



System Assessment and Validation for Emergency Responders (SAVER)

Magnifying Patrol Rifle Scopes Assessment Report

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FOREWORD

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency responder community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment; and
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life- and cost-saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: “What equipment is available?” and “How does it perform?”

As a SAVER Program Technical Agent, the Space and Naval Warfare Systems Center (SPAWARSYSCEN) Atlantic has been tasked to provide expertise and analysis on key subject areas, including communications, sensors, security, weapon detection, and surveillance, among others. In support of this tasking, SPAWARSYSCEN Atlantic developed this report to provide emergency responders with information obtained from an operationally oriented assessment of magnifying patrol rifle scopes, which fall under AEL reference number 03OE-02-BNOC titled Binoculars/Scopes.

Visit the SAVER section of the Responder Knowledge Base (RKB) website at <http://www.rkb.us/saver> for more information on the SAVER Program or to view additional reports on magnifying patrol rifle scopes or other technologies.

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EXECUTIVE SUMMARY

Magnifying patrol rifle scopes aid in aiming a patrol rifle by providing a magnified view of distant threats (e.g., armed gunman). In July 2013, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of magnifying patrol rifle scopes.

Eight magnifying patrol rifle scopes were assessed by law enforcement personnel. The criteria and scenarios used in this assessment were derived from the results of a focus group of law enforcement personnel with experience using magnifying patrol rifle scopes. The assessment addressed 12 evaluation criteria in four SAVER categories: Capability, Deployability, Maintainability, and Usability. The overall results of the assessment are highlighted in the following table.

Product	Overall Score	Overall	Usability	Capability	Deployability	Maintainability
Leupold & Stevens Inc. Mark 6™ 1-6x20mm M6C1		4.0	4.1	3.9	4.0	4.2
Raytheon ELCAN Optical Technologies SpecterDR™ 1.5-6x		4.0	4.1	4.2	3.6	4.1
Nightforce Optics Inc. 1-4x24 NXS™ Compact Riflescope		4.0	3.9	3.9	4.0	4.3
Vortex Optics Razor HD Gen II 1-6x24 Riflescope		3.9	3.8	4.2	3.8	3.9
Trijicon Inc. Trijicon ACOG® 4x32 BAC		3.8	4.2	3.1	3.9	3.9
Bushnell Outdoor Products Elite Tactical SMRS 1-6.5x24mm		3.6	3.6	3.7	3.5	3.8
Burris Company Inc. MTAC Riflescope 1x-4x-24mm		3.5	3.6	3.3	3.7	3.7
Valdada Optics 1:4x32 QR-TS 35mm PITBULL Compact Scope		3.5	3.3	3.5	3.7	3.2
	0 1 2 3 4 5 Lower Higher					

1. INTRODUCTION

Magnifying patrol rifle scopes aid in aiming a patrol rifle by providing a magnified view of distant threats (e.g., armed gunman). In July 2013, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of magnifying patrol rifle scopes. The purpose of this assessment was to obtain information on magnifying patrol rifle scopes that will be useful in making operational and procurement decisions. The activities associated with this assessment were based on recommendations from a focus group of law enforcement personnel with experience using magnifying patrol rifle scopes.

1.1 Evaluator Information

Six law enforcement personnel from various jurisdictions and with at least two years of experience using magnifying patrol rifle scopes were selected to be evaluators for the assessment. Evaluator information is listed in Table 1-1. Prior to the assessment, evaluators signed a nondisclosure agreement, conflict of interest statement, and photo release form.

Table 1-1. Evaluator Information

Evaluator	Years of Experience	State
Sheriff's Office—Training Officer	20+	MI
Police Department—Patrol Officer	20+	OH
Police Department—Investigator/Assault Team, Criminal Investigation Department/SWAT Team	20+	TX
Police Department—Assistant Chief	20+	WI
Sheriff's Office—Detective, Metro/SWAT Team	16-20	SC
Police Department—Patrol Officer	6-10	WA

1.2 Assessment Products

Eight products were selected and purchased for the assessment based on market research and the focus group's recommendations. Final selection was based on how well each product met the product selection criteria identified by the focus group and listed in Table 1-2.








Table 1-2. Product Selection Criteria

Product Selection Criteria	Description
Magnification	The scope should have a minimum magnification of 1.5x or less and a maximum magnification of 3x to 6x.
Reticle	The scope should have an illuminated reticle.
Mount	The scope should include a mount with purchase or feature an industry-standard tube diameter (e.g., 30 mm, 34 mm, 1 inch) for compatibility with universal mounts.
Waterproof	The scope should be waterproof (i.e., submersible).
Fog proof	The scope should be fog proof (i.e., gas filled, purged).
Warranty	The scope, at a minimum, should include a 2-year warranty.

Focus group participants recommended assessing variable-magnification patrol rifle scopes. Variable-magnification scopes permit the user to select any magnification within the magnification range or to select between two magnification settings (i.e., dual magnification). Focus group participants also recommended assessing the Trijicon ACOG® 4x32 BAC fixed-magnification patrol rifle scope because this scope is expected to be available to law enforcement agencies through a Federal government distribution program. Variable-magnification patrol rifle scopes selected for assessment met all product selection criteria except for the Elite Tactical SMRS 1-6.5x24mm by Bushnell Outdoor Products, which slightly exceeds the magnification criterion, and the SpecterDR™ 1.5-6x by Raytheon ELCAN Optical Technologies, which has a 1-year warranty.

Table 1-3 presents the products that were assessed.

Table 1-3. Assessed Products

Vendor	Product	Product Image
Burris Company Inc.	MTAC Riflescope 1x-4x-24mm (200437) (Variable magnification)	
Bushnell Outdoor Products	Elite Tactical SMRS 1-6.5x24mm (ET1624F) (Variable magnification)	
Leupold & Stevens Inc.	Mark 6™ 1-6x20mm M6C1 (115045) (Variable magnification)	
Nightforce Optics Inc.	1-4x24 NXS™ Compact Riflescope (C451) (Variable magnification)	
Raytheon ELCAN Optical Technologies	SpecterDR™ 1.5-6x (903449-002) (Dual magnification)	
Trijicon Inc.	Trijicon ACOG® 4x32 BAC (TA31RCO-M4CP) (Fixed magnification)	
Valdada Optics	1:4x32 QR-TS 35mm PITBULL Compact Scope (Dual magnification)	
Vortex Optics	Razor HD Gen II 1-6x24 Riflescope (RZR-16003) (Variable magnification)	

2. EVALUATION CRITERIA

The SAVER Program assesses products based on criteria in five established categories:

- **Affordability** groups criteria related to life-cycle costs of a piece of equipment or system;
- **Capability** groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more relevant tasks;
- **Deployability** groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use;
- **Maintainability** groups criteria related to the maintenance and restoration of a piece of equipment or system to operational condition by responders; and
- **Usability** groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

The focus group of law enforcement personnel met in December 2012 and identified 12 evaluation criteria within four SAVER categories: Capability, Deployability, Maintainability, and Usability. The focus group discussed the Affordability category but did not identify any evaluation criteria for that category. They assigned a weight for each criterion's level of importance on a scale of 1 to 5, with 1 being somewhat important and 5 being of utmost importance. The SAVER categories were assigned a percentage to represent each category's importance relative to the other categories.

