Night Vision Devices

Market Survey Report

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Science and Technology

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FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory organized within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of state and local first responders to address the homeland security mission. The laboratory provides first responders with the necessary services, products, and tools to prevent, protect against, mitigate, respond to, and recover from homeland security threats and events.

NUSTL manages the SAVER program, which 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.
- 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.

NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, coordinating with other organizations, and ensuring flexibility and responsiveness to first responder requirements.

NUSTL provides expertise and analysis on a wide range of key subject areas, including chemical, biological, radiological, nuclear and explosive weapons detection; emergency response and recovery; and related equipment, instrumentation and technologies. In support of this tasking, NUSTL conducted a market survey of night vision devices to provide emergency responders with reference information on currently available technologies. Night vision devices fall under AEL reference numbers 03OE-02-TILA titled "Optics, Thermal Imaging and/or Light Amplification," and 04MD-01-LAMP titled "Equipment, Light Amplification." As part of the project, assessment recommendations were gathered from a focus group and are highlighted in this report.

Visit the SAVER website at www.dhs.gov/science-and-technology/SAVER for more information on the SAVER program, or to view additional reports on night vision devices and other technologies.

Visit the NUSTL website at www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory, or contact NUSTL@hq.dhs.gov for more information.

U.S. Department of Homeland Security

SAVER

System Assessment and Validation for Emergency Responders

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EXECUTIVE SUMMARY

First responders may use night vision technology for ground-based activities including surveillance, search and rescue, patrol, and SWAT operations conducted in low light or no light conditions. Additionally, night vision devices can be used in aerial and maritime environments for search and rescue, surveillance, and navigational operations, but may require specialized components.

The two main technologies used by these devices are image intensification and thermal imaging. Image intensification works in the visible and near infrared portions of the electromagnetic spectrum. Thermal imaging works in the mid-wave and long-wave portions of that spectrum. Image intensifiers can see through glass while thermal imagers do not work through glass and other thermally insulating materials. Unlike image intensifiers, however, thermal imagers can provide vision through fog, smoke, and dust.

NUSTL, through its Systems Assessment and Validation for Emergency Responders (SAVER) program, and with the support of the U.S. Army Combat Capabilities Development Command (DEVCOM) at Picatinny Arsenal, conducted a market survey of night vision devices. Information was gathered from a "technology scouting request" submitted to the DHS S&T Technology Scouting and Transition group in June 2020; a government-issued request for information (RFI) posted on the System for Award Management (SAM) website in November 2020; a SAVER focus group held in September 2020; and independent research conducted from November 2020 through September 2021.

This market survey identifies 39 commercially available night vision devices ranging in price from $1,895 to $40,000. The report includes binoculars, monoculars, bi-oculars, and integrated devices that use Gen-3 intensifier tubes and can be head- or helmet-mounted. Gen-3 intensifier tubes incorporate improved materials and production methods providing improved resolution, sensitivity, and detection range compared to previous generations of tubes. Integrated devices that utilize both image intensification and thermal imaging are also included in the report. Devices utilizing only thermal imaging are not included in report.

Performance of these products has not been independently verified by NUSTL. Emergency response agencies that consider purchasing night vision devices should carefully research the overall capabilities, limitations, and technical specifications of each system in relation to their agency's operational needs.

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1.0 INTRODUCTION

Night vision devices (NVDs) allow users to see during low or no light conditions. The two main technologies used by these devices are image intensification and thermal imaging. Image intensification works in the visible and near-infrared portions of the electromagnetic spectrum. Thermal imaging works in the mid-wave and long-wave portions of the spectrum. Most image intensification devices have a built-in manually activated infrared (IR) illuminator since the devices require a small amount of light to operate. Some night vision devices use both image intensification and thermal imaging, which helps overcome the limitations of the individual technologies.

To provide emergency responders with information on night vision devices, the System Assessment and Validation for Emergency Responders (SAVER) Program conducted a market survey on commercially available night vision devices.

This market survey report (MSR) identifies 39 commercially available night vision devices ranging in price from $1,895 to $40,000, including binoculars, monoculars, bi-oculars and integrated devices. The report is based on information gathered from November 2020 through September 2021 from vendors, internet research, industry publications, an emergency responder focus group, a technology scouting report, and a government-issued request for information (RFI) that was posted on the System for Award Management (SAM) website.

For inclusion in this report, the night vision devices had to meet the following criteria as recommended by first responders:

- Device must use Gen-3 intensifier tubes
- Device must be head- or helmet-mountable

Image intensification and integrated devices that utilize both image intensification and thermal imaging are included in this report. Devices utilizing only thermal imaging are not included. Due diligence was performed to develop a report that is representative of products currently available in the marketplace.

2.0 NIGHT VISION DEVICES OVERVIEW

Night vision devices are used for the detection, recognition, and identification of people and objects during low or no light operations. They are either head- or helmet-mounted or handheld or weapon-mounted, and generally work in one of two ways. First, night vision devices may use image intensification, which works by collecting tiny amounts of light that may be imperceptible to the human eye and must be amplified to be easily observed. Devices that use imagine intensification are also known as "I^2 devices." The other technology that can enable night vision is thermal imaging, which operates in the portion of the electromagnetic spectrum where energy is emitted as heat by objects instead of reflected as light. This is not visible to the naked eye. Either technology can stand alone or be combined into an integrated device.

I^2 sensors operate in the visible and near-infrared electromagnetic spectrums, while thermal imaging sensors operate in the mid-wave and long-wave infrared spectrums, as illustrated in Figure 2-1.

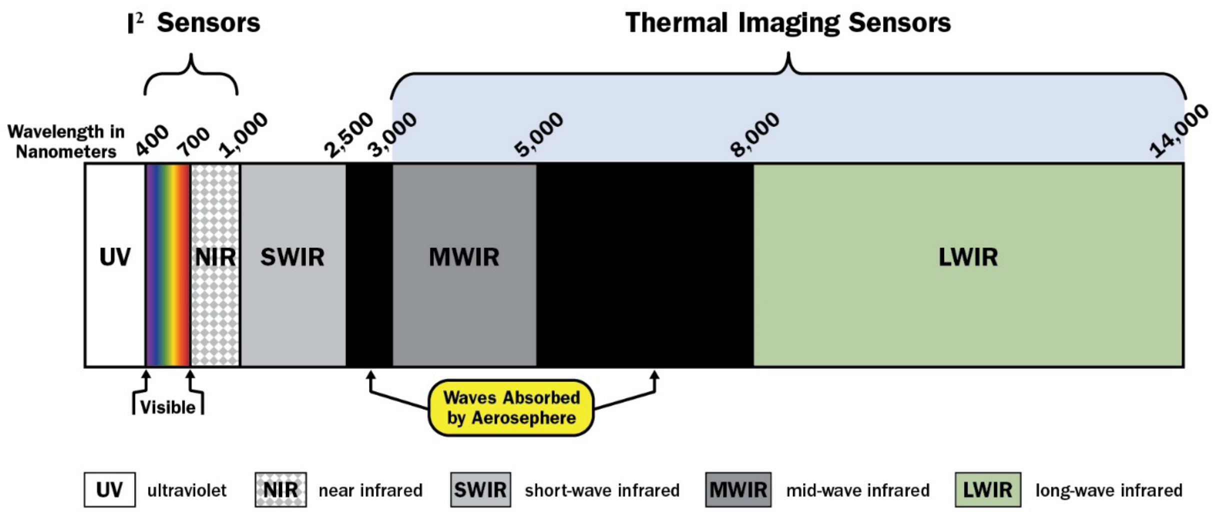

Figure 2-1 Electromagnetic Spectrum

2.1 THE GENERATIONS OF IMAGE INTENSIFIER TUBES

As mentioned in the introduction, use of a Gen3 image intensifier tube was a requirement for inclusion in this market survey. Image intensifier tube technology is generally categorized within four generations, Gen 0, Gen 1, Gen 2, and Gen 3 as established by the U.S. Army. Gen 0 devices were developed during World War II and required a source of infrared light to illuminate the target area. This allowed them to be seen by an enemy with a device capable of seeing infrared. Gen 1 devices, starlight scopes, were developed during the 1960s and consisted of three back-to-back image intensifier tubes. These systems didn't require a source of infrared light, allowing them to be used covertly, but were also bulky and heavy.

In the 1970s, the addition of the microchannel plate (MCP), a metal coated glass disk that multiplies electrons produced in the photocathode, allowed for the development of Gen 2 tubes. The electron multiplication (or "gain") provided by the MCP eliminated the need for back-to-back tubes, thus leading to improvements in image quality and brightness, and to lighter, less bulky tubes, which permitted the device to be attached to a helmet or other headgear. [1]

In the 1980s, two major advancements led to Gen 3 tubes: using a gallium arsenide (GaAs) photocathode and introducing an ion-barrier film on the MCP. Gen 3 tubes are common to all devices in this study, bringing with them the advantages those two technological advancements provide. GaAs is a semiconductor material, which has a very high sensitivity in the visible and near-infrared regions (450 to 950 nanometers). The GaAs photocathode enabled detection of objects at greater distances and under much darker conditions. Gen 3 devices can amplify low ambient light levels 30,000 to 50,000 times. Furthermore, the ion-barrier film increased the operational life of the tube from 2,000 hours (Gen 2) to 10,000 hours (Gen3) while slightly increasing noise. Filmless tubes provide a higher signal-to noise ratio and served to reduce this electronic noise.

2.2 CURRENT TECHNOLOGIES

I^2 sensors work by collecting the available light with an objective lens, which captures the visible light reflected from an object and some light from the near IR portion of the spectrum and focuses this light onto the photocathode. The photocathode then converts the collected light into electrons and this electrical energy is multiplied thousands of times with a microchannel plate (MCP). The electrical energy then strikes a phosphor coated screen that converts the energy into a brightened image that can be seen through the eyepiece lens. On a cloudy, moonless night or in a very dark room where little or no ambient light is present, a visible image cannot be produced by I^2 sensors. Therefore, many I^2 devices have a built-in, manually activated IR light-emitting diode (LED) illuminator, which provides short range (approximately 3 meters) illumination. Accessory illuminators, such as IR flashlights, can be used with devices that do not have them or when extended range illumination is needed. For the internal screen, white phosphor has generally replaced the green phosphor with which most users of night vision are familiar. White phosphor provides a clearer image with more contrast and improved depth perception for many users, and its black and white images are closer to what the human brain is used to, possibly leading to less eye fatigue during prolonged use.

When external illumination levels vary, “automatic brightness control,” ”bright source protection,” and “autogating” features all help ensure image clarity and prevent intensifier tube damage. “Automatic brightness control” controls the voltage across the microchannel plate, regulating its gain according to the amount of external light that enters the tube. (“Gain” is the number of times a night vision device amplifies light input. It is usually measured as tube gain (fL/fc) and system gain (fL/fL).) If an intensifier tube is exposed to daylight or a flash of bright light at night, it may become damaged or burn out. “Bright source protection,” also known as “bright light cutoff,” turns the photocathode voltage off whenever the device is exposed to bright light, preventing tube degradation. In order to produce a normal image under the bright light conditions found in urban areas where streetlights and vehicle lights increase the ambient light levels, the “autogating” feature regulates the power supply to generate rapidly oscillating photocathode voltage. This oscillation prevents the whiting out of the image due to blooming and haloing, making the devices more effective in urban areas. Blooming is temporary loss of contrast in an image and resembles an area that has been blotted out. Haloing occurs when there is a bright light source in the field of view that results in rings around the light source.

Thermal imagers detect infrared radiation using microbolometers[1] – very small, very sensitive thermometers whose electrical resistance changes based on their temperature. A thermal profile is created by thousands of microbolometer pixels, which measure the change in resistance.

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1. A bolometer is a very sensitive thermometer, the electrical resistance of which varies with temperature. Bolometers, and in this case microbolometers, are used in the detection and measurement of weak thermal radiation and are especially adapted to the study of infrared spectra.

Thermal imagers can operate in total darkness without IR illuminators or can be used during daylight to allow one to see through fog, smoke, and dust. However, thermal imagers cannot provide vision through glass and other thermally insulating materials. Thermal imagers have lower image resolution than the I^2 devices, making it difficult for them to recognize faces, but are very good at detecting objects of interest. NVDs may integrate both image intensification and thermal imaging technologies in order to leverage their different strengths. Devices using only thermal imaging are not included in this report.

As pictured in Figure 2-2 below, NVDs are available as monocular, binocular, bi-ocular and integrated systems. Monocular devices have one eyepiece and one lens. Such devices have poor depth perception, a trade-off for having one eye available to adjust to changing ambient light conditions to provide better situational awareness. Bi-ocular systems have two eyepieces and one lens. These devices improve viewing comfort but there is little improvement in depth perception. Binoculars have two eyepieces and two lenses leading to both improved comfort and depth perception. Integrated devices overlay the thermal image onto the I^2 image. An integrated device can be stand alone or be created with a clip-on device. In a clip-on system, a miniature thermal device is attached to an I^2 NVD, and the thermal image is projected into the NVD objective lens with no modification of existing hardware required.

Figure 2-2 Night Vision Device Variations

From left to right: Monocular, bi-ocular, binocular and integrated formats followed by a clip-on thermal accessory

Image Credit: Carson Industries, PRG Defense, ATN Corporation, L3Harris, Optics 1

2.2.1 ACCESSORIES

The use of night vision devices can be enhanced through accessories. Some commonly used accessories are explained below and illustrated in figures 2-3 and 2-4.

Figure 2-3 Night Vision Device Accessories

From left to right: Daylight filter, demist shield, eye cup, eye guard, IR spot/flood lens, sacrificial lens

Image Credit: DEVCOM, GSA Advantage, ANVS, ANVS, ATN, GSA Advantage

Daylight filters, also known as objective lens caps, are designed to fit over the lens of a night vision device and can be used to reduce light input to a safe level allowing for extended use of the NVD for training purposes.

Demist shields can be attached to the eye piece(s) of a night vision device to prevent condensation from forming on the optics.

Eye cups, also known as eye shields or eye guards, are typically made of rubber and attach to the ocular lens of an NVD and are used to limit light spill therefore maintaining light security. They also provide a buffer between the eye and the device.

IR spot/flood lens allows users to diffuse the IR light source and intensify the light beam.

Sacrificial lenses, also known as sacrificial windows, can be attached to the objective lens of a night vision device, and act as a protective barrier from damaging elements.

Mounts are accessories for affixing the night vision device to the wearer's head in order to facilitate hands free use. There are a variety of helmet and head mounts available; compatibility is dependent on the night vision device. Wilcox helmet mounts are among the most commonly used.

Figure 2-4 Night Vision Device Mount Samples

From left to right: Helmet mounts (Wilcox L, 4 G24MICH Helmet Mount Assembly)
Head Mounts (L4 Series NVG Mounting System Light, L4 Series Night NVG Skull Lock Head Mount)

Image Credit: Night Vision Devices, Inc. and Aviation Specialties Unlimited

2.3 APPLICATIONS

Night vision devices vary in form factor and can be operated on different platforms. During a SAVER focus group, emergency responders were asked in what applications would they use NVDs. They identified surveillance, search and rescue, border patrol operations in rugged remote terrain, holding perimeters, and medical aid for SWAT operations. Additionally, night vision devices can be used in aerial and maritime environments for search and rescue, surveillance, and navigational operations.

The strengths and weaknesses of particular night vision technologies may impact their effectiveness for particular applications. For example, I^2 sensors provide a responder with detailed imaging of the surrounding environment when there is little or no available light. This makes them well suited for navigating outdoors by vehicle or on foot as well as for approaching and entering darkened structures covertly. IR illuminators should not be used for covert operations since any other users of NVDs would easily spot them. Integrated NVDs, which include a thermal imaging sensor as well as an I^2 sensor, provide heat signatures, enhancing object or human detection especially in foggy or smoky conditions where I^2 sensors alone are not effective.

2.4 STANDARDS AND REGULATIONS

NVDs used in the aviation industry frequently reference Federal Aviation Administration (FAA) Technical Standard Order (TSO) FAA TSO C164a/Radio Technical Commission for Aeronautics (RTCA) RTCA DO-275. FAA TSO C164a (October 2015). This TSO provides the minimum performance standards the portable imaging components of night vision imaging systems must meet for approval and identification with the applicable TSO marking.

Standard RTCA DO-275 (October 2001) provides minimum operational performance standards (MOPS) for integrated night vision imaging system equipment.

