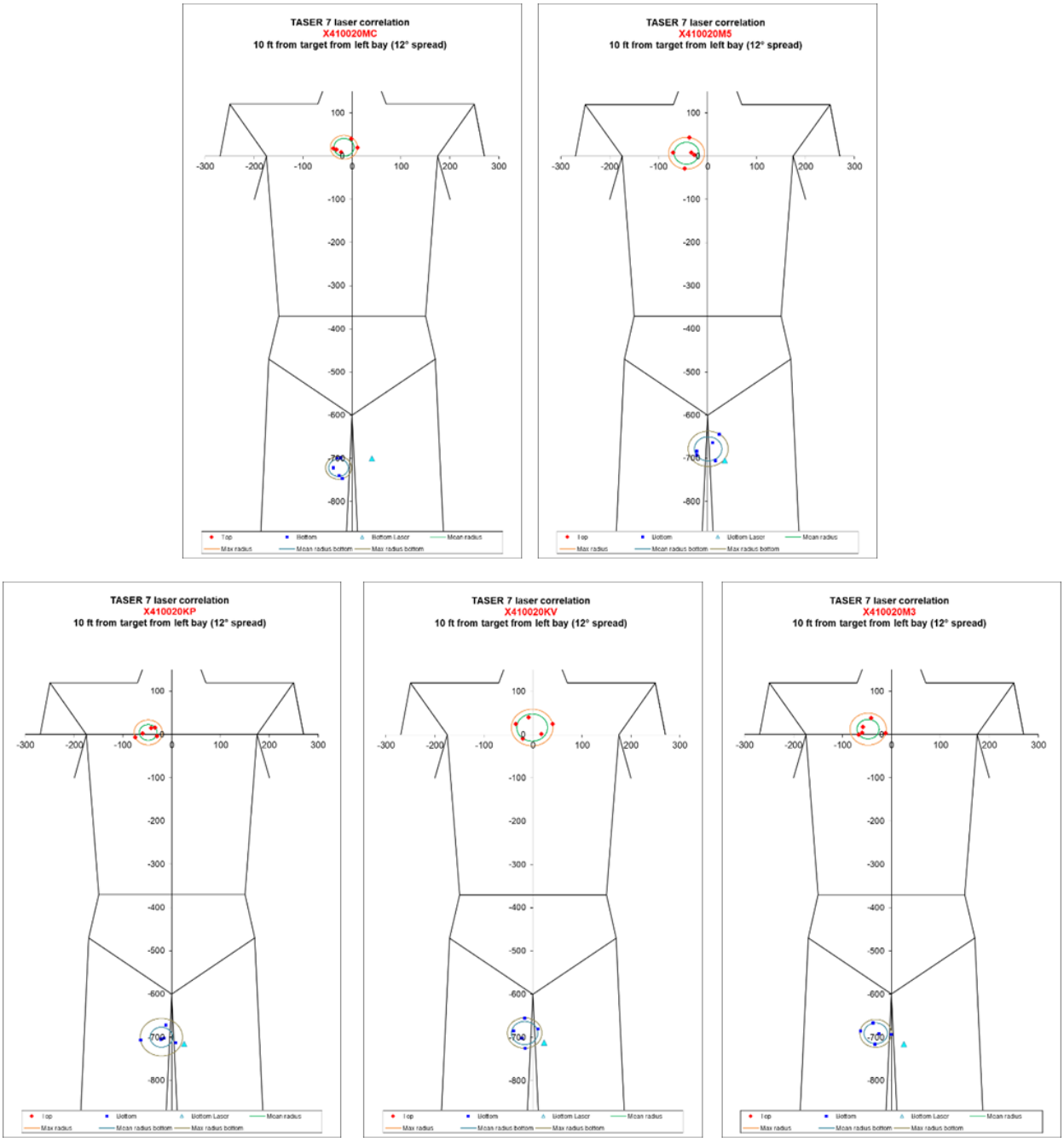


Figure 91: TASER 7™ serial numbers X410020MC, X410020M5, X410020KP, X410020KV and X410020M3 laser correlation target data (scale in mm)

[redacted]

APPENDIX G X26™ operational cartridge probe displacement relative to point of aim

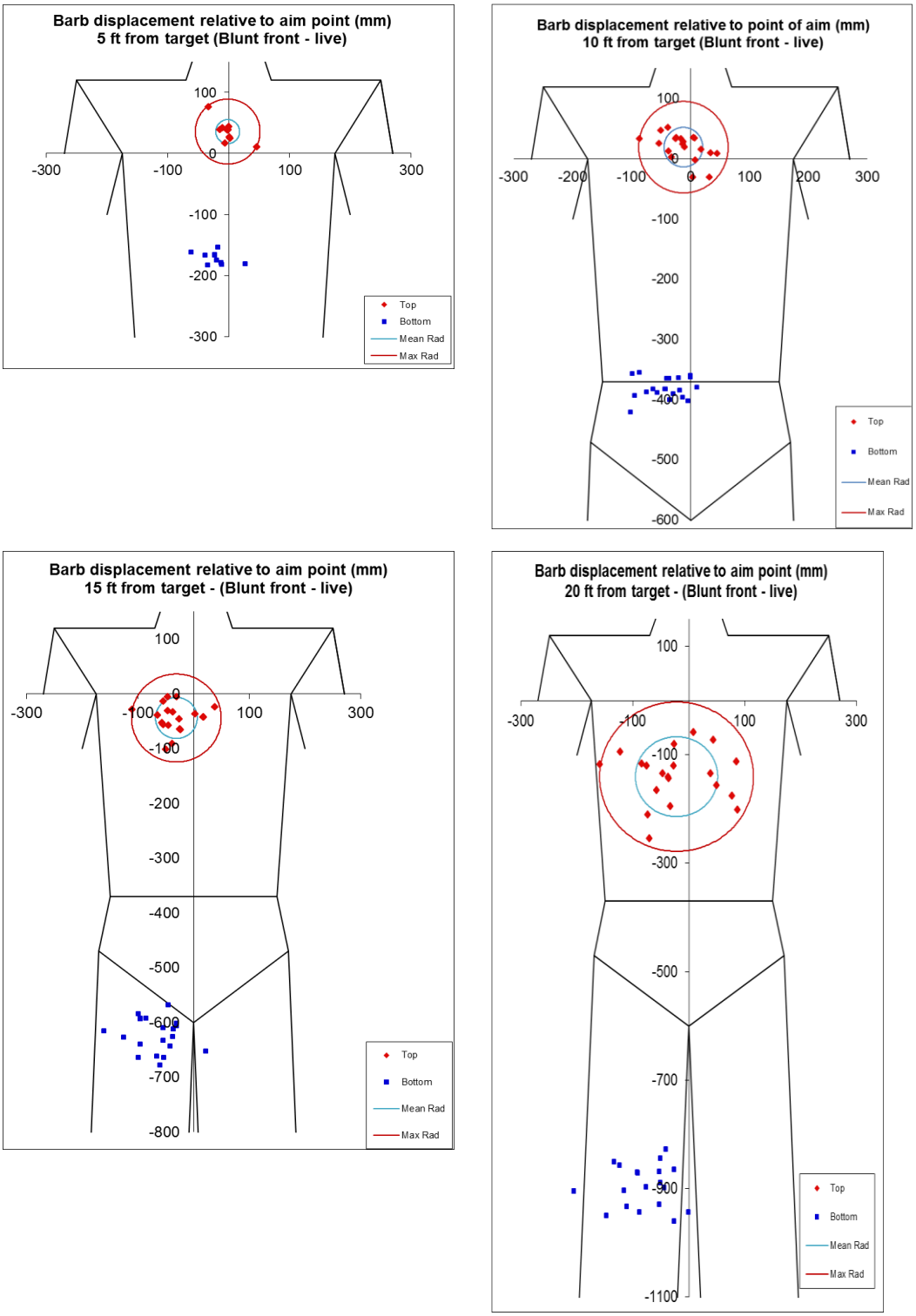


Figure 92: X26™ Operational cartridge probe displacement relative to point of aim at 1.5 m (5 ft), 3.0 m (10 ft), 4.6 m (15 ft) and 6.1 m (20 ft)

