System Assessment and Validation for Emergency Responders (SAVER)

Portable Forensic Light Kits Assessment Report

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Science and Technology

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Prepared by Space and Naval Warfare Systems Center Atlantic

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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 commercially available equipment and systems and develops knowledge products that provide relevant equipment information to the emergency responder community. 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.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: "What equipment is available?" and "How does it perform?" These knowledge products are 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. 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 portable forensic light kits, which fall under AEL reference number 20CS-02-UVLT titled Equipment, Ultraviolet Light Detection.

Visit the SAVER website on First Responder.gov (www.firstresponder.gov/SAVER) for more information on the SAVER Program or to view additional reports on portable forensic light kits or other technologies.

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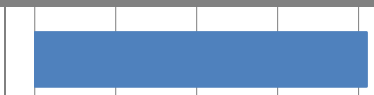
EXECUTIVE SUMMARY

Portable forensic light kits are used by law enforcement to detect and analyze trace evidence found during crime scene investigations. In June 2014, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of portable forensic light kits.

Nine portable forensic light kits were assessed by emergency responders. The criteria and scenarios used in this assessment were derived from the results of a focus group of emergency responders with experience using portable forensic light kits. The assessment addressed 12 evaluation criteria in three SAVER categories: Capability, Deployability, and Usability. The overall results of the assessment are highlighted in the following table.

Product	Overall Score	Overall	Capability	Deployability	Usability
Foster & Freeman USA Complete Crime-lite 2 Kit (QCL2/8KIT/P)		**4.1**	4.1	4.0	4.2
Tritech Forensics Hammerhead Forensic Light Kit - 4+1 (CK-UVH4)		**4.1**	4.0	4.2	4.1
Rofin Forensics Polilight-Flare Plus2 Power Blue Kit (A-FL2KITPB)[1]		**3.9**	4.0	4.0	3.6
Sirchie Finger Print Laboratories megaMAXX ALS System (MMX300)		**3.7**	3.4	3.9	4.1
Arrowhead Forensics Reveal Forensic Field Light Kit (A-FS7)		**3.7**	4.0	3.5	3.6
Lumatec Superlite M (A-3930L)[1]		**3.7**	3.9	3.3	3.7
Labino Nova Torch LED (A-L1102)[1]		**3.6**	3.4	3.6	3.8
CAO Group Inc. UltraLite ALS Ultra Turbo Kit (200-00106)		**3.5**	3.7	3.6	3.2
Spectronics Corporation Spectroline Maxima (MFK-3500S)		**2.7**	3.0	2.9	2.1

[1]Model number is specific to Arrowhead Forensics, a U.S. distributor.

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1. INTRODUCTION

Portable forensic light kits are used by law enforcement to detect and analyze trace evidence found during crime scene investigations. Portable forensic light kits typically include at least one alternate light source (ALS), a barrier filter, a power source, and a carrying case. In June 2014, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted an operationally oriented assessment of portable forensic light kits. The purpose of this assessment was to obtain information on portable forensic light kits 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 emergency responders with experience using portable forensic light kits.

1.1 Evaluator Information

Five emergency responders from various jurisdictions and with at least 6 years of experience using portable forensic light kits 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	State
Law Enforcement, Crime Scene Unit/Forensic Services Division	20+	NC
Fire Enforcement, Training Division	20+	TN
Law Enforcement, Criminalistics Unit	11-15	OH
Law Enforcement, Field Forensic Unit	11-15	VA
Law Enforcement, Crime Scene Response Team	6-10	WA

1.2 Assessment Products

Nine products were selected 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.

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Table 1-2. Product Selection Criteria

Product Selection Criteria	Description
Multiple Wavelengths	Selection between multiple wavelengths using different filters or different lights
Included Wavelengths	At a minimum, blue and ultraviolet (UV) wavelengths
Power	Battery powered with a minimum runtime of 2 hours
Replaceable Battery	Battery is user replaceable
Decontamination	Can be decontaminated with a 10 percent bleach solution, decontamination wipes, or equivalent without damaging the unit
Included Goggles	Compatible with wavelengths in the kit
Included Warranty	1 year
Portability	Carrying case or handle (if self-contained)

Due to insufficient data being available from the vendors, decontamination was not taken into consideration when selecting assessment products. The products selected for assessment met all remaining product selection criteria except for the Polilight-Flare Plus2 Power Blue Kit (A-FL2KITPB), which featured blue and cyan wavelengths only. A Polilight-Flare Plus2 kit with a UV light was not available at the time of the assessment. Table 1-3 presents the demonstration kits that were provided for assessment by the vendors.

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Table 1-3. Assessed Products

Vendor	Product	Product Image
Arrowhead Forensics	Reveal Forensic Field Light Kit (A-FS7)	
CAO Group Inc.	UltraLite ALS Ultra Turbo Kit (200-00106)	
Foster & Freeman USA	Complete Crime-lite 2 Kit (QCL2/8KIT/P)	
Labino	Nova Torch LED (A-L1102)[1]	
Lumatec	Superlite M (A-3930L)[1]	
Rofin Forensics	Polilight-Flare Plus2 Power Blue Kit (A-FL2KITPB)[1]	
Sirchie Finger Print Laboratories	megaMAXX ALS System (MMX300)	
Spectronics Corporation	Spectroline Maxima (MFK-3500S)	
Tritech Forensics	Hammerhead Forensic Light Kit - 4+1 (CK-UVH4)	

Notes:
All product images are courtesy of the respective vendors.
[1]Model number is specific to Arrowhead Forensics, a U.S. distributor.

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2. EVALUATION CRITERIA

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

- **Affordability** groups criteria related to the total cost of ownership over the life of the product. This includes purchase price, training costs, warranty costs, recurring costs, and maintenance costs;
- **Capability** groups criteria related to product features or functions needed to perform one or more responder relevant tasks;
- **Deployability** groups criteria related to preparing to use the product, including transport, setup, training, and operational/deployment restrictions;
- **Maintainability** groups criteria related to the routine maintenance and minor repairs performed by responders, as well as included warranty terms, duration, and coverage; and
- **Usability** groups criteria related to ergonomics and the relative ease of use when performing one or more responder relevant tasks.

The focus group of emergency responders met in November 2013 and identified 18 evaluation criteria within four SAVER categories: Capability, Deployability, Maintainability, and Usability. 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. The focus group discussed the Affordability category but did not identify any evaluation criteria for that category.

Products were assessed against 12 evaluation criteria. The Maintainability category was not assessed due to a lack of vendor-provided information and assessment of demonstration kits in differing conditions. As a result, the Maintainability category weight of 22 percent was distributed to the other categories relative to their original weights of 30, 25, and 23 percent for Capability, Deployability, and Usability respectively. Barrier Filter Quality and Goggle Comfort were not assessed for the megaMAXX ALS System and Nova Torch LED because the goggles that are typically part of the kits were not included in the demonstration kits provided by the vendors. 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 the evaluation criteria definitions.