Night vision devices may also cite U.S. Military Standard MIL-STD-810, "Environmental Engineering Considerations and Laboratory Tests," which is maintained and enforced by the Department of Defense. The standard was initially published in 1962, and each subsequent version is identified by a letter added to the title. The newest version of the standard, MIL-STD-810H, was published in 2019. MIL-STD-810H contains a section on "Laboratory Test Methods" that addresses more than 20 methods for testing of equipment to ensure its ability to sustain various environmental stress factors [2]. These environmental stressors include, but are not limited to, high temperature, temperature shock, contamination by fluids, explosive atmosphere, acceleration, and vibration. Results of these test methods to determine the effects of different stress factors may help a department or agency determine if the equipment being considered for purchase will be reliable and durable for their intended use cases. Information on the individual laboratory test methods is included in Appendix B.

2.4.1 U.S. DEPARTMENT OF STATE EXPORT REGULATIONS

The export of night vision and optical sighting equipment is controlled by the U.S. Department of State, Office of Defense Trade Controls in accordance with International Traffic in Arms Regulations (ITAR) (Article - DDTC Public Portal (state.gov). The State Department's Export Administration Regulations (EAR) must be also be carefully reviewed to ensure compliance when considering purchasing or exporting NVDs. More information regarding export control and regulations can be found at U.S. Export Regulations (trade.gov).

2.4.2 USE OF GRANT FUNDS FOR CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE EQUIPMENT OR SERVICES

The John S. McCain National Defense Authorization Act for Fiscal Year 2019 (NDAA), Pub. L. 115-232, Section 889 [3] prohibits the use of federal funds, including loan and grant[2] funds, to obtain or acquire certain telecommunications technologies manufactured by certain entities or to enter into contracts with entities that use those technologies. The Office of Management and Budget (OMB) published regulations at 2 C.F.R. § 200.216 to clarify the application of the NDAA to the use of federal grant funds to procure or obtain certain telecommunications equipment or services.

Effective August 13, 2020, federal grant recipients and subrecipients (i.e., non-federal entities) are prohibited from obligating or expending loan or grant funds to procure or obtain[3] [2] the following "covered telecommunications equipment or services":

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities)
- For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by:
  - Hytera Communications Corporation
  - Hangzhou Hikvision Digital Technology Company
  - Dahua Technology Company
  - Or any subsidiary or affiliate of such entities
- Other entities identified by the Secretary of Defense

[2] This also includes cooperative agreement funds.
[3] Nor may they extend or renew a contract to procure or obtain, or enter into a contract to procure or obtain the covered equipment or services

The restriction also applies to systems that use the covered equipment or services as a substantial or essential component, and to subsidiaries or affiliates of those listed above[4]. See www.federalregister.gov/d/2020-17468/p-877 [4].

Costs associated with covered equipment and services are "unallowable" for grant funding. Grant recipients are responsible for ensuring funds are used only for allowable costs and would be obligated to refund the government for unallowable costs. The Federal Emergency Management Agency (FEMA) issued FEMA Policy #405-143-1, "Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services (Interim)," [5] for further guidance on the Section 889 prohibitions. Additionally, OMB issued frequently asked questions (FAQs) [6] on the topic.

For federal entities, FEMA published interim rules amending the Federal Acquisition Regulation [7] [8].

2.5 EMERGING TECHNOLOGIES

In the past, the image quality of digital night vision devices could not compare with I^2 devices, but advances in the low-light sensitive sensors may allow digital devices to compete with Gen-3 NVDs in the near future. Digital NVDs use a digital charge-coupled device or complementary metal-oxide semiconductor sensors to convert optical images into an electric signal that is then transferred onto a liquid-crystal display. These devices have features such as resistance to damage from bright light, long lifetimes, low costs, and the ability to easily integrate with digital media and storage.

Military personnel and operations are often the drivers behind technology enhancements in the field of night vision. The Enhanced Night Vision Googles-Binocular III/Family of Weapon Sight-Individual (ENVG-B III/FWS-I), one emergent system tested by the U.S. Army, improves depth perception [9]. Modernization of NVDs has also focused on combining technologies to enhance the user's experience. For example, the Integrated Visual Augmentation System (IVAS), set to enter service in 2021, is a more compact device that will combine I^2 and thermal imaging with a targeting scope wirelessly linked to the user's weapon, navigational markers superimposed on the user's field of view, and other augmented reality aides [10]. These enhancements have the ability to increase safety and precision during operations but are not commercially available. Research is also being conducted on how to produce temporary night vision by injecting nanoparticles that convert infrared light into visible light directly into eyes [11].

[4] as well as telecommunications or video surveillance services provided by entities or using equipment described above.

3.0 BINOCULAR NIGHT VISION DEVICE PRODUCT INFORMATION

This market survey report provides information on 16 binocular night vision devices that range in price from $5,995 to $40,000. All the binocular devices use I^2 technology. One product, the L3Harris BNVD Fused, uses both I^2 and thermal technology. All the devices are available in green and white phosphor, except three of the L3Harris products which are available only in white phosphor. All devices have built in IR LED illuminators, except the L3Harris ANVS-9 and the ASU AN/AVS-9. All devices use some form of brightness control to ensure image quality under changing light conditions and to protect the intensifier tubes from excessive light. All the binoculars allow for thermal integration via an optional Enhanced Clip-On Thermal Imager (ECOTI) accessory and use commercial off-the-shelf batteries that are replaceable in operational settings.

Table 3-1 provides general product characteristics and/or specifications. Product information presented in this section was obtained directly from manufacturers, vendors, and their websites. The information has not been independently verified by the SAVER Program. Information not readily available from the companies is indicated by an "N/A" in the below table and is not described within individual product sections.

Product information in Table 3-1 is defined as follows, listed in column order:

MSRP ($) refers to the manufacturer's suggested retail price of the device and included components, given in U.S. dollars.

Dimensions given as L x W x H refers to the physical dimensions of the device in inches.

Weight refers to the weight of the device with batteries (except where noted) in pounds.

Field of View refers to the degree of horizontal distance that can be viewed through the technology without requiring additional lens options or accessories.

Focus Range refers to the distance (given near to far) away from a night vision device within which it can focus on an object.

Resolution refers to the image quality or object identification capability measured in line pairs per millimeters (lp/mm).

Diopter Adjustment Range refers to the adjustment range for accommodating differences in eyesight between the user's eyes. A diopter is the unit of measurement used to define eye correction or the refractive power of a lens.

Battery Type refers to what sort of battery is needed to operate the device.

Battery Life refers to the amount of time the battery can power the device.

Table 3-1 Binocular Night Vision Devices Product Comparison Matrix

Vendor	Product	MSRP	Dimensions (inches)	Weight (pounds)	Field of View (°)	Focus Range	Resolution (lp/mm)	Diopter Adj. Range (diopters)	Battery Type	Battery Life (hours)
ACTinBlack	DTNVS	$10,700 to $11,700	3.07 x 4.05 x 4.25	0.915 and 1.14	40	25 cm to ∞	64	-6 to +2	CR123A	25
ATN	PS15-3	$5,995	4.7 x 4.5 x 2.7	1.54	40	25 cm to ∞	64	-6 to +2	CR123A, AA	20-40
ATN	PS31	$7,495	4.7 x 7.0 x 3.5	1.27	50	25 cm to ∞	64	-5 to +5	CR123A	55-60
Aviation Specialties Unlimited	AN/AVS 9	$15,100	4.6 x 5.1 x 3.5	1.18*	40	41 cm to ∞	72	-6 to +2	battery pack (2 AA and 2 AA alt)	30
Carson Industries	BNVD	$7,500 to $10,500	4.5 x 3.8 x 3.5	0.99	40	25 cm to ∞	64	-6 to +2	lithium AA	20
Elbit	AN/AVS-9	$9,837	3.3 x 5.1 x 4.1	1.21	40	41 cm to ∞	64-81	-6 to +2	fixed wing use two 1/2 AA rotary wing use four AA	30 per side
Elbit	AN/PVS-31D	$10,985	2.8 x 4.2 x 4.1	1.10	40	25 cm to ∞	64-81	-6 to +2 adj - 2.5 to 2 fixed	alkaline or lithium AA	21+ alkaline, 30 lithium
Kent Optronics	WFOV-NVG	$38,000	4.2 x 4.9 x 3.3	1.5	80	25 cm to ∞	64	-4 to +2	AA	16
L3Harris	ANAVS-9 M949	$10,000 to $13,000	4.6 x 5.1 x 3.5	1.3	40	41 cm to ∞	72	-6 to +2	NiCd AA	16

Vendor	Product	MSRP	Dimensions (inches)	Weight (pounds)	Field of View (°)	Focus Range	Resolution (lp/mm)	Diopter Adj. Range (diopters)	Battery Type	Battery Life (hours)
L3Harris	AN/PVS-31A	$12,500	4.7 x4.2 x3.4	.99	40	46 cm to ∞	FOM 1600-2376	replaceable fixed diopters	AA, 4 AA pack	15 50
L3Harris	BNVD-1531	$10,500	4.6 x 4.5 x 3.6	1.23	40	25 cm to ∞	72+	-6 to +2	AA 4 AA pack	16 50
L3Harris	BNVD-Fused	$35,000 to $40,000	4.2 x 4.5 x 3.9	2.3	38	46 cm to ∞	72+	-2 to +1	AA	8
Nightline	RNVG	$9,000	4.7 x 4.2 x 2.8	1.3	40	25 cm to ∞	64	-6 to +2	CR123A	16
Nightoptix	PVS-31C MILSPEC	$9285 to $14,746	4.4 x 4.1 x 2.8	1.4	40	25 cm to ∞	64–74	-6 to +4	CR123 AA	40
Night Vision Devices	BNVD-Single Gain	$7,644, white $7,394, green	4.3 x 4.2 x 3.3	1.23*	40	25 cm to ∞	dependent on tube	-6 to +2	alkaline or lithium AA	+40 +20
PRG Defense	NVG-51	$8,820	4.4 x 4.6 x 2.9	1.35	51	25 cm to ∞	72	-6 to +2	CR123A AA	20-25

Notes:
* Weight is without batteries.

3.1 ACTINBLACK, DUAL TUBE NIGHT VISION SYSTEM (DTNVS)

Figure 3-1 DTNVS

Image Credit: ACTinBlack

The ACTinBlack Dual Tube Night Vision System (DTNVS) uses I^2 technology and is intended for ground use. This device is available with white or green phosphor. The DTNVS has a field of view of 40 degrees. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. The device uses manual focusing.

The device offers articulating interpupillary adjustment and a diopter adjustment range of -6 to +2 diopters. The DTNVS has a focus range of 25 cm to infinity and has an automatic gain function.

The DTNVS operates on one CR123A battery, with an approximate battery life of 25 hours at room temperature. It is also equipped with a visual battery life indicator in the field of view. Additionally, the device has a built-in IR LED illuminator with IR on and low-battery indicators in the field of view, and automated bright light cutoff.

The DTNVS has exterior dimensions of 3.07 x 4.05 x 4.25 inches and weighs 0.915–1.14 pounds depending on optics and tubes. This device is compatible with current mounting systems, such as the Wilcox G-24 and Norotos INVG. It can be outfitted with a sacrificial lens, which is an optional accessory, and has lens orientation that can be flipped up and to the side.

The DTNVS has an operating temperature range of -22 to 122 degrees Fahrenheit and a storage temperature of -58 to 158 degrees Fahrenheit.

The DTNVS exceeds MIL-STD-810, has an ingress protection (IP) rating of 68, is waterproof for 20 meters (66 feet) for two hours and has corrosion resistance against salt water. More information on IP ratings and levels of solid and liquid ingress protection is provided in Appendix A. Clip-in demist shields are available.

No overall expected lifetime is given for the DTNVS but the tubes have an expected lifetime of 10,000 hours. Manufacturer maintenance requirements are every 90 days for device in regular/daily use at $125 per service plus shipping cost, and for devices with intermediate use manufacturer maintenance requirement is twice a year/every 6 months at $125 plus shipping cost.

The DTNVS has an MSRP from $10,700 to $11,700, which includes a soft carrying case and lens caps, as well as a two-year warranty for the complete unit.

Additional components, which can be purchased separately, include a 3x magnifier lens, shipping/storage case, sacrificial lens covers, counterweight, and Wilcox helmet mount. Operator and maintenance training are available; pricing depends on the number of students. The customer service department is available 10 a.m. to 5 p.m., Monday–Friday via email, text, and phone.

3.2 ATN CORPORATION, PS15-3

The ATN Corporation's PS15-3 uses I^2 technology and is intended for ground use. The device is available with green or white phosphor and has a field of view of 40 degrees. The PS15-3 has a focus range of 25 cm to infinity and offers both auto and manual focusing. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. The device has a diopter adjustment range of -6 to +2 diopters and 25 mm eye relief[5]. Additionally, the PS15-3 has a built-in IR illuminator (with flood lens), a bright light cutoff, and automatic brightness control.

Figure 3-2 PS15-3

Image Credit: ATN Corporation

The PS15-3 operates on one AA or one CR123A battery, either of which has an estimated lifespan of 20–40 hours.

The PS15-3 has exterior dimensions of 4.7 x 4.5 x 2.7 inches and weighs 1.54 pounds. It is compatible with helmet mounts and goggle kits. When using a goggle kit, the lens orientation can be flipped up.

The PS15-3 has an operating temperature range of -40 to 122 degrees Fahrenheit and a storage temperature of -58 to 158 degrees Fahrenheit. This device is water resistant and complies with the MIL-STD-810 standard.

The PS15-3's expected lifetime varies depending on usage hours and handling of the device. Maintenance and repair costs vary and are determined by the price of the particular replacement part and duration of repair.

The PS15-3 has an MSRP starting at $5,995, which includes a soft carrying case, lens tissue, one battery and a goggle kit, as well as a two-year warranty, an instruction manual and access to online training videos. Optional components include an 850 mW IR illuminator, which provides long range illumination, and a 3x afocal lens which extends range performance.

Additional components, extended warranties, and trainings are available for an additional cost. Customer support is available free via phone Monday through Friday during standard business hours.

[5] Eye relief is the distance that a person's eyes must be from the eyepiece in order to see the entire field of view. This feature allows users with eyeglasses to see the whole field of view

3.3 ATN CORPORATION, PS31

The ATN Corporation's PS31 (Model Number 3W) uses I^2 technology and is intended for ground use. The device is available with green or white phosphor and has a field of view of 50 degrees. The PS31 has a focus range of 25 cm to infinity and offers both auto and manual focusing. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. It offers interpupillary adjustment of 55 to 72mm and a diopter adjustment range of -5 to +5 diopters. Additionally, the PS31 has a built-in IR illuminator that can be operated in IR mode or auto mode, in which the system determines when the illuminator should be turned on. The device also has automated bright light cutoff, automatic brightness control, and autogating.

Figure 3-3 PS31

Image Credit: ATN Corporation

The PS31 operates on one CR123A battery, which is proprietary, rechargeable, and has an estimated lifespan of 55 to 60 hours. Alternatively, using a battery pack provides up to 300 hours of service. The device is equipped with a visual battery life indicator.

The PS31 has exterior dimensions of 4.5 x 7 x 3.5 inches and weighs 1.27 pounds. This device, which comes with a mount, is compatible with the Wilcox mount. It can be outfitted with a sacrificial lens and has a lens orientation that can be flipped up or to the side.

The PS31 has an operating temperature range of -59 to 120 degrees Fahrenheit and a storage temperature of -59 to 185 degrees Fahrenheit. The device is water resistant and has an IP rating of 65.

The PS31's expected lifetime varies depending on usage hours and handling of the device. Routine maintenance, including battery charging, cleaning, and dusting, is recommended and can be conducted in-house. It's recommended that repairs are made by the manufacturer. Repair cost is determined by warranty status, price of the replacement part, and duration of repair by a technician.

The PS31's MSRP starts at $7,495, which includes a soft carrying case, lens tissue, helmet mount, one battery, a three-year warranty that covers the body, tube and lens, as well as an instruction manual and access to online training videos.

Additional components, including a hard carrying case and extended battery pack, are available at additional cost. Customer support is available free via phone Monday through Friday during standard business hours.

This information was provided by Atlantic Diving Supply, a distributor of this product.

3.4 AVIATION SPECIALITIES UNLIMITED, INC., AN/AVS-9 WHITE PHOSPHOR

The Aviation Specialties Unlimited, Inc. AN/AVS-9 White Phosphor (9S1005BUWA) uses I^2 technology and is intended for aerial use. The AN/AVS-9 is also available with green phosphor and has a field of view of 40 degrees. The AN/AVS-9 White Phosphor has a focus range of 41 cm to infinity and uses manual focusing. The device is capable of magnification at 1x. and has a resolution of 72 lp/mm. The AN/AVS-9 White Phosphor features an interpupillary adjustment range of 51 to 72 mm and a diopter adjustment range of -6 to +2 diopters. Additionally, the AN/AVS-9 White Phosphor has an automated bright light cutoff and autogating.