[redacted]

[redacted]

APPENDIX H X2™ operational cartridge probe displacement relative to point of aim

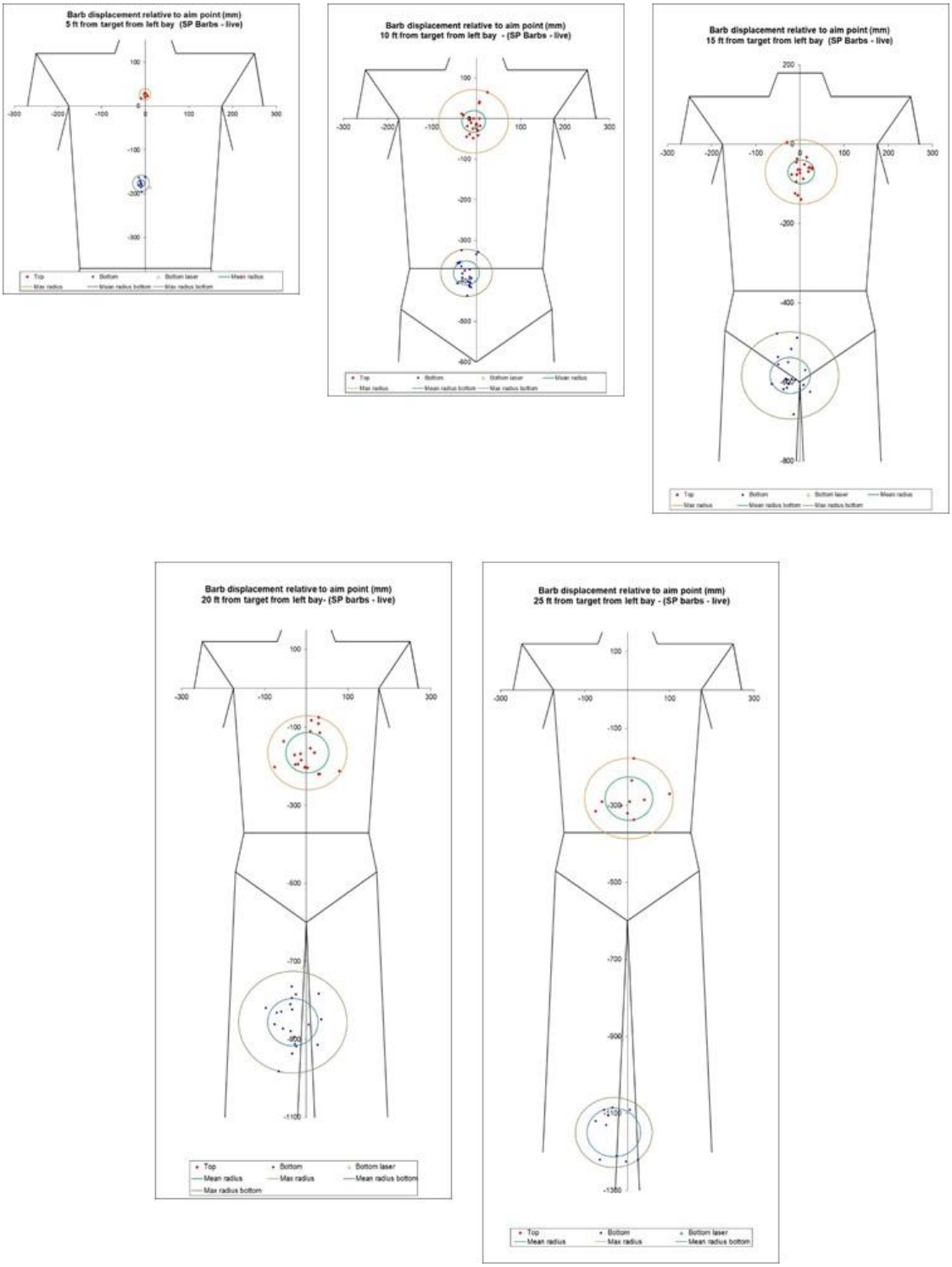


Figure 93: X2™ operational cartridge probe displacement relative to point of aim left bay at 1.5 m (5 ft), 3.0 m (10 ft), 4.6 m (15 ft), 6.1 m (20 ft) and 7.6 m (25 ft)

[redacted]

APPENDIX I TASER 7™ operational 3.5 cartridge probe displacement relative to point of aim

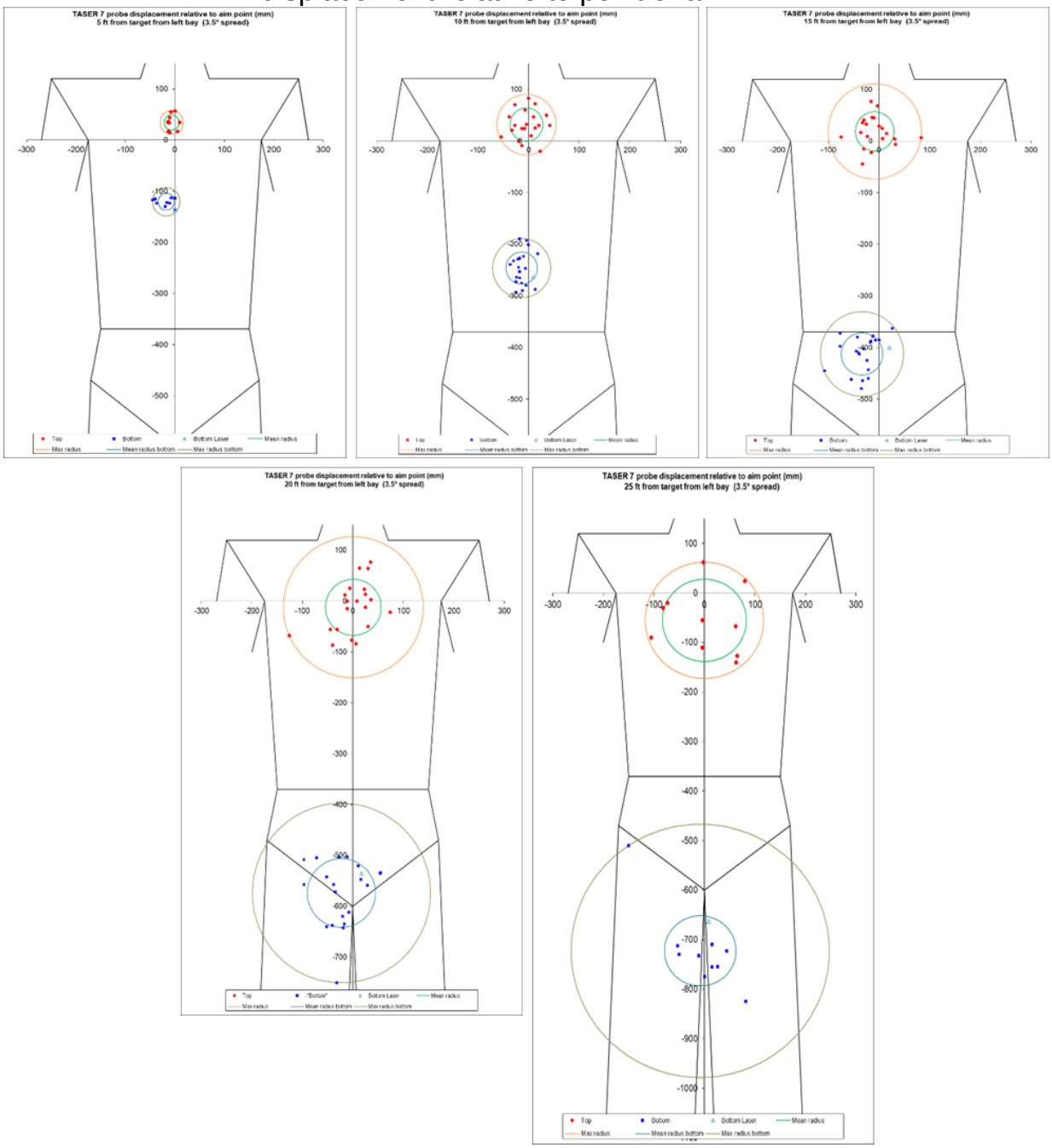


Figure 94: Position of operational 3.5° cartridge probes fired from TASER 7™ left bay at 1.5 m (5 ft), 3.0 m (10 ft), 4.6 m (15 ft), 6.1 m (20 ft) and 7.6 m (25ft)