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Table 2-1. Evaluation Criteria

SAVER CATEGORIES			
Capability	**Deployability**	**Usability**	**Maintainability**
Overall Weight 38%	Overall Weight 32%	Overall Weight 30%	Overall Weight 0%
Evaluation Criteria			
Sensitivity and Specificity Weight: 5	**Battery Runtime** Weight: 5	**Ease of Use** Weight: 4	**Durability** Not Assessed
Versatility Weight: 4	**Portability** Weight: 4	**Goggle Comfort** Weight: 2	**Decontamination** Not Assessed
Intensity Weight: 4	**Power** Weight: 3	**Heat Emission** Weight: 2	**Routine Maintenance** Not Assessed
Barrier Filter Quality Weight: 2	**User Manual** Weight: 2		**Technical Support** Not Assessed
Beam Spread Weight: 2			**Warranty** Not Assessed
			Supporting Documents Not Assessed

3. ASSESSMENT METHODOLOGY

The products were assessed over four 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.

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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 products were assessed in three scenarios: (1) setup scenario, (2) controlled scenario, and (3) crime scene scenario. Evaluators used the products one at a time and completed the assessment worksheets for each product before assessing the next product. Evaluators wore nitrile gloves during the controlled and crime scene scenarios.

3.2.1 Setup Scenario

During the setup scenario, evaluators reviewed the included reference material to become familiar with each kit and determine if a guide that highlights which wavelengths to use for different target samples was included. Next, evaluators removed and replaced the batteries to assess the ease of battery replacement (Figure 3-1).

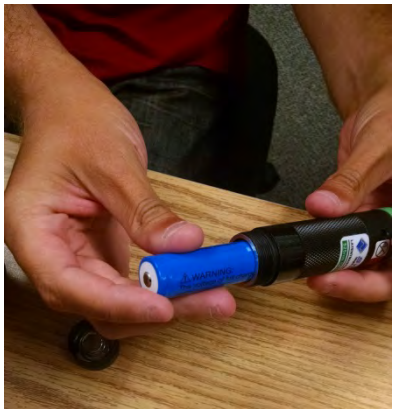

Figure 3-1. Battery Replacement

3.2.2 Controlled Scenario

During the controlled scenario, evaluators used the ALSs in each portable forensic light kit to view a variety of target samples on different substrates in a dark classroom. Six locations, five with target samples and one with a beam spread chart, were setup in the classroom for evaluators to rotate between with only one evaluator at each location. The target samples were on five different tables as follows:

1. Undiluted, 50 percent dilution, and 10 percent dilution samples of blood, semen, and saliva on nine dark red substrates (Figure 3-2). Evaluators used the blue or UV light at this table;
2. Undiluted blood, semen, and saliva samples on five different substrates (Figure 3-3). Evaluators used the blue light at this table;
3. Gunshot residue on nine different substrates (Figure 3-4). Evaluators used the blue light at this table;
4. Hair and bone samples (Figure 3-5). Hair samples consisted of brunette and blonde hair, each on three different substrates. Bone samples consisted of two bone mixtures: crushed bone in dirt and crushed bone in pebbles. Evaluators used the blue light at this table; and
5. Fingerprints with fluorescent dye and fluorescent powder on a piece of cardboard, soda bottle, and to-go cup (Figure 3-6). Evaluators used the blue light at this table.

When viewing the target samples, evaluators took notes regarding the visibility of the samples as well as the intensity of the ALS and whether the intensity was adjustable. Evaluators used the beam spread chart (Figure 3-7) to assess Beam Spread by holding the ALS approximately 6 inches away from the chart and adjusting the beam spread, if possible.

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Figure 3-2. Undiluted and Diluted Samples on Same Substrate

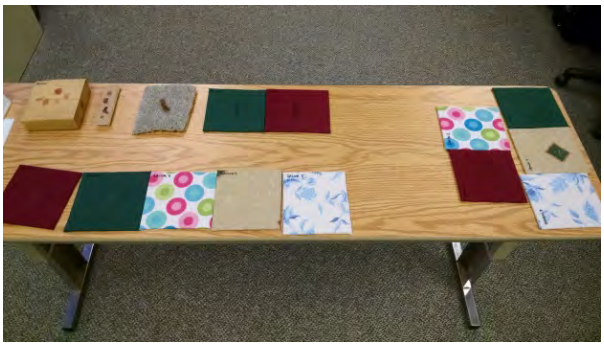

Figure 3-3. Undiluted Samples on Five Different Substrates

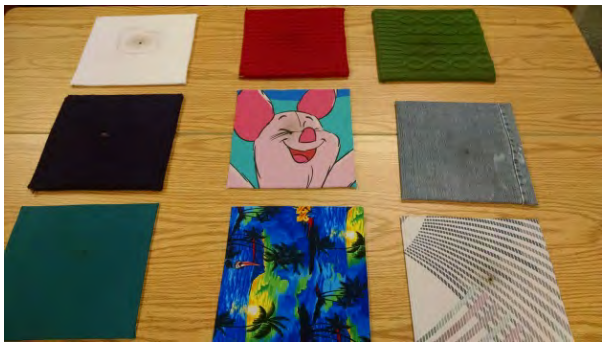

Figure 3-4. Gunshot Residue on Nine Different Substrates

Figure 3-5. Hair on Different Substrates (Left); Bone Samples (Right)

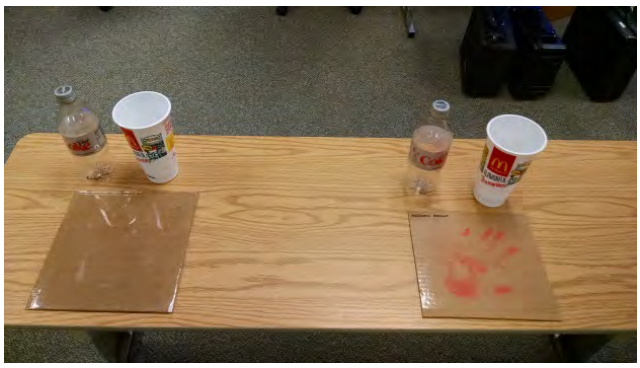

Figure 3-6. Fingerprints with Fluorescent Dye (Left) and Powder (Right) on Different Objects

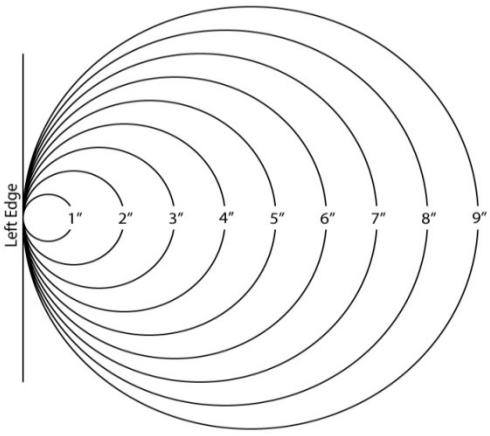

Figure 3-7. Beam Spread Chart

Each evaluator was assigned a portable forensic light kit, and evaluators rotated between all six locations using one kit at a time before providing comments and ratings for Intensity, Sensitivity and Specificity, Beam Spread, Ease of Use, Barrier Filter Quality, and Goggle Comfort. This scenario was repeated until all evaluators assessed all of the kits.