Products were assessed against 12 evaluation criteria. Table 2-1 presents the evaluation criteria and their associated weights as well as the percentages assigned to the SAVER categories. Refer to Appendix A for evaluation criteria considerations.

Table 2-1. Evaluation Criteria

SAVER CATEGORIES			
Usability	Capability	Deployability	Maintainability
Overall Weight 35%	Overall Weight 30%	Overall Weight 25%	Overall Weight 10%
Evaluation Criteria			
Maintain Settings Weight: 5	Reticle Weight: 4	Eye Relief Weight: 5	Technical Support Weight: 4
Durability Weight: 5	Field of View Weight: 4	Setup Weight: 3	User Manual Weight: 2
Optical Quality Weight: 4	Magnification Range Weight: 3		
Ease of Use Weight: 4			
Size and Weight Weight: 3			

3. ASSESSMENT METHODOLOGY

The products were assessed over 5 days. On the first day of the assessment, a subject matter expert (SME) and facilitators presented a safety briefing and an overview of the assessment process, procedures, and schedule to the evaluators. Each product was then assessed in two phases: (1) specification assessment and (2) operational assessment.

3.1 Phase I/Specification Assessment

During the specification assessment, evaluators assessed each product based on vendor-provided information and specifications. Product information was confirmed by vendors prior to the assessment.

3.2 Phase II/Operational Assessment

During the operational assessment, evaluators assessed each product based on their hands-on experience using the product after becoming familiar with its proper use, capabilities, and features. The SME and facilitators assisted the evaluators with product familiarization, and evaluators had access to the reference material included with each product. The magnifying patrol rifle scopes were assessed in three scenarios: (1) pre-fire, (2) live-fire, and (3) active shooter. Evaluators used the magnifying patrol rifle scopes one at a time in each scenario and completed the assessment worksheets for each product before assessing the next product.

3.2.1 Pre-Fire Scenario

During the pre-fire scenario, evaluators reviewed the instructions and diagrams in the user manuals to become familiar with the scopes. The scopes were not mounted to rifles in this scenario. Evaluators powered on the scopes, adjusted the magnification and reticle brightness, and removed and reinstalled the batteries (Figure 3-1). Evaluators also inspected the controls to determine if there were features that prevent accidental adjustments while operating the scopes.



Figure 3-1. Battery Replacement

3.2.2 Live-Fire Scenario

In the live-fire scenario, evaluators put on protective eyewear, double hearing protection, and ballistic vests and completed the course of fire outlined in Table 3-1 on a 50-yard indoor firing range. All scopes were mounted on patrol rifles with quick-release mounts and zeroed by the SME prior to beginning the course of fire. Evaluators made minor adjustments to zero as necessary.

Table 3-1. Course of Fire

Series	Distance from Target	Shooting Position	Lighting Conditions	Magnification Settings	Rounds to Fire
1	50 yards	Prone	Normal	Highest	20
2	50 yards	Prone	Target dark Shooter normal	Lowest for 5 shots Highest for 5 shots	10
3	50 yards	Prone	Target normal Shooter dark	Lowest for 5 shots Highest for 5 shots	10
4	25 yards	Kneeling	Normal	Lowest for 5 shots Highest for 5 shots	10
5	10 yards	Standing	Normal	Lowest	10
6	50 yards	Prone	Normal	Highest	5

Paper targets with bull's eye stickers were used throughout this scenario (Figure 3-2). The bull's eye stickers were used to check zero prior to the course of fire, perform a box drill, and confirm zero at the end of the course of fire. One paper target was used by each evaluator for each of the assessed scopes, and the paper targets were examined and replaced after each course of fire, prior to assessing the next scope. Evaluators were positioned in every other firing lane, and each evaluator had a paper target (Figure 3-2) and resolution chart (Figure 3-3) in direct view (Figure 3-4).



Figure 3-2. Paper Target

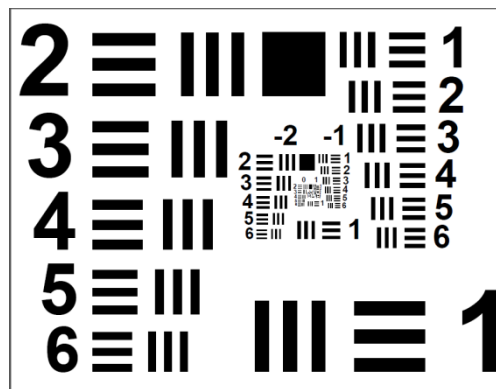


Figure 3-3. Resolution Chart

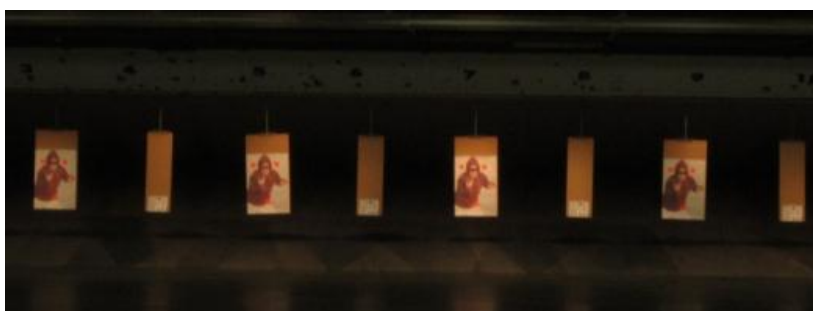


Figure 3-4. Paper Targets and Resolution Charts

As instructed by the range safety officer, evaluators powered on the scopes and shot at the same time and same distance from the paper target throughout the course of fire. In all series, except series 5, rounds were fired at the evaluators' own pace. In series 5, evaluators used the rapid fire shooting technique (i.e., fired multiple rounds as quickly as possible with very little time between rounds).

Throughout the course of fire, evaluators observed if the scopes maintained focus and reticle brightness. In series 1, evaluators set the focus and then checked the zero of the scope by firing five rounds at the top-left bull's eye sticker on the paper target (Figure 3-5). Then, the bottom bull's eye sticker was used to perform a box drill so evaluators could assess the ease of adjusting the windage and elevation controls and ensure these controls permit the scope to return to zero if adjusted. The box drill was conducted as follows:

1. Evaluators fired three rounds at the center of the bull's eye sticker (point of aim [POA]);
2. Evaluators adjusted the elevation control up 10 minutes of angle (MOA) and fired three rounds at the original POA;
3. Evaluators adjusted the windage control 10 MOA to the right and fired three rounds at the original POA;
4. Evaluators adjusted the elevation control down 10 MOA and fired three rounds at the original POA; and
5. Evaluators adjusted the windage control 10 MOA to the left, fired three rounds at the original POA, and confirmed if these rounds struck the target at the same point of

impact as the first rounds fired in step 1 (within the accuracy range of the rifle/shooter).

After the box drill, evaluators made adjustments to zero if necessary. In series 2 through 5 (Figures 3-6, 3-7, 3-8, and 3-9), evaluators aimed and fired at paper targets from 10 to 50 yards while in various shooting positions and lighting conditions, adjusting the reticle brightness and magnification as necessary. At 10, 25, and 50 yards, evaluators assessed the appearance and usefulness of the reticle. Optical quality was also assessed in each series and further assessed upon completion of series 4 by viewing the resolution chart from 25 yards away. In series 1, 4, and 5, evaluators assessed the eye relief of the scopes since each of those series required a different shooting position. In series 6 (Figure 3-10), evaluators checked to see if the scope maintained zero throughout the course of fire by firing five rounds at the top-right bull's eye sticker on the paper target. Evaluators assessed the size of the scope on the rifle throughout this scenario and rated it at the end of the course of fire. Once all evaluators completed the course of fire with all scopes, the range safety officer removed the scopes from the rifles and evaluators inspected them to assess durability.