Figure 3-4 AN/AVS-9 White Phosphor

Image Credit: Aviation Specialties Unlimited, Inc

The AN/AVS-9 White Phosphor operates on an Aeronox battery pack – with four AA batteries (two AA primary and two AA alternate) – that has an estimated lifespan of 30 hours and is equipped with a visual battery life indicator. The battery pack also comes with counterweights.

The AN/AVS-9 White Phosphor has exterior dimensions of 4.6 x 5.1 x 3.5 inches and weighs 1.2 pounds without batteries. The device is compatible with Aeronox Mounts, though alternate helmet mount adapters are available. When not in use, the lenses can be flipped up. Also, the fit can be adjusted vertically -25mm min, fore and aft -27mm min, tilt -10 degree and automatic break away 11–15G.

The AN/AVS-9 White Phosphor has an operating temperature range, storage temperature range and an operational humidity range compliant with FAA TSO C164a/RTCA DO-275.

AN/AVS-9 White Phosphor tubes have an expected lifetime of up to 10,000 hours. Routine preventative maintenance and checks are recommended with each use and can be conducted in-house. Monthly and 180-day inspections per FAA TSO 164a OEM guidance should also be conducted. Additionally, inspections, repairs and upgrades can be made by Aviation Specialties Unlimited Inc., who has a certified Part 145 Certificate with Original Equipment Manufacturer Certification for approved services. Repair cost is determined by the type of service, replacement or upgraded parts, and the duration of time needed by a technician. The company also offers a tiered service plan.

The AN/AVS-9 White Phosphor has an MSRP of $15,100, which includes a soft carrying case, Class B lens, Aeronox battery case, Aeronox helmet mount, lens paper, neck cord, air worthiness log and a lens cap assembly. This product is also available for purchase through a GSA schedule. A warranty that covers the system for one year and image tubes for two years is also included.

Additional components such as a spare battery, case assembly, lens brush, low profile battery pack and corresponding mounting kit, various mount assemblies (Quick Don, SPH-5CG, Banana HGU/55P, Standard V1A), neck cord, ALPHA helmet mount kit, clip-on power supply, spare parts kit, shipping and hard storage case, and battery cartridges are available for additional cost. A filter for daylight training as well as operator and maintenance trainings are also available for an additional cost. Customer support is available via phone.

3.5 CARSON INDUSTRIES/BNVD BINOCULAR NIGHT VISION DEVICE

The Carson Industries' Binocular Night Vision Device (BNVD-450) uses I^2 technology and is intended for ground and maritime use. The BNVD is available with green or white phosphor and has a field of view of 40 degrees. The device has a target identification range of >100m minimum. The BNVD-450 has a focus range of 25 cm to infinity. The device is capable of magnification at 1x and has a resolution of 64 lp/mm minimum. The device has manual focus and manual gain adjustment. It features an interpupillary adjustment of 51 to 76 mm, independent channel adjustment, a gain adjustment range of 50K-80K @2x10-6fc, and a diopter adjustment range of –6 to +2 diopters. Additionally, the BNVD-450 has a built-in 850nm IR LED illuminator, automated bright light cutoff and autogating.

Figure 3-5 BNVD-450

Image Credit: Carson Industries

The BNVD-450 operates on one lithium AA battery that has an estimated lifespan of 20 hours. The device can operate >40 hours with a remote battery pack and is equipped with a visual battery life indicator.

The BNVD-450 has exterior dimensions of 4.5 x 3.75 x 3.5 inches and weighs 0.99 pounds with lightweight optics and 1.28 pounds with standard optics. This device is compatible with standard tactical night vision helmet mounts using dovetail interface (such as Wilcox or Norotos) and head mounts using dovetail interface mounts. It can be outfitted with a sacrificial lens and has a lens orientation that can flip up and to the side. Dual channels allow individual pivoting to adjust for interpupillary distance, single eye operation, or for stowage against a helmet. Vertical adjust and tilt are a function of the helmet mount adjust.

The BNVD-450 has an operating temperature range of -59.8 to 120.2 degrees Fahrenheit, storage temperature of -59.8 to 185 degrees Fahrenheit, and an operable humidity range of 100 percent and reliability per MIL-PRF of 90% humidity for 240 hrs. The device also features purge capabilities to maintain dry internal space around optics to minimize fog.

The BNVD-450 is waterproof submersible to 66' and meets MIL-STD-810 and MIL-PRF-49324.

The BNVD-450 has an expected lifetime of up to 10,000 hours minimum, with lenses lasting up to 10 years and tubes lasting up to 10 years. Routine maintenance is dependent on usage and includes cleaning lenses and replacing batteries. Component level spare parts are available and include eyepiece lens assembly, objective lens assembly, image tube, eyecups, sacrificial window and demist shields. Some maintenance may require special tools.

The BNVD-450 has an MSRP from $7,500–$10,500 based on tube performance specifications, which include eye cups, sacrificial windows, lens covers, demist shields, IR spot/flood adapter, lanyard, lens cleaning, dovetail interface, lanyard, batteries, user's manual, carrying case, and a one-year standard warranty.

Additional components include helmet mount assembly, hard case, remote power battery pack, 3x or 5x afocal magnification lens, and a Steiner DBALA3 laser/illuminator. Operational and depot maintenance training options are available as required for departments/agencies. Customer support is available by phone during standard business hours and 24 hours a day via e-mail.

3.6 ELBIT AN/AVS-9

The Elbit AN/AVS-9 (Model Number F4949) binocular uses I² technology and is intended for aviation and maritime use. The device is available with white phosphor or green phosphor and has a field of view of 40 degrees. The AN/AVS-9 has a focus range of 41 cm to infinity and uses manual focusing.

Figure 3-6 AN/AVS-9

Image Credit: Elbit

The device offers interpupillary adjustment of 51–72 mm and is capable of magnification at 1x. The AN/AVS-9's target identification range depends on environmental conditions such as existing ambient light. The device has a resolution of 64–81 lp/mm, a fixed gain adjustment with a minimum of 5500 fL/fL, and a diopter adjustment range of -6 to +2 diopters.

The AN/AVS-9 operates on alkaline or lithium AA batteries, with fixed wing aircraft using two 1/2 AA lithium and rotary wing aircraft using four AA alkaline. Battery life is nominally 30 hours (per side) under standard conditions. The device is equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator and an automated bright light cutoff.

The AN/AVS-9 has exterior dimensions of 3.3 x 5.1 x 4.1 inches and weighs 1.21 pounds. This device is compatible with ALPHA fixed wing and ALPHA rotary wing mount kits and HGU-55/P, HGU-56/P, HGU-84/p, SPH-4AF, SPH-5CG and JHMCS mounts. The device can be outfitted with a sacrificial lens, which is included with standard accessories, and has a lens orientation that can be flipped up. The fit can be adjusted via eye relief of 25 mm and fore and aft adjustments.

The AN/AVS-9 has an operating temperature range of -25.6 to 125.6 degrees Fahrenheit, and a storage temperature range of -25.6 to 159.8 degrees Fahrenheit. The device is capable of operating at humidity greater than 95 percent for exposures up to 240 hours. The device comes with a demist shield; anti-fog wipes can also be used (sold separately).

The AN/AVS-9 meets MIL-STD-810 for shock resistance, but it does not meet Ingress Protection standards and is not water resistant. The device is FAA TSO-C164 approved and fully compliant with the RCTA DO-275.

An overall expected lifetime for the AN/AVS-9 is not given, but the tubes have an expected lifetime of 10,000 hours. Routine maintenance requirements and instructions for self-maintenance are included in the operator's manual. Some maintenance services are included with the standard warranty; the cost of additional maintenance is dependent on the particular need.

The AN/AVS-9 has an MSRP of $9,837, which includes soft carrying case, lens caps, demist shields, sacrificial lenses, low profile battery pack, and an operator's kit (manual, quick reference card, lens paper), as well as a two-year warranty for the system and a one-year warranty for spare parts and accessories. This product is available for purchase through the GSA schedule.

Additional components that can be purchased separately include helmet mounts, a clip-on power source, and a shipping/storage case; additional accessories are available upon request. The Elbit Customer Repair Service department is open 7 a.m.–4 p.m., Monday–Friday. In person operator and maintenance training is available and is priced by the number of students. Virtual training is also available.

3.7 ELBIT AN/PVS-31D

The Elbit AN/PVS-31D (Model Number F5032) Lightweight Night Vision Binocular uses I² technology and is intended for ground and maritime use. This device comes equipped with white phosphor image intensifier tubes but can also be purchased with green phosphor tubes. The AN/PVS-31D has a field of view of 40 degrees and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 64-81 lp/mm and a gain adjustment range of not less than 5500 fL/fL.

Figure 3-7 AN/PVS-31D

Image Credit: Elbit

The device offers an interpupillary adjustment range of 50-75 mm and fixed or adjustable diopter lenses with a diopter adjustment range of -6 to +2 diopters for the adjustable configuration and -2.5 to +2 diopters for the fixed configuration. The AN/PVS-31D's target identification range depends on environmental conditions such as existing ambient light, user eyesight, etc. The device has a focus range of 25 cm to infinity and uses manual gain control.

The AN/PVS-31D operates on one alkaline or lithium AA battery, with the AA lithium lasting 30 hours and the AA alkaline lasting more than 21 hours. It is also equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator and automated bright light cutoff with manual brightness adjustment available.

The AN/PVS-31D has exterior dimensions of 2.8 x 4.2 x 4.1 inches and weighs 1.10 pounds. This device is compatible with Wilcox G24, Wilcox G22, and Norotos Lo Sto mounts. It can be outfitted with a sacrificial lens, which is included with standard accessories, and has a lens orientation that can be flipped up and to the side. The fit can be adjusted via eye relief.

The AN/PVS-31D has an operating temperature range of -34.6 to 125.6 degrees Fahrenheit, storage temperature of -50.8 to 159.8 degrees Fahrenheit, and does not have a defined relative humidity range. The device can be purchased with either demist shields or protective lenses with anti-fog wipes.

The AN/PVS-31D can be submerged in 66 feet of water for two hours, meets MIL-STD-810 for shock resistance and is contamination resistant.

No overall expected lifetime is given for the AN/PVS-31D, but the tubes have an expected lifetime of 10,000 hours. Routine maintenance requirements and instructions for self-maintenance are included in the operator's manual. Some maintenance services are included with the standard warranty and others may incur additional costs.

The AN/PVS-31D has an MSRP of $10,985, which includes soft carrying case, eye cups, lens caps, demist shields, operator's kit (manual, quick reference card, lens paper) and G24 helmet mount, as well as a two-year warranty for the system and a one-year warranty for spare parts and accessories. The AN/PVS-31D is also available for purchase through GSA schedule.

Additional components, which can be purchased separately, include a 3x magnifier lens, shipping/storage case, clip-on thermal imager, external battery pack with cable, counterweight, amber filters, and G22 helmet mount. Operator and maintenance training are available; pricing depends on the number of students. Virtual training is also available. Elbit's Customer Repair Service department is open 7 a.m.–4 p.m., Monday–Friday.

3.8 KENT OPTRONICS, INCORPORATED WFOV F-NVG

The Kent Optronics, Inc. WFOV F-NVG (Wide FOV Foveal-Night Vision Goggle) uses I^2 technology and is intended for ground use. This device uses a proprietary wide-angle foveal eyepiece and objective lens allowing for a field of view of 80° circular, which increases the viewable observation area. The WFOV F-NVG has a has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. The WFOV F-NVG has eye relief of 15 to 20 mm (80° to 68° field of view) and a diopter adjustment range of -4 to +2 diopters.

Figure 3-8 WFOV-F-NVG

Image Credit: Kent Optronics

The WFOV F-NVG operates on one AA battery and has an estimated lifespan of 16 hours at room temperature. The device has an auditory low battery life indicator. Additionally, the device has a built-in IR illuminator and automated bright light cutoff.

The WFOV F-NVG has dimensions of 4.2 x 4.9 x 3.3 inches with a length of 4.2 inches from the sacrificial filter to the demist shield and weighs approximately 1.5 pounds. This device works with a helmet mount adaptor and can be outfitted with a sacrificial lens. The WFOV F-NVG has an operating temperature range of -59 to 120 degrees Fahrenheit and a storage temperature of -59 to 185 degrees Fahrenheit. It is submersible up to 66 feet.

The WFOV F-NVG has an expected lifetime of 10,000 hours.

The WFOV F-NVG has an MSRP of $38,000, which includes a hard carrying-case, lens tissue, two demist shields, two sacrificial windows, and a one-year warranty. The device is available for purchase on the GSA schedule. Customer support is available 9 a.m.–5 p.m., Monday through Friday.

3.9 L3HARRIS ANVS-9 M949

The L3Harris ANVS-9 M949 (245081-051 and 245081-051T) uses I^2 technology and is intended for aerial use. The device has a field of view of 40 degrees. The ANVS-9 M949 has a focus range of 41 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 72 lp/mm and fixed gain. The ANVS-9 M949 features an interpupillary adjustment of 52 to 72 mm and diopter adjustment range of -6 to +2 diopters. The target identification range is dependent on ambient light.

Figure 3-9 ANVS-9 M949

Image Credit: L3Harris

The ANVS-9 M949 operates on nickel-cadmium (Ni-Cd) AA batteries, which have an estimated lifespan of 16 hours, and is equipped with a visual battery life indicator. Additionally, the device has auto-gated tubes preventing damage in high-light environments.

The ANVS-9 M949 has exterior dimensions of 4.6 x 5.1 x 3.5 inches and weighs 1.3 pounds. This device is compatible with ANVIS Mounts, HGU-56P/ SPH-4, can be outfitted with a sacrificial lens and optional Class A, B or C filters. Its lens orientation can flip up. The goggle's bridge includes a vent, fore-and-aft and tilt adjustments.

The ANVS-9 M949 has an operating temperature range of -25.6 to 125.6 degrees Fahrenheit and storage temperature range of -31 to 203 degrees Fahrenheit.

The ANVS-9 M949 meets all FAA-TSO 164a certification performance requirements.

The overall device is modular, allowing replacements as needed, and contains tubes lasting up to 10,500 hours. Visual inspections are recommended with each use to check for any broken or missing parts. Quarterly and annual routine maintenance requirements depend on owner's TSO certification requirements. Inspections and repairs can be conducted in-house or by the manufacturer. Operator level maintenance is explained in the manual and repair technician classes are available to learn how to repair the device and keep it in factory specifications. Costs for technician classes vary depending on location, length of course and number of students. Maintenance costs vary depending on what needs to be repaired.

The ANVS-9 M949 has an MSRP of \$10,000 to \$13,000 depending on the model and includes battery pack, cable, and helmet mount, depending on the configuration that is ordered. This product is also available for purchase through the GSA schedule. A one-year warranty for the unit and two-year warranty for the tube is included in the base price; extended warranties are available for purchase. A logistics support group is available from 8 a.m.–5 p.m., Monday through Friday via phone.

3.10 L3HARRIS AN/PVS-31A

The L3Harris AN/PVS-31A (BNG-001-A48) uses I² technology and is intended for ground and maritime use. The device is available with green or white phosphor, has a field of view of 40 degrees, and offers adjustable gain. The AN/PVS-31A has a focus range of 46 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has figure of merit (FOM) levels from 1600 to 2376+ ("figure of merit" is calculated by multiplying resolution by signal to noise ratio). This device features an interpupillary adjustment via a flexible bridge and replaceable fixed diopters. The target identification range is dependent on ambient light.

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Figure 3-10 AN/PVS-31A

Image Credit: L3Harris

The AN/PVS-31A operates on either a single AA battery or a four AA battery pack, which have an estimated lifespan of 15 hours with a single battery and 50 hours with the battery pack. The device is equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator and auto-gated tubes that prevent damage in high-light environments, including flash bang tube protection circuits.

The AN/PVS-31A has exterior dimensions of 4.7 x 4.2 x 3.4 inches and weighs 0.99 pounds. This device is compatible with dovetail helmet mounts, can be outfitted with a sacrificial lens and has a lens orientation that can be flipped up or to the side. Fit adjustments are made via the helmet mounting system.

The AN/PVS-31A has an operating temperature and storage temperature range of -68 to 140 degrees Fahrenheit. The device also features prescription plastic lenses which make them more resistant to fogging features. The AN/PVS-31A can withstand being submerged 66 feet in water for two hours.

