# STATEMENTS OF WORK FOR 12-GAUGE SHOTGUNS – May 2009

Immigration and Customs Enforcement (ICE)
National Firearms Tactical Training Unit (NFTTU)

## STATEMENT OF WORK (SOW) I: 12-GAUGE DUTY SHOTGUNS

### 1.0 SCOPE

This detailed specification delineates performance criteria and tests to be used for the evaluation of duty shotgun candidates for Department of Homeland Security (DHS), Immigration and Customs Enforcement (ICE).

### 2.0 APPLICABLE DOCUMENTS

2.1 General. This specification lists all performance requirements for the acquisition of ICE duty shotguns.

2.2 Government Documents. The following documents form a part of this document to the extent specified herein:

**MIL-STD-810G**: Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

**NIJ Standard** – 0113.00: 12-Gauge Shotguns for Police Use
U.S. Department of Justice
National Institute of Justice
Washington, DC 20531

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein:

**ANSI/SAAMI Z299.2-1992: Voluntary Industry Performance Standards for Pressure & Velocity of Shotshell Ammunition for the Use of Commercial Manufacturers**
Sporting Arms and Ammunition Manufacturer's Institute (SAAMI)
P.O. Box 262, Frankfort, NY 13340

**ISO 9001:2000, Quality Management Systems - Requirements**
International Organization for Standardization
1, rue de Varembe, Case postale 56
CH-1211 Geneva 20, Switzerland

(Non-Governmental standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services).

2.4 Order of Precedence. In the event of a conflict between the text of this specification and the references cited herein, this document takes precedence.

### 3.0 REQUIREMENTS

3.1 General. Immigration and Customs Enforcement (ICE), an agency under the Department of Homeland Security (DHS), has a requirement for a 12-gauge duty shotgun. Each vendor will be allowed to submit one specific 12-gauge duty shotgun nomenclature. A solicitation sample of twelve (12) shotguns shall be required for evaluation and testing.

3.2 Testing.

3.2.1 Solicitation Test. The solicitation testing will verify that initial shotgun samples supplied by each competing vendor meet the minimum requirements of this specification. Vendors will be rated on their ability to achieve and/or surpass all performance parameters detailed in Table I. Those performance characteristics listed under Basic Compliance criteria shall be certified by the vendor and/or evaluated by DHS/ICE National Firearms and Tactical Training Unit (NFTTU) using Non-Destructive Inspection (NDI). Major performance characteristics are requirements that will be ascertained by function fire testing. Minor performance characteristics are desired features that will be evaluated by NDI. Testing may be halted for any vendor (and the associated vendor's samples rejected) if a shotgun from that vendor fails any Basic Compliance or Major requirement (as determined by NFTTU). Testing will be halted for any vendor (and the associated vendor's samples rejected) if a shotgun from that vendor exhibits hazardous and/or unsafe attributes (as determined by NFTTU). All samples submitted pursuant to solicitation testing will become property of DHS/ICE NFTTU upon receipt and will not be returned.

3.2.2 First Article Test (FAT). The specifications annotated for FAT in Table I will be verified during the FAT. All firearms must exhibit performance that is comparable to what was exhibited during solicitation testing for all requirements during FAT. At the government's discretion, DHS/ICE NFTTU may elect to reduce the number of specifications that are subjected to testing during the FAT process. All samples submitted pursuant to FAT will become property of DHS/ICE NFTTU upon receipt and will not be returned. The Government may invoke a FAT for any of the following conditions (after contract award):

a. Design change of the shotgun or shotgun components.

b. Relocation of manufacturer's production facility.

c. Manufacturer changes supplier of critical components (barrel, receiver, internal mechanism parts).

The vendor shall be responsible for notifying the government prior to enacting any of the above changes and for conducting a FAT for any of the above conditions.

3.2.3 Limited Technical Inspection (LTI). The specifications annotated for LTI in Table I will be verified during the LTI. An LTI will be conducted for every firearm delivered after the first article. All firearms must exhibit performance that is comparable to what was exhibited during solicitation testing for all requirements during LTI. Shotguns will be inspected in its entirety for general compliance.

**Table I: Requirements Verification Test Matrix**

| | Performance Characteristic | Requirement Paragraph | Test Method | Solicitation | FAT* | LTI* |
|---|---|---|---|---|---|---|
| Basic Compliance | Quality System | 3.3 | 4.2 | X | X | |
| | Sample Size | 3.4 | 4.3 | X | X | |
| | Documentation | 3.5 | 4.4 | X | | |
| | Supplemental Items | 3.6 | 4.5 | X | X | |
| | Action/Mechanism | 3.8 | 4.6 | X | X | X |
| | Overall Length | 3.9 | 4.7 | X | X | X |
| | Weight | 3.10 | 4.8 | X | X | X |
| | Gauge | 3.11 | 4.9 | X | X | X |
| | Finish | 3.15 | 4.13 | X | X | X |
| | Safety | 3.16 | 4.14 | X | X | X |
| | Barrel | 3.17 | 4.15 | X | X | X |
| | Magazine | 3.18 | 4.16 | X | X | X |
| Major | Reliability | 3.20 | 4.18 | X | X | |
| | Durability | 3.21 | 4.19 | X | X | |
| | High Temperature | 3.22 | 4.20 | X | X | |
| | Low Temperature | 3.23 | 4.21 | X | X | |
| | Salt Water Immersion | 3.24 | 4.22 | X | X | |
| | Sand & Dust | 3.25 | 4.23 | X | X | |
| | Parts Interchange | 3.26 | 4.24 | X | X | |
| | Drop Test | 3.27 | 4.25 | X | X | |
| | Shot Pattern/Accuracy | 3.28 | 4.26 | X | X | |
| Minor | Stock/Forend | 3.12 | 4.10 | X | X | X |
| | Sling Attachments | 3.13 | 4.11 | X | X | X |
| | Trigger | 3.14 | 4.12 | X | X | X |
| | Sights | 3.19 | 4.17 | X | X | X |

*FAT: First Article Test *LTI: Limited Technical Inspection

3.3 Quality Management System (QMS). The manufacturer shall have a QMS in place that enables the organization to identify, measure, control and improve key manufacturing processes. It is desired that the manufacturer have a quality system that is certified with ISO 9001: 2000 or 2008, Quality Management Systems - Requirements.