[redacted]

APPENDIX J TASER 7™ operational 12° cartridge probe displacement relative to point of aim

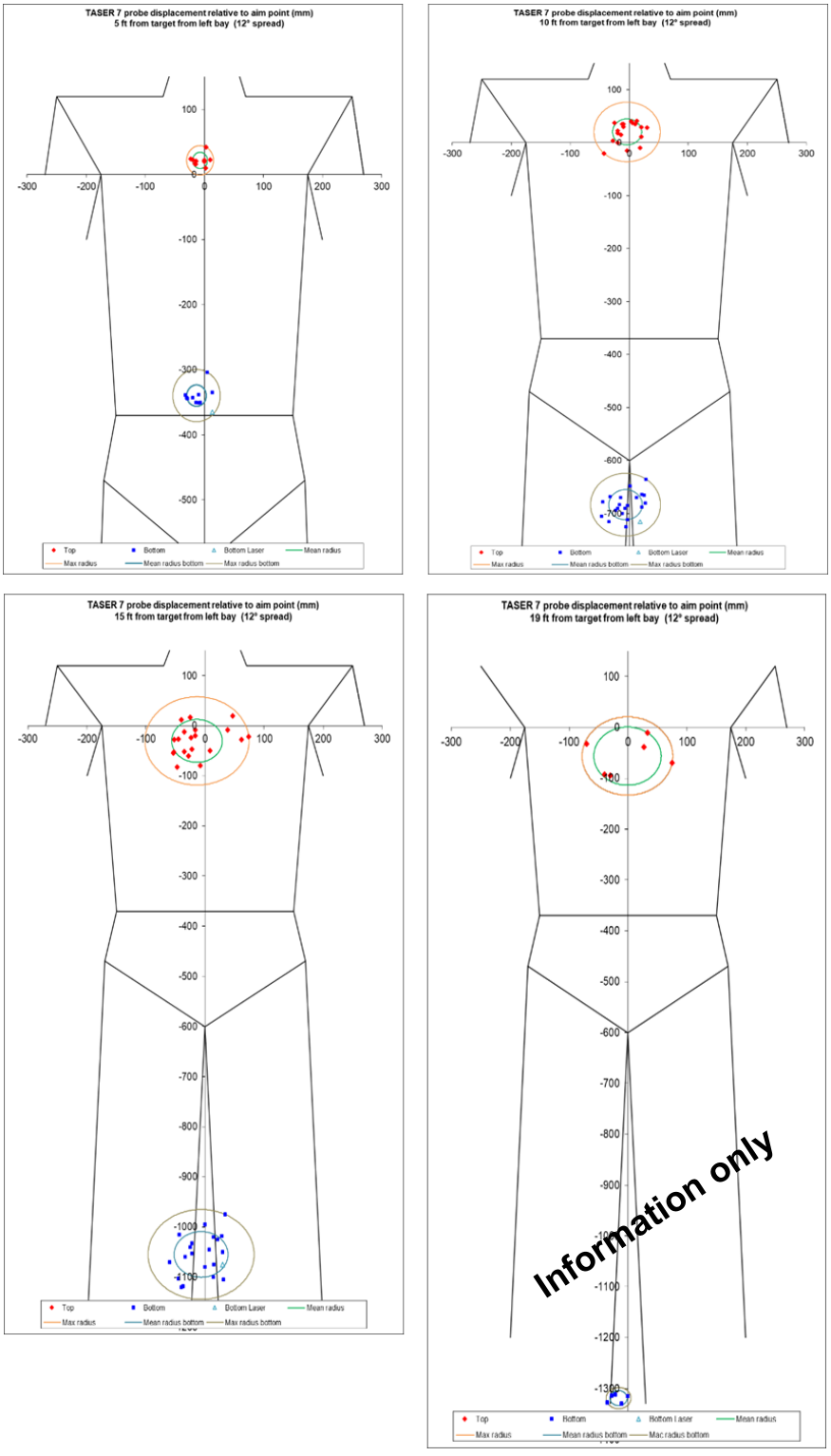


Figure 95: Position of operational 12° cartridge probes fired from TASER 7™ left bay at 1.5 m (5 ft), 3.0 m (10 ft), 4.6 m (15 ft), 5.8 m (19 ft) (for information only)

[redacted]

APPENDIX K Comparison between TASER 7™ left bay and right bay firing operational 3.5° cartridge

LEFT BAY **RIGHT BAY**

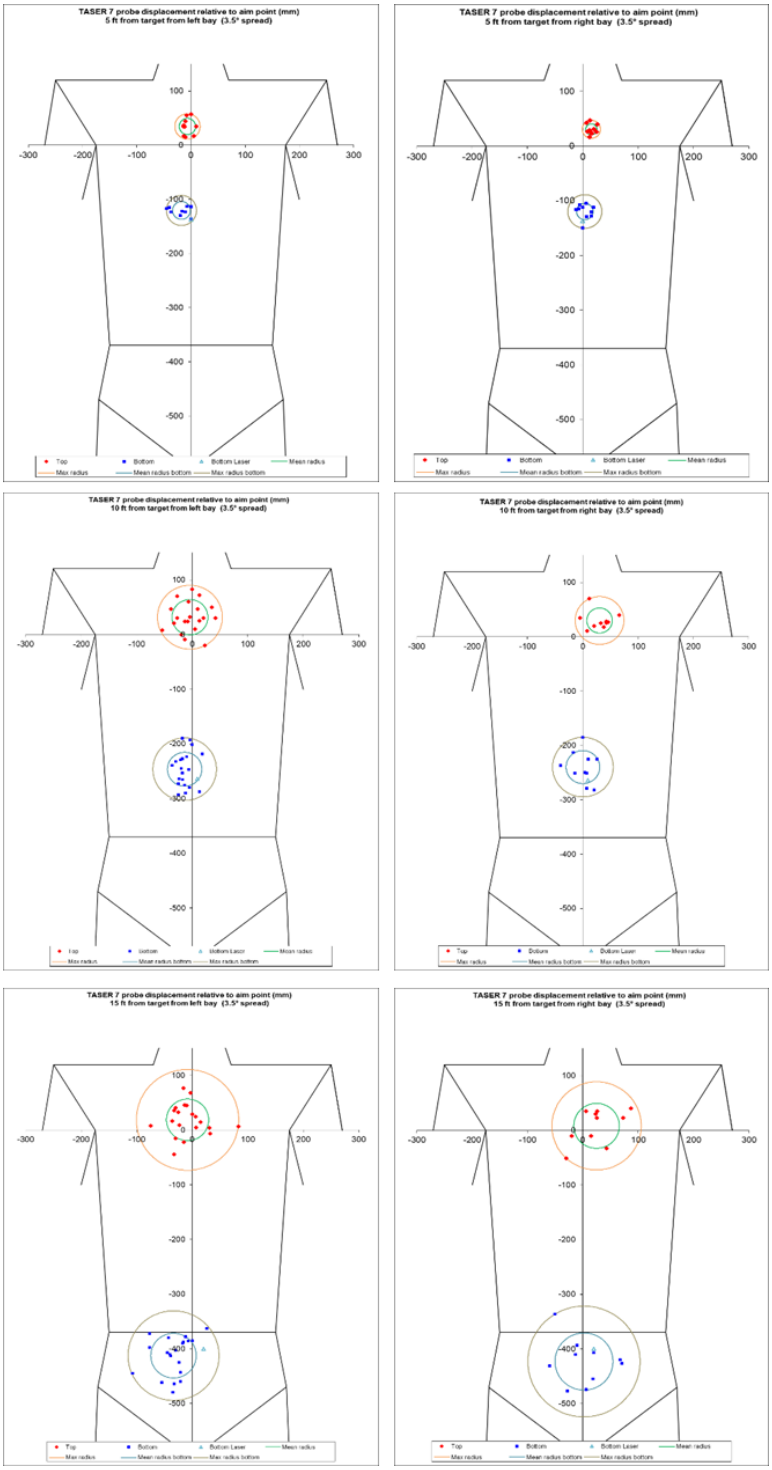


Figure 96: Comparison between TASER 7™ left bay and right bay firing operational 3.5° cartridge probes at 1.5 m (5 ft), 3.0 m (10 ft) and 4.6 m (15 ft)

