FEDERAL BUREAU OF INVESTIGATION

Michigan State Police
Sig Sauer M18 Evaluation

TECHNICAL EVALUATION RESULTS

30 AUGUST 2024

(UNCLASSIFIED – FOUO)

Index

I. INTRODUCTION

The Ballistic Research Facility (BRF) is the FBI's sole research, development, testing and evaluation (RDT&E) facility for weapons, ammunition, armor, and other law enforcement items. The facility was created in March 1988 as a direct result of the April 11, 1986, gunfight in which Special Agents Jerry Dove and Ben Grogan were killed. Following this event, the FBI determined independent research was required to document and explain wounding methods of small arms projectiles; and a scientifically repeatable test method was needed to evaluate ammunition. Ultimately, the industry standard for small arms ammunition was created and became known as the "FBI Protocols".

BRF supports domestic and international law enforcement agencies by providing ballistic test data; training in terminal ballistics; and assisting with department research and testing efforts[1].

BRF is led by a Unit Chief, who serves as the Director of Research, and is comprised of Supervisory Special Agents and Ballisticians. Additionally, BRF has a full-time representative from both the Drug Enforcement Administration and the United States Marshals Service on staff.

II. BACKGROUND

The Michigan State Police (MSP) began transitioning all members from the current Glock pistols issued by the department to the Sig Sauer M18 on or about April 2024. The transition process included issuing the supporting equipment, training each member through a 1,200-round course of fire, and qualifying each member using the department's official pistol qualification course.

On July 31, 2024, a MSP motor officer was standing in a squad area with other members when his department issued Sig Sauer M18[2] fired uncommanded. The firearm was reportedly secured in the department issued Alien Gear Rapid Force Level 3 holster at the time of firing. According to the MSP motor officer's statement and the statements of others present, at no time was the trigger pressed intentionally or inadvertently[3]. The MSP motor officer had objects in his hands at the time of the event, including keys.

The subject firearm, while in the holster, was removed from the member's leg and placed in an evidence bag pending further evaluation.

On August 2, 2024, BRF was requested to conduct an evaluation of the subject pistol.

III. SUBJECT FIREARM

The subject firearm is a Sig Sauer M18 pistol[4], serial number [redacted], with X Flat Blade Trigger. The M18/P320 family of firearms uses a frame assembly group (fire control unit) compatible with multiple grip modules offered by Sig Sauer. The fire control unit is a traditional sear design

[1] Agencies can communicate with BRF at BRF@fbi.gov and access BRF data via Justice Connect on the Law Enforcement Enterprise Portal (https://le.fbi.gov/informational-tools/leep).

[2] The MSP Sig Sauer M18 is mechanically the same as the commercial Sig Sauer P320.

[3] See the MSP investigative file for further details.

[4] The small grip module was utilized by MSP.

which holds a "partially pre-tensioned striker"[5] [6]. Additionally, the Sig Sauer Technical Manual highlights that "the P320 [M18] firing mechanism has designed safety features that prevent the pistol from firing unless the trigger is moved rearward resulting in the de-activation of these safety features. These features include:"[7]

- Striker Safety Lock
- Captive Safety Lever
- Striker Sear Engagement (Primary & Secondary Sear Notch)

The following are photographs of the subject firearm and holster in the condition as delivered:

Figure 1- As Delivered

[5] Sig 320 Technical Armorer's Manual, Page 8

[6] Because the striker pin hook face is angled, the striker moves rearward an additional .010-.014" when the trigger is pressed. However, there is sufficient energy in the striker spring while the striker pin hook is captured in the notch for the weapon to fire without the additional rearward travel.

[7] Sig 320 Technical Armorer's Manual, Page 12

Figure 2- As Delivered

In addition to the firearm and holster, MSP utilizes the Sig Sauer Romeo M17 pistol mounted optic and the Surefire X300 Turbo weapon mounted light.

It was estimated the weapon had been fired 1,300 rounds before the incident took place. The first 1,200 rounds were fired during the transition course. The weapon was cleaned at the conclusion of the course. The remaining 100 rounds were fired during an open range session in mid-July 2024. The MSP motor officer did not clean the weapon following that open range session.

On July 31, 2024, and several minutes prior to the uncommanded firing, the MSP motor officer conducted approximately three presentation drills from the holster to practice acquiring the red dot.

The only known modification to the subject weapon, and all MSP weapons, was to the trigger. When MSP took delivery of the weapons from Sig Sauer, MSP experienced "dead" trigger issues. Sig Sauer determined the triggers were out of specification and ground off 0.020". The updated triggers were largely installed by Sig Sauer, however, an MSP armorer trained in the Sig Sauer P320 platform installed the subject weapon's modified trigger.

Besides the dead triggers, the only other weapon related issue reported, as of the date of this document, was a broken disconnector that occurred in the first few hundred rounds on a single MSP firearm during the transition.

Based on the weapon's design, if an uncommanded firing occurred, two things would be required; a complete[8] loss of sear engagement and a failure of the striker safety lock.

IV. EVALUATION

The evaluation began August 7, 2024, following the transport of the subject firearm, ammunition, and a reference pistol by members of the MSP[9]. Additionally, [redacted], Executive Vice President of Alien Gear, participated in the initial evaluation. Sig Sauer, Inc. was requested by MSP to participate in the evaluation but declined.

The evaluation was conducted to determine if there was any evidence indicating the trigger had been pressed; if the holster may have caused the incident; and to determine the plausibility of the firearm firing uncommanded.