3.3.1 Quality Manual. The manufacturer shall provide a copy of their Quality Manual. The Quality Manual shall, at a minimum, address:

a. Process control plan
b. Quality inspection plan
c. Non-conforming material identification and disposition
d. Lot/batch identification
e. Document control
f. Control of monitoring and measuring devices

3.4 Sample Size. Twelve (12) shotguns shall be submitted for solicitation and FAT testing.

3.5 Documentation. The following documentation shall be supplied with each shotgun model submitted for solicitation and FAT testing:

- Owner's Manual
- Parts list detailing all shotgun components.
- Maintenance procedures detailing a preventative maintenance regiment for replacement or adjustment of parts and recommended solvents and lubricants. (This will be the basis for the vendor to determine the quantity of spare parts to supply with the shotgun samples and will be adhered to during reliability/durability function fire testing.)
- It is desired that an Armorers Manual be provided with the shotgun samples.

- Copy of manufacturer's Quality Manual.
- Certificate of Conformance (C of C) that the shotgun samples meet all Statement of Work Basic Compliance requirements.

3.6 Supplemental Items. The following items shall be supplied with each shotgun model submitted for solicitation and FAT testing:

- All potential spare parts (excluding barrel, bolt, pump action assembly, and receiver) needed to support reliability/durability testing outlined in Section 3.20/3.21. The quantity of spare parts supplied by the vendor should be based on the manufacturer's recommended maintenance intervals for a 10,000 round test.
- Two (2) sets of special tools, if needed, necessary to disassemble/reassemble the shotgun.

3.7 Training. The manufacturer awarded the contract shall provide armorer/gunsmith training (after contract award). Training shall be provided to no less than twelve (12) designated armorers, on-site at the NFTTU Altoona, PA location within thirty days of contract award. Training duration shall be up to five (5) days in length and will cover all aspects of maintenance and repair of the shotgun. The manufacturer shall provide four (4) cut-away models of the shotgun at the time of on-site training. All training and instructional material shall be written or communicated in the English language.

3.8 Action/Mechanism. The action shall be a pump-action. The action shall be designed to operate smoothly during cycling with no binding. The mechanism shall possess an inertia firing pin and be designed to prevent accidental discharges if the firearm is dropped. The shotgun shall be designed in such a way that the operator can clear a malfunction using immediate action without the use of special tools. The shotgun shall be capable of being unloaded by removing the cartridges directly from the magazine. The firearm shall be able to be safely operated by a shooter wearing gloves.

3.9 Overall Length. The overall length of the shotgun shall not exceed 35".

3.10 Weight. The empty weight of the shotgun shall not exceed 7.75 lbs.

3.11 Gauge. The shotgun shall be chambered for 12-gauge 3-inch magnum cartridges. All chamber dimension specifications and pressure limitations shall conform to the Sporting Arms and Ammunition Manufacturer's Institute (SAAMI) specifications for 12-gauge (chambered for 3-inch magnum cartridges) shotguns.

3.12 Stock/Forend. It is desired that the stock be a fixed, vertical pistol grip stock constructed of a durable composite material and equipped with a recoil-absorbing pad. It is desired that the length of pull (LOP) measure 13 inches. The LOP dimensional tolerance is ±0.125". It is desired that the stock have a black, non-reflective finish and incorporate a non-slip grip surface. It is desired that the following optional stocks be available for the shotgun:

a. Version with 13.75 inch LOP having the same exterior dimensions and other features as the standard stock.
b. Version designed to securely store a minimum of four rounds of 12-gauge ammunition having the same exterior dimensions and other features as the standard stock. LOP may be up to 14 inch.
c. Version that possesses a recoil reduction or recoil dampening system.

It is desired that the forend be constructed of the same material as the stock and have a non-reflective finish with a non-slip, raised rib type grip surface to prevent the shooter's hand from sliding off the grip. It is desired that the forend design be equal to or better than the Speedfeed LE forend, part number 0256. It is desired that the forend not cover any portion of the ejection or loading ports when pulled fully to the rear. It is desired that the shotgun have the option of being supplied with a forend that incorporates a MIL-STD 1913 Picatinny rail to accommodate the attachment of a light.

3.13 Sling Attachments. It is desired that the shotgun be equipped with sling attachments that accommodate the use of a 1 ¼" wide sling. It is desired that the front sling attachment be designed to accommodate a bottom sling attachment and be designed to convert from bottom attachment to left side and right side attachment. It is desired that the front sling attachment shall not swivel. It is desired that the front sling attachment shall be positioned on the shotgun between the muzzle and the front of the forend. It is desired that the rear sling attachment shall be permanently attached to the firearm within 2 to 4 inches of the toe of the recoil pad (on the underside of the stock).

3.14 Trigger. It is desired that the trigger pull not be less than 5 pounds and not exceed 8 pounds force.

3.15 Finish. The external finish shall be a matte black or grey color that is corrosion resistant. "Corrosion resistant" is the ability to prevent formation of corrosion under normal operating conditions.

3.16 Safety. The shotgun shall be equipped with an externally controlled, manual safety mechanism that possesses both a "SAFE" and "FIRE" position. With the hammer cocked, when safety is placed in the "SAFE" position, it shall prevent the trigger from releasing the hammer so that the shotgun is incapable of firing. The shooter shall be able to visually and physically verify the position of the safety.

3.17 Barrel. The barrel shall have a non-removable modified choke. Barrel length shall be a minimum of 14 inches and a maximum of 14.5 inches. Barrels shall be easily interchangeable without special tools.

3.18 Magazine. The magazine shall have a capacity to hold five (5) 2 ¾ inch, 12-gauge rounds loaded at the maximum overall length as specified by SAMMI for 12-gauge ammunition. It is desired that the magazine follower be of a highly visible color and non-binding design and material. The shooter shall be able to ascertain if the magazine is empty by either visually or physically checking the position of the follower.