[redacted]

LEFT BAY **RIGHT BAY**

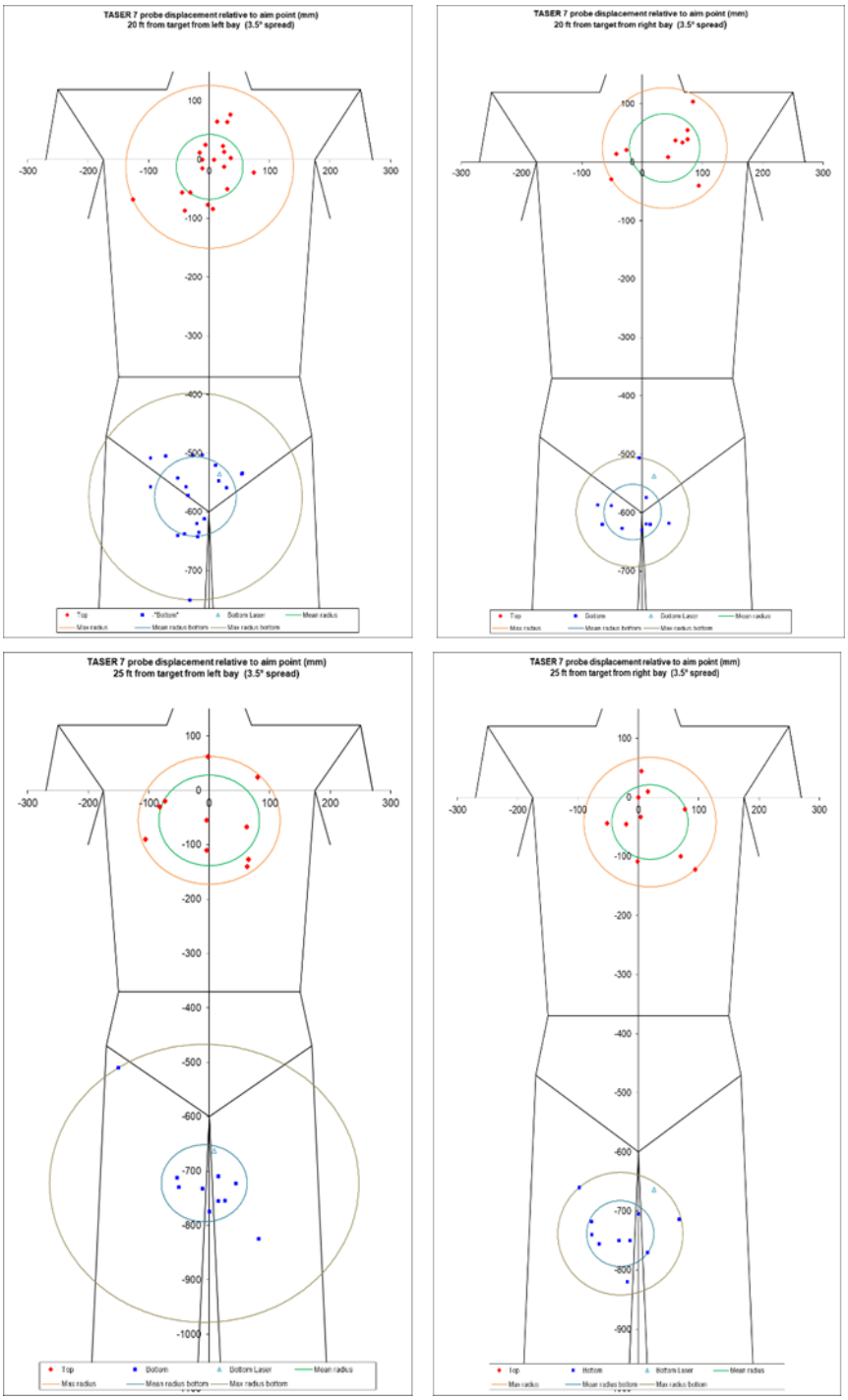


Figure 97: Comparison between the TASER 7™ left bay and right bay firing standard operational 3.5° cartridge probes fired at 6.1 m (20 ft) and 7.6 m (25 ft)

[redacted]

[redacted]

APPENDIX L Comparison between TASER 7™ left bay and right bay firing operational 12° cartridge

LEFT BAY **RIGHT BAY**

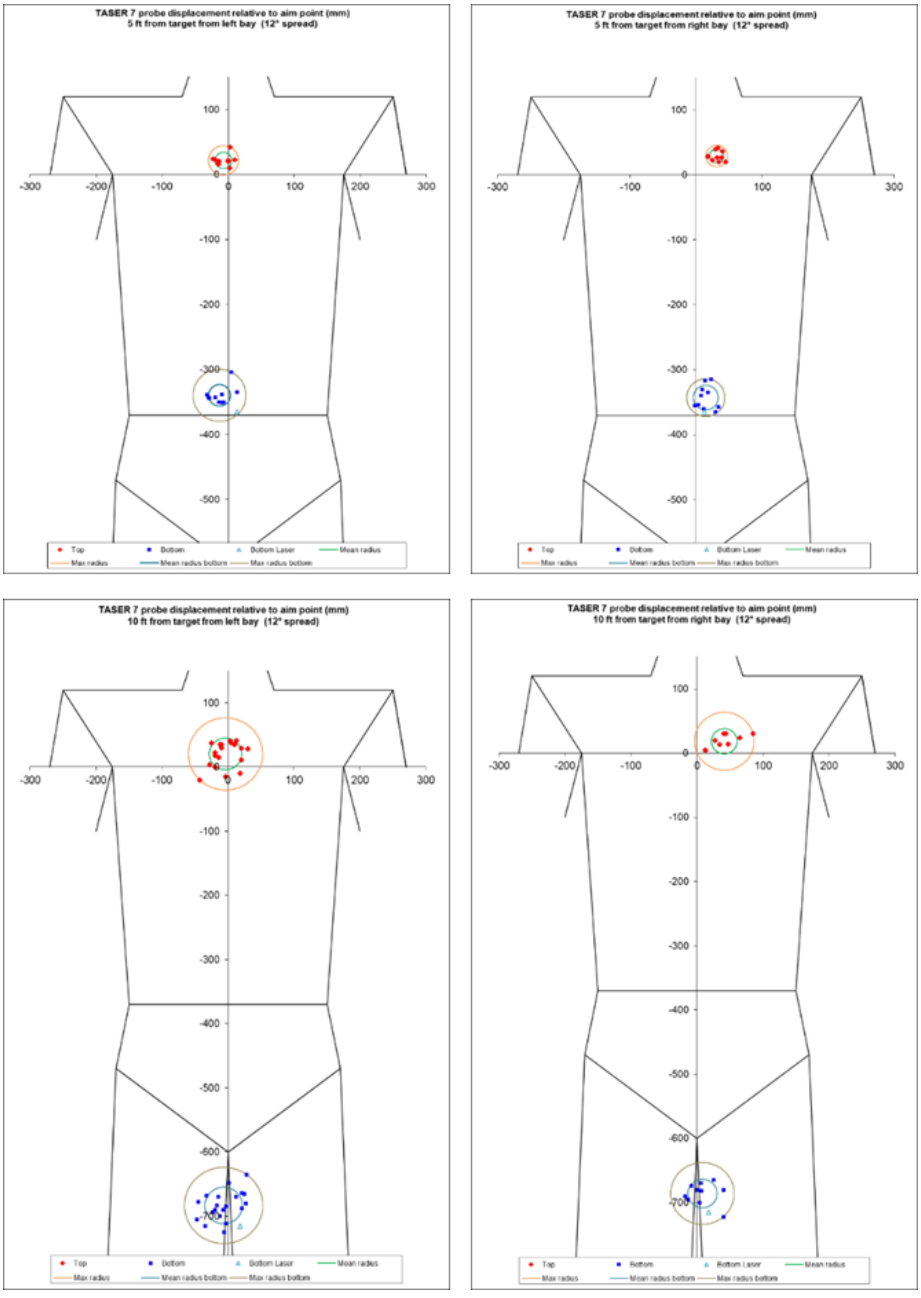


Figure 98: Comparison between the TASER 7™ left bay and right bay firing operational 12° cartridge probes fired at 1.5 m (5 ft) and 3.0 m (10 ft)