Figure 3-5. Series 1: Focusing, Checking Zero, and Box Drill Exercise



Figure 3-6. Series 2: Target Dark, Shooter Normal



Figure 3-7. Series 3: Target Normal, Shooter Dark



Figure 3-8. Series 4: Kneeling, 25 Yards and Viewing Resolution Chart



Figure 3-9. Series 5: Standing, 10 Yards, Rapid Fire



Figure 3-10. Series 6: Rechecking Zero

3.2.3 Active Shooter Scenario

During the active shooter scenario, the scopes were mounted on nonfunctional rifles (i.e., bolts were removed). While wearing medium-thickness gloves, evaluators powered on the scopes and used them to detect two subjects walking around a vehicle approximately 150 yards away (Figure 3-11). One of the subjects was armed with a decoy weapon to represent the threat, and the other subject was carrying a black checkbook (Figures 3-12 and 3-13).



Figure 3-11. Subjects Walking Around Vehicle



Figure 3-12. Decoy Weapon



Figure 3-13. Black Checkbook

To ensure a clear line of sight, evaluators were split into two groups of three. Evaluators made adjustments to magnification, focus, and reticle brightness as necessary, and assessed the optical quality, size of the scope on the rifle, appearance and usefulness of the reticle, and eye relief of the scopes. As pictured in Figure 3-14, evaluators viewed the subjects while looking through the scopes and noted the field of view. If required, evaluators approached the subjects until the threat could be identified. Evaluators also noted if the reticle interfered with identifying the threat. The scopes were used in a shaded area as well as in bright sunlight.

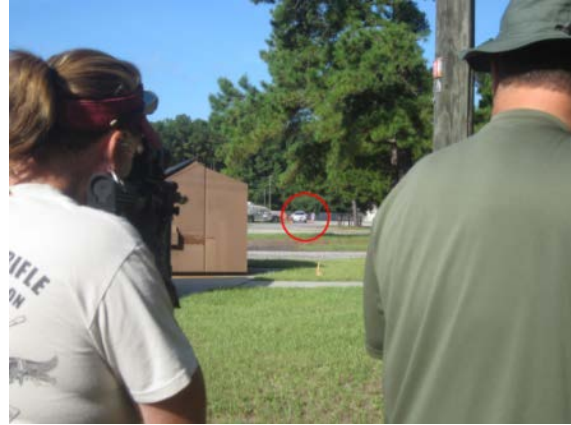


Figure 3-14. Identifying Threat from 150 Yards Away

Once all evaluators assessed all the scopes, they moved to an area outside the entrance of a building. One at a time, evaluators entered the building, stopped, and looked to the room on their left using the scope. A subject appeared in the doorway, approximately 7 yards away, and evaluators identified if the subject was a threat by shouting “shoot” or “no shoot,” depending on whether the subject was armed with the decoy weapon or holding a cellphone. The subject then stepped out of view and returned, and again evaluators shouted “shoot” or “no shoot” (Figure 3-15). This occurred a total of three times, and the lights illuminating the subject were turned off during the last run (Figure 3-16).



Figure 3-15. Subject Holding Cellphone (“No Shoot”), Normal Lighting

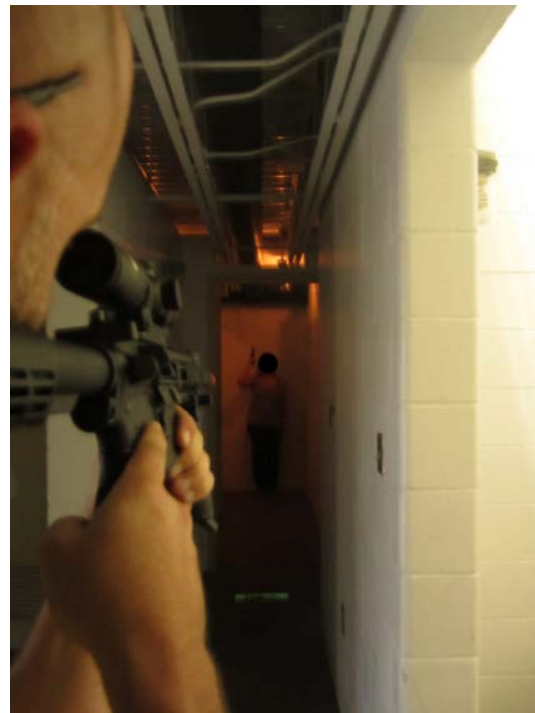


Figure 3-16. Subject Holding Decoy Weapon (“Shoot”), Lights Off

3.3 Data Gathering and Analysis

Each evaluator was issued an assessment workbook that contained vendor-provided information and specifications, assessment procedures, and worksheets for recording criteria ratings and comments. Evaluators used the following 1 to 5 scale to rate each product:

1. *Meets none* of my expectations for this criterion;
2. *Meets some* of my expectations for this criterion;
3. *Meets most* of my expectations for this criterion;
4. *Meets all* of my expectations for this criterion; and
5. *Exceeds* my expectations for this criterion.

Criteria that were rated multiple times throughout the assessment were assigned final overall ratings by the evaluators. Facilitators captured advantages and disadvantages for the assessed products as well as general comments on the magnifying patrol rifle scopes assessment and the assessment process. Once assessment activities were completed, evaluators had an opportunity to review their criteria ratings and comments for all products and make adjustments as necessary.

At the conclusion of the assessment activities, an overall assessment score, as well as category scores and criteria scores, were calculated for each product using the formulas referenced in Appendix B. In addition, evaluator comments for each product were reviewed and summarized for this assessment report.

4. ASSESSMENT RESULTS

Overall scores for the assessed products ranged from 3.5 to 4.0. Table 4-1 presents the overall assessment score and category scores for each product. The small range of scores between products indicates only slight differences in the overall performance of the scopes. Products are listed in order from highest to lowest overall assessment score throughout this section.

Calculation of the overall score uses the raw scores for each category, prior to rounding; products with the same rounded overall score are in order based on the raw data.