3.19 Sights.

3.19.1 Front Sight. It is desired that the front sight have a black or dark gray non-reflective finish and be equipped with a tritium insert contained in a break resistant ampoule. It is desired that the front sight be of a sufficient height to afford zeroing the sights to point of impact. It is desired that the front sight be a snag resistant, square steel blade design and be non-adjustable for windage and elevation (not dovetailed). It is desired that the front sight not have side guards/wings.

3.19.2 Rear Sight. It is desired that the rear sight be of a large-aperture "ghost ring" design, with a black or dark gray non-reflective finish and mounted at the rear of the receiver. It is desired that the rear sight be removable and allow the top of the receiver to be unobstructed after the rear sight assembly is removed. It is desired that the rear sight be fully adjustable for windage and elevation and equipped with tritium inserts contained in break resistant ampoules. It is desired that the tritium inserts be placed in the rear sight such that, when properly aligned with the front sight, will form a horizontal line or "3 dot configuration" over the target. It is desired that the rear sight not have side guards/wings. It is desired that the rear sight be designed for replacement without the use of special tools or soldering. It is desired that the rear sight be designed to allow replacement of the ring aperture without requiring the replacement of the entire sight assembly, unless replacing the entire rear sight is similar in time and cost to replacing the aperture ring only.

It is desired that both the front and rear sights be able to withstand 3-foot drop testing without rendering the sights unserviceable. Tritium failure during the drop test will not be considered unserviceable.

3.20 Reliability. Nine (9) shotguns samples shall be tested with 3000 rounds (per shotgun). It is desired that the nine (9) shotguns collectively exhibit not more than seventeen (17) Class 1, not more than seven (7) Class 2, and not more than one (1) Class 3 malfunctions (not due to ammunition). The shotguns shall exhibit no Class 4 malfunctions. Malfunction codes are listed in Table II. Vendor shall supply a minimum of nine (9) trained shooters to participate in reliability testing. A manufacturers' representative can be available during testing to assist NFTTU personnel with maintenance and shotgun repairs (using vendor

supplied replacement parts). Testing shall be discontinued for a shotgun if replacement parts are not available.

3.20.1 Cycles Completed - Reliability. Each shotgun will be rated for its ability to complete 200 round firing cycles. It is desired that each shotgun complete at least 12 of 15 cycles during the reliability testing with no parts replacement.

3.21 Durability. Three (3) shotgun samples shall be tested with an additional 7,000 rounds (per shotgun). It is desired that the three (3) shotguns collectively exhibit not more than a total of fourteen (14) Class 1, not more than six (6) Class 2, and not more than one (1) Class 3 malfunctions (not due to ammunition). The shotguns shall exhibit no Class 4 malfunctions. Vendor shall supply a minimum of six (6) trained shooters to participate in durability. A manufacturers' representative can be available during testing to assist NFTTU personnel with maintenance and shotgun repairs (using vendor supplied replacement parts). Testing shall be discontinued for a shotgun if replacement parts are not available.

3.21.1 Cycles Completed - Durability. Each shotgun will be rated for its ability to complete 200 round firing cycles. It is desired that each shotgun complete at least 28 of 35 cycles during the durability testing with no parts replacement.

NOTE: The total duration of the duty shotgun reliability/durability testing will be approximately 10 weekdays and will be conducted near the NFTTU Ft Benning, GA location. NFTTU will coordinate with each vendor regarding testing schedule.

**Table II: Malfunction and Type Allowance**

| Class | Type |
|---|---|
| 1 | Malfunction can be cleared by the operator within 10 seconds. |
| 2 | Malfunction that cannot be cleared by operator within 10 seconds; but can be cleared by operator with equipment immediately available to a law enforcement officer in the field (i.e., Leatherman-type tool or pocketknife). |
| 3* | Malfunction not correctable by operator and requires a higher level of maintenance. This may include the replacement or repair of a part other than the barrel, bolt, pump action assembly, or receiver. |
| 4 | Catastrophic malfunction that requires replacement of the barrel, bolt, pump action assembly, receiver, and/or anything that affects safe operation. |

*Parts replacement(s) in accordance with the manufacturer's recommendation for preventative maintenance does not constitute a Class 3 malfunction.

3.22 High Temperature. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after temperature soaking of the shotgun for 8 hours at 160°F. The shotgun shall not exhibit any Class 4 malfunctions.

3.23 Low Temperature. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing, after temperature soaking of the shotgun for 8 hours at –30°F. The shotgun shall not exhibit any Class 4 malfunctions.

3.24 Salt Water Immersion. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after immersion in a 5% saline solution at a depth of 6 inches for one minute followed by 24 hours in an environmental chamber at 70°F and 70% humidity. The shotgun shall not exhibit any Class 4 malfunctions.

3.25 Sand & Dust. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after being subjected to a blowing sand and dust environment in accordance with MIL-STD-810G. The shotgun shall not exhibit any Class 4 malfunctions.

3.26 Parts Interchange. All shotgun components subjected to field-stripping shall be 100% interchangeable between shotguns without additional fitting or alternation. Upon reassembly, the shotgun shall be fully functional. It is desired that the shotgun be capable of being field stripped without the use of special tools.

3.27 Drop Test. The shotgun shall be equipped with a discharge control mechanism that is designed to prevent the firearm from firing as a result of an impact, while the hammer is in the cocked position, with the safety off. Additionally, the shotgun shall be serviceable and exhibit no major damage as the result of being dropped on a concrete pad from a height of three feet in the following orientations:

a. Muzzle facing the concrete pad.
b. Butt of stock down facing the concrete pad.
c. Top of the receiver and barrel facing the concrete pad.

Major damage is defined as damage that would result in the gun being unsafe to fire, discharging during testing, or malfunctioning during firing.

3.28 Shot Pattern/Accuracy.

3.28.1 Shot Pattern. The shotgun shall be able to place at least 8 of 9 buckshot pellets (using duty 00 buck shot ammunition) within a 25" diameter circle at a range of 25 yards.