A. X-Rays:

Prior to any manipulation of the firearm or holster, x-rays were taken to determine the condition of the weapon and for any meaningful observations since the firearm had not been altered since the incident. There were no abnormal observations related to the firearm or signs of foreign objects in the holster as seen below[10]:

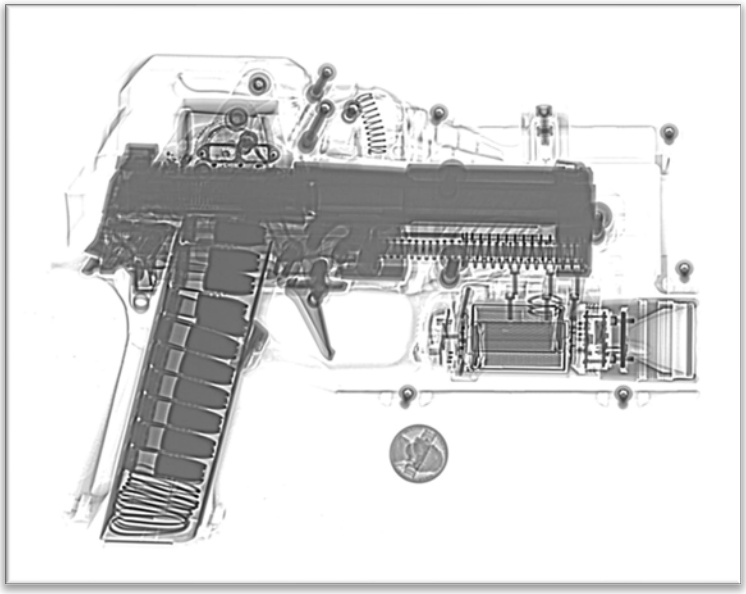

Figure 3- Initial X-Ray

[8] Disengagement from the primary sear notch and failure of the secondary notch to catch the striker.

[9] [redacted]

[10] The nickel is placed for scale and located adjacent to the item being x-rayed.

Following the initial x-ray, the firearm was removed and photographed:

Figure 4- Firearm

Figure 5- Firearm

As visible in the additional x-rays, the firearm had one fired case in the chamber and had appeared to reset while in the holster as seen in the below images:

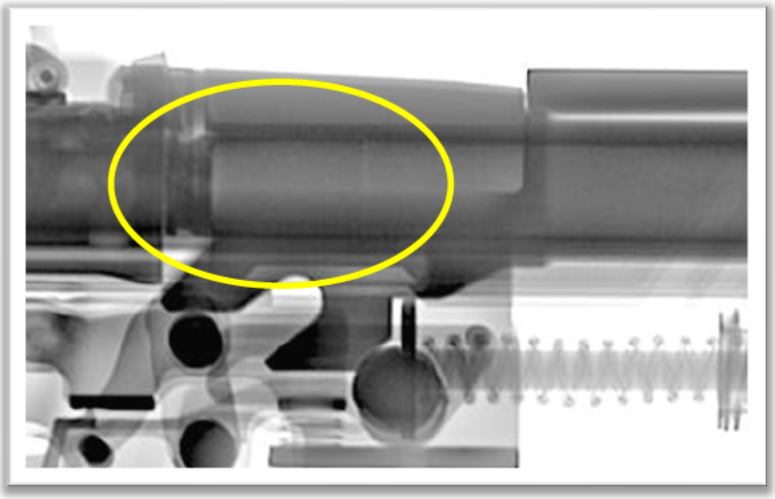

Figure 6- Fired Case

Figure 7- Primary Sear Engagement

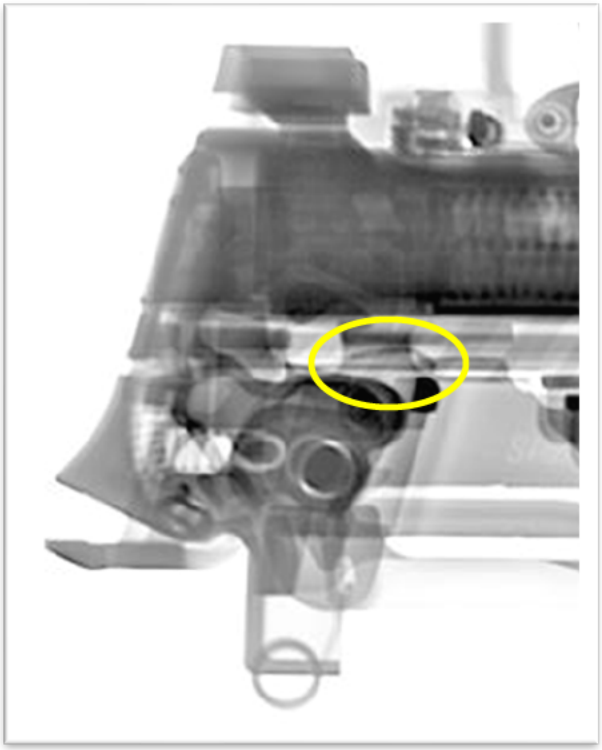

Figure 8- Captive Safety Lever Down

Following the removal of the firearm and to determine if the trigger had completely reset while in the holster, a coordinate measuring machine[11] was used to scan the trigger's location prior to conducting a function test of the subject firearm. Following the function test, a second scan was taken and compared to the original scan as seen below:

[11] Quantum Max FaroArm Model 21000

Figure 9 - Comparative Trigger Scan

The color variance from green to blue indicates between zero and 0.0025" change between the location of the trigger in the two scans. No significant change occurred indicating a full and proper reset of the trigger. If an abnormal condition was present in the firearm at the time of the uncommanded firing it was no longer observable following the complete reset of the trigger in the holster.