3.2.3 Crime Scene Scenario

During the crime scene scenario, a variety of target samples were placed in a mock apartment consisting of three adjoining rooms with different lighting conditions: (1) all lights on, (2) dimly lit with light entering through an adjoining room, and (3) blacked out with the window covered.

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Five target samples were used in each room for this scenario and included samples similar to those used in the controlled scenario, such as hair, fingerprints, gunshot residue, and semen. Each evaluator was assigned a kit, and only one evaluator at a time was in each room. Evaluators had 5 minutes to unpack the kit, view the target samples placed throughout the room, and repack the kit before moving to the next room. Evaluators were permitted to use any of the wavelengths provided in the kit. Each evaluator used the same kit in all three rooms before providing comments and ratings for Intensity, Ease of Use, Heat Emission, Portability, and Goggle Comfort. This part of the scenario was repeated until all evaluators assessed all of the kits in all three rooms. Images of this scenario are provided in Figure 3-8 through Figure 3-11.

Figure 3-8. Fingerprints on Headboard in Fully Lit Room

Figure 3-9. Semen on Bed Sheets in Fully Lit Room

Figure 3-10. Hair on Upholstery in Dimly Lit Room

Figure 3-11. Fluorescent Powder on Handprint in Dimly Lit Room

Lastly, evaluators provided comments and a rating for the User Manual based on their experience using the manual throughout the assessment.

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;

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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 portable forensic light kits 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 2.7 to 4.1. Table 4-1 presents the overall assessment score and category scores for each product. 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.

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Table 4-1. Assessment Results

Product	Overall Score	Overall	Capability	Deployability	Usability
Foster & Freeman USA Complete Crime-lite 2 Kit (QCL2/8KIT/P)		**4.1**	4.1	4.0	4.2
Tritech Forensics Hammerhead Forensic Light Kit - 4+1 (CK-UVH4)		**4.1**	4.0	4.2	4.1
Rofin Forensics Polilight-Flare Plus2 Power Blue Kit (A-FL2KITPB)[1]		**3.9**	4.0	4.0	3.6
Sirchie Finger Print Laboratories megaMAXX ALS System (MMX300)		**3.7**	3.4	3.9	4.1
Arrowhead Forensics Reveal Forensic Field Light Kit (A-FS7)		**3.7**	4.0	3.5	3.6
Lumatec Superlite M (A-3930L)[1]		**3.7**	3.9	3.3	3.7
Labino Nova Torch LED (A-L1102)[1]		**3.6**	3.4	3.6	3.8
CAO Group Inc. UltraLite ALS Ultra Turbo Kit (200-00106)		**3.5**	3.7	3.6	3.2
Spectronics Corporation Spectroline Maxima (MFK-3500S)		**2.7**	3.0	2.9	2.1
	0 1 2 3 4 5 Lower Higher				

[1]Model number is specific to Arrowhead Forensics, a U.S. distributor.

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 definitions. Table 4-3 presents vendor-provided key specifications for the assessed products.

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Table 4-2. Criteria Ratings

KEY: Lowest Rating → Highest Rating										
Category	**Evaluation Criteria**	**Complete Crime-lite 2 Kit**	**Hammer-head Forensic Light Kit - 4+1**	**Polilight-Flare Plus2 Power Blue Kit**	**megaMAXX ALS System**	**Reveal Forensic Field Light Kit**	**Superlite M**	**Nova Torch LED**	**UltraLite ALS Ultra Turbo Kit**	**Spectroline Maxima MFK-3500S**
Capability	Sensitivity and Specificity	◕	◕	●	◑	◕	◕	◑	◕	◑
	Versatility	●	◕	◑	◕	◕	◑	◕	◕	◕
	Intensity	◕	◕	●	◑	◕	◕	◑	◕	◔
	Barrier Filter Quality	◕	◕	◕	Not Assessed[1]	◕	◕	Not Assessed[1]	◕	◕
	Beam Spread	◕	◕	◕	◑	◕	◕	◑	●	◔
Deployability	Battery Runtime	◕	●	●	◕	◕	◑	◕	◑	◑
	Portability	◕	◕	◕	◕	◕	◕	◕	◕	○
	Power	◕	◑	◑	◑	◑	◑	◑	◕	◑
	User Manual	●	◕	◕	◕	◑	◑	◕	◕	◑
Usability	Ease of Use	◕	◕	◑	◕	◕	◕	◕	◑	◔
	Goggle Comfort	●	◑	●	Not Assessed[1]	◑	◑	Not Assessed[1]	◑	◑
	Heat Emission	◕	◕	◑	◕	◕	◕	◕	◕	◔

Notes:
All product images are courtesy of the respective vendors.
[1]The goggles that are typically included with purchase for the megaMAXX ALS System and Nova Torch LED were not included in the demonstration kits borrowed from the vendor.

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Table 4-3. Key Specifications

Key Specification	Complete Crime-lite 2 Kit	Hammer-head Forensic Light Kit - 4+1	Polilight-Flare Plus2 Power Blue Kit	megaMAXX ALS System	Reveal Forensic Field Light Kit	Superlite M	Nova Torch LED	UltraLite ALS Ultra Turbo Kit	Spectroline Maxima MFK-3500S
MSRP	$7,577	$2,148	$4,120	$1,195	$2,300	$4,750	$2,724	$5,600	$5,738
Warranty Duration	1 year	2 years	1 year	90 days	1 year	1 year	1 year	1 year	1 year[1] (housing)
Dimensions (inches)	ALS: 9 x 1.8 Kit: 19x14x8	ALS: 6.6x2.2x1.5 Kit: 19.8x15.5x5.4	ALS: 10.8 long Kit: 24x12x6	ALS: 5.3x0.8 Kit: 18x15.5x5.5	ALS: 4.4x1 Kit: 16x6x6	ALS: 9.5 long Kit: 14x6x4	ALS: 6.3 long Kit: 12x6x3	ALS: 6x4.5x1.3 Kit: 15.6x18.4x5	ALS: 15x6 Kit: 21x14x10
Weight (pounds)	ALS: 1.1 Kit: 28	ALS: 0.5 Kit: 10	ALS: 1.9 Kit: 5	ALS: 0.2 Kit: 10.4	ALS: 0.3 Kit: 9	ALS: 1.1 Kit: 10	ALS: 0.4 Kit: 7	ALS: 0.7 Kit: 9.2	ALS: 12.3 Kit: 29
Number of ALSs	8	5	2	8	6	1	8	1	1
Wavelengths (nm)	White 365 (UV) 410 (Violet) 445 (Blue) 480 (Cyan) 530 (Green) 590 (Orange) 640 (Red)	White 395 (UV) 470 (Blue) 495 (Cyan) 525 (Green)[2]	450 (Blue) 505 (Cyan)	White 395 (UV) 455, 470 (Blue) 505 (Cyan) 530 (Green) 590 (Orange) 625 (Red)	White 365 (UV) 455 (Blue) 525 (Green) 625 (Red) 850 (IR)	White 365 (UV) 405 (Violet) 455 (Blue)	White 365 (UV) 400 (Purple) 455 (Blue) 505 (Cyan) 530 (Green) 590 (Amber) 625 (Red)	White 400 (UV) 450 (Blue) 525 (Green) 590 (Yellow) 630 (Red)	Five inter-changeable barrier filters: 365 (UV) 450 (Blue) 500 (Cyan) 525 (Green) 600 (Clear)
Bulb Type	LED	LED	LED	LED	LED	LED	LED	LED	Micro Discharge Lamp
Battery Type and Size	1 user-replaceable 7.2V NiMH	3 user-replaceable CR123 or 1 non user-replaceable Li-ion[3]	1 non user-replaceable 12V Li-ion	2 user-replaceable CR123 or 3 user-replaceable AAA[4]	1 user-replaceable 3.7V Li-ion	1 user-replaceable 12V Li-ion	1 user-replaceable 3.7V Li-ion	1 user-replaceable 12V Li-ion	1 user-replaceable 12V lead acid