3.28.2 Accuracy. The shotgun shall exhibit a mean radius of no greater than 2.75 inches and an extreme spread of no more than 8 inches when firing 1oz slug ammunition at a range of 50 yards.

## 4. 0 VERIFICATION

4.1 Performance verification. Table I details all performance criteria. Except as otherwise specified, ICE NFTTU reserves the right to perform any of the inspections and tests set forth in this specification where such inspections and tests are necessary to ensure that supplies and services conform to prescribed requirements.

4.2 Quality Management System. NFTTU will analyze the vendor's quality management system for basic compliance. If the contractor is ISO 9001:2000 certified, they shall submit written proof of ISO 9001:2000 certification from an accredited agency. NOTE: ISO 9001:2000 certification is not required, but will suffice for compliance with 3.3. Additionally, government personnel or a third-party representative may perform a QC system audit after contract award. If conducted, the audit will be performed at the vendor's manufacturing facility.

4.3 Sample Size. All samples submitted will be visually inspected.

4.4 Documentation. All required documentation shall accompany the sample and will be examined to verify compliance.

4.5 Supplemental Items. All item will be inspected to verify compliance.

4.6 Action/Mechanism. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.7 Overall Length. All samples submitted will have the overall length measured with a calibrated rule to verify compliance.

4.8 Weight. All samples submitted will be weighed using a calibrated electronic scale to verify compliance.

4.9 Gauge. All samples submitted will have the chamber dimensions verified by physical inspection and the use of certified (in accordance with SAAMI) GO/NO-GO gauges.

4.10 Stock/Forend. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance. Length of pull (LOP) will be measured from the center of the curve of the trigger to the center of the recoil pad.

4.11 Sling Attachments. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.12 Trigger. All samples submitted will have the trigger pull measured by a calibrated Dvorak TriggerScan trigger pull tester. The average of three trigger pulls will be used to verify compliance.

4.13 Finish. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.14 Safety. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance of the shotgun safety mechanism. The safety mechanism of all samples submitted will be tested for compliance by actuating and checking for function every 200 rounds during the reliability/durability test phase.

4.15 Barrel. All samples submitted will have the barrel length measured with a calibrated depth gage to verify compliance.

4.16 Magazine. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance. Five dummy rounds of SAAMI maximum length will be loaded into the shotgun magazine tube. The last round must be able to be loaded into the magazine tube.

4.17 Sights. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.18 Reliability. Nine (9) samples will undergo a 3,000 round (per shotgun) reliability test in multiples of 200 round firing cycles. Each firing cycle will consist of 150 rounds of duty 00 buckshot ammunition and 50 rounds of 1 oz slug ammunition for a total of 15 cycles. All testing will be fired from the shoulder. The shotguns will be cleaned after each firing cycle. A detailed inspection will be performed after every third firing cycle. All recommended maintenance procedures will be adhered to and parts will be changed at the recommended maintenance interval (using vendor supplied replacement parts). All malfunctions will be analyzed by two (2) NFTTU armorers to determine the malfunction type/cause and malfunctions attributed to the firearm(s) will be recorded. Shotguns experiencing a Class 3 malfunction will be repaired (using vendor supplied replacement parts) and will continue testing. Testing shall be discontinued for a shotgun if replacement parts are not available. If any shotgun experiences a Class 4 malfunction, testing of that vendor's samples will be discontinued.

4.19 Durability. Three (3) of the shotgun samples used in the reliability test will undergo an additional 7,000 round (per shotgun) durability test in multiples of 200 round firing cycles. Each firing cycle will consist of 150 rounds of duty 00 buckshot ammunition and 50 rounds of 1 oz slug ammunition for a total of 35 cycles. All shotguns will be fired from the shoulder. The shotguns will be cleaned after each firing cycle. A detailed inspection will be performed after every third firing cycle. All recommended maintenance procedures will be adhered to and parts will be changed at the recommended maintenance interval (using vendor supplied replacement parts). All malfunctions will be analyzed by two (2) NFTTU armorers to determine the malfunction type/cause and malfunctions attributed to the firearm(s) will be recorded. Shotguns experiencing a Class 3 malfunction will be repaired (using vendor supplied replacement parts) and will continue testing. Testing shall be discontinued for a shotgun if replacement parts are not available. If any shotgun experiences a Class 4 malfunction, testing of that vendor's samples will be discontinued.

Non-destructive testing will be conducted on each firearm after completion of the reliability/durability test and at any other time deemed necessary or desirable. The key firearm components (barrel, bolt, pump action assembly, and receiver) shall be free of cracks.

4.20 High Temperature. Three (3) shotgun samples will be temperature conditioned in an environmental chamber at 160 $\pm 5^{\circ}$F and 0% humidity for 8 hours. After 8 hours of temperature conditioning each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot and 10 rounds of 1 oz slug ammunition) within 20 minutes after removal from the environmental chamber. Any malfunction will be recorded and analyzed by NFTTU armorers.

4.21 Low Temperature. Three (3) shotgun samples will be temperature conditioned in an environmental chamber at -30 $\pm 5^{\circ}$F and 0% humidity for 8 hours. After 8 hours of temperature conditioning each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot ammunition and 10 rounds of 1oz slug ammunition) within 20 minutes after removal from the environmental chamber. The ammunition used will also be temperature conditioned at -30$^{\circ}$F for 8 hours. Any malfunction will be recorded and analyzed by NFTTU armorers.

4.22 Salt Water Immersion. Three (3) shotgun samples will be immersed in 5% (by weight) saline solution at a depth of 6 inches for one minute. Upon removal from the saline solution, the shotguns will be subjected to environmental conditioning at 70 $\pm 5^{\circ}$F and 70% humidity for 24 hours in an environmental conditioning chamber. After environmental conditioning, each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot ammunition and 10 rounds of 1oz slug ammunition) within 20 minutes after removal from the environmental chamber. Any malfunction observed will be recorded and analyzed by NFTTU armorers.