Table 4-1. Assessment Results









Product	Overall Score	Overall	Usability	Capability	Deployability	Maintainability
Leupold & Stevens Inc. Mark 6™ 1-6x20mm M6C1		4.0	4.1	3.9	4.0	4.2
Raytheon ELCAN Optical Technologies SpecterDR™ 1.5-6x		4.0	4.1	4.2	3.6	4.1
Nightforce Optics Inc. 1-4x24 NXS™ Compact Riflescope		4.0	3.9	3.9	4.0	4.3
Vortex Optics Razor HD Gen II 1-6x24 Riflescope		3.9	3.8	4.2	3.8	3.9
Trijicon Inc. Trijicon ACOG® 4x32 BAC		3.8	4.2	3.1	3.9	3.9
Bushnell Outdoor Products Elite Tactical SMRS 1-6.5x24mm		3.6	3.6	3.7	3.5	3.8
Burris Company Inc. MTAC Riflescope 1x-4x-24mm		3.5	3.6	3.3	3.7	3.7
Valdada Optics 1:4x32 QR-TS 35mm PITBULL Compact Scope		3.5	3.3	3.5	3.7	3.2
	0 1 2 3 4 5 Lower Higher					

Table 4-2 presents the criteria ratings for each product. The ratings are graphically represented by colored and shaded circles. A green, fully shaded circle represents the highest rating. Refer to Appendix A for evaluation criteria considerations. All eight products received a green, three-quarter shaded circle for the durability, eye relief, and technical support criteria. All of the scopes appeared to withstand heat, recoil, muzzle blast, and shock generated by firing the rifles. Overall, there were no signs of damage, and the controls were still working properly when inspected at the end of the live-fire scenario. In addition, most evaluators agreed that the eye reliefs of the scopes were sufficient throughout all scenarios and at varying magnifications. Evaluators also noted the technical support for all scopes—available Monday through Friday, for at least 8 hours each day, for the life of the products—met expectations. Table 4-3 presents vendor-provided key specifications for the assessed products. All products are waterproof and gas-filled. A hard copy of the user manual is available upon request for all products.

Table 4-2. Criteria Ratings

KEY									
Lowest Rating		Highest Rating							
Category	Evaluation Criteria	Mark 6™ 1-6x20mm M6C1	SpecterDR™ 1.5-6x	1-4x24 NXS™ Compact Riflescope	Razor HD Gen II 1-6x24 Riflescope	Trijicon ACOG® 4x32 BAC	Elite Tactical SMRS 1-6.5x24mm	MTAC Riflescope 1x-4x-24mm	1:4x32 QR-TS 35mm PITBULL Compact Scope
Usability	Maintain Settings								
	Durability								
	Optical Quality								
	Ease of Use								
	Size and Weight								
Capability	Reticle								
	Field of View								
	Magnification Range								
Deployability	Eye Relief								
	Setup								
Maintainability	Technical Support								
	User Manual								

Table 4-3. Key Specifications

Key Specification	Mark 6™ 1-6x20mm M6C1	SpecterDR™ 1.5-6x	1-4x24 NXS™ Compact Riflescope	Razor HD Gen II 1-6x24 Riflescope	Trijicon ACOG® 4x32 BAC	Elite Tactical SMRS 1-6.5x24mm	MTAC Riflescope 1x-4x-24mm	1:4x32 QR-TS 35mm PITBULL Compact Scope
MSRP	\$2,440	\$1,599	\$1,370	\$1,899	\$1,645	\$1,968	\$399	\$1,395
Warranty Duration	5 years	1 year	Limited lifetime	Limited lifetime	Limited lifetime	Limited lifetime	Limited lifetime	Limited lifetime
Transferrable Warranty	✓	✓	✓	✓			✓	
Length (inches)	10.3	7.3	8.8	10.1	5.8	10.6	11.3	7.3
Tube Diameter	34 mm	41 mm; integrated mount	30 mm	30 mm	Not available; integrated mount	30 mm	30 mm	35 mm
Weight (without mount, ounces)	17.0	17.5 (with mount)	17.0	16.0	15.8 (with mount)	18.5	17.0	23.0
Eye Relief (inches) ¹	4.4 to 3.6	2.8	3.5	4.0	1.5	3.8	4.0 to 3.5	3.5
Field of View ¹	106 to 19 feet at 100 yards	16° to 4°	100 to 25 feet at 100 yards	115 to 21 feet at 100 yards	37 feet at 100 yards	106 to 16 feet at 100 yards	100 to 32 feet at 100 yards	144 to 38 feet at 100 yards
Reticle Assessed	TMR-D	5.56 caliber	FC-3G™	JM-1 BDC (MOA)	Chevron with target reference system	BTR-1	Ballistic CQ 5.56 caliber	CQB with 2 MOA dot
Other Available Reticles	✓	✓	✓		✓	✓		
Reticle Illumination Source	LED	LED	LED	LED	Fiber optics and tritium	LED	LED	LED
Reticle Location ²	First focal plane	Second focal plane	Second focal plane	Second focal plane	Not applicable; fixed magnification	First focal plane	Second focal plane	Second focal plane

Magnifying Patrol Rifle Scopes Assessment Report

Key Specification	Mark 6™ 1-6x20mm M6C1	SpecterDR™ 1.5-6x	1-4x24 NXS™ Compact Riflescope	Razor HD Gen II 1-6x24 Riflescope	Trijicon ACOG® 4x32 BAC	Elite Tactical SMRS 1-6.5x24mm	MTAC Riflescope 1x-4x-24mm	1:4x32 QR-TS 35mm PITBULL Compact Scope
Click Value	0.2 mil	½ MOA	¼ MOA	½ MOA	½ MOA	0.1 mil	½ MOA	0.1 mil
Battery Type	CR123	DL 1/3N	CR2032	CR2032	No batteries required	CR2032	CR2032	CR2032
Night Vision Compatible Illumination	✓	✓	✓			✓		
Mounting Options	Standard tube diameter; mount not included	Integrated quick-release mount	Standard tube diameter; mount not included	Standard tube diameter; mount not included	Integrated flattop mount with thumbscrews	Standard tube diameter; mount not included	Standard tube diameter; mount not included	Rings included; proprietary quick-release mount available for additional cost
Anodized Coating	✓	✓	✓	✓	✓		✓	Optional
Scratch-Resistant Lenses	✓	✓	✓	✓		✓	✓	✓
Operating Temperature	-40° to 120°F	-40° to 140°F	-80° to 200°F	-20° to 120°F	-51° to 185°F	-25° to 150°F	-4° to 149°F	-40° to 150°F
Storage Temperature	-40° to 160°F	-40° to 180°F	-80° to 200°F	-20° to 120°F	-51° to 185°F	-25° to 150°F	-40° to 158°F	Information not available
User Manual Availability	Online, e-mail	Online, e-mail	Online, e-mail	Online, e-mail	Hard copy by mail only	Online, e-mail	E-mail	E-mail
<p>Notes:</p> <p>¹A range is provided from minimum to maximum magnification if applicable and available.</p> <p>²A reticle located in the first focal plane will change in size as the magnification is adjusted, while a reticle located in the second focal plane will stay the same size.</p> <p>✓—scope is equipped with corresponding feature</p> <p>Blank cell—scope is not equipped with corresponding feature</p> <p>MSRP—manufacturer's suggested retail price</p> <p>°F—degrees Fahrenheit</p> <p>Click Value: milliradian (mil); minute of angle (MOA)</p>								

4.1 Leupold & Stevens Inc. – Mark 6™ 1-6x20mm M6C1

The Mark 6 1-6x20mm M6C1 variable-magnification scope (Figure 4-1) received an overall assessment score of 4.0 and costs \$2,440. An Allen wrench for setting zero, front and rear lens covers, a user manual, a reticle guide, and a transferrable 5-year warranty are included with purchase.