Trigger pull weights were taken using a Dvorak Instruments Trigger Scan tool and the following pull weights were obtained:

Trigger Scans	
Scan	**Weight (lbs.)**
1	**6.74**
2	**6.64**
3	**6.79**
4	**6.52**
5	**6.77**
Average	**6.69**

B. Weapon & Parts Inspection:

A parts inspection was conducted by two FBI Defensive Systems Unit (DSU) gunsmiths who were certified by Sig Sauer to work on the M18/P320 weapon. The purpose of the inspection was to determine if there were any obvious abnormalities (i.e., a burr, excessive wear, etc.). The following parts were inspected and compared to the equivalent part from a brand-new

Sig Sauer M18 pistol[12] supplied by MSP. The parts inspected include, but were not limited to, the following[13]:

- Striker
  - Striker Pin
  - Striker Safety Lock Notch
- Striker Safety Lock
- Striker Safety Lock Spring
- Sear
  - Primary Sear Notch
  - Secondary Sear Notch
- Sear Pin
- Sear Springs
- Captive Safety Lever
- Captive Safety Lever Pin
- Trigger Bar

The initial observations of these parts without magnification showed little observable information. However, there were a few items selected for further inspection.
The striker safety lock spring is used to hold the striker safety lock in a downward position until acted upon by the captive safety lever. The striker safety lock is intended to prevent the striker from moving forward in the event sear engagement (primary or secondary) is lost. It was observed that the spring was not fully seated on its post as seen in the below photograph:

[12] Serial Number [redacted]
[13] Additional parts inspections were conducted by BRF staff throughout the evaluation.

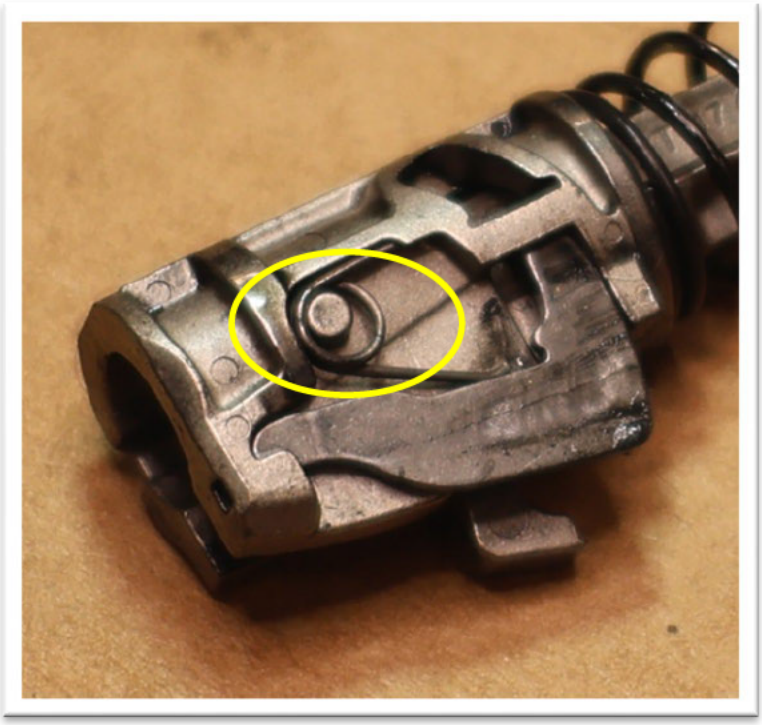

Figure 10- Striker Safety Lock Spring Position

It was also observed that the striker safety lock spring was only captured at the top of the striker housing. A pre-upgrade Sig Sauer P320 striker safety lock was reviewed for comparison, and it was observed that both the top and bottom of the striker safety lock spring was captured[14]. If the striker safety lock spring leg lost engagement with the top of the striker safety lock, the lock would no longer be spring loaded and could possibly seize or "free-float" rendering the striker safety lock inoperable.

Additionally, the wear on the sear appeared to be off-center and both the primary and secondary sear notch edges appeared worn as shown in the photograph below:

[14] Sig Sauer P320 Technical Armorer's Manual, Page 114, "the current production does not have a slot for the safety lock spring leg."

Figure 11- Sear Wear

The striker pin hook was examined due to its relationship to the sear during normal function. It was observed that the bottom of the striker pin hook face that engages with the sear had a "ledge" rather than being flat.

Figure 12- Striker Pin "Ledge"

Lastly, an abrasion was observed on the right-hand side of the weapon on the trigger guard as seen below:

Figure 13- Trigger Guard Abrasion

It was reported by MSP that the motor officer's weapon impacted the ground during the transition program. However, it is unknown if this caused the abrasion.