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Key Specification	Complete Crime-lite 2 Kit	Hammer-head Forensic Light Kit - 4+1	Polilight-Flare Plus2 Power Blue Kit	megaMAXX ALS System	Reveal Forensic Field Light Kit	Superlite M	Nova Torch LED	UltraLite ALS Ultra Turbo Kit	Spectroline Maxima MFK-3500S
Battery Runtime (hours)	2 to 4 (varies with mode)	2 to 8 (varies with mode)	5	3	3	2.5	3	1	2
AC Power Option	✓		✓			✓	✓	✓	✓
Low-Battery Indicator	✓		✓		✓	✓		✓	
Goggles and Other Barrier Filters	Pale yellow, yellow, orange, and red goggles and glass camera filters. Clear UV safety goggles. Blue, green, and red contrast filters for use with white light.	Yellow, orange, and red goggles	Yellow, orange, and red goggles	Clear UV safety, yellow, orange, and red goggles	Clear UV safety, yellow, orange, and red goggles	Three pairs of orange goggles and one pair of clear UV safety goggles	Clear UV safety, yellow, orange, and red goggles	Yellow, orange, and red goggles	Clear UV safety, yellow, orange, and red goggles
Operating Temperature	32° to 86°F	-22° to 122°F	30° to 90°F	Information not provided	30° to 90°F	30° to 90°F	30° to 90°F	-22° to 104°F	41° to 104°F
Storage Temperature	-4° to 104°F	-22° to 122°F	30° to 90°F	Information not provided	30° to 90°F	30° to 90°F	30° to 90°F	-22° to 104°F	41° to 104°F

Notes:
✓—product is equipped with corresponding feature
ALS—alternate light source
nm—nanometers
[1]The bulb, battery, and filters are covered for 30 days.
[2]As assessed; an 850nm IR light is also available and can be selected at time of purchase in place of one of the other forensic lights.
[3]The white ALS requires 1 Li-ion battery; all others require 3 CR123 batteries.
[4]The UV ALS requires 3 AAA batteries; all others require 2 CR123 batteries.

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4.1 Foster & Freeman USA Complete Crime-lite 2 Kit (QCL2/8KIT/P)

The Complete Crime-lite 2 Kit (Figure 4-1 and Figure 4-2) received an overall assessment score of 4.1 and costs $7,577. Eight flashlight-style ALSs of different wavelengths with batteries; clear UV safety, pale yellow, yellow, orange, and red goggles; pale yellow, yellow, orange, and red glass camera filters with a filter pouch; blue, green, and red contrast filters for use with the white light; three spare batteries; an AC charger; an AC power adapter; a magnifier attachment; a hard-sided carrying case; a user manual; and a 1-year warranty are included with purchase.

Figure 4-1. Complete Crime-lite 2 Kit

Photo courtesy of Foster & Freeman USA

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

Capability

The Complete Crime-lite 2 Kit received a Capability score of 4.1. The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario; however, it was sometimes difficult to see body fluids and gunshot residue on red substrates;
- The versatility of the kit exceeded expectations due to the wavelength, goggle, and camera filter options included in the kit;
- Even though intensity was not adjustable, the ALSs were bright enough to view target samples in all lighting conditions;
- The barrier filter goggles included with the kit (Figure 4-3) met expectations and positively affected the visibility of the target samples because they fit to the form of the face and prevented stray light from entering the eyes; and
- The beam was focused and uniform; there was no hot spot. The beam spread was not adjustable and measured approximately 4 inches in diameter when the ALS was held 6 inches away from the beam spread chart.

Figure 4-2. Complete Crime-lite 2 Kit ALS

Photo courtesy of Foster & Freeman USA

Figure 4-3. Complete Crime-lite Kit 2 Goggles

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Deployability

The Complete Crime-lite 2 Kit received a Deployability score of 4.0. The following information is based on evaluator comments:

- The kit was moderate in weight and size, which is expected with the number of components included in the kit. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- Changing the battery was easy and only required the user to unscrew the battery cap from the end of the ALS and remove and replace the battery. The ALSs met expectations for power because they featured low-battery indicators and could run on AC power; and
- The user manual contained very comprehensive operational information and a quick-reference guide for determining which wavelength to use based on the application.

Usability

The Complete Crime-lite 2 Kit received a Usability score of 4.2. The following information is based on evaluator comments:

- The ALSs were about the size and weight of an average flashlight, making them easy to hold and use with one hand. It was simple to change the wavelength by selecting another ALS in the kit. The on/off switch located on the side of the barrel near the light head was easily accessible and easy to activate, even when wearing gloves;
- The included goggles (Figure 4-3) were more comfortable than standard plastic goggles because they were formed to fit the face; and
- The ALSs remained cool during operation.

4.2 Tritech Forensics Hammerhead Forensic Light Kit – 4+1 (CK-UVH4)

The Hammerhead Forensic Light Kit – 4+1 (Figure 4-4 and Figure 4-5) received an overall assessment score of 4.1 and costs $2,148. Four flashlight-style ALSs of different wavelengths with batteries; yellow, orange, and red goggles; a rechargeable standing inspection white light with AC power adapter; a hard-sided case; a user manual; and a 2-year warranty are included with purchase.