Visual inspections, as well as wiping off all dirt and removing the battery when not in use, are recommended with each use. Inspections and repairs can be conducted in-house or by the manufacturer. Technician classes are available to learn how to repair the device and keep it in factory specifications. Costs for technician classes vary depending on location, length of course and number of students. Maintenance costs vary depending on what needs to be repaired. The overall device is modular, allowing replacements as needed, and contains tubes lasting up to 10,500 hours.

The AN/PVS-31A has an MSRP of $12,500, which includes a soft padded case, eye cups, battery pack and cable, lens cover, manual, quick reference guide, neck cord and cleaning cloth. A one-year warranty for the unit and two-year warranty for the tube is included in the base price. This product is also available for purchase through a GSA schedule. Logistics support is available via phone from 8 a.m.–5 p.m., Monday through Friday.

3.11 L3HARRIS BNVD-1531

The L3Harris BNVD-1531 (BNR-001-A4) uses I² technology and is intended for ground and maritime use. The device has a field of view of 40 degrees and a target identification range dependent on ambient light. The BNVD-1531 has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x, has a resolution of 72+ lp/mm, and adjustable gain

Figure 3-11 BNVD-1531

Image Credit: L3Harris

The device contains a flexible bridge for interpupillary adjustment and diopter adjustment range of -6 to +2 diopters. The BNVD-1531 operates on either a single AA battery or a four AA battery pack, which have an estimated lifespan of 16 hours with a single battery and 50 hours with the battery pack and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator and auto-gated tubes preventing damage in high-light environments including flash bang tube protection circuits.

The BNVD-1531 has exterior dimensions of 4.6 x 4.5 x 3.6 inches and weighs 1.23 pounds. This device can be operated as a helmet-mounted, head-mounted, or handheld system and is compatible with dovetail helmet mounts. It can be outfitted with a sacrificial lens and has a lens orientation that can be flipped up or to the side. Fit adjustments are made via the helmet mounting system.

The BNVD-1531 has an operating temperature range of -4 to 122 degrees Fahrenheit and storage temperature of -4 to 140 degrees Fahrenheit.

The BNVD-1531 meets or exceeds the MIL-STD-810 standards and can withstand submerging one meter into water for 30 minutes.

Visual inspections are recommended with each use. Inspections and repairs can be conducted in-house or by the manufacturer. Technician classes are available to learn how to repair the device and keep it in factory specifications. Costs for technician classes vary depending on location, length of course, and number of students. Maintenance costs vary depending on what needs to be repaired. The overall device is modular, allowing replacements as needed, and contains tubes that last up to 10,500 hours.

The BNVD-1531 has an MSRP of $10,500, which includes eye cups, battery pack and cable, soft case, neck cord, manual, quick reference guide, lens cleaning papers, lens covers, and sacrificial windows. A one-year warranty for the unit and two-year warranty for the tube is included in the base price. Extended warranties are available. This product is also available for purchase through a GSA schedule. Logistics support is available by phone from 8 a.m.–5 p.m., Monday through Friday.

3.12 L3HARRIS BNVD-FUSED

The L3Harris BNVD-FUSED (multiple models and configurations) uses integrated I^2 and thermal technology and is intended for ground and maritime use. The device comes with white phosphor tubes and has a field of view of 38 degrees. The BNVD-FUSED has a focus range of 46 cm to infinity and uses manual focusing. The device is capable of magnification at 1x features, has a resolution of 72+ lp/mm, and adjustable gain. The device has an interpupillary adjustment of 51 to 71 mm and a diopter adjustment range of -2 to +1 diopters. The target identification range is dependent on ambient light.

Figure 3-12 BNVD-FUSED

Image Credit: L3 Harris

The BNVD-FUSED operates on lithium AA batteries, which have an estimated lifespan of eight hours while in fused operation and is equipped with a visual battery life indicator. Additionally, the device has auto-gated tubes, which preventing damage in high-light environments, including flash bang tube protection circuits and can be purchased with or without an IR illuminator.

The BNVD-FUSED has exterior dimensions of 4.2 x 4.5 x 3.9 inches and weighs 2.3 pounds. This device is compatible with a BNVS mounting system, can be outfitted with a sacrificial lens, and has a lens orientation that can be flipped up or to the side. The BNVS mount is fixed on the goggle and all adjustments are made through the helmet mount.

The BNVD-FUSED has an operating temperature range of -25 to 120 degrees Fahrenheit and storage temperature of -51 to 160 degrees Fahrenheit.

The device works with weapon sights by a secure wireless system and will work with smart phones for the Android Team Awareness Kit (ATAK) and other navigation systems. The goggle comes standard with a 10-digit GPS location of the operator, magnetic compass, altitude above sea level, and GMT time/local time. The goggle can be upgraded by changing the standard battery pack for the L3Harris Smart Battery Pack. This expands the device's capabilities to include wireless communications, augmented reality via the Android Team Awareness Kit (ATAK), Blue Force Tracker, Jump Master Board and other plugins.

The BNVD-FUSED meets or exceeds the MIL-STD-810 standards.

Visual inspections are recommended with each use to check for any broken or missing parts. Inspections and repairs can be conducted in-house or by the manufacturer. Operator level maintenance is explained in the manual; technician classes are available to learn how to repair the device and keep it in factory specifications. Costs for technician classes vary depending on location, length of course and number of students. Maintenance costs vary depending on what needs to be repaired. The overall device is modular allowing replacements as needed and contains tubes lasting up to 10,500 hours.

The BNVD-FUSED has an MSRP of $35,000 to $40,000, depending on the configuration, and includes eye cups, lens covers, battery pack and cable, manual, quick reference guide and soft case. A one-year warranty for the unit and two-year warranty for the tube is included in the base price. This product is also available for purchase through a GSA schedule. Extended warranties are available. Logistics support is available via phone from 8:00 a.m.–5:00p.m., Monday through Friday.

3.13 NIGHTLINE, INC. RNVG

The Nightline, Inc. RNVG (Ruggedized Night Vision Goggle) uses I^2 technology and is intended for ground and maritime use. The device is available with green or white intensifier tubes, has a field of view of 40 degrees and a target identification range of 200 meters in a full moon. The RNVG has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. The RNVG features an interpupillary adjustment of 51 mm to 73 mm and diopter adjustment range of -6 to +2 diopters.

It operates on a single CR123A battery, which has an estimated lifespan of approximately 16 hours, and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR LED illuminator with spot/flood light adaptor. The installed image tubes have automatic brightness control to supply constant output image brightness as light levels increase and provide protection during exposure to high light levels.

The RNVG has exterior dimensions of 4.7 x 4.2 x 2.8 inches and weighs 1.26 pounds. This device is compatible with Wilcox and Norotos dovetail mounts and any dovetail style facemask, head or helmet mounts, can be outfitted with a sacrificial lens and has a lens orientation that can flip up. Additional fit adjustments can be performed via a helmet mount, such as height, elevation and eye relief.

The RNVG has an operating temperature range of -40 to 120.2 degrees Fahrenheit, storage temperature of -59.8 to 185 degrees Fahrenheit and has an operational humidity range of 0% to 95% humidity. The RNVG is hermetically sealed and comes nitrogen purged to prevent interior fogging. The system also comes standard with demist shields that prevent the exterior lenses of the eyepieces from fogging. Additionally, the RNVG system can be connected to an SLR or camcorder device via optional camera adapters.

The RNVG meets or exceeds IP68 and MIL-STD-810G standards and is contamination resistant.

The RNVG has an expected lifetime of up to 10 years, with lenses lasting up to 10 years and tubes lasting up to 10,000 hours. Routine maintenance includes cleaning the objective and eyepiece lenses with lens paper when they get dirty and drying the device after it gets wet. A thorough cleaning and inspection for wear and tear is recommended annually. For optimum performance, the device must be nitrogen (N_2) purged every six months, which can be completed in-house or by the manufacturer. The manufacturer provides evaluations, tests, repairs and upgrades. Depot-level inspection and purging is done by the manufacturer for $150 every six months. Costs for replacement parts, repairs and upgrades vary depending on the parts being worked on. The manufacturer provides a two-day basic user training for $3,000 and a 5-day depot level maintenance training for $9,500 in a facility located in Mountain City, Tennessee.

The RNVG has an MSRP of $9,000 which includes soft carrying case, two eye cups, two sacrificial windows, two demist shields, lens tissue, neck cord, two lens covers and a CR123A battery. A two-year limited warranty is included with the device that covers the system and image intensifier tube. Consumable items that have usage wear and tear have a 90-day warranty. Additional components including a variety of mounts for helmets, flip-up face mask, objective lens afocal with 3x and 5x magnification (with adapter and carrying case), adapters and lenses for video cameras, compass, hard carrying case and shuttered eye guards are available for an additional cost.

Diagnostic analysis, parts to repair the device, labor to repair the device and manufacturer defects are covered by the 24-month limited warranty. Customer support is available via phone or email during business hours: 9 a.m.–5 p.m. EST Monday through Thursday and 9a.m.–3 p.m. on Fridays.

3.14 NIGHTOPTIX PVS-31C-MILSPEC

The Nightoptix PVS-31C-MILSPEC Night Vision Binocular uses I^2 technology. The device is available with green or white phosphor and has a field of view of 40 degrees. The PVS-31C has a focus range of 25 cm to infinity, resolution of 64-74 lp/mm. The device is capable of magnification at 1x. Additionally the PVS-31C has a built IR illuminator with an IR-on indicator as well as an automatic light overload shut-off system and bright light protection. It has a diopter adjustment range of -6 to +4 diopters,

Figure 3-13 PVS-31C-MILSPEC

Image Credit: Nightoptix

The PVS-31C operates on one AA or one CR123 battery, which have estimated lifespans of up to 40 hours. The device is also equipped with a low battery indicator and features any polarity battery insertion.

The PVS-31C has exterior dimensions of 4.4 x 4.1 x 2.8 mm and weighs 1.4 pounds. This device is compatible with a Standard Head Gear PHG-7, Flip-Up Head Gear HG-714m, Advanced Flip-Up Helmet Mount HM-714XM-C, Advanced Flip-Up Helmet Mount HM-14XM-SR, Flip-up Helmet Mount Kit HM 714S-R and Advanced Flip-Up Helmet Mount HM-714LP-C. The device has a lens orientation that can be turned off when flipped up and can effectively become a single-eye goggle system. It can also be outfitted with a sacrificial window.

The PVS-31C has an operating temperature range of -40 to 122 degrees Fahrenheit. The device meets or exceeds the IP67 standards.

The PVS-31C expected lifetime varies depending on usage hours and handling of the device. Maintenance and repair costs vary and are determined by the price of the replacement part and duration of repair.

The PVS-31C has an MSRP of $9285–$14,746 depending on product type and tube (green or white phosphor). The PVS-31c includes a soft pouch, hard waterproof case, daytime filter, demist shield, sacrificial window, AA battery, a five-year limited warranty and an instruction manual. Additional components and accessories are available for an additional cost including head gear, helmet mount and 3x and 5x magnification afocal objective lenses. Customer support is available via e-mail.

3.15 NIGHT VISION DEVICES, INC. BNVD BINOCULAR NIGHT VISION DEVICE – SINGLE GAIN

Night Vision Devices, Inc./BNVD Binocular Night Vision Device – Single Gain (NVD-BNVD-SG-P45 White Phosphor and NVD-BNVD-SG-P43 Green Phosphor) use I^2 technology and are intended for ground and maritime use. The device has a field of view of 40 degrees and a focus range of 25 cm to infinity. The BNVD is capable of magnification at 1x and has a resolution of 64 to 81 lp/mm. The gain adjustment range for a fixed gain system is greater than 5,500 fL/fL and for an adjustable gain system:0 fL/fL to greater than 5,500 fL/fL. The device features an interpupillary adjustment of 51 to in excess of 76 mm range and diopter adjustment range of --6 to +2 diopters. The target identification range varies.

Figure 3-14 NVD BNVD-SG

Image Credit: Night Vision Devices Inc.

The BNVD-SG operates on lithium, alkaline & Ni-MH batteries, which have an estimated lifespan of 20+ hours for alkaline and 40+ hours for lithium and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR LED illuminator with spot/flood light capabilities and an automated bright light cutoff.

The BNVD-SG has exterior dimensions of 4.3 x 4.2 x 3.3 inches and weighs 1.23 pounds. This device is compatible with the Wilcox helmet mount and the Norotos Lo Sto helmet mount and can be outfitted with a sacrificial lens.

The BNVD-SG has an operating temperature range of -59.8 to 125.6 degrees Fahrenheit and temperatures ranging from 69.8 to 149 degrees Fahrenheit for exposures up to 240 hours, in accordance with MIL-STD-810G. The device's storage temperature range is -59.8 to 185 degrees Fahrenheit, and it has an operational relative humidity range greater than 90 percent. Demist shields are part of the standard accessory kit.

The BNVD-SG meets IP68 (submersible 20 meters for two hours) and MIL-STD-810G for shock resistance, as it can withstand a drop of one meter in its carry case without sustaining damage.

The BNVD-SG has an expected lifetime of 12,000 to 15,000 hours depending upon use conditions and maintenance, with lenses lasting up to 12,000 to 15,000 hours and tubes lasting up to 10,000 hours. Preventative maintenance procedures include inspection, cleaning, and performance of checkout procedures. Maintenance costs vary.

The BNVD-SG has an MSRP of $7,644.33 for P-45 white phosphor and $7,394.31 for P-43 green phosphor. Purchase price includes soft carrying case, demist shields, sacrificial windows, IR spot/flood lens, dovetail mounting adapter, lens tissue, two AA batteries, an operator's manual and card, neck cord, eyecups and retaining lens covers, as well as a 10-year warranty. This product is also available for purchase through a GSA schedule.

Additional components available for an additional cost include 3x magnifier, Wilcox G24 helmet mount, shuttered eye guards, camera adapter, and battery pack for 50-60 hours of continual use for extended missions. Customer support is available during normal hours of operation: 8:30 a.m.–5:30 p.m. EST.

3.16 PRG DEFENSE NVG-51

The Potomac River Group (PRG) Defense White Phosphor NVG-51 (1DNV512PDPP022M) uses I² technology and is intended for ground use. The device is also available with green phosphor intensifier tubes. The NVG-51 has a field of view of 51 degrees, with a 40 degree version available. The NVG-51 has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 64 to 72 lp/mm and manual gain adjustments of 40k-80k fL/fc. It has an interpupillary adjustment range of 54 to 78 mm and a diopter adjustment range of -6 to +2 diopters.

Figure 3-15 NVG-51

Image Credit: PRG Defense

The NVG-51 operates on a single CR123A or AA battery, with an operating battery life of up to 20 to 25 hours at room temperature and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator with two power levels and an automated bright light cutoff as well as autogating.

The NVG-51 has exterior dimensions of 4.4 x 4.6 x 2.9 inches and weighs 1.35 pounds. The device is compatible with dovetail or Rhino mounts, can be outfitted with a sacrificial lens, and has a lens orientation that can be flipped up or to the side. The fit can be adjusted via eye relief of 17 mm (25 mm for the 40-degree version), pivot adjustments and fore-and-aft adjustments.

The NVG-51 has an operating temperature range of -40 to 122 degrees Fahrenheit, a storage temperature of -58 to 122 degrees Fahrenheit and does not suffer degradation of performance when subjected to relative humidity up to 90 percent. The device is purged with dry nitrogen to prevent fogging and condensation and comes with a demist shield as standard equipment.

The NVG-51 has an IP rating of 67, meets MIL-STD-810-G for shock resistance and is contamination resistant.

The overall device has an expected lifetime of up to five years. Routine maintenance includes removing the batteries after each use and annual nitrogen (N_2) purges. Basic cleaning and maintenance are outlined in the operator's manual. An additional cleaning kit, which includes lens cleaning solution and disposable lens tissues, can be purchased for $18. The manufacturer provides inspection and repair services of varying costs. A one-day operator course is available for $800, and if conducted in-person. Federal Travel Regulation per-diem rates and other travel costs apply.

The NVG-51 has an MSRP of $8,820, which includes a soft case, Dovetail or Rhino mount adapter, lens cloth, demist shield, eye cups and operator manual. A two-year system warranty and five-year image tube warranty is included in the base price. An additional two-week diagnostic analysis warranty coverage is available for $100. This product is also available for purchase through a GSA schedule.

Additional components including a hard case, external battery pack, helmet mount, afocal lens kit (cannot be used with thermal clip-on) and amber filters are available for an additional cost. Customer and technical support are available by telephone during business hours.