[redacted]

[redacted]

LEFT BAY **RIGHT BAY**

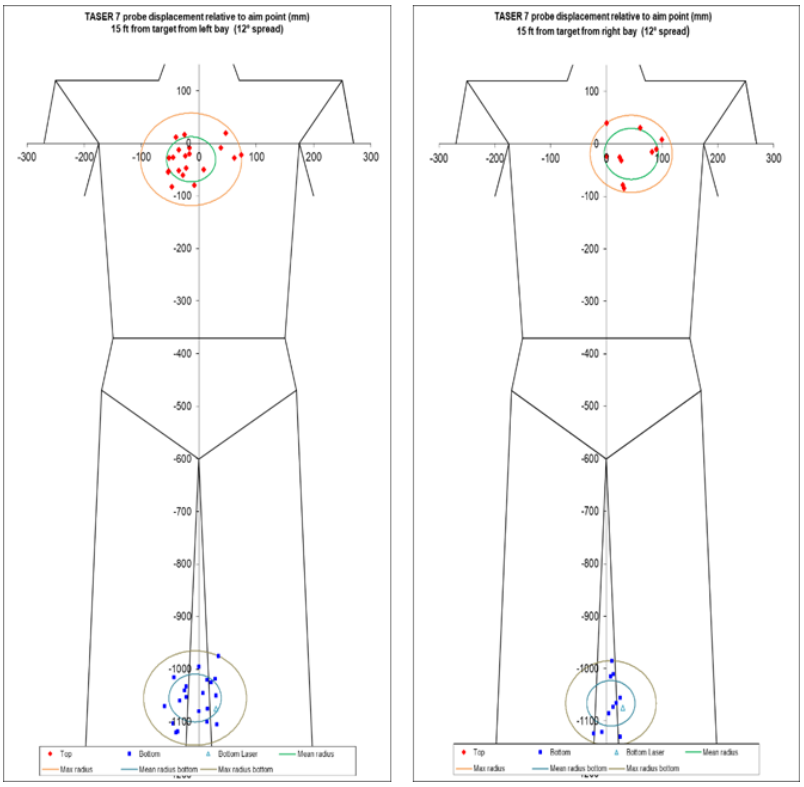


Figure 99: Comparison between the TASER 7™ left bay and right bay firing operational 12° cartridge probes fired at 4.6 m (15 ft)

[redacted]

APPENDIX M Comparison between TASER 7™ operational 3.5° cartridge and HALT™ training 3.5° cartridges fired from left bay

Operational **Training**

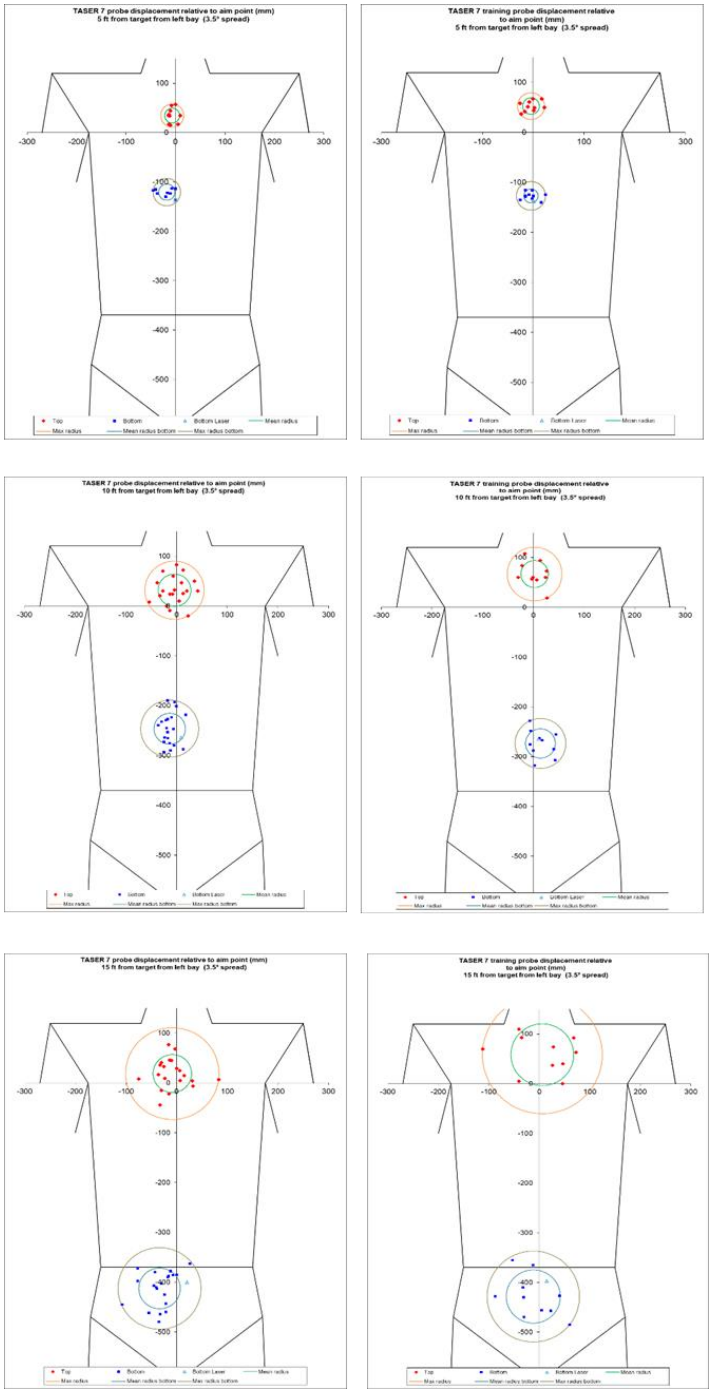


Figure 100: Comparison between TASER 7™ standard operational 3.5° cartridge probes and HALT™ training 3.5° cartridges fired from left bay at 1.5 m (5 ft), 3.0 m (10 ft) and 4.6 m (15 ft)

[redacted]