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

Figure 4-4. Hammerhead Forensic Light Kit – 4+1

Photo courtesy of Tritech Forensics

Figure 4-5. Hammerhead Forensic Light Kit – 4+1 ALS

Photo courtesy of Tritech Forensics

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Capability

The Hammerhead Forensic Light Kit – 4+1 received a Capability score of 4.0. The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario; however, it was sometimes difficult to see body fluids and gunshot residue on red substrates;
- The wavelength and goggle options included in the kit met expectations for versatility. An option to select an IR wavelength in the kit exceeded some expectations; however, camera filters should also be included;
- The ALSs had two levels of intensity. Overall, they were bright enough to identify target samples in dimly lit or dark environments, which met expectations for typical use;
- The barrier filter goggles included with the kit met expectations. They were standard plastic goggles that did not hinder the visibility of target samples; and
- The beam spread was adjustable. The diffused beam had a hot spot 4 to 8 inches in diameter, depending on the brightness setting, when held 6 inches away from the beam spread chart. The diffused part of the beam had a diameter of 18 to 24 inches.

Deployability

The Hammerhead Forensic Light Kit – 4+1 received a Deployability score of 4.2. The following information is based on evaluator comments:

- The kit was lightweight and compact. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- Changing the batteries was easy and only required the user to unscrew the battery cap from the end of the ALS and remove and replace the batteries. This kit is not equipped to run on AC power, except for the standing inspection white light. Also, the ALSs did not have low-battery indicators; and
- The user manual was easy to follow and included a quick-reference guide as well as a chart that recommends which wavelength and goggles to use based on the target sample being viewed.

Usability

The Hammerhead Forensic Light Kit – 4+1 received a Usability score of 4.1. The following information is based on evaluator comments:

- The ALSs were compact and lightweight, and featured hand straps and ridges, making them easy to hold and use with one hand. It was simple to change the wavelength by selecting another ALS in the kit. The on/off switch on the rear of the handle was easily accessible and easy to activate, even when wearing gloves; and
- The ALSs remained cool during operation, even on high power.

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4.3 Rofin Forensics Polilight-Flare® Plus2 Power Blue Kit (A-FL2KITPB)

The Polilight-Flare Plus2 Power Blue Kit (Figure 4-6 and Figure 4-7) received an overall assessment score of 3.9 and costs $4,120. Two flashlight-style ALSs of different wavelengths with batteries; yellow, orange, and red upgraded goggles; beam-shaping filters to modify the beam spread; an AC power adapter; a charging dock; a DC power adapter; a hard-sided carrying case; a user manual; and a 1-year warranty are included with purchase.

Figure 4-6. Polilight-Flare Plus2 Power Blue Kit

Photo courtesy of Arrowhead Forensics

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

Capability

The Polilight-Flare Plus2 Power Blue Kit received a Capability score of 4.0. The following information is based on evaluator comments:

Figure 4-7. Polilight-Flare Plus2 Power Blue Kit ALS

Photo courtesy of Arrowhead Forensics

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario. The contrast of the illuminated target samples on the dark substrates exceeded expectations;
- The kit included two frequently used wavelength options; however, other commonly used wavelength options (e.g., UV, red) were not included. The goggle options included in the kit met expectations; although, camera filters should also be included;
- The intensity of the ALSs was adjustable. The ALSs were extremely bright and enabled viewing of target samples in all lighting conditions;
- The barrier filter goggles provided with the kit (Figure 4-8) were an upgrade ($40 each) from the standard plastic goggles typically included in the kit. The goggles met expectations and positively affected the visibility of the target samples because they fit to the form of the face and prevented stray light from entering the eyes; and
- The beam had a very small hotspot. The beam spread was not adjustable and measured approximately 4 inches in diameter when the ALS was held 6 inches away from the beam spread chart.

Figure 4-8. Polilight-Flare Plus2 Power Blue Kit Upgraded Goggles

Photo courtesy of Arrowhead Forensics

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Deployability

The Polilight-Flare Plus2 Power Blue Kit received a Deployability score of 4.0. The following information is based on evaluator comments:

- The kit was lightweight and compact, which was expected considering that only two ALSs were included in the kit. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- The battery is not user replaceable, which is not preferred since a user would have to run it on AC power or recharge the ALS before it could be used again. The ALSs featured low-battery indicators, which met expectations; and
- Although a quick-reference guide was not included, the user manual was easy to follow and included a chart that recommended which wavelength and goggles to use based on the target sample being viewed.

Usability

The Polilight-Flare Plus2 Power Blue Kit received a Usability score of 3.6. The following information is based on evaluator comments:

- The ALSs were somewhat large and heavier than expected. They could be held with one hand, but two hands were required for operation (e.g., turn it on/off, adjust the brightness) since the knob around the barrel had to be twisted to activate it and/or adjust the brightness. It was simple to change the wavelength by selecting the other ALS in the kit. On occasion, the strobe was accidentally activated when attempting to power the ALS on or off. Gloves did not affect the ease of use;
- The upgraded goggles (Figure 4-8) were more comfortable than standard plastic goggles because they were formed to fit the face; and
- Heat was emitted from the ALSs during operation, which did not meet expectations.

4.4 Sirchie Finger Print Laboratories megaMAXX ALS System (MMX300)

The megaMAXX ALS System (Figure 4-9) received an overall assessment score of 3.7 and costs $1,195. Eight flashlight-style ALSs of different wavelengths; clear UV safety, yellow, orange, and red goggles; three AAA batteries (for UV light); 14 CR123 batteries; a light diffuser for photography; a tripod; a hard-sided case; a user manual; and a 90-day warranty are included with purchase.

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

Figure 4-9. megaMAXX ALS System

Photo courtesy of Sirchie Finger Print Laboratories

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Capability

The megaMAXX ALS System received a Capability score of 3.4. The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of some target samples in the controlled scenario. While visibility of fingerprint powder was good, other target samples were difficult to see, especially on substrates darker in color;
- The wavelength and goggle options included in the kit met expectations for versatility; however, camera filters should also be included;
- The intensity of the ALSs was not adjustable or very bright. The ALSs performed best in dark rooms. A brighter beam with adjustable intensity was preferred; and
- The beam spread was not adjustable and measured approximately 3 inches in diameter when the ALS was held 6 inches away from the beam spread chart; however, the lack of brightness made it very difficult to see the diffused area of the beam of light on the chart when wearing goggles, so only a small portion of the light was usable.

Deployability

The megaMAXX ALS System received a Deployability score of 3.9. The following information is based on evaluator comments:

- The kit was lightweight and compact. The hard-sided carrying case appeared somewhat durable and featured foam cutouts for organizing all kit components;
- Changing the batteries was easy and only required the user to unscrew the battery cap from the end of the ALS and remove and replace the batteries. This kit is not equipped to run on AC power, and the ALSs did not have low-battery indicators; and
- Although a quick-reference guide was not included, the user manual was easy to follow and included a comprehensive chart that recommended which wavelength and goggles to use based on the sample being viewed.

Usability

The megaMAXX ALS System received a Usability score of 4.1. The following information is based on evaluator comments:

- The ALSs were pocket sized and lightweight, making them easy to hold and use with one hand. It was simple to change the wavelength by selecting another ALS in the kit. The on/off switch on the handle near the light head was easily accessible and easy to activate, even when wearing gloves; and
- The ALSs remained cool during operation.