4.0 MONOCULAR NIGHT VISION DEVICE PRODUCT INFORMATION

This section of the market survey report provides information on 17 monocular night vision devices that range in price from $2,195 to $5,034. All the monocular NVDs use I^2 technology. All devices are available in both green and white phosphor, except the Nightline NL914C and the Superior Tactical PVS-14, which are available only in white. All 17 monoculars have built in IR LED illuminators and some form of brightness control to ensure image quality under changing light conditions and to protect the intensifier tubes from excessive light. All devices allow for thermal integration via the optional Enhanced Clip-On Thermal Imager (ECOTI) accessory and use commercial off-the-shelf batteries that are replaceable in operational settings.

Table 4-1 provides general product characteristics and specifications. Product information presented in this section was obtained directly from manufacturers, vendors and their websites. The information has not been independently verified by the SAVER program. Information not readily available from the companies is indicated by an "N/A" in the below table and is not described within individual product sections.

Product information in Table 4-1 is defined as follows, listed in column order:

MSRP ($) refers to the manufacturer's suggested retail price of the device and included components, given in U.S. dollars.

Dimensions given as L x W x H refers to the physical dimensions of the device in inches.

Weight refers to the weight of the device with batteries (except where noted) in pounds.

Field of View refers to the degree of horizontal distance that can be viewed through the technology without requiring additional lens options or accessories.

Focus Range refers to the distance (given near to far) away from a night vision device within which it can focus on an object.

Resolution refers to the image quality or object identification capability measured in line pairs per millimeters (lp/mm).

Diopter Adjustment Range refers to the adjustment range for accommodating differences in eyesight between the user's eyes. A diopter is the unit of measurement used to define eye correction or the refractive power of a lens.

Battery Type refers what sort of battery needed to operate the device.

Battery Life refers to the amount of time the battery can power the device.

Table 4-1 Monocular Night Vision Devices Product Comparison Matrix

Vendor	Product	MSRP	Dimensions (inches)	Weight (pounds)	Field of View (°)	Focus Range	Resolution (lp/mm)	Diopter Adj. Range (diopters)	Battery Type	Battery Life (Hours)
Advanced Night Vision Systems	PVS-14	$2,795–$3,995	4.5 x 2.5 x 2.75	0.675*	40	25 cm to ∞	64	-6 to +2	AA	50+
AGM Global	PVS-14	$2,934–$5,034	4.5 x 2.5 x 2.7	0.71	40	25 cm to ∞	64	-6 to +4	AA	N/A
AGM Global	NVM	$2,619–$3,250	6.9 × 2.2 × 3.1	0.75	40	25 cm to ∞	64–72	-6 to +2	AA CR123A	40
ATN	NVM14-3	$2,195–$3,695	4.7 x 1.9 x 2.7	0.7	40	25 cm to ∞	51–72	-6 to +2	CR123A	50-60
ATN	PVS-14	$2,995–$4,995	4.5 x 2 x 2.5	0.78	40	25 cm to ∞	64–72	-6 to +2	AA	50
Aviation Specialties Unlimited	AN/PVS-14 (Digital)	$4,500	4.5 x 2 x 2.2	0.6	40	25 cm to ∞	64	-6 to +2	AA	40
Aviation Specialties Unlimited	AN/PVS-14	$4,500	4.5 x 2.0 x 2.2	0.747	40	25 cm to ∞	64	-6 to +2	AA	15
Carson Industries	AN/PVS-14	$4,500	4.5 x 2.0 x 2.25	0.8	40	25 cm to ∞	64	-6 to +2	AA	40
L3Harris	AN/PVS-14	$3,900	4.5 x 2.5 x 2.4	0.77	40	25 cm to ∞	64	-6 to +2	AA	48

Vendor	Product	MSRP	Dimensions (inches)	Weight (pounds)	Field of View (°)	Focus Range	Resolution (lp/mm)	Diopter Adj. Range (diopters)	Battery Type	Battery Life (Hours)
Elbit	AN/PVS-14	$3,672	2.4 x 2.3 x 4.5	0.783	40	25 cm to ∞	64–81	-6 to +4	AA	60
Nightline, INC.	NL914C (AN/PVS-14 style)	$4,500	4.5 x 2.4 x 2.5	0.66	40	25 cm to ∞	64	-6 to +2	AA CR123A	50 for AA 75 for CR123A
Nightoptix	PVS-14C	$3449–$7446	4.3 x 2.6 x 2.2	0.73	40	25 cm to ∞	64-74	-6 to +4	AA CR123A	40
Night Vision Devices	AN/PVS-14	$2,838–$2,879	4.5 x 2.5 x 2.75	0.677*	40	25 cm to ∞	N/A	-6 to +2	AA	50+
NIVISYS LLC	MUM-14	$3,999	4.5 x 2 x 3.1	0.65	40	25 cm to ∞	64	-6 to +2	AA CR123A	20 for AA 40 for CR123A
N-Vision Optics	PVS-14	$2,569–$4,125	4.5 x 2 x 2.25	0.71	40	25 cm to ∞	64	-6 to +2	AA	N/A
PRG Defense	PVS-14	$2615–$3560	4.4 x 2.4 x 2.4	0.7	40	25 cm to ∞	N/A	-6 to +4	AA	50
Superior Tactical	PVS-14	$2799–$4299	4.5 x 2.0 x 2.7	0.71	40	25 cm to ∞	64	-6 to +4	AA	50

Notes:

* Weight provided is without batteries.

N/A indicates that information was not readily available from the manufacturer.

4.1 ADVANCED NIGHT VISION SYSTEMS (ANVS) PVS-14

The PVS-14 (ANVS-1347) night vision monocular uses I^2 technology and is intended for ground use. The ANVS PVS-14 comes in green or white phosphor image intensifier tubes and in various configurations. The device has a field of view of 40 degrees and has a focus range of 25 cm to infinity. The ANVS PVS-14 is capable of magnification at 1x and has a resolution of 64 lp/mm. The device has a diopter adjustment range of - 6 to +2 diopters. Additionally, the ANVS PVS-14 has a built-in IR illuminator, automatic brightness control and a bright light shut-off.

Figure 4-1 PVS-14

Image Credit: PRG Defense

The ANVS PVS-14 operates on one AA battery, which has an estimated lifespan of 50+ hours, and is equipped with a low battery life indicator.

The ANVS PVS-14 has exterior dimensions of 4.5 x 2.5 x 2.75 inches and weighs 0.675 pounds without battery. This device is compatible with various mounts on weapons, cameras, and helmets.

The ANVS PVS-14 is waterproof to 66 feet for one hour and complies with the MIL-STD-810 standard.

The ANVS PVS-14 has an MSRP of $2,795 to $3,995 for the standard and digital versions. The ANVS PVS-14 includes soft carry case, operator's manual, two AA batteries, demist shield, sacrificial filter for objective lens, head/helmet mount adapter (J-arm), head mount assembly with three brow pads, lens tissue, neck cord, eyecup, and front lens cap. Additional components, mounts, and other accessories are available for an additional cost. This device is also available with L3 white phosphor, unfilmed as model Gen-3 FOM 2000 at an MSRP of $3,495–$3,995; technical specifications are consistent with the PVS-14 (ANVS-1347) information provided above. GSA pricing is available for the PVS-14 with white phosphor tubes.

All ANVS devices are covered by a warranty ranging from 12 months to 10 years depending on the specific product. The warranty does not cover accidental damage or misuse. Customer support is available free via phone Monday through Friday during working hours.

4.2 AGM GLOBAL VISION PVS-14

The AGM Global Vision offers multiple variations of the PVS-14 night vision device. The devices use I^2 technology and is intended for ground use. They have a field of view of 40 degrees and a focus range of 25 cm to infinity. The AGM Global Vision PVS-14 is capable of magnification at 1x with optional 3x and 5x magnification and has a resolution of 64 lp/mm. The device has a diopter adjustment range of -6 to +4 diopters. Additionally, the device has a built-in IR illuminator, automatic shut-off system, and a bright light cutoff.

Figure 4-2 PVS-14

Image Credit: AGM Global Vision

The AGM Global Vision PVS-14 operates on one AA battery, which has an estimated battery life of 50 hours and is equipped with a low battery life and excessive light conditions LED indicators.

The AGM Global Vision PVS-14 has exterior dimensions of 4.5 x 2.5 x 2.7 inches and weighs 0.71 pounds with battery.

The device has an operating temperature range of -60 to 120 degrees Fahrenheit and a storage temperature of -60 to 185 degrees Fahrenheit. This AGM Global Vision PVS-14 devices complies with the MIL-STD-810G standard.

The AGM Global Vision PVS-14 devices have an MSRP of from $2,934 to $5,034, which includes head mount assembly, brow pad, eye cup, helmet/head mount adapter, system soft carrying case, daylight filter, shoulder strap, lens paper, diopter lens cap, sacrificial window, demist shields, operator's manual, and battery, as well as a limited three-year warranty. Customer support is available via phone and email.

4.3 AGM GLOBAL VISION NVM

The AGM Global Vision offers multiple variations of its NVM night vision devices, the AGM NVM-40s and AGM-50s. The devices use I^2 technology and are intended for ground and maritime use. The devices have a field of view of 40 degrees and a focus range of 25 cm to infinity. The AGM Global Vision NVM is capable of magnification at 1x with optional 3x and 5x magnification and has a resolution of 64-72 lp/mm. The device has a diopter adjustment range of -6 to +2 diopters. Additionally, the device has a built-in IR illuminator, flood lens, automatic shut-off system, and a bright light cutoff.

Figure 4-3 NVM

Image Credit: AGM Global Vision

The AGM Global Vision NVM utilizes a single CR123A lithium or AA battery for an estimated battery life of 40 hours. It is equipped with LED indicators for low battery life and excessive light conditions.

The AGM Global Vision NVM has exterior dimensions of 6.9 × 2.2 × 3.1 inches and weighs 0.75 pounds with battery.

The AGM Global Vision NVM has an operating temperature range of -40 to 122 degrees Fahrenheit and a storage temperature of -58 to 122 degrees Fahrenheit.

This AGM Global Vision NVM devices complies with the MIL-STD-810G standard.

The AGM Global Vision NVM devices have an MSRP of $2,619 to $3,250, which includes lens cloth, soft carrying case, and manual, as well as a limited three-year warranty. Customer support is available via phone and email.

4.4 ATN CORPORATION NVM14-3

The ATN Corporation NVM14-3 uses I^2 technology and is intended for ground use. The device is available in green or white phosphor, has a field of view of 40 degrees, and a focus range of 25 cm to infinity. The NVM14-3 is capable of magnification at 1x and has a resolution of 64 lp/mm. The device has a diopter adjustment range of -6 to +2 diopters. Additionally, the NVM14-3 has a built-in IR illuminator, automatic brightness control and a bright light cutoff.

Figure 4-4 NVM14-3

Image Credit: ATN Corporation

The NVM14-3 operates on one CR123A battery that has an estimated lifespan of 50–60 hours and is equipped with a low battery life indicator within the field of vision.

The NVM14-3 has exterior dimensions of 4.7 x 1.9 x 2.7 inches and weighs 0.7 pounds. This device is compatible with Personal Armor System for Ground Troops (PASGT) and dual bridge mounts.

The NVM14-3 has an operating temperature range of -40 to 122 degrees Fahrenheit and a storage temperature of -58 to 158 degrees Fahrenheit.

This device is waterproof based on manufacturer descriptions and complies with the MIL-STD-810 standard.

The NVM14-3's expected lifetime varies depending on usage hours and handling of the device. Routine maintenance can be conducted in-house and includes battery charging, cleaning and dusting, as well as visual inspection of optical surfaces, battery cap housing, monocular, eyepiece lens, eyecup, eye guard and objective lens is recommended before and after use. Additionally, it's recommended that repairs are made by the manufacturer. Costs are determined by warranty status, price of the replacement part(s) and duration of repair by a technician.

The NVM14-3 has an MSRP of $2,795, which includes a lens cap, eyecup, soft carrying case, operator's manual, one battery, a battery adapter, and a neck cord as well as a two-year warranty. This device is also available in three additional models based on tube generation: the NVM14-3W, which has a resolution of 64 lp/mm and a price of $3,695; the NVM14-3P, which has a resolution range of 64–72 lp/mm and a price of $2,995; and the NVM14-WPT, which has a resolution range of 5–64 lp/mm and a price of $2,195. All other specs are consistent with the NVM14-3 information provided above.

Additional components, mounts, extended warranties and trainings are available for an additional cost. Customer support is available free via phone Monday through Friday during work hours.

4.5 ATN CORPORATION, PVS14-3

The ATN Corporation PVS14-3 uses I^2 technology, and is intended for ground use. The device is available in green or white phosphor and has has a field of view of 40 degrees. The PVS14-3 has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x, but offers additional options up to 3x and 5x. The device has a resolution of 64–72 lp/mm, gain adjustment range of 25 to greater than 3,000 FL/FL (which can be adjusted via a knob) and a diopter adjustment range of -5 to +2 diopters. The PVS14-3 also has a built-in IR illuminator and an autogated bright light cutoff.

Figure 4-5 PVS14-3

Image Credit: ATN Corporation

The PVS14-3 operates on one 1.5V AA battery, which has an estimated lifespan of 50 hours, and is equipped with a battery life indicator.

The PVS14-3 has exterior dimensions of 4.5 x 2 x 2.5 inches and weighs 0.78 pounds. This device is compatible with modular integrated communications helmet (MICH), PASGT or WILCOX mounts and can be outfitted with a sacrificial lens.

The PVS14-3 has an operating temperature range of -60 to 120 degrees Fahrenheit, storage temperature of -60 degrees to 185 degrees Fahrenheit. The device also features anti-fog capability.

The device is water resistant and meets MIL-STD-810 and comes with a Proshield lens coating.

The PVS14-3's expected lifetime varies depending on usage hours and handling of the device. Routine maintenance, including battery charging, cleaning and dusting, is recommended and can be conducted in-house. Additionally, it's recommended that repairs are made by the manufacturer, cost is determined by warranty status, price of the replacement part and duration of repair by a technician.

The PVS14-3 has an MSRP of $2,995 which includes a soft carrying case, lens tissue, one battery, helmet mount, demist shield, sacrificial filter, neck cord, a three-year warranty which covers the body, tube and lens, as well as an instruction manual and access to online training videos. Additional components, including alternate helmet mount kits, 3x and 5x lens magnifiers and weapon mounts are available at additional cost.

This device is available in five other models based on tube generation:

- PVS14-2, which has a resolution of 45–54 lp/mm and a price of $2295
- PVS14/6015-WPT, which has a resolution of 51–64 lp/mm and a price of $2,495
- PVS14-4, which has a resolution of 64–72 lp/mm and a price of $4,995
- PVS14-3P, which has a resolution of 64–72 lp/mm and a price of $3,195
- PVS14/6015-3W, which has a resolution of 64–72 lp/mm and a price of $3,895

All other specs are consistent with the PVS14-3 information provided above. Customer support is available via phone Monday through Friday during work hours at no cost.

This information was provided by Atlantic Diving Supply, a distributor of this product.

4.6 AVIATION SPECIALITIES UNLIMITED INC., DIGITAL AN/PVS-14

The Aviation Specialties Unlimited Inc. Digital AN/PVS-14 (Model number PVS-14 Digital) uses I^2 technology and is intended for ground and maritime use. The device has a field of view of 40 degrees and a focus range of 25 cm to infinity. The device is capable of magnification at 1x. The device has a resolution of 64 lp/mm, gain adjustment range of 25 to greater than 3,000 FL/FL which can be adjusted via digital push button control and diopter adjustment range of -6 to +2 diopters. Additionally, the Digital AN/PVS-14 has a built-in IR illuminator and automatic brightness control.

Figure 4-6 Digital AN/PVS-14

Image Credit: Aviation Specialties Unlimited Inc.

The Digital AN/PVS-14 operates on one AA battery, which has an estimated lifespan of 40 hours at room temperature and is equipped with a visual battery life indicator.

The Digital AN/PVS-14 has exterior dimensions of 4.5 x 2 x 2.2 inches and weighs 0.6 pounds. Digital controls reduce the weight and extend the battery life compared to the traditional AN/PVS-14. This device is compatible with PVS-14 head and helmet mounts as well as weapon mount adapters for Picatinny Rails and can be outfitted with a sacrificial lens. When not in use, the lens can be flipped up. The fit can be adjusted via 25 mm eye relief. The device also features a demist shield assemble, which helps prevent fogging.