A Keyence digital microscope[15] was used to further evaluate the parts as shown in the below images:

Striker Safety Lock:

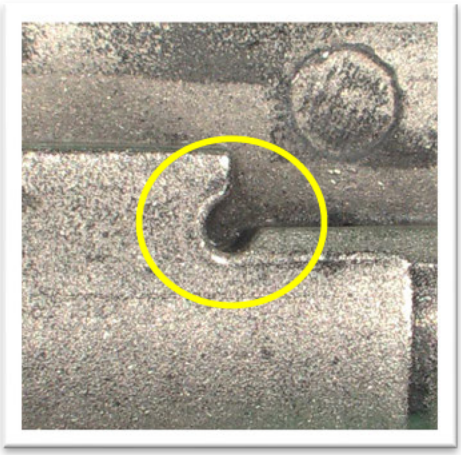

Figure 14- Striker Safety Lock Notch

[15] Model VHX-7000

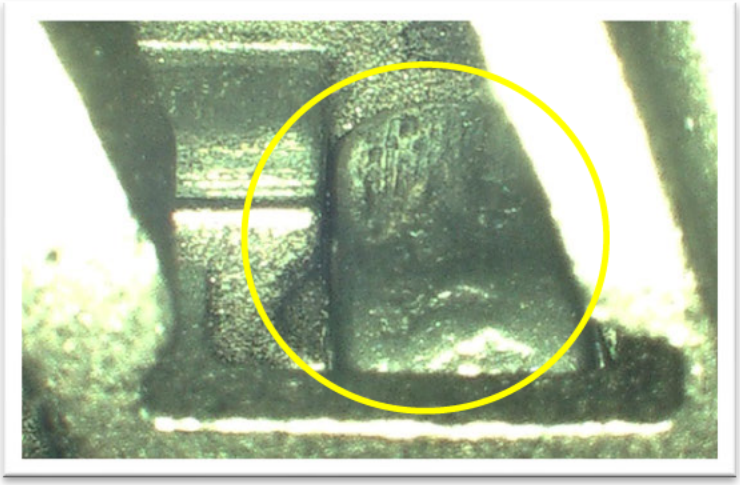

Figure 15- Striker Safety Lock Engaged

Sear:

The primary sear notch holds the striker, which is under spring tension, to the rear until the trigger is pressed. The secondary sear notch is located forward of the primary sear notch and "is designed to capture the striker pin hook in the event of sear and striker separation without the trigger being pressed."[16] Sig Sauer recommends a replacement schedule of the sear every 20,000 rounds "to prevent equipment failure before it actually occurs".[17]

The primary and secondary sear notch edges exhibit wear aligned with the striker pin hook. The face edge of each sear notch has a "chipped" appearance. Additionally, there appears to be a manufacturing artifact on the primary sear ramp just in front of the primary sear notch.

[16] Sig P320 Technical Armorer's Manual
[17] Ibid.

Figure 16- Wear on the Primary Sear Notch[18]

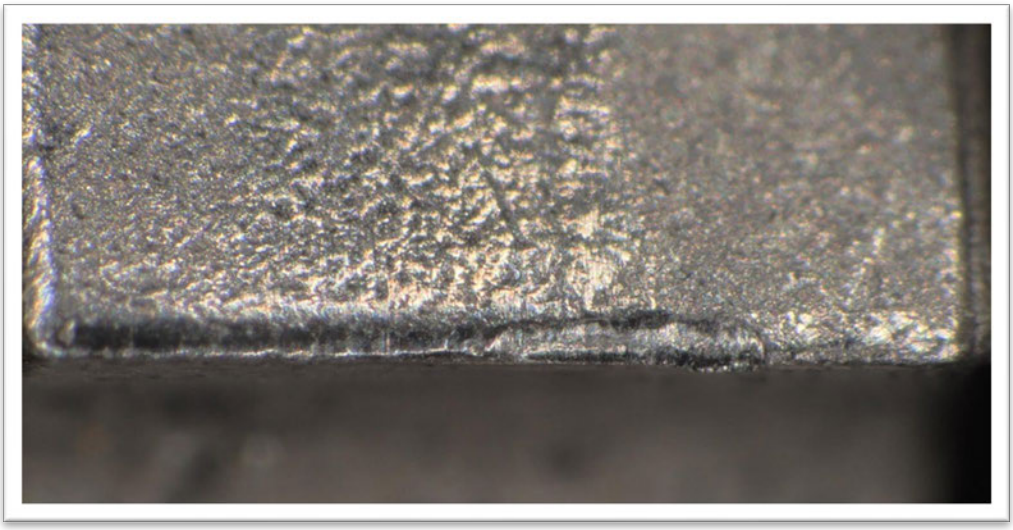

Figure 17- Wear on the Secondary Sear Notch

[18] The "scratch" marks on the sear ramp are a result of manually pressing the sear down with a punch.

Striker Pin:

Figure 18- Subject Firearm Striker Pin Hook "Ledge"

Figure 19- Reference Striker Pin Hook for Comparison

The striker pin hook "ledge" shown in Figure 18 reduces the engagement surface between the primary sear notch and the striker pin face to the "face" of the "ledge". Additionally, the misshapen striker pin hook face may be contributing to excessive wear on the primary and secondary sear notches.

In addition to the above parts, BRF staff observed movement of the slide downward while the trigger was being pressed rearward on an empty chamber. The observed movement between the slide and frame was measured by DSU gunsmiths.

With the weapon mounted to a fixture, measurements were taken at the rear and front of the weapon when manipulated by hand or a trigger pull. These measurements were obtained in different configurations and the results were as follows:

Left/Right Movement	
By Hand - Empty Chamber	
Rear	Front
.003"	.005"

Up/Down Movement	
By Hand - Loaded Chamber	
Rear	Front
-0.0045"	0.0045"

Up/Down Movement	
Trigger Press - Loaded Chamber	
Rear	Front
-0.006"	0.003"

Up/Down Movement	
Dead Trigger - Loaded Chamber	
Rear	Front
0.004"	-0.0015"

Additionally, during dry-fire manipulation it was observed the trigger could be partially pressed to the rear and the slide manipulated by hand causing the striker to fall completely. This was then tested using a primed case and the striker did in fact fire the primed case, indicating the striker safety lock was disabled based on the partial trigger press.