Operational **Training**

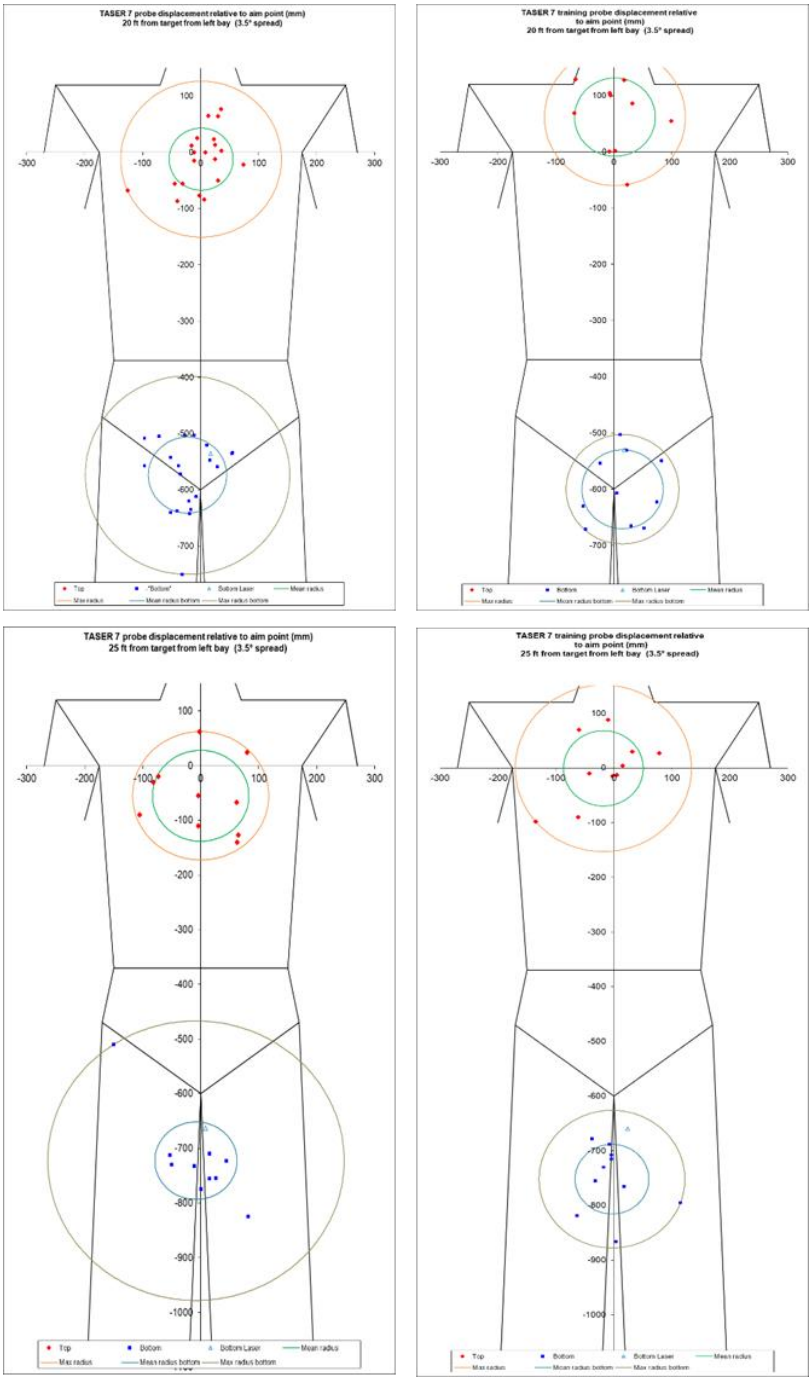


Figure 101: Comparison between TASER 7™ standard operational 3.5° cartridge probes and HALT™ training 3.5° cartridges fired from left bay at 6.1 m (20 ft) and 7.6 m (25 ft)

[redacted]

[redacted]

APPENDIX N Comparison between TASER 7™ operational 12° cartridge and HALT™ training 12° cartridge fired from left bay

Operational **Training**

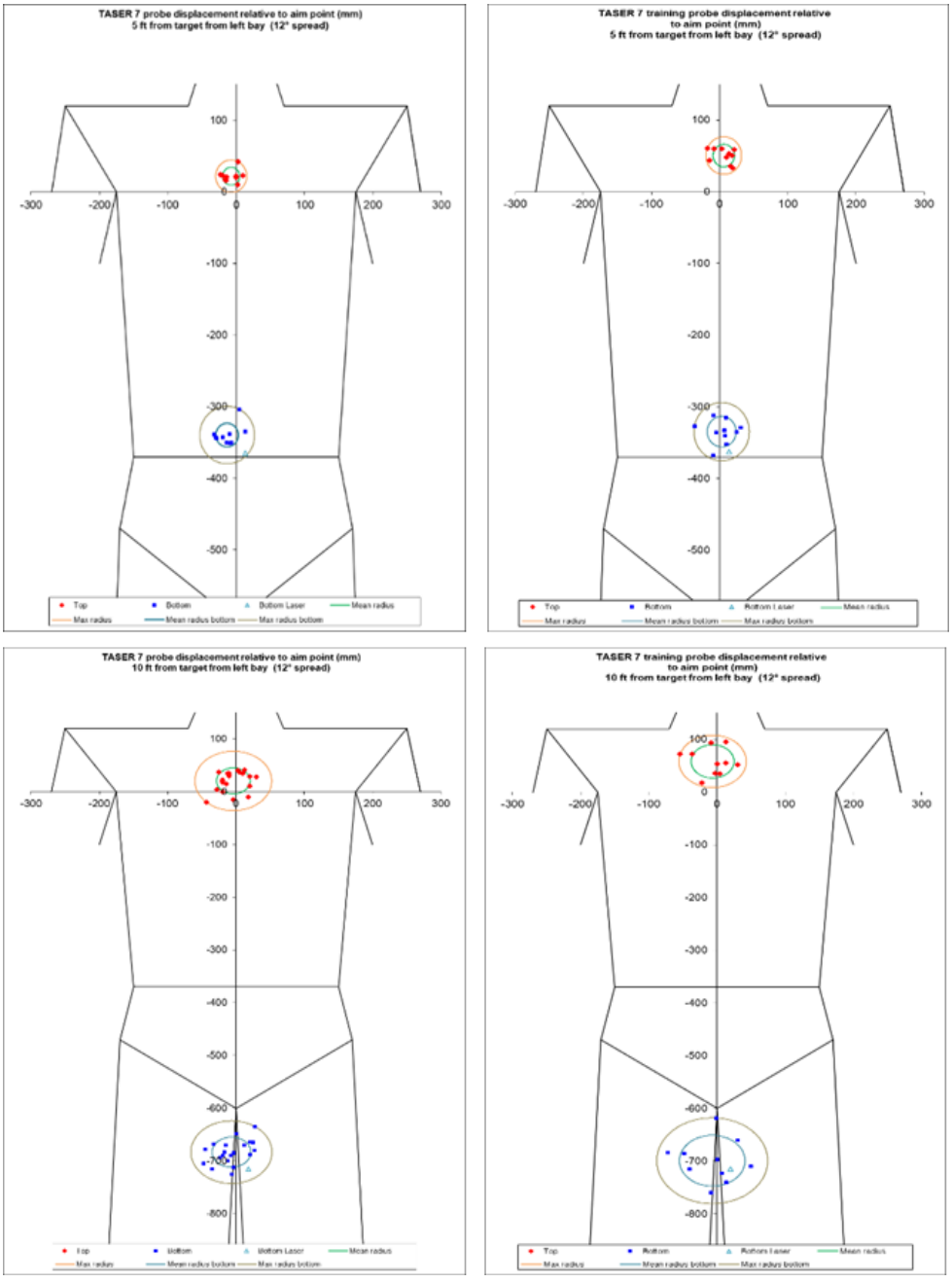


Figure 102: Comparison between TASER 7™ standard operational 12° cartridge and HALT™ training 12° cartridge fired from left bay at 1.5 m (5 ft), 3.0 m (10 ft)

[redacted]

[redacted]