The Digital AN/PVS-14 has an operating temperature range, storage temperature range and an operational humidity range compliant with MIL-STD-810. The Digital AN/PVS-14 is outfitted for contamination resistance and meets MIL-STD-810.

The Digital AN/PVS-14 tubes have an expected lifetime of up to 10,000 hours. Routine preventative maintenance and checks are recommended with each use and can be conducted in-house. Additionally, high level maintenance services, repairs and upgrades can be made by Aviation Specialties Unlimited Inc., cost is determined by the price of the replacement or upgraded parts and duration of time needed by a technician. The company also offers a tiered service plan.

The Digital AN/PVS-14 has an MSRP of $4,500 which includes a soft carrying case, operator manual, battery, demist shield assembly, eye guard, sacrificial window assembly, lens paper, shoulder strap, retainer cord, head mount assembly, weapon and head/helmet mount adaptors, as well as a one-year warranty which covers the housing and tubes. Additional components such as spare batteries, 3x or 5x afocal lens assemblies and spare parts kit are available for an additional cost. Customer Support is available via phone.

4.7 AVIATION SPECIALTIES UNLIMITED INC., AN/PVS-14

The Aviation Specialties Unlimited Inc., AN/PVS-14 (Model Number M914A) uses I^2 technology and is intended for ground and maritime use. The device has a field of view of 40 degrees. The AN/PVS-14 has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x. The device has a resolution of 64 lp/mm, gain adjustment range of 25 to greater than 3,000 FL/FL and diopter adjustment range of -6 to +2 diopters. Additionally, the AN/PSV-14 has a built-in IR illuminator and an automated bright light cutoff when in the up position.

Figure 4-7 AN/PVS-14

Image Credit: Aviation Specialties Unlimited Inc.

The AN/PVS-14 operates on one AA battery, which has an estimated lifespan of 15 hours at room temperature and is equipped with a visual battery life indicator.

The AN/PVS-14 has exterior dimensions of 4.5 x 2.0 x 2.2 inches and weighs 0.747 pounds. This device is compatible with head and helmet mounts and can be outfitted with a sacrificial lens. When not in use, the lens can be flipped up. When using a head mount assembly, adjustment of a weapon and head mounted adaptor can be used. The device also features a demist shield assembly, which helps prevent fogging.

The AN/PVS-14 has an operating temperature range, storage temperature range and an operational humidity range compliant with MIL-STD-810. The AN/PVS-14 is shock resistant and meets MIL-STD-810.

AN/PVS-14 tubes have an expected lifetime of up to 10,000 hours. Routine preventative maintenance and checks are recommended with each use and can be conducted in-house. Aviation Specialties Unlimited Inc. offers inspections, repairs and upgrades, costs are determined based on service or by the price of the replacement part and duration of time needed by a technician. The company also offers a tiered service plan. Additionally, Aviation Specialties Unlimited Inc. offer formal training for personnel to learn how to maintain their own systems.

The AN/PVS-14 has an MSRP of $4,500. The PVS-14 includes a soft carrying case, operator manual, one battery, demist shield assembly, eyecup, sacrificial window assembly, lens paper, shoulder strap, retention cord and head mount assembly, as well as a one- year warranty which covers the housing and tubes. Additional components such as spare batteries, 3x or 5x afocal lens assemblies, spare parts kit, lens brush, weapon mount adapter, shipping case, head/helmet mount adapters and training operator maintenance as well as service plans and trainings are available for an additional cost. Customer support is available via phone.

4.8 CARSON INDUSTRIES AN/PVS-14

The Carson Industries AN/PVS-14 (PVS-14 CKS1400) monocular night vision device (MNVD) is a single channel night vision system that utilizes a single image intensifier and is available with green or white phosphor tubes. The AN/PVS-14 uses I^2 technology and is intended for ground and maritime use. The device has a field of view of 40 degrees +/-2 degrees and a target identification range of >100m minimum. The AN/PVS-14 has a focus range of 25 cm to infinity and is capable of magnification at 1x. The device has a resolution of 64 lp/mm minimum, gain adjustment range of 50K-80K @2x10-6fc (tube) and diopter adjustment range of -6 to +2 diopters. Additionally, the device operates in 0 LUX, uses on-board 850nm IR LED illumination for total darkness and has automated bright light cutoff.

Figure 4-8 AN/PVS-14

Image Credit: Carson Industries

The AN/PVS-14 operates on AA batteries, which have an estimated lifespan of 40 hours, and is equipped with a visual battery life indicator.

The AN/PVS-14 has exterior dimensions of 4.5 x 2.0 x 2.25 inches and weighs 0.8 pounds. This device is compatible with standard night vision helmet mounts from Wilcox or Norotos mounts, can be outfitted with a sacrificial lens and has a flip-up lens orientation. Fit adjustments are made utilizing the helmet mount for x-y, vertical, tilt and eye relief.

The AN/PVS-14 has an operating temperature range of -59.8 degrees to 120.2 degrees Fahrenheit, storage temperature of -59.8 degrees to 185 degrees Fahrenheit, and has an operational humidity range of 90% relative humidity (RH) for 240 hours. The device has purging capability to prevent fogging from the inside. The AN/PVS-14 meets water resistance at 3' for 30 minutes; and shock resistance per MIL-STD-810 and MIL-PRF-49324.

The AN/PVS-14 has an expected lifetime of up to 10,000 hours, with lenses lasting up to 10 years and tubes lasting up to 10 years. Routine maintenance, clean lens as required; check or replace batteries depending on usage is recommended. Component spare parts available include eyepiece lens assembly, objective lens assembly, image tube, eyecup, sac window, demist shield.

The AN/PVS-14 has an MSRP of $2,900–$3,300 depending on tube performance specifications, and includes eyecup, lens cover, sacrificial window, demist shield, lanyard, helmet mount adapter, head mount, cleaning kit, carrying case with shoulder strap, batteries, and user’s manual with a one-year standard warranty. Additional components (helmet mount, weapon mount, 3x or 5x afocal mag lens, COTI, and Steiner DBAL-A3), extended warranties and operational and/or maintenance training are available for an additional cost. Carson Industries PVS-14 LW is a lightweight monocular night vision device that is 30% lighter than a standard PVS-14 (.55 lbs.) and utilizes lightweight optics and an ergonomically designed digital keypad with the same functions as a standard PVS-14. The device uses an IR LED illuminator and a single AA battery. Customer support is available 24/7 using email/voice message after normal business hours.

4.9 ELBIT AN/PVS-14

The Elbit AN/PVS-14 (Model Number F6015) uses I^2 technology and is intended for ground and maritime use. It can be purchased with either white or green phosphor tubes. The device has a field of view of 40 degrees. The AN/PVS-14 has a focus range of 25 cm to infinity, uses manual focusing and is capable of magnification at 1x. The device has a resolution of 64-81 lp/mm, gain adjustment range of 55 to 5500 fL/fL, and diopter adjustment range of -6 to +4 diopters. Additionally, the AN/PVS-14 has a built-in IR illuminator and an automated bright light cutoff.

Figure 4-9 AN/PVS-14

Image Credit: Elbit Systems of America

The AN/PVS-14 operates on one lithium or alkaline AA battery; the alkaline has an estimated lifespan of 60 hours at standard temperature. The device is equipped with a visual battery life indicator.

The AN/PVS-14 has exterior dimensions of 2.4 x 2.3 x 4.5 inches and weighs 0.783 pounds. This device is compatible with PASGT, ACH/MICH, ACVC, K1, MK6, CGF, RBR, CG634 mounts and can also be used with a head mount. The AN/PVS-14 can be outfitted with a sacrificial lens, which is included with standard accessories, and has a lens orientation that can be flipped up. Fit adjustments include eye relief and fore-and-aft adjustments.

The AN/PVS-14 has an operating temperature range of -60 to 120 degrees Fahrenheit, a storage temperature range of -60 to 185 degrees Fahrenheit. It does not suffer performance degradation when subjected to relative humidity greater than 90 percent for exposures up to 240 hours. The device also comes with a demist shield. Anti-fog wipes, sold separately, can also be used.

The AN/PVS-14 can be submerged in water at 66 feet for two hours, meets MIL-STD-810 for shock resistance and is contamination resistant.

An overall expected lifetime for the AN/PVS-14 is not given but the tubes have an expected lifetime of 10,000 hours. Routine maintenance requirements and instructions for self-maintenance are included in the operator’s manual. Some maintenance services are included with the standard warranty while others would pose additional costs.

The AN/PVS-14 has a MSRP of $3,672, which includes head/helmet mount adapter (j-arm), soft carrying case, eye cups, lens cap, demist shield, sacrificial lenses and operator's kit (manual, quick reference card, lens paper), as well as a two-year warranty for the system and a one-year warranty for spare parts and accessories. This product is also available for purchase through GSA schedule.

Additional components which can be purchased separately include helmet or head mount assembly, small arms mounting adapter, eye guard, camera adapter ring, 3x or 5x magnifier lens, shipping/hard storage case, and a dual mount adapter. Additional accessories available upon request. The customer repair service department is open 7 a.m.–4 p.m., Monday–Friday. Operator's and maintenance training are available, with pricing dependent on number of students; virtual training is also available.

4.10 L3HARRIS AN/PVS-14

The L3Harris AN/PVS-14 (M914A) uses I^2 technology and is intended for ground and maritime use. The device is available with green or white phosphor. The device has a field of view of 40 degrees and a target identification range dependent on ambient light. The AN/PVS-14 is has a focus range of 25 cm to infinity, uses manual focusing and is capable of magnification at 1x. The device features an eye relief adjustment of 25 mm and diopter adjustment range of -6 to +2 diopters. Additionally, the AN/PVS-14 has a built-in IR illuminator and auto-gated tubes to prevent damage in high-light environments.

Figure 4-10 AN/PVS-14

Image Credit: L3Harris

The AN/PVS-14 operates on a single AA battery, which has an estimated lifespan of 48 hours at 77 degrees Fahrenheit, and it is equipped with a visual battery life indicator.

The AN/PVS-14 has exterior dimensions of 4.5 x 2.5 x 2.4 inches and weighs 0.77 pounds with battery. This device is compatible with J-arm to wedge or BNVS mount, can be outfitted with a sacrificial lens and has a lens orientation that can be flipped up or to the side. Fit adjustments are made via the helmet mounting system.

The AN/PVS-14 has an operating temperature range of -60 to 120 degrees Fahrenheit, storage temperature of -60 to 185 degrees Fahrenheit. The AN/PVS-14 can be submerged 1 meter in water for 30 minutes.

The overall device is rebuildable with a replaceable lens and tubes lasting up to 10,500 hours. Visual inspections are recommended with each use. Inspections and repairs can be conducted in-house or by the manufacturer. Technician classes are available on how to repair the device and keep it in factory specifications. Costs for technician classes vary depending on location, length of course and number of students. Replacement parts are available. Maintenance costs vary and are directly correlated to the cost of the replacement part and technician's time.

The AN/PVS-14 has an MSRP of $3,900, which includes a soft case, operational manual, eye cup, battery, demist shield, sacrificial window, lens paper, shoulder strap, retainer cord, head mount, and weapon and head mount adaptors. A 1-year warranty for the unit and 2-year warranty for the tube is also included in the base price. An additional component, a 3x magnifier, is available for an additional cost. This product is also available for purchase through a GSA schedule. Logistics support is available by phone from 8 a.m.–5 p.m., Monday through Friday.

4.11 NIGHTLINE, INC. NL914C™

The Nightline, Inc. NL914C (AN/PVS-14 style) uses I^2 technology and is intended for ground and maritime use. The device is available in white phosphor. The device has a field of view of 40 degrees. The NL914C has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x and has a resolution of 64 lp/mm. The device has a gain adjustment range of ±10 to >3,000 and diopter adjustment range of -6 to +2 diopters. Additionally, the NL914C has a built-in IR LED illuminator and an automated bright light cutoff.

Figure 4-11 NL914C

Image Credit: Nightline, Inc.

The NL914C operates on a single AA battery, which has an estimated lifespan of 50 hours, or a single CR123A battery, which has an estimated lifespan of 75 hours. The device is equipped with a visual battery life indicator.

The NL914C has exterior dimensions of 4.5 x 2.4 x 2.5 inches and weighs 0.66 pounds. This device is compatible with any Bayonet style facemask, head mount or helmet mount and comes included with a head mount assembly and head/helmet mount adapter (swing arm). The device can be outfitted with a sacrificial lens and has a lens orientation that can flip up. It can be connected to an SLR or camcorder device via optional camera adapters.

The NL914C has an operating temperature range of -60 to 122 degrees Fahrenheit, a storage temperature of -60 to 185 degrees Fahrenheit and an operational humidity range of 0 to 95 percent humidity. The NL914C comes nitrogen purged to prevent interior fogging. The system also comes with demist shields, which prevent the exterior lens of the eyepiece from fogging. The NL914C meets or exceeds the IP68 and MIL-STD-810G standards and is hermetically sealed providing contamination resistance.

The NL914C has an expected lifetime of up to 10 years, with lenses lasting up to 10 years and tubes lasting up to 10,000 hours. Routine maintenance includes cleaning the objective and eyepiece lenses with lens paper when they get dirty and drying the device after it gets wet. A thorough cleaning and inspection for wear and tear are recommended annually. The device must be nitrogen purged every six months for optimum performance and can be completed in-house or by the manufacturer. Inspection and purging are offered by the manufacturer for $75.00 every six months. The manufacturer also offers evaluations, tests, repairs and upgrades. Costs for replacement parts, repairs and upgrades vary depending on the parts being worked on. The manufacturer provides a two-day basic user training for $3,000 and a five-day depot level maintenance training for $9,500, both in a facility located in Mountain City, Tennessee.

The NL914C has an MSRP of $4,500, which includes a soft case, monocular assembly, head mount assembly, alkaline AA battery, CR123A battery, soft carrying case, head/helmet mount adapter, neck cord, objective lens cover, eye cup assembly, demist shield, sacrificial filter, lens cleaning paper and operator manual. A two-year limited warranty that covers the system and image intensifier tube is also included. Diagnostic analysis, parts to repair the device, labor to repair the device and manufacturer defects are covered by the 24-month limited warranty. Consumable items that have usage wear and tear have a 90-day warranty.

Additional components including a variety of mounts for helmets, flip-up face mask, objective lens afocals with 3x and 5x magnification (with adapter and carrying case), adapters and lenses for video cameras, compass, hard carrying case, and shuttered eye guard are available for an additional cost. Customer support is available by phone or email from 9 a.m.–5 p.m. EST, Monday through Thursday and 9 a.m.–3 p.m. EST on Fridays.

4.12 NIGHTOPTIX PVS-14

The Nightoptix PVS-14C Night Vision Monocular uses I^2 technology and is available in green or white phosphor. The device has a field of view of 40 degrees. The PVS-14C has a focus range of 25 cm to infinity. The device has a diopter adjustment range of -6 to +4 diopters, a resolution of 64-74 lp/mm, and is capable of magnification at 1x. Additionally, the PVS-14C has a built-in IR illuminator with an IR-on indicator as well as an automatic shut-off system and bright light protection.

Figure 4-12 PVS-14C

Image Credit: Nightoptix

The PVS-14C operates on one AA battery or one CR123 battery, both of which have an estimated lifespan of up to 40 hours. The device is also equipped with a low battery indicator and features any polarity battery insertion.

The PVS-14C has exterior dimensions of 4.3 x 2.6 x 2.2 inches and weighs 0.73 pounds. This device is compatible with a J-Arm adapter interface, standard PHG-7 head gear, HG0714m flip-up head gear, advanced flip-up helmet mount HM-714XM-C, advanced flip-up helmet mount HM-14XM-SR, flip-up helmet mount kit HM 714R-C, and low-profile flip-up helmet mount HM-714LP-SR. It can also be outfitted with a sacrificial window.

The PVS-14C has an operating temperature range of -40 to 122 degrees Fahrenheit.

The PVS-14C meets or exceeds the IP76 standards. It is equipped with a stow safety feature that when activated turns the unit off upon stowing and powers the unit on when returned to a horizontal position.

The PVS-14C expected lifetime varies depending on usage hours and handling of the device. Maintenance and repair costs vary and are determined by the price of the replacement part and duration of repair.

The PVS-14C has an MSRP of $3449–$7446 depending on product type and tube (green or white phosphor). The purchase price includes a soft pouch, hard waterproof case, daytime filter, demist shield, sacrificial window, neck strap, extended AA battery, an instruction manual, and a five-year limited warranty.

Additional components and accessories are available at an additional cost. Customer support is available by e-mail.