C. Fired Casing Review:

After the function test was completed and prior to the commencement of the parts inspection the fired case was extracted from the weapon. A digital linear gauge[19] was used to measure the striker indentation on the primer. The primer indentation measured 0.025"[20].

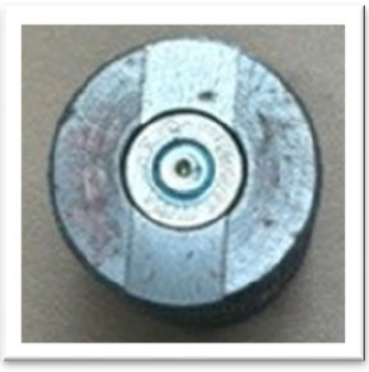

Figure 20- Spent Case

[19] Peacock Model PDN25N

[20] BRF considers an indentation of .013" sufficient to cause consistent primer ignition.

D. Holster Review:

MSP utilizes a modified Alien Gear Rapid Force Level 3 Duty holster. The holster was modified to reduce the ability of an officer to access the trigger while the Sig Sauer M18 was secured in the holster. As shown previously in Figures 1 and 2 the weapon was properly seated in the holster with all levels of retention in place. While holstered, there is approximately 1/8" of spacing between the weapon's pistol grip and the holster body and approximately 7/16" between the trigger guard and the holster body.

The uncommanded discharge resulted in no observable damage to the holster. This is due to the open muzzle design of the holster which allows any debris which might fall into the holster to escape. The only observable wear was inside the holster and is a result of the takedown lever contacting a shelf inside the holster as seen below:

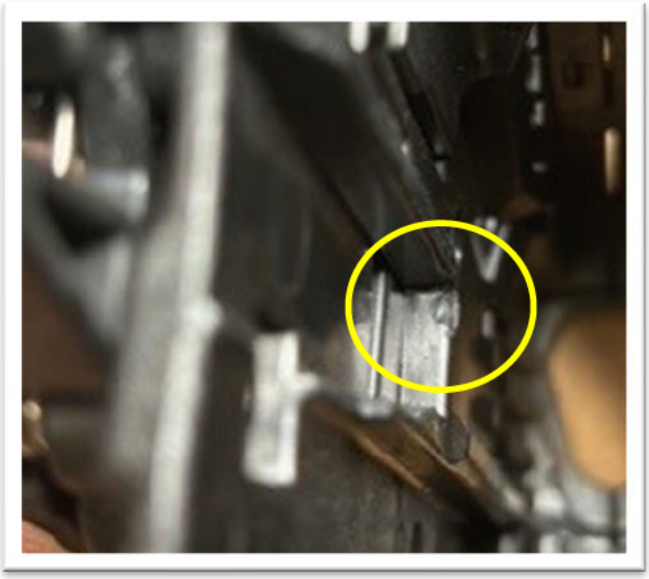

Figure 21- Holster Wear

[redacted], Executive Vice President of Alien Gear, inspected the holster and confirmed the holster was undamaged and in normal working order.

An attempt was made by a BRF staff member[21] to access the trigger while the weapon was properly holstered. The staff member was able to force his finger into the holster and contact the trigger. Due to the excessive force necessary, it is an improbable event[22].

As previously stated, the MSP member was holding objects in his hands when the event occurred, including his keys which are shown below:

[21] SSA [redacted]

[22] There was also noticeable discomfort in the effort and deflection of the skin afterward.

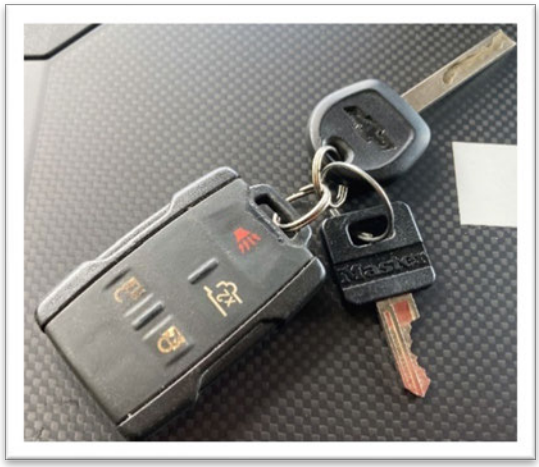

Figure 22- MSP Member's Keys

BRF was successful in using keys, both flat and serrated profiles, to press the trigger while the M18 was holstered. The keys were approximately 1.7" and 1.0" respectively. The trigger could be fully pressed to the rear with sufficient pressure against the side of the trigger only, or by using the holster as a fulcrum. During this test it was observed that the keys caused an abrasion on the trigger guard near the area of the abrasion seen on the weapon when it arrived (Figure 13).

V. LIVE-FIRE TESTING

A. Limited Function Testing:

Following the initial evaluation, limited live-fire testing was conducted for function and to determine if the striker safety lock spring moved. The striker safety lock spring was fully seated prior to testing by pressing the spring fully against the striker housing. Thereafter, BRF fired 50 rounds using MSP service ammunition[23]. The striker assembly was removed to observe the position of the spring. This process was completed three times.

It was observed on all three iterations the striker safety lock spring moved during firing as seen in representative images below:

[23] Federal Premium Tactical HST 147 grain (P9HST2)

Figure 23- Pre-firing Spring Position

Figure 24- Post-Firing Spring Position

As previously stated, should the spring leg slip off the striker safety lock, it may leave the safety inoperable. So long as the space between the striker channel wall and the striker safety lock does not exceed the width of the striker safety lock spring, it should remain in place despite not being captured by design.