Figure 4-1. Mark 6 1-6x20mm M6C1

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The Mark 6 1-6x20mm M6C1 received a Usability score of 4.1. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. The windage and elevation turrets were uncovered but featured a locking mechanism to prevent accidental adjustments. The zero stop made it easy to return to zero when the windage and elevation turrets were adjusted;
- The optical quality was excellent; the image was very clear, bright, and sharp at all magnifications and in different lighting conditions;
- The brightness and magnification controls were very easily adjusted, even while wearing gloves. An “off” position located between each brightness setting made it very easy to power off the scope. In addition, the magnification control was large and easy to reach, and it featured a slight protrusion on the top of the control when the scope was set at the lowest magnification (Figure 4-2); and
- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.



Figure 4-2. Large Magnification Control with Slight Protrusion

Capability

The Mark 6 1-6x20mm M6C1 received a Capability score of 3.9. The following information is based on evaluator comments:

- The overall appearance and brightness of the reticle were good; however, the reticle was oversized at 6x. This cluttered the image seen through the scope and interfered with shot placement and threat identification from a distance. In addition, the illuminated reticle flickered with the slightest head movement;
- The field of view was very good; and
- The magnification range of 1x to 6x was very useful; 1x permitted both eyes to remain open while shooting, and 6x provided a detailed view of the target for precise shot

placement and rapid threat identification from a distance. The threat was identified from the maximum distance assessed (150 yards) using the 6x magnification.

Deployability

The Mark 6 1-6x20mm M6C1 received a Deployability score of 4.0. The following information is based on evaluator comments:

- The windage and elevation turrets were very easy to adjust. In addition, the turrets were clearly marked and viewable from the shooter's position. The focus ring was a little difficult to adjust due to its small size but it locked in place and did not need to be adjusted often. Battery replacement was easy with a button-activated, flip-up cap that should not require tools; however, a small tool or coin was needed to reach the recessed button.

Maintainability

The Mark 6 1-6x20mm M6C1 received a Maintainability score of 4.2. The following information is based on evaluator comments:

- The user manual was thorough and intuitive with detailed instructions and diagrams specific to this scope and other scopes in the same line. In addition, the reticle guide provided a complete explanation of the reticle properties.

4.2 Raytheon ELCAN Optical Technologies – SpecterDR™ 1.5-6x

The SpecterDR 1.5-6x dual-magnification scope (Figure 4-3) received an overall assessment score of 4.0 and costs \$1,599. Front and rear lens covers, a soft carry case, a cleaning kit, an integrated quick-release mount, a user manual, and a transferrable 1-year warranty are included with purchase.



Figure 4-3. SpecterDR 1.5-6x

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The SpecterDR 1.5-6x received a Usability score of 4.1. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. The windage and elevation turrets were recessed, and the windage turret required a tool, which prevents accidental adjustments;
- The optical quality was very good; the image was very clear, bright, and sharp at both magnifications and in different lighting conditions;

- The brightness and magnification controls were very easily adjusted, even while wearing gloves. The scope was very easy to power on and off using the same control used to adjust the reticle brightness; however, there were no “off” positions between the brightness settings, which required the user to rotate the knob through the brightness settings to turn it off. The magnification throw lever (Figure 4-4) clicked in place and enabled the user to quickly and easily change between the two magnification settings; and



Figure 4-4. Magnification Throw Lever

- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.

Capability

The SpecterDR 1.5-6x received a Capability score of 4.2. The following information is based on evaluator comments:

- The overall appearance and brightness of the reticle were good. The reticle did not interfere with shot placement or threat identification and was clearly seen in bright sunlight. The user could choose to illuminate either the dot or crosshair in the reticle;
- The field of view was excellent; and
- The 6x magnification provided a detailed view of the target for precise shot placement and rapid threat identification from a distance. The threat was identified from the maximum distance assessed (150 yards) using the 6x magnification. The 1.5x magnification permitted quick target acquisition at shorter distances. However, a true 1x scope is preferred to enable both eyes to remain open while shooting.

Deployability

The SpecterDR 1.5-6x received a Deployability score of 3.6. The following information is based on evaluator comments:

- The fixed focus was excellent. The elevation turret was located in an awkward position that was very close to the mount, which protected it from being bumped but made it difficult to adjust and to feel the positive clicks. The windage turret required a tool to adjust, which resulted in adjustments being difficult to make in the field. Figure 4-5 shows the location of the elevation and windage turrets. In



Figure 4-5. Elevation and Windage Turrets

addition, the windage and elevation turrets were not marked and did not have a reference to zero. The battery cap was threaded and easily removed without tools; however, the lanyard on the battery cap interfered with removal and replacement of the cap.

Maintainability

The SpecterDR 1.5-6x received a Maintainability score of 4.1. The following information is based on evaluator comments:

- The user manual was specific to this scope and easy to understand. It provided good photos and all the necessary information, including replacement part numbers.

4.3 Nightforce Optics Inc. – 1-4x24 NXS™ Compact Riflescope

The 1-4x24 NXS Compact Riflescope variable-magnification scope (Figure 4-6) received an overall assessment score of 4.0 and costs \$1,370. Two Allen wrenches (one for installing the magnification throw lever and another for setting zero), front and rear lens covers, a lens cleaning cloth, a user manual, a user manual/product catalog on CD, a reticle guide, and a transferrable limited lifetime warranty are included with purchase.



Figure 4-6. 1-4x24 NXS Compact Riflescope

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The 1-4x24 NXS Compact Riflescope received a Usability score of 3.9. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. In addition, the windage and elevation turrets were covered by threaded caps to prevent accidental adjustments;
- The optical quality was very good; the image was very clear, bright, and sharp at all magnifications and in different lighting conditions;
- The brightness and magnification controls were very easily adjusted, even while wearing gloves. The scope was very easy to power on and off using the same control used to adjust the reticle brightness; however, there were no “off” positions between the brightness settings, requiring the user to rotate the knob through the brightness settings to turn it off. The magnification control featured a throw lever, enabling quick magnification adjustments (Figure 4-7); and



Figure 4-7. Magnification Throw Lever

- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.

Capability

The 1-4x24 NXS Compact Riflescope received a Capability score of 3.9. The following information is based on evaluator comments:

- The overall appearance of the reticle was good. The reticle did not interfere with shot placement or threat identification. It was difficult to see the reticle in bright sunlight but the reticle was still visible;
- The field of view was very good; and
- The magnification range of 1x to 4x was very useful; 1x permitted both eyes to remain open while shooting, and 4x enabled the user to quickly acquire the target for precise shot placement and rapid threat identification from a distance. The threat was identified from 135 to 140 yards away using the 4x magnification.

Deployability

The 1-4x24 NXS Compact Riflescope received a Deployability score of 4.0. The following information is based on evaluator comments:

- The windage and elevation turrets were very easy to adjust. In addition, the turrets were clearly marked and viewable from the shooter's position. Once the rubber lens cap was removed, it was easy to adjust the focus ring and lock it in place, with or without gloves on. Battery replacement was easy and did not require tools. The battery cap was threaded and unscrews by turning the cap, located on the brightness control, counter-clockwise. This may cause an inadvertent change to the brightness setting during a battery change.

Maintainability

The 1-4x24 NXS Compact Riflescope received a Maintainability score of 4.3. The following information is based on evaluator comments:

- The user manual was extensive, informative, and easy to understand with detailed instructions and diagrams specific to this scope. In addition, an online tutorial and a copy of the user manual on CD were also available to assist the user with setup.