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4.5 Arrowhead Forensics Reveal Forensic Field Light Kit (A-FS7)

The Reveal Forensic Field Light Kit (Figure 4-10) received an overall assessment score of 3.7 and costs $2,300. Six flashlight-style ALSs of different wavelengths with batteries; clear UV safety, yellow, orange, and red goggles; two AC chargers; a DC charger; a hard-sided case; a user manual; and a 1-year warranty are included with purchase.

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

Figure 4-10. Reveal Forensic Field Light Kit

Photo courtesy of Arrowhead Forensics

Capability

The Reveal Forensic Field Light Kit received a Capability score of 4.0. The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario. The contrast of the illuminated target samples on dark backgrounds exceeded the expectations of some evaluators;
- The wavelength and goggle options included in the kit met expectations for versatility. An IR ALS is included in the kit, which exceeded the expectations of some evaluators; however, camera filters should also be included;
- Even though intensity was not adjustable, the ALSs were bright enough to view target samples in all lighting conditions, although it was sometimes difficult to see samples in well-lit rooms;
- The barrier filter goggles included with the kit met expectations. They were standard plastic goggles that did not hinder the visibility of target samples; and
- Although the beam spread was not adjustable, it met expectations. The diffused beam had a hot spot 2 to 4 inches in diameter when held 6 inches away from the beam spread chart. The diffused part of the beam had a diameter of approximately 9 inches.

Deployability

The Reveal Forensic Field Light Kit received a Deployability score of 3.5. The following information is based on evaluator comments:

- The kit was lightweight and compact. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- Changing the battery was easy and only required the user to unscrew the battery cap from the end of the ALS and remove and replace the battery. However, a small metal disc/washer in the battery compartment fell out during battery replacement and it could be easily lost. The ALSs featured low-battery indicators, but this kit is not equipped to run on AC power; and

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- The user manual contained a lot of detail on the general process of using ALSs but was not very specific to the kit. A more product-specific manual with a quick-reference guide is preferred.

Usability

The Reveal Forensic Field Light Kit received a Usability score of 3.6. The following information is based on evaluator comments:

- The ALSs were pocket sized and lightweight, making them easy to hold and use with one hand. It was simple to change the wavelength by selecting another ALS in the kit. The on/off switch on the handle near the light head was easily accessible and easy to activate, even when wearing gloves, although the button was small and difficult to locate at times; and
- Overall, the ALSs remained cool during operation, with only minimal heat noticed after extended use.

4.6 Lumatec Superlite M (A-3930L)

The Superlite M (Figure 4-11) received an overall assessment score of 3.7 and costs $4,750. One flashlight-style ALS with two batteries; four interchangeable wavelength heads; clear UV safety and orange goggles; an AC charger; an AC power adapter; a DC charger/power adapter; a hard-sided carrying case; a user manual; and a 1-year warranty are included with purchase.

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

Figure 4-11. Superlite M

Photo courtesy of Arrowhead Forensics

Capability

The Superlite M received a Capability score of 3.9.
The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario. The contrast of the hair samples on carpet exceeded the expectations of some evaluators;
- This kit includes four commonly used wavelengths; however, other commonly used wavelength options (e.g., green, red) were not included. The goggle options included in the kit met expectations; although, camera filters should also be included;
- The ALS had three levels of intensity. It was bright enough to view target samples in all lighting conditions, although it was sometimes difficult to see samples in well-lit rooms;
- The barrier filter goggles included with the kit met expectations. They were standard plastic goggles that did not hinder the visibility of target samples; and

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- The beam was focused and uniform; there was no hot spot. The beam spread had great adjustability and measured 2 to 4 inches in diameter when the ALS was held 6 inches away from the beam spread chart.

Deployability

The Superlite M received a Deployability score of 3.3. The following information is based on evaluator comments:

- The kit was lightweight and compact. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- The proprietary battery pack was easy to change by pulling the battery pack apart from the light head, lining up the arrows on the side of the battery pack with the lines on the light head, and pushing them back together. The ALS met expectations for power because it featured a low-battery indicator and could run on AC power; and
- The user manual contained operational information in great detail, but the way the information was organized, made it difficult to quickly search through for specifics. In addition, it lacked a quick-reference guide and an ALS guide for recommended wavelengths based on the application.

Usability

The Superlite M received a Usability score of 3.7. The following information is based on evaluator comments:

- The size and weight of the ALS met expectations. The lightweight construction of the ALS felt comfortable and well balanced. Although the ALS could be held and easily activated with one hand, two hands were required to remove and replace the light head to change the wavelength. In addition, the placement of the on/off button near the end of the handle away from the light head made locating it difficult at times, especially in poor lighting conditions. Gloves did not affect the ease of use; and
- Overall, the ALS remained cool during operation, and it had a built-in fan to assist with cooling. Only minimal heat was noticed near the light head; the handle stayed cool.

4.7 Labino Nova Torch LED (A-L1102)

The Nova Torch LED (Figure 4-12) received an overall assessment score of 3.6 and costs $2,724. Eight flashlight-style ALSs of different wavelengths with batteries (Figure 4-13); clear UV safety, yellow, orange, and red goggles; two AC chargers; an AC power adapter; a DC charger; two spare batteries; a tripod; a hard-sided carrying case; a user manual; and a 1-year warranty are included with purchase.

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

Figure 4-12. Nova Torch LED

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Capability

The Nova Torch LED received a Capability score of 3.4. The following information is based on evaluator comments:

Figure 4-13. Nova Torch LED ALSs

- The sensitivity and specificity of the ALS permitted visibility of some target samples in the controlled scenario but only after holding the ALS very close to the samples. While visibility of bones and fingerprint powder was good, other target samples were difficult to see, especially on substrates darker in color;
- The wavelength and goggle options included in the kit met expectations for versatility; however, camera filters should also be included;
- The intensity of the ALSs was not adjustable or very bright, and the ALSs had to be held very close to the target samples. A brighter beam with adjustable intensity was preferred; and
- The beam was focused and uniform; there was no hot spot. The beam spread was not adjustable and measured approximately 3 inches in diameter when the ALS was held 6 inches away from the beam spread chart; however, the lack of brightness made it very difficult to see the beam of light on the chart.

Deployability

The Nova Torch LED received a Deployability score of 3.6. The following information is based on evaluator comments:

- The kit was compact but slightly heavy due to the number of components included in the kit, which is as expected. The hard-sided carrying case appeared durable and featured two-layers of foam cutouts for organizing all kit components. The top foam layer must be removed to access components on the bottom layer. If the top layer is placed on the ground after removal, it could be contaminated;
- Changing the battery was easy and only required the user to unscrew the battery cap from the end of the ALS and remove and replace the battery. The ALSs can be AC powered, which met expectations; however, they did not have low-battery indicators; and
- Although a quick-reference guide was not included, the user manual was easy to follow and included a section called “rookie” that highlighted goggles suggested for use with different wavelengths. It also included a laminated ALS guide that recommended which wavelength and goggles to use based on the application.