4.13 NIGHT VISION DEVICES, INC. PVS-14 NIGHT VISION MONOCULAR

The Night Vision Devices PVS-14 Night Vision Monocular (NVD-PVS-14-P43 Green Phosphor and NVD-PVS-14-P45 White Phosphor) uses I^2 technology and is intended for ground and maritime use. The device has a field of view of 40 degrees. The PVS-14 has a focus range of 25 cm to infinity. The device has a diopter adjustment range of -6 to +2 diopters. The device is capable of magnification at 1x. Additionally, the PVS-14 has a built-in IR LED illuminator and has an automated bright light cutoff.

Figure 4-13 NVD PVS-14

Image Credit: Night Vision Devices Inc.

The PVS-14 operates on a single AA battery, which has an estimated lifespan of 50+ hours for both alkaline and lithium versions and is equipped with a visual battery life indicator.

The PVS-14 has exterior dimensions of 4.5 x 2.5 x 2.75 inches and weighs 0.677 pound without batteries. This device is compatible with a standard MICH helmet mount, standard PASGT helmet mount, and Wilcox helmet mounts. It can be outfitted with a sacrificial lens and has lens that flip up. The fit can be adjusted with fore/aft adjustments, lateral adjustments, and minor pitch adjustments.

The PVS-14 has an operating temperature range of -59.8 to 125.6 degrees Fahrenheit, storage temperature range of -59.8 to 185 degrees Fahrenheit, and an operational relative humidity range greater than 90 percent and temperatures ranging from 69.8 to 149 degrees Fahrenheit for exposures up to 240 hours. The device also features anti-fog demist shields accessory.

The PVS-14 is able to withstand a drop of 48 inches in its carrying case or shipping case without damage (meeting the MIL-STD-810G shock test) and is water resistance at IP68 – 20 meters, two hours. This system complies with MIL-STD-810G.

The PVS-14 has an expected lifetime of up to 12,000 to 15,000 hours depending upon use conditions and maintenance. Its lenses last 12,000 to 15,000 hours and tubes lasting up to 10,000 hours. Preventative maintenance procedures include inspection, cleaning and performing the checkout procedures. A maintenance kit including a Hoffman test set, purge kit, specialized tool kit and field test kit is available. Maintenance costs vary.

The PVS-14 has an MSRP of $2,837.47 for the P-43 Green Phosphor and $2,878.59 for the P-45 White Phosphor. Prices include soft carrying case, operator's manual, two AA batteries, demist shield, sacrificial filter for objective lens, head/helmet mount adapter (J-arm), head mount assembly with three brow pads, lens tissue, neck cord, eyecup, and front lens cap, as well as a 120-month warranty. Prices may vary depending on image intensifier type. This product is also available for purchase through a GSA schedule.

Additional components include Picatinny Rail weapon mount, shuttered eye guard, hard case, 3x magnifier, 5x magnifier, compass assembly, PASGT helmet mount, MICH helmet mount, and camera adapter. Extended warranties and further trainings are available at an additional cost. Customer support is available from 8:30 a.m.–5:30 p.m. EST.

4.14 NIVISYS LLC, MUM-14™

The Nivisys MUM-14™ multi-use monocular (model NVM 3000) uses I² technology and is intended for ground and maritime use. The device is available in green or white phosphor. It has a field of view of 40 degrees and a target identification range of 25 cm to infinity. The device is capable of magnification at 1x and has a resolution of 64+ lp/mm. The MUM-14's diopter adjustment range of -6 to +4 diopters. The device is equipped with a visual battery life indicator and has an integrated IR illuminator and an automated bright light cutoff

Figure 4-14 MUM-14

Image Credit: Nivisys LLC

The MUM-14 operates on a single CR123A battery or uses a battery adaptor for one AA battery, with the CR123A having a lifespan of 40 hours and the AA a lifespan of 20 hours

The MUM-14 has exterior dimensions of 4.5 x 1.9 x 3.1 inches and weighs 0.65 pounds. This device can be head- or helmet-mounted and is compatible with the standard RHNO mount, as well as the MICH and PASGT mount. It can also be outfitted with a sacrificial lens.

The MUM-14 has an operating temperature range of -35 to 129 degrees Fahrenheit and a storage temperature of -60 to 160 degrees Fahrenheit.

The device has an ingress protection rating of 68+ for water resistance and meets MIL-STD-810G for shock resistance.

The MUM-14's tube has an expected lifetime of 10,000 hours and the lens has an expected lifetime of 10 years or more. Routine maintenance includes monthly lens cleaning, annual inspection for functionality and possible need of a nitrogen purge every 2–5 years. The inspection and nitrogen purge may cost up to $150. Lens caps and cups, lens cleaning kit, sacrificial window and demist shield are available for users to perform in-house maintenance.

The MUM-14 has an MSRP of $3,999, which includes a soft canvas case, helmet mount adaptor, weapon mount, battery adaptor, lens cap and cup, sacrificial lens, demist shield, batteries, lens tissue, helmet mount, shoulder strap, manual and a standard two-year warranty. Additional components, including 3x and 5x afocal lenses, compass, IR flood/spotlight, shuttered eye cups, helmet mount and camera adaptor are available at additional cost. Customer support is free and available via phone Monday through Friday during normal business hours.

4.15 N-VISION OPTICS, PVS-14 NIGHT VISION MONOCULAR

The N-Vision Optics, PVS-14-night vision monocular uses I^2 technology and includes a built-in IR illuminator. The PVS-14 comes in white or green phosphor, has multiple variants, and is intended for ground and maritime use. The device has a field of view of 40 degrees. The PVS-14 has a focus range of 25 cm to infinity, uses auto focusing, and is capable of magnification at 5x with optional accessories purchase. The device has a resolution of 64 lp/mm, variable gain control, and diopter adjustment range of -6 to +2 diopters. Additionally, the PVS-14 has a built-in IR illuminator and an automated bright light cutoff.

Figure 4-15 PVS-14

Image Credit: N-Vision Optics

The PVS-14 operates on one AA battery. Information on the estimated battery life and whether the PVS-14 has a battery life indicator was not readily available.

The PVS-14 has exterior dimensions of 4.5 x 2 x 2.25 inches and weighs 0.71 pounds. This device is compatible with various helmet and weapon mounts and can be outfitted with a sacrificial lens.

The PVS-14 has an operating temperature range of -59.8 to 122 degrees Fahrenheit and a storage temperature of -59.8 to 185 degrees Fahrenheit.

The PVS-14 has an expected lifetime of up to 10,000 hours, with lenses lasting up to 10,000 hours. Routine maintenance is recommended but details were not readily available.

The PVS-14 has an MSRP of $2,569.00–$4,125.00, which includes adapter (J-arm), sacrificial window, demist shield, eyecup, lens cap, neck cord, soft carry case, lens cleaning paper, battery and user manual. The device is covered by a 10-year warranty. This product is also available for purchase through a GSA schedule. Additional components, extended warranties and further trainings are available at additional cost.

4.16 PRG DEFENSE PVS-14

PRG Defense manufactures several variants of the PVS-14 night vision monocular. The PRG Defense PVS-14 uses I^2 technology, comes in white or green phosphor, and is intended for ground and maritime use. The device has a field of view of 40 degrees. The PVS-14 has a focus range of 25 cm to infinity and is capable of magnification up to 5x with optional accessory purchase. The device has manual gain control and a diopter adjustment range of -6 to +4 diopters. Additionally, the PVS-14 has a built-in IR illuminator and an automated bright light cutoff.

Figure 4-16 PVS-14

Image Credit: PRG Defense

The PVS-14 operates on one AA battery and has up to 50 hours of battery life. The device includes indicators for low battery life, “infrared on,” and excessive light conditions.

The PVS-14’s exterior measures 4.4 × 2.4 × 2.4 inches and weighs 0.7 pounds. This device is compatible with various helmet and weapon mounts, can be outfitted with a sacrificial lens.

The PVS-14 has an operating temperature range of -60 to 120 degrees Fahrenheit and storage temperature range of -60 to 185 degrees Fahrenheit.

The PVS-14 has an MSRP of $2,615.00–$3,560.00, which includes head mount assembly, brow pad, eye cup, helmet/head mount adapter, system soft carrying case, daylight filter, shoulder strap, lens paper, diopter lens cap, sacrificial window, demist shields, operator's manual, and battery. The device is covered by a two-year limited warranty. This product is also available for purchase through a GSA schedule. Additional components, extended warranties and trainings are available at additional cost.

4.17 SUPERIOR TACTICAL PVS-14

The Superior Tactical PVS-14 Night Vision Monocular uses I^2 technology and comes in white phosphor. The PVS-14 is intended for ground and maritime use and is used by the law enforcement community under the name "Night Enforcer NEPVS-14." The PVS-14 also has multiple L3 and Elbit variants. The device has a field of view of 40 degrees. It has a focus range of 25 cm to infinity, uses auto focusing, and is capable of magnification at 1x (3x and 5x with accessories). The device has a resolution of 64 lp/mm, variable gain control, and a diopter adjustment range of -6 to +4 diopters. Additionally, the PVS-14 has a built-in IR illuminator and an automated bright light cutoff.

Figure 4-17 PVS-14

Image Credit: Superior Tactical

The PVS-14 operates on a single AA battery with 50 hours operating battery life.

The PVS-14 has exterior dimensions of 4.5 x 2.0 x 2.7 inches and weighs 0.71 pounds. This device is compatible with various helmet and weapon mounts and can be outfitted with a sacrificial lens.

The PVS-14 has an operating temperature range of -60 to 120 degrees Fahrenheit, and storage temperature range of -60 to 185 degrees Fahrenheit.

The Superior Tactical PVS-14 products meet MIL-STD-810G standards.

The PVS-14 has an MSRP of $2,799–$4,299, which includes head mount assembly, brow pad, eye cup, helmet/head mount adapter, system soft carrying case, daylight filter, shoulder strap, lens paper, diopter lens cap, sacrificial window, demist shields, operator's manual, and battery. The device is covered by a limited three-year warranty.

Superior Tactical offers free diagnostic and repair services by experienced professionals. Customer support is available via phone and email.

5.0 BI-OCULAR PRODUCT INFORMATION

This market survey report provides information on six bi-ocular night vision devices that range in price from $1,895–$3,895. All the bi-oculars herein use I^2 technology and are available in both green and white phosphor. All devices have built-in IR LED illuminators and some form of brightness control that ensures image quality under changing light conditions and protects the intensifier tubes from excessive light. Each bi-ocular uses commercial off-the-shelf batteries that are replaceable in operational settings. Table 5-1 provides general product characteristics and specifications.

Product information presented in this section was obtained directly from manufacturers, vendors and their websites. The information has not been independently verified by the SAVER Program. Information not readily available from the companies is indicated by an "N/A" in the below table and is not described within individual product sections.

Product information in Table 5-1 is defined as follows, listed in column order:

MSRP ($) refers to the manufacturer's suggested retail price of the device and included components, given in U.S. dollars.

Dimensions given as L x W x H refers to the physical dimensions of the device in inches.

Weight refers to the weight of the device with batteries (except where noted) in pounds.

Field of View refers to the degree of horizontal distance that can be viewed through the technology without requiring additional lens options or accessories.

Focus Range refers to the distance (given near to far) away from a night vision device within which it can focus on an object.

Resolution refers to the image quality or object identification capability measured in line pairs per millimeters (lp/mm).

Diopter Adjustment Range refers to the adjustment range for accommodating differences in eyesight between the user's eyes. A diopter is the unit of measurement used to define eye correction or the refractive power of a lens.

Battery Type refers what sort of battery needed to operate the device.

Battery Life refers to the amount of time the battery can power the device.

Table 5-1 Bi-ocular Night Vision Devices Product Comparison Matrix

Vendor	Product	MSRP $	Dimensions (inches)	Weight (pounds)	Field of View (°)	Focus Range	Resolution (lp/mm)	Diopter Adj. Range	Battery Type	Battery Life (hours)
ATN	NVG7-3	$1,895–$3,895	6.3 x 6.0 x 3.0	2.2	40	25 cm to ∞	51–72	-6 to +2	CR123A	60
ATN	PVS7-3	$3,099	6.4 x 3.0 x 6.0	1.5	40	20 cm to ∞	64	-6 to +2	AA	50
Aviation Specialties Unlimited	AN/PVS-7	available upon request	14.1 x 15.6 x 7.9	1.43	40	25 cm to ∞	64	-6 to +2	AA	40
Elbit	AN/PVS-7	$3,672	5.9 x 6.0 x 3.0	1.5	40	25 cm to ∞	64–81	-6 to +2	AA	115-132
Night Vision Devices, Inc.	PVS-7	$2,716.48 – $2,891.48	6.0 x 6.0 x 3.0	1.5*	40	25 cm to ∞	1.15	-6 to +2	AA	40+
N-Vision Optics	PVS-7	$2702.32 – $2903.88	6.0 x 6.0 x 3.0	1.5	40	25 cm to ∞	N/A	-6 to +2	AA	N/A

Notes:
* Weight is without batteries.
N/A indicates information was not readily available from the manufacturer.

5.1 ATN CORPORATION NVG7-3

Figure 5-1 NVG7-3

Image Credit: ATN Corporation

The ATN Corporation NVG7-3 uses I² technology and is intended for ground use. It can be purchased with either white or green phosphor tubes. The device has a field of view of 40 degrees NVG7-3 has a focus range of 25 cm to infinity. The device offers interpupillary adjustment and is capable of magnification at 1x.

The device has a resolution of 64 lp/mm and diopter adjustment range of -6 to +2 diopters. The NVG7-3 operates on one CR123A battery, which has an estimated lifespan of 60 hours, and is equipped with a low battery indicator. Additionally, the device has a built-in IR illuminator, a bright-light cut-off and automatic brightness control.

The NVG7-3 has exterior dimensions of 6.3 x 6 x 3 inches and weighs 2.2 pounds. This device is compatible with goggle kits.

The NVG7-3 has an operating temperature range of -40 to 122 degrees Fahrenheit and a storage temperature range of -58 to 158 degrees Fahrenheit. The NVG7-3 is water resistant.

The lifetime of the NVG7-3 and its components are dependent on use. Maintenance and repair costs vary and are determined by the price of the replacement part and duration of repair.

The NVG7-3 has an MSRP of $2,795, which includes a lens tissue, soft carrying case, operator's manual, one battery, a goggle kit as well as a two-year warranty.

This device is also available in three additional models based on lens generation: the NVG7-3P, which has a resolution of 64 –72 lp/mm and a price of $2,995; the NVG7-3W, which has a resolution range of 64–72 lp/mm and a price of $3,895; and the NVG7-WPT, which has a resolution range of 51–64 lp/mm and a price of $1,895.

Additional components – including lenses at 3x, 5x and 8x magnification – extended warranties and trainings are available for additional cost. Customer support is free and available via phone Monday through Friday during work hours.

5.2 ATN CORPORATION, PVS7-3

Figure 5-2 PVS7-3

Image Credit: ATN Corporation

The ATN Corporation PVS7-3 uses I² technology and is intended for ground use. It can be purchased with either white or green phosphor tubes. The device has a field of view of 40 degrees. The PVS7-3 has a focus range of 20 cm to infinity, and uses auto or manual focusing. The device is capable of magnification at 1x.

The device has a resolution of 64 lp/mm and diopter adjustment range of -6 to +2 diopters. The PVS7-3 operates on two 1.5V AA batteries, which have an estimated lifespan of 50 hours, and is equipped with a low battery life indicator. Additionally, the device has a built-in IR illuminator, automatic brightness control and bright light cutoff.

The PVS7-3 has exterior dimensions of 6.4 x 3 x 6 inches and weighs 1.5 pounds. This device is compatible with head and helmet mounts, can be outfitted with a sacrificial window and has a lens orientation that can be flipped up when using a head mount.

The PVS7-3 has an operating temperature range of -60 to 120 degrees Fahrenheit and a storage temperature of -60 to 185 degrees Fahrenheit. The device is also water and fog resistant.

The PVS7-3 complies with the MIL-STD-810 standard.

The PVS7-3 has an expected lifetime varies depending on usage hours and handling of the device. Maintenance and repair costs vary and are determined by the price of the replacement part and duration of repair.

The PVS7-3 has an MSRP of $3,099 which includes a soft carrying case, lens tissue, two batteries, helmet mount, demist shield, sacrificial filter and a neck cord, as well as a two-year warranty, an instruction manual and access to online training videos.

This device is also available in three additional models based on lens generation: the PVS7-3P, which has a resolution of 64–72 lp/mm and a price of $3,195; the PVS7-3W. which has a resolution range of 64 lp/mm and a price of $3,995; and the PVS7-WPT, which has a resolution range of 45–54 lp/mm and a price of $2,395.