Operational **Training**

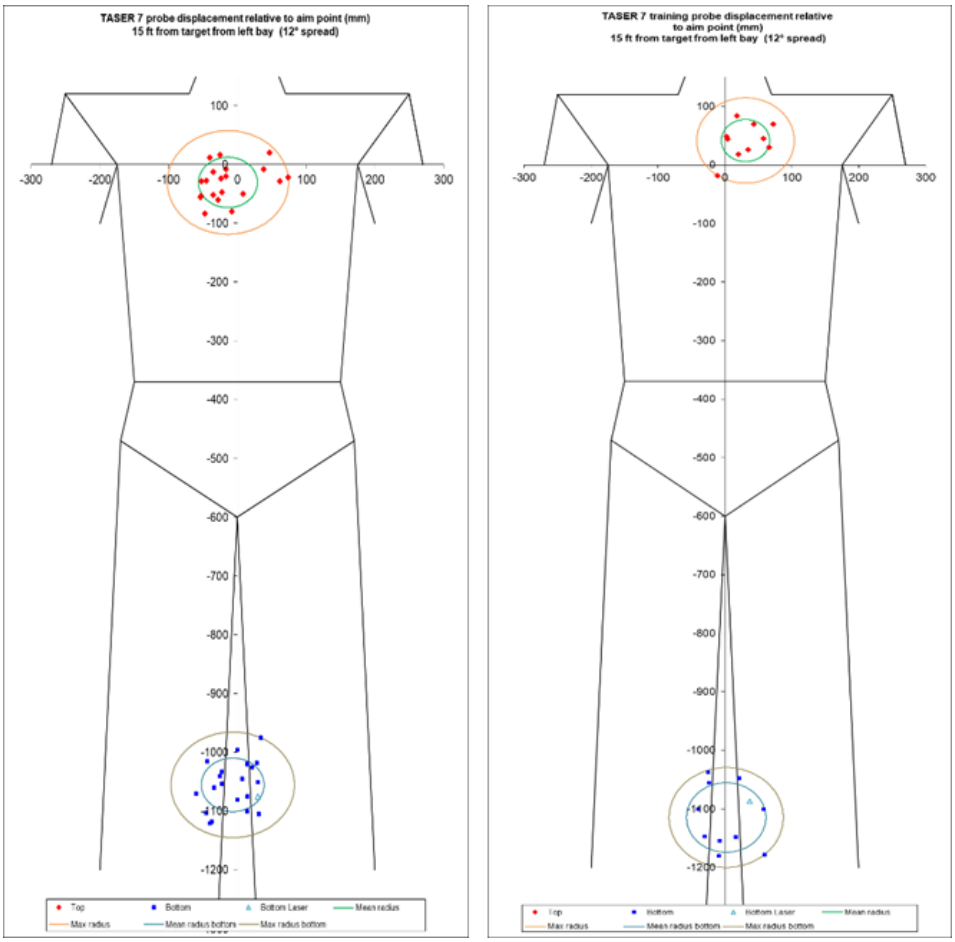


Figure 103: Comparison between TASER 7™ operational 12° cartridge probes and HALT™ training 12° cartridges fired from left bay at 3.0 m (15 ft) and 5.8 m (19 ft)

[redacted]

[redacted]

APPENDIX O Drop Test of TASER 7™ (X410020KP) with safety switch in safe position

Drop position	Post drop check		Test fire	Check laser from pre-drop origin (cm)				Comments
	Visual	CID		Top X	Top Y	Bottom X	Bottom Y	
1	OK	OK	OK	-0.2	0	-0.2	0	No change
2	OK	OK	OK	-0.5	0	-0.2	0	Both cartridges displaced and separated
3	OK	OK	OK	-0.5	0	-0.2	0	Both cartridges displaced and separated
4	OK	OK	OK	-0.5	0	-0.2	0	Both cartridges displaced and separated
5	OK	OK	OK	-0.2	0	-0.2	0	No change
6	OK	OK	OK	0	0	0	0	No change
7	OK	OK	OK	0	0	0.2	0	No change
8	OK	OK	OK	0	0	0.2	0	No change
9	OK	OK	OK	-0.2	0	-0.2	0	No change
10	OK	OK	OK	-0.5	0	-0.5	0	No change

Table 31: Drop test of TASER 7™ (X410020KP) with safety switch in safe position

[redacted]

TASER 7™: Serial number X410020KP

Battery: Serial number X44305663 92% prior to drop test

12° operational cartridges

Pre-drop test top and bottom lasers marked at a range of 4.6 m (15 ft)

All test firings were conducted from the left bay only

When cartridges had been displaced upon impact, they were reloaded prior to test firing the device

Data download conducted on 16 September 2019 at 1651hrs

Download showed no faults immediately after drop test.

Battery: Serial number X44305663 88% post drop test

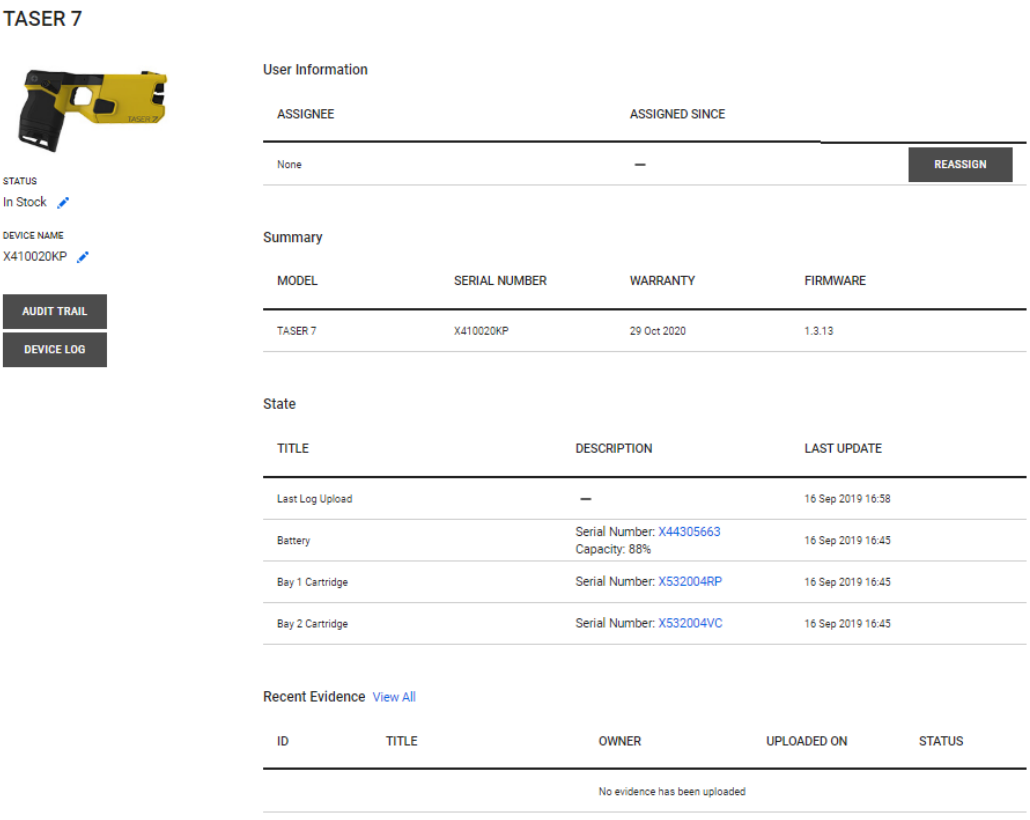


Figure 104: Screenshot from Evidence.com™ of TASER 7™ X410020KP post drop test

[redacted]

APPENDIX P Drop test of TASER 7™ (X410020M4) with safety switch in armed position

Drop position	Post drop check		Test fire	Check laser from pre-drop origin (cm)				Comments
	Visual	CID		Top X	Top Y	Bottom X	Bottom Y	
1	OK	OK	OK	0	0	0	1.0	No change
2	OK	OK	OK	0	0	0	1.0	Drop repeated because TASER 7™ not armed initially. Both cartridges displaced and separated
3	OK	OK	OK	0	0	0	0.7	Both cartridges slightly displaced but remained clipped together
4	OK	OK	OK	-0.2	-0.2	0.5	0.5	Cartridges remained in bays, however CID showed fault bay 2, cartridges reloaded and fault cleared, test fired OK
5	OK	OK	OK	0	0	0	0.5	No change
6	OK	OK	OK	0.2	0.2	0.5	0.5	No change
7	OK	OK	OK	0.5	-0.5	0	0	Battery ejected, cartridge 2 showing fault, reloaded and fault cleared
8	OK	OK	OK	0.2	0.2	1.0	1.2	No change
9	OK	OK	OK	0.2	0.2	1.0	1.2	No change
10	OK	OK	OK	0.2	0.2	0.5	1.0	No change

Table 32: Drop Test of TASER 7™ (X410020M4) with safety switch in armed position

[redacted]

[redacted]