B. <u>High-Speed Video:</u>

To gain a better understanding of the movement of the subject weapon and its components during live-fire, test shots were taken utilizing a high-speed camera[24]. As part of this testing, the following two modifications were made to spare parts. First, the rear slide cap was trimmed so that movement of the sear and striker could be observed. Second, a spare slide was milled to view movement of the striker safety lock and spring. The remaining parts were original to the subject pistol.

A review of the high-speed video resulted in the following observations:

- Slide Catch Lever bounce
- Sear bounce
- Striker Safety Lock & spring movement

[24] Phantom TMX7510

Slide Catch Lever Bounce:

During recoil BRF observed the slide catch lever bounce into the slide catch notch. While no malfunctions were observed during this testing, [redacted][25].

Figure 25- Slide Catch in the down position

Figure 26- Slide Catch in the up position

Sear Bounce:

Both the sear and sear housing were observed to bounce during recoil. The sear bounced multiple times and impacted the striker pin and bottom of the slide several times during rearward slide travel. It is likely a combination of the forward striker pin movement and striker impacts during recoil that cause wear on the sear surfaces including the "chipping" of the sear face edges.

[25] [redacted]

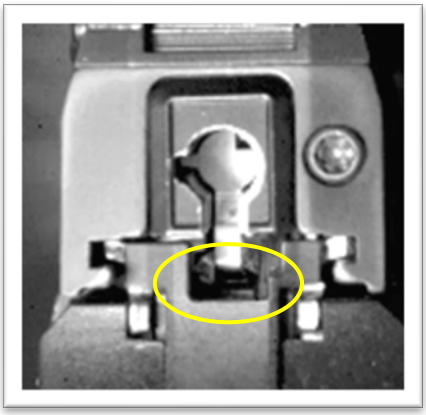

Figure 27 - Sear Released and Down

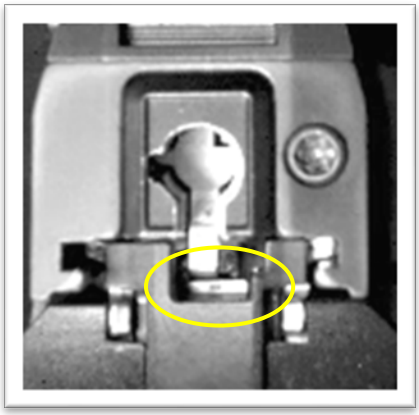

Figure 28 - Sear Up in Bounce

Striker Safety Lock & Spring Movement:

As previously mentioned, the striker safety lock spring is responsible for keeping downward pressure on the striker safety lock until the captive safety lever presses the striker safety lock upward allowing the striker to move forward enough to impact the primer. The spring is a single coil, two-leg design and as previously stated only captured at the top leg location. During recoil the movement of the striker safety lock and spring were observed and there were no obvious abnormalities.

Figure 29 - Striker Safety Lock (down position)

Figure 30 - Striker Safety Lock (up position)

VI. SUPPLEMENTAL TESTING

A. Secondary Sear Notch Test

Because uncommanded firing requires both the loss of sear engagement and the failure of the striker safety lock, additional testing of these components was conducted. As previously stated, the sear has both a primary and secondary sear notch. The primary notch is used to hold the striker pin hook during normal function of the weapon. The secondary notch is located forward of and lower than the primary notch. The secondary notch is designed to catch the striker pin hook in the event it loses connection with the primary notch. In addition to other changes to the sear, the secondary notch was added as part of Sig Sauer's Voluntary Upgrade Program[26].

[26] The voluntary upgrade program began August 8, 2017. The voluntary upgrade program was in response to the risk of "potential discharge of the firearm" when dropped. Other changes were made to the striker and trigger, as well as a mechanical disconnect being incorporated. All firearms manufactured after this date contained the updated parts.

To test the secondary sear notch, milling of the primary sear notch was necessary. In order to avoid altering the fire control unit (FCU) of the subject firearm, a spare FCU was utilized[27]. The objective was to provide enough engagement between the striker pin hook and the primary sear notch that connection would not be lost until intentionally induced. The inherent issue with changing the primary sear engagement is the change in timing of the secondary sear notch to "catch" the striker pin hook.

Milling the primary sear notch[28] resulted in less vertical distance the secondary sear notch had to travel (thereby increasing the possibility it catches the striker) but it also reduced the spacing between the last point of primary sear contact and the secondary sear notch face (reducing the possibility it catches the striker). As such, the result of this supplemental test is limited to the modified test firearm and should not be applied to the subject weapon. However, the test does provide insight into the design and function of Sig Sauer's added safety feature.

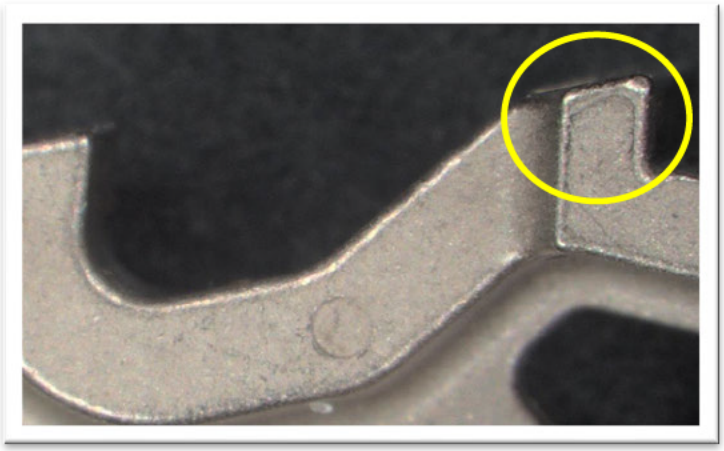

Figure 31 - Pre-milled Sear

[27] Serial number [redacted]

[28] The sear was milled at 45 degrees using a custom fixture created by DSU gunsmiths.