4.4 Vortex Optics – Razor HD Gen II 1-6x24 Riflescope

The Razor HD Gen II 1-6x24 Riflescope variable-magnification scope (Figure 4-8) received an overall assessment score of 3.9 and costs \$1,899. An Allen wrench for setting zero, a cleaning cloth, a user manual, a reticle guide, and a transferrable limited lifetime warranty are included with purchase.

The following sections, broken out by SAVER category, summarize the assessment results.



Figure 4-8. Razor HD Gen II 1-6x24 Riflescope

Usability

The Razor HD Gen II 1-6x24 Riflescope received a Usability score of 3.8. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. In addition, the windage and elevation turrets were covered, and the brightness control locked in place to prevent accidental adjustments;
- The optical quality was very good; the image was very clear, bright, and sharp at all magnifications and in different lighting conditions;
- The brightness control was large and easily adjusted. There was an “off” position located between each brightness setting, which made it very easy to power off the scope. The magnification control was also large and easily adjusted, even while wearing gloves; however, multiple short turns were required to get from minimum to maximum magnification. It would be easier to adjust if there was a protrusion or throw lever on the control; and
- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.

Capability

The Razor HD Gen II 1-6x24 Riflescope received a Capability score of 4.2. The following information is based on evaluator comments:

- The overall appearance and brightness of the reticle were good. The reticle did not interfere with shot placement or threat identification and was clearly seen in bright sunlight;
- The field of view was very good; and
- The magnification range of 1x to 6x was very effective; 1x permitted both eyes to remain open while shooting, and 6x provided a detailed view of the target for precise shot placement and rapid threat identification from a distance. The threat was identified from the maximum distance assessed (150 yards) using the 6x magnification.

Deployability

The Razor HD Gen II 1-6x24 Riflescope received a Deployability score of 3.8. The following information is based on evaluator comments:

- The windage and elevation turrets were very easy to adjust. In addition, the turrets were clearly marked and viewable from the shooter’s position, although the markings were small and somewhat difficult to read. It was easy to adjust the focus ring, with or without gloves on. Battery replacement was easy; however, a coin or screwdriver was required to remove the threaded cap (Figure 4-9).



Figure 4-9. Battery Cap

Maintainability

The Razor HD Gen II 1-6x24 Riflescope received a Maintainability score of 3.9. The following information is based on evaluator comments:

- The user manual was specific to this scope and easy to understand. It provided good photos and all the necessary information.

4.5 Trijicon Inc. – Trijicon ACOG® 4x32 BAC

The Trijicon ACOG 4x32 BAC fixed-magnification scope (Figure 4-10) received an overall assessment score of 3.8 and costs \$1,645. An anti-reflective device (ARD), a hard-sided storage case, a soft cover, a LensPen®, an integrated flattop mount with thumb screws, a user manual, a product catalog, and a non-transferrable limited lifetime warranty are included with purchase.



Figure 4-10. Trijicon ACOG 4x32 BAC

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The Trijicon ACOG 4x32 BAC received a Usability score of 4.2. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. In addition, the windage and elevation turrets were covered by tethered caps to prevent accidental adjustments;
- The optical quality was very good; the image was clear, bright, and sharp in different lighting conditions;
- The scope was very easy to use since there were no brightness or magnification controls to operate. In addition, the scope was always on; and
- The scope, which included an integrated mount, was very light and compact for a magnifying patrol rifle scope.

Capability

The Trijicon ACOG 4x32 BAC received a Capability score of 3.1. The following information is based on evaluator comments:

- The overall appearance of the reticle was good. The reticle did not interfere with shot placement or threat identification. The reticle brightness in normal lighting was very good. However, in disparate lighting conditions (series 2 and 3 of the live-fire scenario), the reticle was too bright when the target was dark and the shooter was illuminated and not bright enough when the target was illuminated and the shooter was dark;
- The field of view was very good when the scope was used at a distance of 150 yards; however, it was too narrow for close-quarter operations; and

- The threat was identified from the maximum distance assessed (150 yards) using the 4x fixed magnification. The lack of a lower magnification setting hindered the field of view at closer distances and slowed target acquisition as a result.

Deployability

The Trijicon ACOG 4x32 BAC received a Deployability score of 3.9. The following information is based on evaluator comments:

- The fixed focus was excellent. The windage and elevation turrets were very easy to adjust but did not have a reference to zero. In addition, the markings on the turrets lacked numbering and were not easily viewed from the shooter's position. This scope did not require batteries, which made battery replacement a non-issue and setup very easy.

Maintainability

The Trijicon ACOG 4x32 BAC received a Maintainability score of 3.9. The following information is based on evaluator comments:

- The user manual was specific to this scope and easy to understand. It provided good photos and all the necessary information. However, availability online or by e-mail is preferred.

4.6 Bushnell Outdoor Products – Elite Tactical SMRS 1-6.5x24mm

The Elite Tactical SMRS 1-6.5x24mm variable-magnification scope (Figure 4-11) received an overall assessment score of 3.6 and costs \$1,968. Front and rear lens covers, a user manual, and a non-transferrable limited lifetime warranty are included with purchase.

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The Elite Tactical SMRS 1-6.5x24mm received a Usability score of 3.6. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. In addition, the windage and elevation turrets were covered by threaded caps to prevent accidental adjustments. However, once uncapped, the push-pull design of the turrets could cause the user to unintentionally change the zero of the scope;
- The optical quality was very good; the image was clear, bright, and sharp at all magnifications and in different lighting conditions;
- For the most part, the brightness and magnification controls were easily adjusted, even while wearing gloves; however, sometimes the controls were somewhat slick and a little difficult to turn. An “off” position was located between each brightness setting,



Figure 4-11. Elite Tactical SMRS 1-6.5x24mm

which made it very easy to power off the scope. The magnification control would be easier to adjust if it had a protrusion or throw lever; and

- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.

Capability

The Elite Tactical SMRS 1-6.5x24mm received a Capability score of 3.7. The following information is based on evaluator comments:

- The overall appearance and brightness of the reticle were good; however, the reticle was oversized at 6.5x. This cluttered the image seen through the scope and interfered with shot placement and threat identification from a distance;
- The field of view was very good; and
- The magnification range of 1x to 6.5x was very useful; 1x permitted both eyes to remain open while shooting, and 6.5x provided a detailed view of the target for precise shot placement and rapid threat identification from a distance. The threat was identified from the maximum distance assessed (150 yards) using the 6.5x magnification.

Deployability

The Elite Tactical SMRS 1-6.5x24mm received a Deployability score of 3.5. The following information is based on evaluator comments:

- The windage and elevation turrets were clearly marked, viewable from the shooter's position, and very easy to adjust. It was easy to adjust the focus ring, with or without gloves on. Battery replacement was easy; however, a coin or screwdriver was required to remove the threaded cap (Figure 4-12).



Figure 4-12. Battery Cap

Maintainability

The Elite Tactical SMRS 1-6.5x24mm received a Maintainability score of 3.8. The following information is based on evaluator comments:

- The user manual was easy to understand but was not unit specific and did not provide all the necessary information (e.g., specifics on the reticle, battery replacement).

4.7 Burris Company Inc. – MTAC Riflescope 1x-4x-24mm

The MTAC Riflescope 1x-4x-24mm variable-magnification scope (Figure 4-13) received an overall assessment score of 3.5 and costs \$399. A user manual, quick-look guide, and transferrable limited lifetime warranty are included with purchase.