4.23 Sand & Dust. Three (3) shotgun samples will be subjected blowing sand and dust. After sand and dust conditioning, each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds of 00 buckshot ammunition and 10 rounds of 1oz slug ammunition). Any malfunction observed will be recorded and analyzed by NFTTU armorers.

4.24 Parts Interchange. Prior to reliability testing, an NFTTU armorer will field strip all shotgun samples. All parts and assemblies will be sorted and placed in individual bins. All parts and assemblies will be inspected for burrs, sharp edges and workmanship. A second NFTTU armorer will reassemble the shotguns using randomly selected components. Any components found not to be interchangeable and the need for any tools needed to disassemble/reassemble the shotgun will be noted.

4.25 Drop Test. Three (3) shotgun samples will undergo 3-foot drop testing onto a concrete pad. One shotgun will be oriented to drop so as to land on the muzzle, one shotgun will be oriented to drop so as to land on the butt of the shotgun stock, and one shotgun will be oriented to drop so as to land on the top of the barrel/receiver. Each shotgun will contain a magazine loaded with dummy ammunition. A cartridge case containing a live primer will be in the chamber during the drop test. After drop testing, the shotguns will undergo a LTI by NFTTU armorers and 5 rounds of duty 00 buckshot ammunition will be fired in each shotgun. Any discharges during drop testing and malfunctions during subsequent firing will be recorded and analyzed by NFTTU armorers.

4.26 Shot Pattern/Accuracy.

4.26.1 Shot Pattern. Shot pattern will be evaluated at 25 yards by shooting three (3) shotgun samples (using duty 00 buckshot ammunition) at a paper target. The shotgun will be mounted in a return to battery machine rest. A calibrated 25-inch diameter circular template will be placed over the calculated geometric center of each shot pattern and the pellet hits outside the template will be recorded. Ten shots will be fired and each shot pattern will be analyzed separately.

4.26.2 Accuracy. Accuracy will be evaluated at 50 yards by shooting three (3) 10-shot groups with three (3) separate shotguns (using duty 1 oz slug ammunition). The shotgun will be mounted in a return to battery machine rest and an Oehler optical target will be used to record the groups. The mean radius and extreme spread will be calculated and recorded by an Oehler Model 83 computer.

## STATEMENT OF WORK (SOW) II: 12-GAUGE MARINE SHOTGUNS

### 1.0 SCOPE

This detailed specification delineates performance criteria and tests to be used for the evaluation of marine shotgun candidates for Department of Homeland Security (DHS), Immigration and Customs Enforcement (ICE).

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| | Sample Size | 3.4 | 4.3 | X | X | |
| | Documentation | 3.5 | 4.4 | X | | |
| | Supplemental Items | 3.6 | 4.5 | X | X | |
| | Action/Mechanism | 3.8 | 4.6 | X | X | X |
| | Overall Length | 3.9 | 4.7 | X | X | X |
| | Weight | 3.10 | 4.8 | X | X | X |
| | Gauge | 3.11 | 4.9 | X | X | X |
| | Finish | 3.15 | 4.13 | X | X | X |
| | Safety | 3.16 | 4.14 | X | X | X |
| | Barrel | 3.17 | 4.15 | X | X | X |
| | Magazine | 3.18 | 4.16 | X | X | X |
| Major | Reliability | 3.20 | 4.18 | X | X | |
| | Durability | 3.21 | 4.19 | X | X | |
| | High Temperature | 3.22 | 4.20 | X | X | |
| | Low Temperature | 3.23 | 4.21 | X | X | |
| | Salt Fog | 3.24 | 4.22 | X | X | |
| | Sand & Dust | 3.25 | 4.23 | X | X | |
| | Parts Interchange | 3.26 | 4.24 | X | X | |
| | Drop Test | 3.27 | 4.25 | X | X | |
| | Shot Pattern/Accuracy | 3.28 | 4.26 | X | X | |
| Minor | Stock/Forend | 3.12 | 4.10 | X | X | X |
| | Sling Attachments | 3.13 | 4.11 | X | X | X |
| | Trigger | 3.14 | 4.12 | X | X | X |
| | Sights | 3.19 | 4.17 | X | X | X |

3.3 Quality Management System (QMS). The manufacturer shall have a QMS in place that enables the organization to identify, measure, control and improve key manufacturing processes. It is desired that the manufacturer have a quality system that is certified with ISO 9001: 2000 or 2008, Quality Management Systems - Requirements.

3.3.1 Quality Manual. The manufacturer shall provide a copy of their Quality Manual. The Quality Manual shall, at a minimum, address:

a. Process control plan

b. Quality inspection plan

c. Non-conforming material identification and disposition

d. Lot/batch identification

e. Document control

f. Control of monitoring and measuring devices

3.4 Sample Size. Twelve (12) shotguns shall be submitted for solicitation FAT testing.

3.5 Documentation. The following documentation shall be supplied with each shotgun model submitted for solicitation and FAT testing:

- Owner's Manual
- Parts list detailing all shotgun components.
- Maintenance procedures detailing a preventative maintenance regiment for replacement or adjustment of parts and recommended solvents and lubricants. (This will be the basis for the vendor to determine the quantity of spare parts to supply with the shotgun samples and will be adhered to during reliability/durability function fire testing.)
- It is desired that an Armorers Manual be provided with the shotgun samples.
- Copy of manufacturer's Quality Manual.

- Certificate of Conformance (C of C) that the shotgun samples meet all Statement of Work Basic Compliance requirements.

3.6 Supplemental Items. The following items shall be supplied with each shotgun model submitted for solicitation and FAT testing:

- All potential spare parts (excluding barrel, bolt, pump action assembly, and receiver) needed to support reliability/durability testing outlined in Section 3.20/3.21. The quantity of spare parts supplied by the vendor should be based on the manufacturer's recommended maintenance intervals for a 10,000 round test.
- Two (2) sets of special tools, if needed, necessary to disassemble/reassemble the shotgun.

3.7 Training. The manufacturer awarded the contract shall provide armorer/gunsmith training (after contract award). Training shall be provided to no less than twelve (12) designated armorers, on-site at the NFTTU Altoona, PA location within thirty days of contract award. Training duration shall be up to five (5) days in length and will cover all aspects of maintenance and repair of the shotgun. The manufacturer shall provide four (4) cut-away models of the shotgun at the time of on-site training. All training and instructional material shall be written or communicated in the English language.