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Usability

The Nova Torch LED received a Usability score of 3.8. The following information is based on evaluator comments:

- The ALSs were pocket sized and lightweight, and featured hand straps, making them easy to hold and use with one hand. It was simple to change the wavelength by selecting another ALS in the kit. The on/off switch on the rear of the handle was easily accessible and easy to activate, even when wearing gloves; and
- The ALSs remained cool during operation.

4.8 CAO Group Inc. UltraLite ALS Ultra Turbo Kit (200-00106)

The UltraLite ALS Ultra Turbo Kit (Figure 4-14) received an overall assessment score of 3.5 and costs $5,600. One UltraLite handle; six interchangeable wavelength heads; yellow, orange, and red goggles; two batteries; an AC power adapter; an AC power adapter pack (replaces battery for AC or DC power use); a charging dock; a DC power adapter; a hard-sided case; a user manual; and a 1-year warranty are included with purchase.

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

Figure 4-14. UltraLite ALS Ultra Turbo Kit

Photo courtesy of Arrowhead Forensics

Capability

The UltraLite ALS Ultra Turbo Kit received a Capability score of 3.7. The following information is based on evaluator comments:

- The sensitivity and specificity of the ALS permitted visibility of most target samples in the controlled scenario; however, it was sometimes difficult to see body fluids on substrates darker in color;
- The wavelength and goggle options included in the kit met expectations for versatility; however, camera filters should also be included;
- The ALS had four levels of intensity. Overall, the two highest settings were bright enough to view target samples in all lighting conditions;
- The barrier filter goggles included with the kit met expectations. They were standard plastic goggles that did not hinder the visibility of target samples; and
- Although the beam spread was not adjustable, it exceeded expectations with a diameter of up to 9 inches on the highest brightness setting when the ALS was held 6 inches away from the beam spread chart.

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Deployability

The UltraLite ALS Ultra Turbo Kit received a Deployability score of 3.6. The following information is based on evaluator comments:

- The kit was lightweight and compact. The hard-sided carrying case appeared durable and featured foam cutouts for organizing all kit components;
- Changing the battery was easy and only required the user to press the release button to eject the battery and then snap it back into place (Figure 4-15). The ALS met expectations for power because it featured a low-battery indicator and could run on AC power; and
- The user manual was short, similar to a quick-reference guide, and provided a good overview of the device and its use. The ALS guide was in black-and-white, and a color ALS guide is preferred.

Figure 4-15. UltraLite ALS Battery Change

Usability

The UltraLite ALS Ultra Turbo Kit received a Usability score of 3.2. The following information is based on evaluator comments:

- The size and weight of the ALS met expectations, and the ALS was ergonomically shaped with a trigger activation button, making it easy to hold and turn on/off with one hand. It also featured visual indicators for intensity and on/off, as well as an audible beep for on/off. Changing wavelengths required two hands to unscrew the light head from the ALS and attach another light head with a different wavelength. This was difficult to do in the dark, and sometimes gloves would get pinched where the light head and the ALS connected. In addition, the buttons on the ALS were accidentally activated multiple times during the assessment due to their placement; and
- Overall, the ALS remained cool during operation, and it had a built-in fan to assist with cooling. Only minimal heat was noticed near the lamp.

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4.9 Spectronics Corporation Spectroline Maxima (MFK-3500S)

The Spectroline Maxima (Figure 4-16) received an overall assessment score of 2.7 and costs $5,738. One forensic spot beam lamp (Figure 4-17); five interchangeable barrier filters; a 12V lead acid battery; an AC charger; an AC power adapter; a DC power adapter; clear UV safety, yellow, orange, and red goggles; a hard-sided case for the forensic lamp; a soft carrying case for the filters and goggles; a user manual; a 1-year housing warranty; and 30-day bulb, battery, and filter warranty are included with purchase.

Figure 4-16. Spectroline Maxima

Photo courtesy of Spectronics Corporation

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

Capability

The Spectroline Maxima received a Capability score of 3.0. The following information is based on evaluator comments:

Figure 4-17. Spectroline Maxima ALS

- The sensitivity and specificity of the ALS permitted visibility of some target samples in the controlled scenario. Samples on substrates lighter in color had good contrast; however, most samples on darker substrates were difficult to see;
- The wavelength and goggle options included in the kit met expectations for versatility; however, camera filters should also be included;
- The intensity of the ALS was not adjustable or very bright. A brighter beam with adjustable intensity was preferred;
- The barrier filter goggles included with the kit met expectations. They were standard plastic goggles that did not hinder the visibility of target samples. The barrier filters used to change the wavelength were made of glass and appeared durable; and
- The beam was very diffused (approximately 24 inches in diameter) and not adjustable. It featured only a small usable hot spot that measured approximately 3 to 4 inches in diameter in poorly lit conditions and 1 inch in diameter in the well-lit room.

Deployability

The Spectroline Maxima received a Deployability score of 2.9. The following information is based on evaluator comments:

- The kit consisted of two carrying cases: a hard-sided case and a soft-sided case, which made carrying the kit from room to room inconvenient. The hard-sided case was

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heavy and appeared to be durable. It featured foam cutouts for the ALS and power source; however, the ALS and power source only fit in the case one way and required the power source to be disconnected from the ALS. The soft-sided case stored the goggles and interchangeable barrier filters in an organized manner but could not be decontaminated. It was lightweight and featured a shoulder strap;

- Changing the battery required detaching and reattaching three cables, which was confusing. The ALS can be AC powered, which met expectations; however, it did not have a low-battery indicator; and
- The user manual contained detailed operational information; however, it lacked an ALS guide for recommended wavelengths based on the application as well as a quick-reference guide.

Usability

The Spectroline Maxima received a Usability score of 2.1. The following information is based on evaluator comments:

- The ALS is very large and heavy with cords running between the ALS and separate power source. The battery pack featured a carrying strap, but it was still awkward to carry both the battery pack and ALS. Two controls had to be activated to turn it on, and they were both located on the battery pack instead of on the ALS (Figure 4-18). While the ALS could be activated with one hand, two hands are really required for use due to the size and weight of the battery pack and ALS. Gloves did not affect the ease of use; and

Figure 4-18. Power Buttons on Battery Pack of Spectroline Maxima

- The ALS became very warm during operation, and the lens became hot enough that an injury could occur if the lens was accidentally touched. The user manual warned users not to touch the lens during operation.

5. SUMMARY

Based on evaluator feedback, the portability of a forensic light kit is important; therefore, compact and lightweight kits are preferred for field use. In addition, the ALSs should be lightweight and durable. Backup power options (e.g., an AC power option) were preferred by all evaluators. The advantages and disadvantages for the assessed products are highlighted in Table 5-1.