Figure 4-13. MTAC Riflescope 1x-4x-24mm

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The MTAC Riflescope 1x-4x-24mm received a Usability score of 3.6. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario. In addition, the windage and elevation turrets were covered by threaded caps to prevent accidental adjustments;
- The optical quality was good; the image was clear and sharp in well-lit environments. However, it was sometimes difficult to see the dark target in series 2 of the live-fire scenario and identify the threat during the active shooter scenario when the lights were dimmed;
- The brightness and magnification controls were very easily adjusted, even while wearing gloves. An “off” position is located between each brightness setting, which made it very easy to power off the scope. The magnification control would be easier to adjust if it had a protrusion or throw lever; and
- The size and weight of the scope were average for a variable-power magnifying patrol rifle scope.

Capability

The MTAC Riflescope 1x-4x-24mm received a Capability score of 3.3. The following information is based on evaluator comments:

- The reticle brightness was good in normal lighting conditions. The reticle was clearly seen in bright sunlight but it could not be dimmed enough for use in poorly lit conditions. In addition, the reticle was too large at all magnifications and interfered with shot placement and threat identification. This was less noticeable at 10 yards during the live-fire scenario;
- The field of view was very good; and
- The magnification range of 1x to 4x was very helpful; 1x permitted both eyes to remain open while shooting, and 4x provided rapid threat identification from a distance. The threat was identified from the maximum distance assessed (150 yards) using the 4x magnification.

Deployability

The MTAC Riflescope 1x-4x-24mm received a Deployability score of 3.7. The following information is based on evaluator comments:

- The windage and elevation turrets were very easy to adjust. In addition, the turrets were clearly marked, although the directional markings were not viewable from the shooter’s position and were somewhat difficult to read. It was easy to adjust the focus ring, with or without gloves on. The battery cap was threaded and easily removed without tools for battery replacement.

Maintainability

The MTAC Riflescope 1x-4x-24mm received a Maintainability score of 3.7. The following information is based on evaluator comments:

- The user manual was easy to understand and provided basic information but was not unit specific.

4.8 Valdada Optics – 1:4x32 QR-TS 35mm PITBULL Compact Scope

The 1:4x32 QR-TS 35mm PITBULL Compact Scope dual-magnification scope (Figure 4-14) received an overall assessment score of 3.5 and costs \$1,395. An Allen wrench for setting zero, mounting rings, a user manual, and a non-transferrable limited lifetime warranty are included with purchase.



Figure 4-14. 1:4x32 QR-TS 35mm PITBULL Compact Scope

The following sections, broken out by SAVER category, summarize the assessment results.

Usability

The 1:4x32 QR-TS 35mm PITBULL Compact Scope received a Usability score of 3.3. The following information is based on evaluator comments:

- The scope maintained zero, focus, and reticle brightness throughout the live-fire scenario; however, the windage and elevation turrets were not covered or recessed and could be easily changed accidentally;
- The optical quality was good; the image was clear and sharp in well-lit environments. However, it was sometimes difficult to see the dark target in series 2 of the live-fire scenario and identify the threat during the active shooter scenario when the lights were dimmed;
- The brightness and magnification controls could be adjusted, even while wearing gloves. The scope was very easy to power on and off using the same control used to adjust the reticle brightness. However, there were no “off” positions between the brightness settings, which required the user to rotate the knob through the brightness settings to turn it off. The magnification control featured a throw lever (Figure 4-15), which enabled quick magnification adjustments but was a little difficult to turn; and
- The size of the scope was average for a variable-power magnifying patrol rifle scope. Although it was heavier than similar scopes, the weight of the scope was not noticeable once mounted on the rifle.



Figure 4-15. Magnification Throw Lever

Capability

The 1:4x32 QR-TS 35mm PITBULL Compact Scope received a Capability score of 3.5. The following information is based on evaluator comments:

- The overall appearance of the reticle was good. The reticle did not interfere with shot placement or threat identification. However, the reticle brightness caused haloing around the outer edge of the image and blooming around the reticle, even on the lowest brightness setting;
- The field of view was very good; and
- The magnification range of 1x to 4x was very helpful; 1x permitted both eyes to remain open while shooting, and 4x provided rapid threat identification from a distance. The threat was identified from 125 to 140 yards away using the 4x magnification.

Deployability

The 1:4x32 QR-TS 35mm PITBULL Compact Scope received a Deployability score of 3.7. The following information is based on evaluator comments:

- The windage and elevation turrets were very easy to adjust. In addition, the turrets were clearly marked, although the directional markings were not viewable from the shooter's position. It was easy to adjust the focus ring, with or without gloves on. The battery cap was threaded and no tools were required for battery replacement. However, the brightness control had to be held in place while unscrewing the battery cap to prevent inadvertently changing the brightness setting.

Maintainability

The 1:4x32 QR-TS 35mm PITBULL Compact Scope received a Maintainability score of 3.2. The following information is based on evaluator comments:

- The user manual was four loose sheets of paper that provided very basic information on this scope with limited diagrams. It did not describe windage and elevation adjustment procedures, brightness settings, or battery replacement.






5. SUMMARY

According to evaluators, magnifying patrol rifle scopes should not be considered a replacement for iron sights; any of these scopes can fail (e.g., batteries die, tritium loses illumination), and iron sights are most reliable since they are less likely to fail. In addition, training on the use of magnifying patrol rifle scopes should be required prior to deployment. Evaluators noted variable-magnification scopes may be better suited for patrol rifle use than fixed-magnification scopes since it may be important for a patrol officer to use minimal or no magnification. Evaluators further noted scopes with illuminated reticles assist the user in adapting to different lighting conditions. They agreed that all of the assessed scopes had maximum magnifications that were helpful in assisting with identification of subjects from a distance, and most evaluators agreed that the eye reliefs of the scopes were sufficient throughout all scenarios and at varying magnifications. In addition, evaluators stated the weights of the assessed scopes did not impact

rifle operation. All of the scopes appeared to withstand heat, recoil, muzzle blast, and shock generated by firing the rifles. Overall, there were no signs of damage, and the controls were still working properly when inspected at the end of the live-fire scenario. Evaluators also noted the technical support for all scopes—available Monday through Friday, for at least 8 hours each day, for the life of the products—met expectations. The advantages and disadvantages for the assessed products are highlighted in Table 5-1.