3.8 Action/Mechanism. The action shall be a pump-action. The action shall be designed to operate smoothly during cycling with no binding. The mechanism shall possess an inertia firing pin and be designed to prevent accidental discharges if the firearm is dropped. The shotgun shall be designed in such a way that the operator can clear a malfunction using immediate action without the use of special tools. The shotgun shall be capable of being unloaded by removing the cartridges directly from the magazine. The firearm shall be able to be safely operated by a shooter wearing gloves.

3.9 Overall Length. The overall length of the shotgun shall not exceed 35.5".

3.10 Weight. The empty weight of the shotgun shall not exceed 8 lbs.

3.11 Gauge. The shotgun shall be chambered for 12-gauge 3-inch magnum cartridges. All chamber dimension specifications and pressure limitations shall conform to the Sporting Arms and Ammunition Manufacturer's Institute (SAAMI) specifications for 12-gauge (chambered for 3-inch magnum cartridges) shotguns.

3.12 Stock/Forend. It is desired that the stock be a vertical pistol grip stock constructed of a durable composite material with adjustments for length and equipped with a spring loaded recoil-dampening system and recoil-absorbing pad. It is desired that the stock have a minimum of 2.75" length of pull (LOP) adjustment. It is desired that the stock have a black, non-reflective finish and incorporate a non-slip grip surface.

It is desired that the forend be constructed of the same material as the stock and have a non-reflective finish with a non-slip, raised rib type grip surface to prevent the shooter's hand from sliding off the grip. It is desired that the forend design be equal to or better than the Speedfeed LE forend, part number 0256. It is desired that the forend not cover any portion of the ejection or loading ports when pulled fully to the rear. It is desired that the shotgun have the option of being supplied with a forend that incorporates a MIL-STD 1913 Picatinny rail to accommodate the attachment of a light.

3.13 Sling Attachments. It is desired that the shotgun be equipped with sling attachments that accommodate the use of a 1 ¼" wide sling. It is desired that the front sling attachment be designed to accommodate a bottom sling attachment and be designed to convert from bottom attachment to left side and right side attachment. It is desired that the front sling attachment shall not swivel. It is desired that the front sling attachment shall be positioned on the shotgun between the muzzle and the front of the forend. It is desired that the rear sling attachment shall be permanently attached to the firearm within 2 to 4 inches of the toe of the recoil pad (on the underside of the stock).

3.14 Trigger. It is desired that the trigger pull not be less than 5 pounds and not exceed 8 pounds force.

3.15 Finish. The external finish shall be non-reflective. All parts shall be constructed of or coated with a material that is corrosion resistant and suitable for extended use in a salt water marine environment.

3.16 Safety. The shotgun shall be equipped with an externally controlled, manual safety mechanism that possesses both a "SAFE" and "FIRE" position. With the hammer cocked, when safety is placed in the "SAFE" position, it shall prevent the trigger from releasing the hammer so that the shotgun is incapable of firing. The shooter shall be able to visually and physically verify the position of the safety.

3.17 Barrel. The barrel shall have a non-removable modified choke. Barrel length shall be a minimum of 14 inches and a maximum of 14.5 inches. Barrels shall be easily interchangeable without special tools.

3.18 Magazine. The magazine shall have a capacity to hold five (5) 2 ¾ inch, 12-gauge rounds loaded at the maximum overall length as specified by SAMMI for 12-gauge ammunition. It is desired that the magazine follower be of a highly visible color and non-binding design and material. The shooter shall be able to ascertain if the magazine is empty by either visually or physically checking the position of the follower.

3.19 Sights.

3.19.1 Front Sight. It is desired that the front sight have a black or dark gray non-reflective finish and be equipped with a tritium insert contained in a break resistant ampoule. It is desired that the front sight be of a sufficient height to afford zeroing the sights to point of impact. It is desired that the front sight be a snag resistant, square steel blade design and be non-adjustable for windage and elevation (not dovetailed). It is desired that the front sight not have side guards/wings.

3.19.2 Rear Sight. It is desired that the rear sight be of a large-aperture "ghost ring" design, with a black or dark gray non-reflective finish and mounted at the rear of the receiver. It is desired that the rear sight be removable and allow the top of the receiver to be unobstructed after the rear sight assembly is removed. It is desired that the rear sight be fully adjustable for windage and elevation and equipped with tritium inserts contained in break resistant ampoules. It is desired that the tritium inserts be placed in the rear sight such that, when properly aligned with the front sight, will form a horizontal line or "3 dot configuration" over the target. It is desired that the rear sight not have side guards/wings. It is desired that the rear sight be designed for replacement without the use of special tools or soldering. It is desired that the rear sight be designed to allow replacement of the ring aperture without requiring the replacement of the entire sight assembly, unless replacing the entire rear sight is similar in time and cost to replacing the aperture ring only.

It is desired that both the front and rear sights be able to withstand 3-foot drop testing without rendering the sights unserviceable. Tritium failure during the drop test will not be considered unserviceable.

3.20 Reliability. Nine (9) shotguns samples shall be tested with 3000 rounds (per shotgun). It is desired that the nine (9) shotguns collectively exhibit not more than seventeen (17) Class 1, not more than seven (7) Class 2, and not more than one (1) Class 3 malfunctions (not due to ammunition). The shotguns shall exhibit no Class 4 malfunctions. Malfunction codes are listed in Table II. Vendor shall supply a minimum of nine (9) trained shooters to participate in reliability testing. A manufacturers' representative can be available during testing to assist NFTTU personnel with maintenance and shotgun repairs (using vendor supplied replacement parts). Testing shall be discontinued for a shotgun if replacement parts are not available.

3.20.1 Cycles Completed - Reliability. Each shotgun will be rated for its ability to complete 200 round firing cycles. It is desired that each shotgun complete at least 12 of 15 cycles during the reliability testing with no parts replacement.