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Table 5-1. Product Advantages and Disadvantages

Vendor/Products	Advantages	Disadvantages
 Foster & Freeman USA Complete Crime-lite2 Kit (QCL2/8KIT/P) MSRP: $7,577 Overall Score: 4.1	• ALSs had sturdy construction • ALSs had flat edges to prevent rolling when set down • Kit included a variety of accessories (e.g., camera filters) • AC power option • Uniform beam of light • Goggles conformed to the shape of the face, blocked out ambient light, and were comfortable	• The ALSs and kit were moderately heavy
 Tritech Forensics Hammerhead Forensic Light Kit - 4+1 (CK-UVH4) MSRP: $2,148 Overall Score: 4.1	• ALSs were well constructed with ridges to enhance grip • ALSs had flat edges to prevent rolling when set down • ALSs appeared extremely durable • Kit was lightweight and resilient • ALSs remained cool even on high power • Customizable kit; an IR ALS was an option • Non-proprietary batteries	• The beam of light was somewhat diffused
 Rofin Forensics Polilight-Flare Plus2 Power Blue Kit (A-FL2KITPB)[1] MSRP: $4,120 Overall Score: 3.9	• ALSs produced an extremely bright light • Good adjustable intensity • AC power option • Upgraded goggles conformed to the shape of the face, blocked out ambient light, and were comfortable • Activation used a knob around the barrel, which is more durable than an on/off button • Housing appeared rugged	• ALS activation was not intuitive and required two hands • The ALSs were heavier than expected • Must be docked to be recharged

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Vendor/Products	Advantages	Disadvantages
 Sirchie Finger Print Laboratories megaMAXX ALS System (MMX300) MSRP: $1,195 Overall Score: 3.7	• Good portability; pocket-sized ALSs • Tripod included • Non-proprietary batteries	• The battery carousel top broke during the assessment; questionable durability • Light not bright enough • Only a small area of the light (i.e., the hotspot) was usable
 Arrowhead Forensics Reveal Forensic Field Light Kit (A-FS7) MSRP: $2,300 Overall Score: 3.7	• IR ALS included • Good portability; pocket-sized ALSs	• Disc in battery compartment fell out during battery replacement • IR ALS had no power indicator; could not tell when it was turned on
 Lumatec Superlite M (A-3930L)[1] MSRP: $4,750 Overall Score: 3.7	• Adjustable, uniform beam of light • Lightweight construction felt comfortable and well balanced • AC power option • Internal fan to cool electrical components	• On/Off button is in an awkward location near the end of the handle
 Labino Nova Torch LED (A-L1102)[1] MSRP: $2,724 Overall Score: 3.6	• Good portability; pocket-sized ALSs • Uniform beam of light • On/Off button recessed and sturdy • AC power option • Non-proprietary battery	• Kit components were placed in two layers inside the case, making it inconvenient to access all components
 CAO Group Inc. UltraLite ALS Ultra Turbo Kit (200-00106) MSRP: $5,600 Overall Score: 3.5	• ALS had good ergonomics • Tripod attachment point on ALS • Battery ejection made for easy battery replacement • Visual indicators for intensity and on/off • Audible indicator for on/off • AC power option • Beam spread diameter	• Interchangeable light head design • Cross threading occurred during assessment, making the light head difficult to remove • Sensitive buttons were accidentally activated

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Vendor/Products		Advantages	Disadvantages
MSRP: $5,738	Spectronics Corporation Spectroline Maxima (MFK-3500S) Overall Score: 2.7	• ALS can be used as a white light spotlight when the filter is removed • AC power option	• Poor portability; very heavy and requires two carrying cases • Cords connecting the ALS to the battery may be an entanglement hazard • Light could be easily damaged if dropped
Notes: All product images are courtesy of the respective vendors. [1]Model number is specific to Arrowhead Forensics, a U.S. distributor.			

Emergency responder agencies that consider purchasing portable forensic light kits should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs.

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APPENDIX A. EVALUATION CRITERIA DEFINITIONS

The focus group identified 18 evaluation criteria, which are defined as follows.

CAPABILITY

Sensitivity and Specificity refers to the visibility of target samples when illuminated by the alternate light source (ALS). Focus group participants noted that the narrowness of the wavelength (e.g., how precise the light spectrum can be adjusted) influences the sensitivity and specificity of the ALS.

Versatility refers to the kit including an assortment of accessories for use in a variety of applications with different target samples. Accessories might include ALSs with different wavelengths, barrier filters, and goggles.

Intensity refers to the brightness of the ALS and the range of adjustability.

Barrier Filter Quality refers to the quality of the filters (e.g., plastic versus glass), which may affect the visibility of the target sample.

Beam Spread refers to the area covered by the beam of light from the ALS and its adjustability.

DEPLOYABILITY

Battery Runtime refers to the length of time the ALS can operate before the batteries require replacement or charging.

Portability refers to the ease of carrying the entire kit to the site of intended use. The size and weight of the kit, as well as the quality and organization of the case, influence portability.

Power refers to the size and type of batteries required to power the ALS, including whether they are internal, external, or user replaceable; and rechargeable or single use. AC and DC charging and power options are also preferred, in addition to a low-battery indicator or other feature that indicates the ALS is losing intensity. Power also includes how easily the batteries can be changed.

User Manual refers to a user manual and/or quick-reference guide being included with purchase and having instructions and diagrams that are easy to understand. In addition, the user manual and/or quick-reference guide should include operational information (e.g., ALS guide that highlights which wavelengths to use for different target samples).

USABILITY

Ease of Use refers to the ease of activating the ALS and adjusting the wavelength, with and without gloves. The size and weight of the ALS, the placement of controls on the ALS, and whether the ALS can be used single-handed also affect the ease of use.

Goggle Comfort refers to the comfort of the goggles, including if they stay in place and do not cause discomfort after extended use.

Heat Emission refers to the amount of heat emitted by the ALS while in use.

MAINTAINABILITY

Durability refers to the overall ruggedness of the ALS. Durability includes if the ALS is waterproof, dust-resistant, and drop-test rated, as well as its operating and storage temperatures.

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Decontamination refers to the ease of decontaminating the ALS.

Routine Maintenance refers to whether the bulb(s) and/or batteries are user replaceable or if the ALS must be shipped to the vendor for these services.

Technical Support refers to the duration of technical support included with purchase as well as the hours of availability. Focus group participants noted that a local or regional representative to contact directly as well as 24/7 support are preferred.

Warranty refers to the duration and terms of the warranty included with purchase.

Supporting Documents refers to certifications and documentation provided by the vendor that testifies to the initial accuracy of the wavelengths emitted by the ALS (e.g., performance checks, calibrations, tested/actual wavelength specifications).

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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

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

Category Score Example[1]

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

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

$$\sum\left(Category\ Score \times Category\ Percentage\right) = Overall\ Assessment\ Score$$

Overall Score Example[1]

Capability	*Usability*	*Affordability*	*Maintainability*	*Deployability*	
$(4.0\times 33\%)$	+ $(4.2\times 27\%)$	+ $(4.2\times 20\%)$	+ $(3.8\times 10\%)$	+ $(4.5\times 10\%)$	= 4.1

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

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