Table 5-1. Product Advantages and Disadvantages

Vendor/Products		Advantages	Disadvantages
	Leupold & Stevens Inc. Mark 6™ 1-6x20mm M6C1 (Variable magnification)	<ul style="list-style-type: none"> • Locking windage and elevation turrets and zero stop • Excellent optical quality • Illuminated reticle is night vision compatible • Thorough and intuitive user manual • Wide magnification range 	<ul style="list-style-type: none"> • Oversized reticle at maximum magnification • Illuminated reticle flickered with slightest head movement
MSRP: \$2,440	Overall Score: 4.0		
	Raytheon ELCAN Optical Technologies SpecterDR™ 1.5-6x (Dual magnification)	<ul style="list-style-type: none"> • Recessed windage and elevation turrets • Reticle clearly seen in bright sunlight • Dot or crosshair reticle options • Built-in iron sights • Integrated quick-release mount • Magnification throw lever • Illuminated reticle is night vision compatible 	<ul style="list-style-type: none"> • No mid-range magnification options • A tool, such as a coin or screwdriver, is required to adjust windage turret • Unmarked windage and elevation turrets with no reference to zero • Minimum magnification should be a true 1x
MSRP: \$1,599	Overall Score: 4.0		
	Nightforce Optics Inc. 1-4x24 NXS™ Compact Riflescope (Variable magnification)	<ul style="list-style-type: none"> • Covered windage and elevation turrets • Magnification throw lever • Illuminated reticle is night vision compatible • Extensive user manual with additional resources available (online options and CD included) 	<ul style="list-style-type: none"> • Difficult to see reticle in bright sunlight
MSRP: \$1,370	Overall Score: 4.0		

Vendor/Products		Advantages	Disadvantages
 <p>Vortex Optics Razor HD Gen II 1-6x24 Riflescope (Variable magnification)</p> <p>MSRP: \$1,899</p> <p>Overall Score: 3.9</p>		<ul style="list-style-type: none"> • Covered windage and elevation turrets • Locking brightness control • Reticle clearly seen in bright sunlight • Wide magnification range 	<ul style="list-style-type: none"> • None
 <p>Trijicon Inc. Trijicon ACOG® 4x32 BAC (Fixed magnification)</p> <p>MSRP: \$1,645</p> <p>Overall Score: 3.8</p>		<ul style="list-style-type: none"> • Tethered windage and elevation caps that did not interfere with operation • No batteries required • Compact size and lightweight • Integrated flattop mount with thumbscrews 	<ul style="list-style-type: none"> • No manual reticle brightness controls • Windage and elevation turrets have no reference to zero • No low-magnification option
 <p>Bushnell Outdoor Products Elite Tactical SMRS 1-6.5x24mm (Variable magnification)</p> <p>MSRP: \$1,968</p> <p>Overall Score: 3.6</p>		<ul style="list-style-type: none"> • Covered windage and elevation turrets • Wide magnification range • Illuminated reticle is night vision compatible 	<ul style="list-style-type: none"> • Oversized reticle at maximum magnification • Could unintentionally change zero due to push-pull design of windage and elevation turrets (when not capped)
 <p>Burris Company Inc. MTAC Riflescope 1x-4x-24mm (Variable magnification)</p> <p>MSRP: \$399</p> <p>Overall Score: 3.5</p>		<ul style="list-style-type: none"> • Covered windage and elevation turrets • Reticle clearly seen in bright sunlight 	<ul style="list-style-type: none"> • Oversized reticle regardless of magnification • Lower end of operating temperature is too high
 <p>Valdada Optics 1:4x32 QR-TS 35mm PITBULL Compact Scope (Dual magnification)</p> <p>MSRP: \$1,395</p> <p>Overall Score: 3.5</p>		<ul style="list-style-type: none"> • Magnification throw lever 	<ul style="list-style-type: none"> • Windage and elevation turrets not covered or recessed • No mid-range magnification options • Minimal information in user manual • Haloing around outer edge of image and blooming around reticle

Emergency responder agencies that consider purchasing magnifying patrol rifle scopes should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

APPENDIX A. EVALUATION CRITERIA CONSIDERATIONS

Criterion	Specification Assessment	Pre-Fire Scenario	Live-Fire Scenario	Active Shooter Scenario	Consideration
Usability					
Maintain Settings		✓			Do the scope's features that prevent accidental adjustments meet expectations?
			✓		How well does the scope maintain zero, focus, and reticle brightness during operational use (e.g., recoil)?
Durability	✓				Does the scope feature an anodized coating? Does the scope's resistance to water meet expectations? Is the scope gas-filled for resistance to humidity? Does the scope's scratch-resistant lens coating meet expectations? Do the minimum and maximum storage and operating temperatures of the scope meet expectations?
			✓		How well does the scope withstand heat, recoil, muzzle blast, and shock generated by firing the rifle? Does the scope's lenses' resistance to warping and discoloration meet expectations? How well do the scope's controls withstand repetitive use?
Optical Quality			✓		Do the brightness, sharpness, and clarity of the image viewed through the scope allow you to clearly see the target/resolution chart?
				✓	Do the brightness, sharpness, and clarity of the image viewed through the scope allow you to identify the threat?
Ease of Use		✓		✓	How easily and quickly can the scope be powered on?
		✓	✓	✓	How easily and quickly can the magnification be adjusted? How easily and quickly can the reticle brightness be adjusted?
Size and Weight	✓				Does the weight of the scope without a mount meet expectations?
			✓	✓	Does the overall size of the scope when mounted on the rifle meet expectations?

Criterion	Specification Assessment				Consideration
	Pre-Fire Scenario	Live-Fire Scenario	Active Shooter Scenario		
Capability					
Reticle			✓	✓	Does the reticle brightness meet expectations? Do the reticle appearance (e.g., size, shape, color) and overall usefulness meet expectations?
			✓		Does the reticle interfere with shot placement?
				✓	Does the reticle interfere with threat identification?
Field of View				✓	Does the field of view meet expectations?
Magnification Range			✓		How useful is the magnification range in viewing the target?
				✓	How useful is the magnification range in detecting and identifying the threat?
Deployability					
Eye Relief			✓	✓	Does the eye relief meet expectations?
Setup		✓			How easy are the batteries to install? If batteries are not required, does this impact ease of setup?
			✓	✓	How easy is the scope to focus?
			✓		How easily can the windage and elevation controls be adjusted?
Maintainability					
Technical Support	✓				Does the duration of technical support included with purchase meet expectations? Does the availability of technical support meet expectations?
User Manual	✓				Does the availability of the user manual meet expectations?
		✓			How easy to understand are the instructions and diagrams in the included user manual?

APPENDIX B. ASSESSMENT SCORING FORMULAS

The overall score for each product was calculated using the product's averaged criterion ratings and category scores. An average rating for each criterion was calculated by summing the evaluators' ratings and dividing the sum by the number of responses. Category scores for each product were calculated by multiplying the average criterion rating by the weight assigned to the criterion by the focus group, resulting in a weighted criterion score. The sum of the weighted criterion scores was then divided by the sum of the weights for each criterion in the category as seen in the formula and example below.

Category Score Formula

$$\frac{\sum (Average\ Criterion\ Rating \times Criterion\ Weight)}{\sum (Criterion\ Weights)} = \frac{Category}{Score}$$

Category Score Example¹

$$\frac{(4.3 \times 4) + (5 \times 4) + (4 \times 3) + (4.5 \times 3) + (4.5 \times 3)}{4 + 4 + 3 + 3 + 3} = 4.5$$

To determine the overall assessment score for each product, each category score was multiplied by the percentage assigned to the category by the focus group. The resulting weighted category scores were summed to determine an overall assessment score as seen in the formula and example below.

Overall Score Formula

$$\sum (Category\ Score \times Category\ Percentage) = \frac{Overall\ Assessment}{Score}$$

Overall Score Example¹

<u>Capability</u>	<u>Usability</u>	<u>Affordability</u>	<u>Maintainability</u>	<u>Deployability</u>	
$(4.0 \times 33\%)$	$(4.2 \times 27\%)$	$(4.2 \times 20\%)$	$(3.8 \times 10\%)$	$(4.5 \times 10\%)$	$= 4.1$

¹Examples are for illustration purposes only. Formulas will vary depending on the number of criteria and categories assessed and the criteria and category weights.