3.21 Durability. Three (3) shotgun samples shall be tested with an additional 7,000 rounds (per shotgun). It is desired that the three (3) shotguns collectively exhibit not more than a total of fourteen (14) Class 1, not

more than six (6) Class 2, and not more than one (1) Class 3 malfunctions (not due to ammunition). The shotguns shall exhibit no Class 4 malfunctions. Vendor shall supply a minimum of six (6) trained shooters to participate in durability. A manufacturers' representative can be available during testing to assist NFTTU personnel with maintenance and shotgun repairs (using vendor supplied replacement parts). Testing shall be discontinued for a shotgun if replacement parts are not available.

3.21.1 Cycles Completed - Durability. Each shotgun will be rated for its ability to complete 200 round firing cycles. It is desired that each shotgun complete at least 28 of 35 cycles during the durability testing with no parts replacement.

NOTE: The total duration of the marine shotgun reliability/durability testing will be approximately 10 weekdays and will be conducted near the NFTTU Ft. Benning, GA location. NFTTU will coordinate with each vendor regarding testing schedule.

**Table II: Malfunction and Type Allowance**

| Class | Type |
|---|---|
| 1 | Malfunction can be cleared by the operator within 10 seconds. |
| 2 | Malfunction that cannot be cleared by operator within 10 seconds; but can be cleared by operator with equipment immediately available to a law enforcement officer in the field (i.e., Leatherman-type tool or pocketknife). |
| 3* | Malfunction not correctable by operator and requires a higher level of maintenance. This may include the replacement or repair of a part other than the barrel, bolt, pump action assembly, or receiver. |
| 4 | Catastrophic malfunction that requires replacement of the barrel, bolt, pump action assembly, receiver, and/or anything that affects safe operation. |

*Parts replacement(s) in accordance with the manufacturer's recommendation for preventative maintenance does not constitute a Class 3 malfunction.

3.22 High Temperature. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after temperature soaking of the shotgun for 8 hours at 160°F. The shotgun shall not exhibit any Class 4 malfunctions.

3.23 Low Temperature. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing, after temperature soaking of the shotgun for 8 hours at –30°F. The shotgun shall not exhibit any Class 4 malfunctions.

3.24 Salt Fog. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after completing four (4), 24 hour salt fog exposure each followed by a 24 hour dry cycle in an environmental chamber at 70°F and 50% humidity. The shotgun shall not exhibit any Class 4 malfunctions.

3.25 Sand & Dust. It is desired that the shotgun not exhibit any Class 1, Class 2 or Class 3 malfunctions (not due to ammunition), during a 40 round firing cycle, after being subjected to a blowing sand and dust environment in accordance with MIL-STD-810G. The shotgun shall not exhibit any Class 4 malfunctions.

3.26 Parts Interchange. All shotgun components subjected to field-stripping shall be 100% interchangeable between shotguns without additional fitting or alternation. Upon reassembly, the shotgun shall be fully functional. It is desired that the shotgun be capable of being field stripped without the use of special tools.

3.27 Drop Test. The shotgun shall be equipped with a discharge control mechanism that is designed to prevent the firearm from firing as a result of an impact, while the hammer is in the cocked position, with the safety off. Additionally, the shotgun shall be serviceable and exhibit no major damage as the result of being dropped on a concrete pad from a height of three feet in the following orientations:

a. Muzzle facing the concrete pad.
b. Butt of stock down facing the concrete pad.
c. Top of the receiver and barrel facing the concrete pad.

Major damage is defined as damage that would result in the gun being unsafe to fire, discharging during testing, or malfunctioning during firing.

3.28 Shot Pattern/Accuracy.

3.28.1 Shot Pattern. The shotgun shall be able to place at least 8 of 9 buckshot pellets (using duty 00 buck shot ammunition) within a 25" diameter circle at a range of 25 yards.

3.28.2 Accuracy. The shotgun shall exhibit a mean radius of no greater than 2.75 inches and an extreme spread of no more than 8 inches when firing 1oz slug ammunition at a range of 50 yards.

## 4.0 VERIFICATION

4.1 Performance verification. Table I details all performance criteria. Except as otherwise specified, ICE NFTTU reserves the right to perform any of the inspections and tests set forth in this specification where such inspections and tests are necessary to ensure that supplies and services conform to prescribed requirements.

4.2 Quality Management System. NFTTU will analyze the vendor's quality management system for basic compliance. If the contractor is ISO 9001:2000 certified, they shall submit written proof of ISO 9001:2000 certification from an accredited agency. NOTE: ISO 9001:2000 certification is not required, but will suffice for compliance with 3.3. Additionally, government personnel or a third-party representative may perform a QC system audit after contract award. If conducted, the audit will be performed at the vendor's manufacturing facility.

4.3 Sample Size. All samples submitted will be visually inspected.

4.4 Documentation. All required documentation shall accompany the sample and will be examined to verify compliance.

4.5 Supplemental Items. All item will be inspected to verify compliance.

4.6 Action/Mechanism. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.7 Overall Length. All samples submitted will have the overall length measured with a calibrated rule to verify compliance.

4.8 Weight. All samples submitted will be weighed using a calibrated electronic scale to verify compliance.

4.9 Gauge. All samples submitted will have the chamber dimensions verified by physical inspection and the use of certified (in accordance with SAAMI) GO/NO-GO gauges.

4.10 Stock/Forend. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance. Length of pull (LOP) will be measured from the center of the curve of the trigger to the center of the recoil pad.

4.11 Sling Attachments. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.12 Trigger. All samples submitted will have the trigger pull measured by a calibrated Dvorak TriggerScan trigger pull tester. The average of three trigger pulls will be used to verify compliance.

4.13 Finish. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.14 Safety. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance of the shotgun safety mechanism. The safety mechanism of all samples submitted will be tested

for compliance by actuating and checking for function every 200 rounds during the reliability/durability test phase.

4.15 Barrel. All samples submitted will have the barrel length measured with a calibrated depth gage to verify compliance.