TASER 7™: Serial number X410020M4

Battery: serial number X44305665 96%

12° operational cartridges

Pre-drop test top and bottom lasers marked at a range of 4.6 m (15 ft)

All test firings were conducted from the left bay only

When cartridges were displaced upon impact, they were reloaded prior to test firing the device

Data download conducted on 17 September 2019 at 1100hrs

Battery: Serial number X44305663 84% post drop test

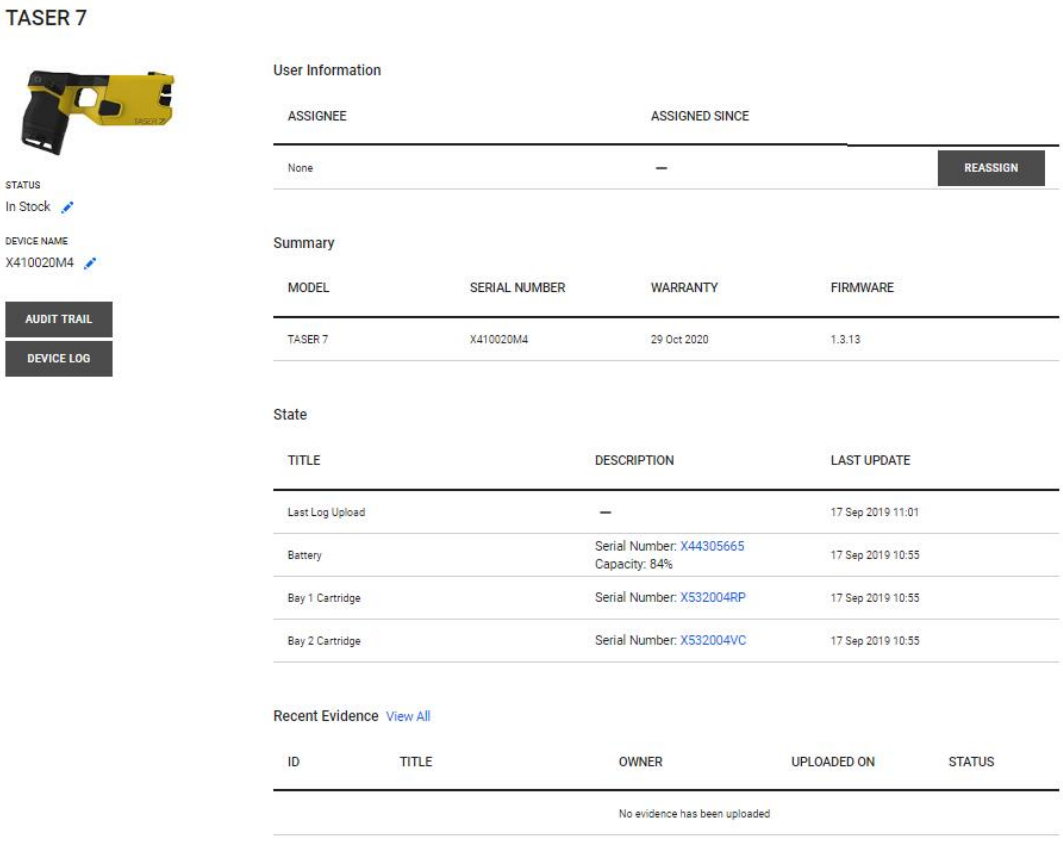


Figure 105: Screenshot from Evidence.com™ of TASER 7™ X410020M4 post drop test (safety switch in FIRE position)

[redacted]

[redacted]

APPENDIX Q Cartridge drop test results

Drop No.	Cartridge type	Probe mass (g)	Orientation			CID check	Test fire
			Blast doors up	Blast doors up	Blast doors down		
1	3.5° Ops	Single	ok	ok	ok	ok	ok
2	3.5° Ops	Paired	separated	separated	separated	ok	ok
3	12° Ops	Single	ok	ok	ok	ok	ok
4	12° Ops	Paired	separated	separated	separated	ok	ok
5	3.5° HALT	Single	ok	ok	ok	ok	ok
6	3.5° HALT	Paired	separated	separated	ok	ok	ok
7	12° HALT	Single	ok	ok	ok	ok	ok
8	12° HALT	Paired	separated	separated	separated	ok	ok

Table 33: Drop test results

[redacted]

[redacted]

Acknowledgements

The authors would like to convey sincere thanks to the staff at West Midlands Police Training Centre for their hospitality and use of their excellent facility.Thanks for the commitment and professionalism conveyed by the officers who volunteered to participate in the user handling trial.

The authors would also like to acknowledge staff from the College of Policing and the National TASER™ Practitioner Group for their assistance in supervising the user handling trial exercises.

[redacted]

[redacted]

Initial distribution

1.	KIS	Dstl	electronic
2.	Home Office Security, Science and Innovation (SSI) Commissioning Hub	Home Office	electronic
3.	National Police Chiefs Council (NPCC) Less Lethal Weapons Working Group	Police	electronic
4.	National Police Chiefs Council (NPCC) Covert Conducted Energy Device Working Group	Police	electronic
5.	Home Office Police Powers Unit	Home Office	electronic
6.	College of Policing	Police	electronic
7.	Scientific Advisory Committee on the Medical Implications of Less-Lethal Weapons	SACMILL	electronic

[redacted]

[redacted]

Report documentation page v5.0

* Denotes a mandatory field

Report number:	Dstl/TR117685	**1b. Version number:**	v1.0
Date of publication: *	13/03/2020	**3. Number of pages:**	xii + 132
Report UK protective marking: *UK OFFICIAL	[redacted]		
Report national caveats: *			
Report descriptor: *	[redacted]		

Title: *

Physical Assessment of TASER 7™

Title UK protective marking: *	UK OFFICIAL
Title national caveats: *	
Title descriptor: *	

Authors: *

[redacted].; [redacted].; [redacted].; [redacted]

Abstract: *

The TASER 7™ was identified a suitable conducted energy device for UK police use. Dstl were tasked by the NPCC via the UK Home Office to conduct an assessment of TASER 7™ for both covert and overt police roles against a Police Operational Requirement. This assessment is to assist the NPCC in their understanding of the system and its compliance with their Operational Requirement. This assessment will form also part of the submission to the independent Scientific Advisory Committee on the Medical Implications of Less-Lethal weapons to aid their understanding of the TASER 7™ system and performance.

This assessment followed a similar methodology to that used during the previous TASER X26™ and TASER X2™ assessments to allow comparison. This comprised of two main aspects: a User Handling Trial and a Technical Assessment.

During the assessment phases the performance of the device was measured along with the user acceptability. The device was determined as broadly acceptable, with some performance issues noted. These have been submitted to the Home Office and NPCC for further consideration to determine whether these aspects meet the Operational Requirement when the context of officer selection, training and threat are considered.

Abstract UK protective marking: *	UK OFFICIAL
Abstract national caveats: *	

[redacted]

[redacted]

Abstract descriptor: *
Keywords:
Conducted Energy Device, TASER 7(TM), Conducted Energy Weapon, Non-Lethal Weapon, Less-Lethal Weapons, Less than Lethal Weapon

Please note: Unclassified, Restricted and Confidential markings can only be used where the report is prepared on behalf of an international defence organisation and the appropriate prefix (e.g. NATO) included in the marking.

* Denotes a mandatory field

Name and address of publisher: *	**10. Name and address of funding source:**
Dstl Counter Terrorism and Security Porton Down Salisbury Wilts SP4 0JQ	Home Office Commissioning Hub Home Office Science, 2 Marsham Street, London SW1P 4HR

Funding source contract:	CAPS SLA	
Dstl project number:	710103 LLW	
Programme:	Crime and Policing Support	
Other report numbers:		
Contract start date:		**15b. Contract end date:**
IP conditions for report: *	Non-MOD Funded Dstl authored report	
Patents:	NO	
Application number:		
Release authority role:	Capability Lead - Counter Terrorism and Security	

[redacted]

[redacted]

THIS PAGE INTENTIONALLY LEFT BLANK

[redacted]

[redacted]

[redacted]