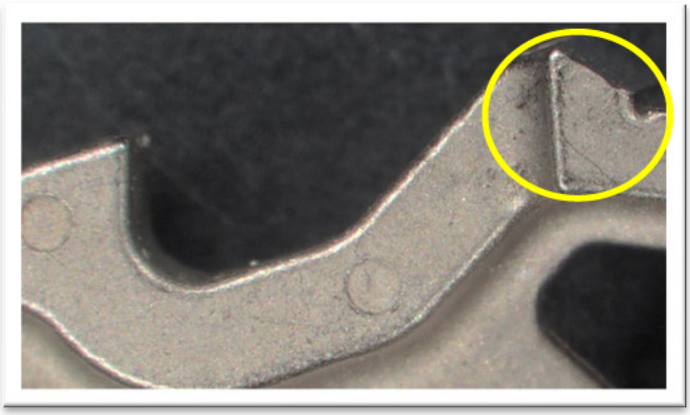

Figure 32 - Post-milled Sear

Once milling was complete, the subject FCU was removed and replaced with the FCU containing the altered sear. Additionally, the modified rear slide cap was used to observe the sear. All other components belonged to the subject weapon.

BRF conducted ten tests of the secondary sear in which the striker pin hook was placed on the 45-degree cut primary notch and released the striker by tapping the holstered firearm with a dead blow mallet[29]. The secondary sear successfully caught the striker pin hook on all ten attempts.

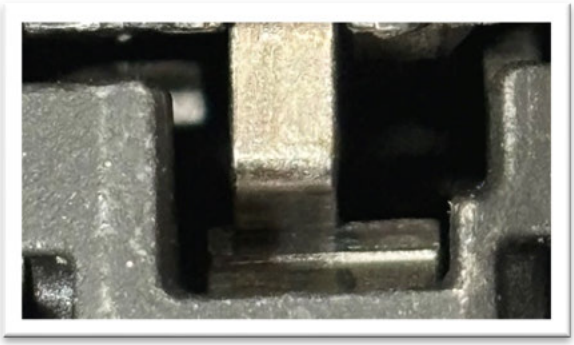

Figure 33 - Striker Hook Placement on Primary Notch

[29] Mallet weighed 0.74 lbs.

Figure 34 – Striker Hook Placement on Secondary Notch

B. <u>Striker Safety Lock Test:</u>

The striker safety lock is the only "active"[30] safety preventing the striker from inadvertently striking the primer. It is the last safety with an opportunity to catch the striker should the primary notch lose engagement and the secondary notch be overridden[31]. As such, additional testing related to the striker safety lock's design and function were conducted.

Each test was conducted using the subject weapon and trimmed rear slide cap. The weapon was placed into the subject holster and secured to a table. The holster's optic and slide covers were left in the open position to access the sear as shown below:

[30] Active meaning the safety is disengaged as part of the trigger press. Both the second sear notch and disconnect are not changed as part of the normal firing process.

[31] 5 Steps Required To Fire a P320 (01/05/2022) by Sig Sauer, Inc.- www.youtube.com/watch?v=pLtTP8xp_WU

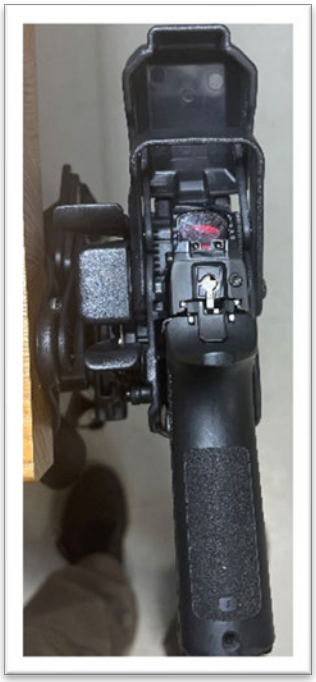

Figure 35 - Test set-up

A primed case was placed into the chamber and a magazine loaded with dummy rounds was inserted. Thereafter, a punch was used to manually disengage the primary sear notch from the striker pin hook[32] to fire the primed case, thereby testing the function of the striker safety lock.

The procedure was conducted 100 times at both the primary and secondary sear notch locations. After every 10 attempts the primed case was inspected for primer indentation. Across all attempts at both locations the primed case never fired nor was there any indication the striker touched the primer. Therefore, the striker safety lock functioned as designed under these conditions.

A second test with the striker at the primary sear notch location was conducted to test the striker safety lock. The test involved tapping the holstered weapon (on both the holster and weapon) with a dead blow hammer 50 times at multiple locations. After every 50 taps the sear was manually disengaged and the primed case was inspected for contact by the striker.

The following locations were struck:

- Holster- Right Side
- Holster- Slide Cover
- Holster- Back Side Top Screw
- Holster- Front
- Holster- Bottom

[32] This method allows for the loss of sear engagement without the expected loss of the striker safety lock and prevents the secondary sear notch from interfering with the test.