4.16 Magazine. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance. Five dummy rounds of SAAMI maximum length will be loaded into the shotgun magazine tube. The last round must be able to be loaded into the magazine tube.

4.17 Sights. All samples submitted will be visually and physically examined by NFTTU armorers to verify compliance.

4.18 Reliability. Nine (9) samples will undergo a 3,000 round (per shotgun) reliability test in multiples of 200 round firing cycles. Each firing cycle will consist of 150 rounds of duty 00 buckshot ammunition and 50 rounds of 1 oz slug ammunition for a total of 15 cycles. All testing will be fired from the shoulder. The shotguns will be cleaned after each firing cycle. A detailed inspection will be performed after every third firing cycle. All recommended maintenance procedures will be adhered to and parts will be changed at the recommended maintenance interval (using vendor supplied replacement parts). All malfunctions will be analyzed by two (2) NFTTU armorers to determine the malfunction type/cause and malfunctions attributed to the firearm(s) will be recorded. Shotguns experiencing a Class 3 malfunction will be repaired (using vendor supplied replacement parts) and will continue testing. Testing shall be discontinued for a shotgun if replacement parts are not available. If any shotgun experiences a Class 4 malfunction, testing of that vendor's samples will be discontinued.

4.19 Durability. Three (3) of the shotgun samples used in the reliability test will undergo an additional 7,000 round (per shotgun) durability test in multiples of 200 round firing cycles. Each firing cycle will consist of 150 rounds of duty 00 buckshot ammunition and 50 rounds of 1 oz slug ammunition for a total of 35 cycles. All shotguns will be fired from the shoulder. The shotguns will be cleaned after each firing cycle. A detailed inspection will be performed after every third firing cycle. All recommended maintenance procedures will be adhered to and parts will be changed at the recommended maintenance interval (using vendor supplied replacement parts). All malfunctions will be analyzed by two (2) NFTTU armorers to determine the malfunction type/cause and malfunctions attributed to the firearm(s) will be recorded. Shotguns experiencing a Class 3 malfunction will be repaired (using vendor supplied replacement parts) and will continue testing. Testing shall be discontinued for a shotgun if replacement parts are not available. If any shotgun experiences a Class 4 malfunction, testing of that vendor's samples will be discontinued.

Non-destructive testing will be conducted on each firearm after completion of the reliability/durability test and at any other time deemed necessary or desirable. The key firearm components (barrel, bolt, pump action assembly, and receiver) shall be free of cracks.

4.20 High Temperature. Three (3) shotgun samples will be temperature conditioned in an environmental chamber at 160 $\pm 5^{\circ}$F and 0% humidity for 8 hours. After 8 hours of temperature conditioning each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot and 10 rounds of 1 oz slug ammunition) within 20 minutes after removal from the environmental chamber. Any malfunction will be recorded and analyzed by NFTTU armorers.

4.21 Low Temperature. Three (3) shotgun samples will be temperature conditioned in an environmental chamber at -30 $\pm 5^{\circ}$F and 0% humidity for 8 hours. After 8 hours of temperature conditioning each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot ammunition and 10 rounds of 1oz slug ammunition) within 20 minutes after removal from the environmental chamber. The ammunition used will also be temperature conditioned at -30$^{\circ}$F for 8 hours. Any malfunction will be recorded and analyzed by NFTTU armorers.

4.22 Salt Fog. Three (3) shotgun samples will be placed in an environmental chamber and exposed to 5% (by weight) salt fog for a period of 24 hours. The shotguns will then be subjected to environmental conditioning at 70 $\pm 5^{o}$F and 50% humidity for 24 hours in an environmental conditioning chamber. After environmental conditioning, each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds 00 buckshot ammunition and 10 rounds of 1oz slug ammunition) within 20 minutes after removal from the environmental chamber. Any malfunction observed will be recorded and analyzed by NFTTU armorers.

4.23 Sand & Dust. Three (3) shotgun samples will be subjected blowing sand and dust. After sand and dust conditioning, each shotgun will be used to fire 40 rounds of duty ammunition (30 rounds of 00 buckshot ammunition and 10 rounds of 1oz slug ammunition). Any malfunction observed will be recorded and analyzed by NFTTU armorers.

4.24 Parts Interchange. Prior to reliability testing, an NFTTU armorer will field strip all shotgun samples. All parts and assemblies will be sorted and placed in individual bins. All parts and assemblies will be inspected for burrs, sharp edges and workmanship. A second NFTTU armorer will reassemble the shotguns using randomly selected components. Any components found not to be interchangeable and the need for any tools needed to disassemble/reassemble the shotgun will be noted.

4.25 Drop Test. Three (3) shotgun samples will undergo 3-foot drop testing onto a concrete pad. One shotgun will be oriented to drop so as to land on the muzzle, one shotgun will be oriented to drop so as to land on the butt of the shotgun stock, and one shotgun will be oriented to drop so as to land on the top of the barrel/receiver. Each shotgun will contain a magazine loaded with dummy ammunition. A cartridge case containing a live primer will be in the chamber during the drop test. After drop testing, the shotguns will undergo a LTI by NFTTU armorers and 5 rounds of duty 00 buckshot ammunition will be fired in each shotgun. Any discharges during drop testing and malfunctions during subsequent firing will be recorded and analyzed by NFTTU armorers.

4.26 Shot Pattern/Accuracy.

4.26.1 Shot Pattern. Shot pattern will be evaluated at 25 yards by shooting three (3) shotgun samples (using duty 00 buckshot ammunition) at a paper target. The shotgun will be mounted in a return to battery machine rest. A calibrated 25-inch diameter circular template will be placed over the calculated geometric center of each shot pattern and the pellet hits outside the template will be recorded. Ten shots will be fired and each shot pattern will be analyzed separately.

4.26.2 Accuracy. Accuracy will be evaluated at 50 yards by shooting three (3) 10-shot groups with three (3) separate shotguns (using duty 1 oz slug ammunition). The shotgun will be mounted in a return to battery machine rest and an Oehler optical target will be used to record the groups. The mean radius and extreme spread will be calculated and recorded by an Oehler Model 83 computer.