- Holster- Left Side
- Weapon- Rear Slide Cap
- Weapon- Magazine Floor Plate
- Weapon- Right Side
- Weapon- Left Side
- Weapon- Pistol Grip

The striker safety lock successfully prevented the striker from contacting the primed case after each manual release of the sear. No slip of the sear engagement was observed during the strikes; however, the striker would shift laterally on the primary sear surface approximately 1/32".

Because of the inherent movement between the slide and frame, a third test of the striker safety lock was conducted. Approximately 50 attempts were made to determine if the striker would impact the primed case after manipulating the weapon while holstered. The weapon was pressed together and pulled apart (at the slide and frame). Thereafter, pressure was applied to the frame and the sear manually released from the primary notch. The intent of the manipulation and pressure was to mimic what might occur to a holstered weapon during an officer's duties, such as running, jumping, climbing, fighting, pressing a weapon against a wall or vehicle, or obtaining a master grip on the pistol prior to drawing, etc.

BRF staff observed the primed case fired on nine attempts with the primer indent measuring between 0.019"-0.026" with an average of 0.023". While staging one attempt to allow another BRF staff member to observe the striker safety lock function as designed, the weapon was prepared and placed into the holster with no manipulation. A second staff member released the primary sear notch from the striker and the primed case fired indicating failure of the striker safety lock. The primer indention measured 0.018".

BRF observed six instances where the primer did not fire but a small indentation was present indicating the striker had contacted the primer. These indentations measured between 0.0005"-0.001".

The remaining attempts resulted in no firing of the primed case and no evidence that the striker had contacted the primer. Ultimately, in these instances the striker safety lock functioned as designed.

A brand-new unfired Sig Sauer M18 pistol[33] was obtained from MSP to determine if the test could be repeated on another weapon. On the first attempt, the striker safety lock successfully prevented the striker from impacting the primed case. However, on the second

[33] Serial Number [redacted]

attempt the primed case fired, indicating the striker safety lock failed to stop the striker's forward movement. The primer indent measured 0.023".

Figure 36 - Striker Safety Lock Test (no manipulation)

Figure 37 – Manipulating the Weapon

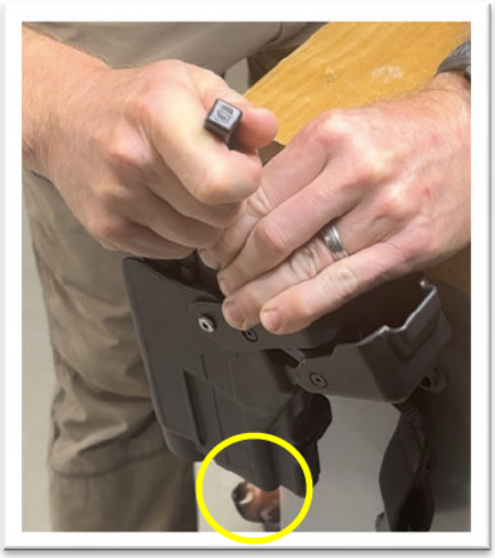

Figure 38 – Muzzle Flash Highlighted

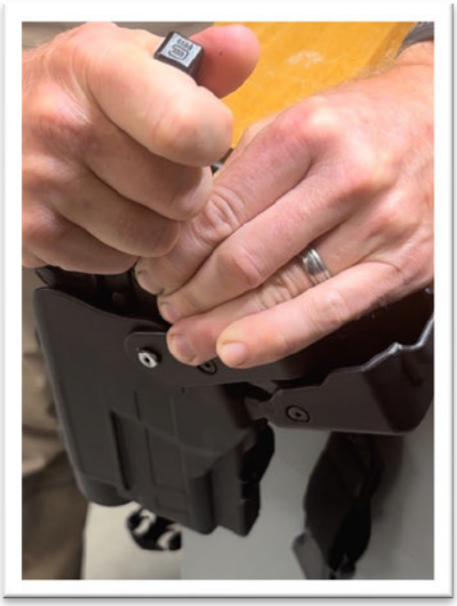

Figure 39 - Striker Safety Lock Primed Case Not Fired

VII. CONCLUSION

According to Sig Sauer, Inc. "five independent actions must occur before the P320 will discharge. Those actions are: (1) trigger is pressed to the rear moving the trigger bar forward, (2) captive safety lever rotates upward, (3) striker safety lock rotates upward, and (4) sear rotates downward, and (5) striker pin is released"[34]. Should the striker and primary sear notch lose engagement there are two safeties designed to prevent the weapon from firing: these are (1) Secondary Sear Notch and the (2) Striker Safety Lock.

A reliable test could not be developed at the time of this document to test the effectiveness of the secondary sear notch. However, testing did indicate with movements representing those common to a law enforcement officer it is possible to render the Striker Safety Lock inoperable and ineffective at preventing the striker from impacting a chambered round if complete sear engagement is lost. It is important to note that the Striker Safety Lock, by design, is the last safety in line to prevent an unintended discharge as it is in place to protect against a secondary sear notch override[35].

While examination of the subject weapon did not independently provide evidence of an uncommanded discharge it does indicate that it may be possible if sear engagement is lost. The disabling of the striker safety lock through movement and friction creates a condition which merits further exploration to fully assess potential risk.

BRF recommends that MSP weigh the content of this report with the outcome of the internal investigation in making its final determination related to the Sig Sauer M18 as an issued firearm within the department.

- - End - -

Authored by: [redacted]
Reviewed by: BRF

[34] 5 Steps Required To Fire a P320 (01/05/2022) by Sig Sauer, Inc.- www.youtube.com/watch?v=pLtTP8xp_WU
[35] Ibid.