Additional components, extended warranties and trainings are available for an additional cost. Customer support is available via phone Monday through Friday during work hours at no cost.

5.3 AVIATION SPECIALITIES UNLIMITED INC., AN/PVS-7

The Aviation Specialties Unlimited Inc. AN/PVS-7 (Model number M963) uses green phosphor I^2 and is intended for ground and maritime use. It can be purchased with the optional white phosphor tube. The device has a field of view of 40 degrees and a target identification range of 25 cm to infinity. The AN/PVS-7 has a focus range of 25 cm to infinity and uses manual focusing. The device is capable of magnification at 1x.

Figure 5-3 AN/PVS-7

Image Credit: Aviation Specialties Unlimited Inc.

The device has a resolution of 64 lp/mm and diopter adjustment range of -6 to +2 diopters. Eye relief of 15 mm is offered. The AN/PVS-7 operates on two alkaline AA batteries, which have an estimated lifespan of 40 hours at room temperature and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR LED illuminator, automatic brightness control and high-light cutoff tube protection. The AN/PVS-7 is also available with autogating.

The AN/PVS-7 has exterior dimensions of 14.1 x 15.6 x 7.9 inches and weighs 1.43 pounds with mask assembly. This device is compatible with PVS-7 head and helmet mounts as well as Helmet Mount Assembly 7B-SPH-5CG and can be outfitted with a sacrificial lens. When not in use, the lens can be flipped up. The device also features a demist shield assembly, which helps prevent fogging.

The AN/PVS-7 has an operating temperature range, storage temperature range, operational humidity range and shock resistance compliant with MIL-STD-810.

The AN/PVS-7 tubes have an expected lifetime of up to 10,000 hours. Routine preventative maintenance and checks are recommended with each use and can be conducted in-house. Additionally, high level maintenance services, repairs and upgrades can be made by Aviation Specialties Unlimited Inc., cost is determined by the price of the replacement or upgraded parts and duration of time needed by a technician. The company also offers a tiered service plan.

The AN/PVS-7 pricing is available upon request via Aviation Specialties Unlimited, purchase includes a soft carrying case, operator manual, battery, demist shield assembly, eye cups, sacrificial window assembly, lens paper, shoulder strap, retainer cord, head mount assembly as well as a one-year warranty which covers the housing and tubes. Additional components such as adapter assembly (7B to 7A), adapter kit (5x Afocal, 7B), spare batteries, shipping case, packed assembly case, compass, lens assemblies (162mm/108mm/), lens brush, helmet mount assembly, mount assembly (7B-SPH-5CG), sacrificial filter assembly (75/108/162mm), sacrificial window, spare parts kit and tripod adapter assembly. Training for operators and maintenance are available for an additional cost. Customer Support is available via phone.

5.4 ELBIT AN/PVS-7

The Elbit AN/PVS-7 (Model Number F5001) uses I² technology and is intended for ground and maritime use. It can be purchased with either white phosphor or green phosphor tubes. The device has a field of view of 40 degrees and its target identification range depends on environmental conditions (existing ambient light), user eyesight, etc. The AN/PVS-7 has a focus range of 25 cm to infinity and uses manual focusing. The device offers interpupillary adjustment of 55-71 mm and is capable of magnification at 1x.

Figure 5-4 AN/PVS-7

Image Credit: Elbit

The device has a resolution of 64–81 lp/mm, a fixed gain (minimum 5000 fL/fL) and diopter adjustment range of -6 to +2 diopters. The AN/PVS-7 operates on alkaline or lithium AA batteries, with the lithium 3Vdc (BA-5567/U) operating for 36 hours, 2 lithium AA operating for 132 hours and 2 alkaline AA for 115 hours and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR illuminator and an automated bright light cutoff.

The AN/PVS-7 has exterior dimensions of 5.9 x 6 x 3 inches and weighs 1.5 pounds. This device is compatible with PASGT, ACH/MICH, ACVC, K1, MK6, CGF, RBR, CG634 mounts and can also be used with a head mount. The AN/PVS-7 can be outfitted with a sacrificial lens which is included with standard accessories and has a lens orientation which can be flipped up. The fit can be adjusted via eye relief and fore and aft adjustments.

The AN/PVS-7 has an operating temperature range of -60 degrees to 120 degrees Fahrenheit, storage temperature of -60 degrees to 185 degrees Fahrenheit, and does not suffer degradation of performance after being subjected to relative humidity greater than 90 percent for exposures up to 240 hours. The device is contamination resistant. The AN/PVS-7 comes with a demist shield and anti-fog wipes which are sold separately.

The AN/PVS-7 can be submerged in three feet of water and meets MIL-STD-810 for shock resistance.

Routine maintenance requirements and instructions for self-maintenance are included in the Operator's Manual. Some maintenance services are included with the standard warranty and others may incur additional costs. The AN/PVS-7 has no defined overall expected lifetime but the tubes have an expected lifetime of 10,000 hours.

The AN/PVS-7 has an MSRP of $3,672 which includes soft carrying case, eye cups, lens cap, demist shield, sacrificial lenses and operator's kit (manual, quick reference card, lens paper), a two-year warranty for the system and a one-year warranty for spare parts and accessories. Additional components which can be purchased separately include the head mount assembly, helmet mount assembly, 3x or 5x magnifier lens, shipping/storage case with additional accessories available upon request. The Elbit Customer Repair Service department is open 7 a.m.–4 p.m., Monday–Friday.

Operator and maintenance training is available with the cost dependent on number of students in attendance; virtual training is also available. This product is also available for purchase through GSA schedule.

5.5 NIGHT VISION DEVICES, INC./ PVS-7 NIGHT VISION GOGGLE

Night Vision Devices, Inc./PVS-7 Night Vision Goggle, which comes in both green and white phosphor, uses I^2 technology and is intended for ground and maritime use. The device has a field of view of 40 degrees. The PVS-7 has a focus range of 25 cm to infinity with no auto-focusing. The device features an interpupillary adjustment of 55 to 71 mm and is capable of magnification at 1x.

Figure 5-5 NVD PVS-7

Image Credit: Night Vision Devices Inc.

The device has a resolution of 1.15 lp/mm, fixed gain, not less than 2,000 fL/fL and diopter adjustment range of -6 to +2 diopters. The PVS-7 operates on alkaline and lithium AA batteries, which have an estimated lifespan of 40+ hours for the alkaline and 40+ hours for lithium and is equipped with a visual battery life indicator. Additionally, the device has a built-in IR LED illuminator and an automated bright light cutoff.

The PVS-7 has exterior dimensions of 6 x 6 x 3 in inches and weighs 1.5 pounds without batteries. This device is compatible with Standard MICH Mount (A3256368-2) and PASGT (A3256368-1) mounts and can be outfitted with a sacrificial lens.

The PVS-7 has an operating temperature range of -59.8 to 113 degrees Fahrenheit, storage temperature of -59.8 to 159.8 degrees Fahrenheit, and has an operational humidity range up to 149 degrees Fahrenheit and a relative humidity up to 94 percent plus/minus 4 percent. The device also has demist shields and anti-fog features.

The PVS-7 withstands drop of 48 inches in carrying case and shipping case without damage in accordance with MIL-STD-810G, Method 516.7 Procedure IV. The device is water resistant and meets or exceeds IP67's standards and can be submerged in three feet of water for 30 minutes.

Routine preventive should be performed in accordance with Preventative Maintenance Checks and Services Table 2.2, A/N PVS-7 US Army TM 11-5855-262-10-2 Operator's Manual (Section II, Page 2-6). Prior to each mission preventative maintenance procedures include inspection, cleaning, and performance of the checkout procedures. There is a $100 Evaluation/Assessment Fee for Standard Repairs and Maintenance for the PVS-7 in addition to any accrued repair costs. The device comes with a 10-year warranty. The PVS-7 has an expected lifetime of up to 10 years, with lenses lasting up to 12,000 to 15,000 hours depending upon use conditions, and maintenance and tubes lasting up to 10,000 hours.

The PVS-7 has an MSRP of $2,716.48 (P-43 Green Phosphor) and $2,891.48 (P-45 White Phosphor) which includes soft carrying case, operator's manual, AA batteries, lens tissue, head mount assembly, demist shields and sacrificial window. This product is also available for purchase through a GSA schedule. Additional components, extended warranties and further trainings are available for an additional cost. Night Vision Devices, Inc.'s customer support is available 8:30 a.m.–5:30 p.m. EST.

5.6 N-VISION OPTICS, PVS-7 NIGHT VISION GOGGLES

Figure 5-6 N-Vision Optics PVS-7

Image Credit: N-Vision Optics Inc.

The N-Vision Optics PVS-7 Night Vision Goggles uses I^2 technology, utilizes green or white phosphor, built-in IR illuminator, and is intended for ground and maritime use. The device has a field of view of 40 degrees and a focus range of 25 cm to infinity. The N-Vision Optics PVS-7 is capable of magnification at 1x and has a diopter adjustment range of -6 to +2 diopters.

The N-Vision Optics PVS-7 operates on two AA batteries and is equipped with an internal low battery, note that battery life span was not readily available from the supplier. The device has IR on and low power indicators, an automated bright light cutoff and automatic brightness control.

The N-Vision Optics PVS-7 has exterior dimensions of 6 x 6 x 3 in inches and weighs 1.5 pounds. This device is compatible with head or helmet mounts and can be outfitted with a sacrificial lens.

The N-Vision Optics PVS-7 has an operating temperature range of -59.8 to 120.2 degrees Fahrenheit, storage temperature of -59.8 to 185 degrees Fahrenheit.

The N-Vision Optics PVS-7 is covered by a 10-year warranty. N-Vision Optics, LLC states it shall make every effort to repair the device at a reasonable cost after expiration of the warranty.

The N-Vision Optics PVS-7 has MSRP range of $2,702–$2,903. This product is also available for purchase through a GSA schedule. Additional components, extended warranties and further trainings are available for an additional cost. Customer support is available through N-Vision Optics Customer Care Department.

6.0 MANUFACTURER AND VENDOR CONTACT INFORMATION

Additional information on the insert product/technology included in this market survey report can be obtained from the manufacturers and vendors listed in Table 6-1.

Table 6-1 Manufacturer and Vendor Contact Information

Vendor	Address	Phone Number	E-mail or Web Form	Website
ACTinBlack US, LLC	3144 Joyce Drive Fort Worth, TX 76116	682-610-3407	info@actinblackus.com	www.actinblack.com/us/
Atlantic Diving Supply	621 Lynnhaven Parkway Suite 160 Virginia Beach, VA 23452	866-781-6609	customercare@adsinc.com	www.adsinc.com
ATN Corporation	2400 NW 95 Avenue Doral, FL 33172	650-989-5100	customersupportusa@atncorp.com	www.atncorp.com
Aviation Specialties Unlimited, Inc.	4632 West Aeronca Street Boise, Idaho 83705	208-426-8117	www.asu-nvg.com/about_us/contact_us	www.asu-nvg.com
Carson	2070 5th Avenue Ronkonkoma, NY 11779	631-963-5000	info@carson.com	www.carson.com
Elbit Systems of America	7635 Plantation Road Roanoke, VA 24019	540-563-0371	nightvision@elbitsystems-us.com	www.elbitsystems-us.com

Vendor	Address	Phone Number	E-mail or Web Form	Website
Kent Optronics	40 Corporate Park Drive Hopewell Junction, NY 12533	845-897-0138	info@kentoptronics.com	www.kentoptronics.com
L3 Harris	201 12th Street South Suite 800 Arlington, VA 22202	703-412-7190	www.l3harris.com/contact-us	www.l3harris.com
N-Vision Optics	220 Reservoir Street Suite 26 Needham, MA 02494	781-505-8360	info@nvisionoptics.com	www.nvisionoptics.com
Nightline, Inc.	300 Industrial Drive Mountain City, TN 37683	423-727-5900	info@nightline.us	www.nightline-inc.com
Night Vision Devices, Inc.	Whitehall, PA	610-395-9743	sales@nvdevices.com	www.nvdevices.com
Nivisys LLC	3900 Early Road Harrisonburg, VA 22801	877-535-8774	www.tssi-ops.com/contact-us	www.tssi-ops.com/nivisys
PRG Defense	19775 Belmont Executive Plaza Suite 525 Ashburn, VA 20147	703-771-3003	info@prgusa.net	www.prgdefense.com

7.0 CONCLUSION

Night vision technologies provide enhanced vision, sensing and awareness for first responders operating in low- or no-light conditions. In different configurations and applications, night vision technologies may be useful to law enforcement, fire departments, and emergency medical services. The devices can enhance sight to assist in evidence collection, surveillance, border patrol, navigating smoke-filled environments, and search and rescue. All NVDs require some ambient light, which can be moonlight, starlight or artificial light. When no ambient light is available the user must introduce an IR light source, which will be visible to any other NVDs users on site.

This market survey report provides information on 38 commercially available night vision devices:

- Sixteen binoculars, which have two eyepieces and two lenses, ranging in price from $5,995 to $40,000
- Seventeen monoculars which have one eye piece and one lens, ranging in price from $2,195 to $5,034
- Six bi-oculars devices which have two eyepieces and one lens, ranging in price from $1,895 to $2,895

All of the products in this market survey report have Gen-3 intensifier tubes, can be head- or helmet-mounted and are reliant on battery power. (Aviators must use helmet-mounted binoculars.) All devices use I^2 technology and provide magnification of 1x. One product, the L3 Harris BNVD Fused, uses both I^2 and thermal technology. The binoculars and monoculars allow for thermal integration via the optional Enhanced Clip-On Thermal Imager (ECOTI) accessory.

Most devices, more than 90%, are available in both green and white phosphor. Almost all the devices have built in IR LED illuminators. All devices offer some form of brightness control to ensure image quality under changing light conditions and to protect the intensifier tubes from excessive light.

Additional specifications that may be of interest to the emergency responder community, such as focus range, resolution, price, weight and field of view, vary per device. Other features that may be of interest to responders include anti-fogging capabilities, ability to maintenance in-house, ease of gain and focus control and durability.

Emergency responder agencies that consider purchasing night vision devices should carefully research each product's overall capabilities and limitations in relation to their agency's operational needs. A particular first responder operation or application including deployment methods and operating environments should be a guide to device requirements such as resolution, range, no light or low light functionality, field of view, and size.

Appendix A. Ingress Protection Levels (IP)

This section provides information on the levels of ingress protection as specified by the 2-digit designations in the IEC 60529 standard [12]. Table A-1 provides levels of solid ingress protection (first digit). Table A-2 provides levels of liquid ingress protection (second digit).

Table A-1 Levels of Solid Ingress Protection per First Digit of IP Code

Digit	Object Size Effective Against	General Description
0	No Protection	No protection against contact and ingress of solids
1	> 50 mm	Large surfaces, e.g., back of hand, but no protection against deliberate contact with body part
2	> 12.5 mm	Prevents entry of fingers and similarly sized objects
3	> 2.5 mm	Prevents entry of tools, thick wires, etc.
4	> 1 mm	Prevents entry of most wires, screws, large ants, etc.
5	Dust Protected	Dust ingress not entirely prevented but does not enter in sufficient quantity to interfere with satisfactory operation of equipment
6	Dust Tight	No ingress of dust

Table A-2 Levels of Liquid Ingress Protection per Second Digit of IP Code

Digit	Water Exposure Protection	General Description
0	No Protection	No protection
1	Vertically dripping water	Vertically dripping water has no harmful effects
2	Dripping water, enclosure tilted up to 15 degrees	Vertically dripping water has no harmful effects when enclosure is tilted at an angle up to 15 degrees of normal vertical position
3	Spraying water	Water sprayed at angles up to sixty degrees from the vertical position has no harmful effects
4	Splashing water	Water splashed against the enclosure from any direction has no harmful effect
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction has no harmful effects
6	Powerful water jets	Water projected in powerful jets against the enclosure from any direction has no harmful effects
7	Temporary immersion in water	Ingress of water in harmful quantity is not possible when the enclosure is temporarily immersed in water under standard conditions or pressure and time
8	Continuous immersion in water	The equipment is suitable for continuous immersion in water under conditions more severe than for numeral 7

Appendix B. MIL-STD-810 Laboratory Test Methods

This section provides information about laboratory test methods specified by MIL-STD-810 [13]. Table B-1 provides the title and purpose of each test method.

Table B-1 Laboratory Test Methods as per MIL-STD-810

Method Number	Title	Purpose
500	Low Pressure (Altitude)	Use low pressure (altitude) tests to determine if materiel can withstand and/or operate in a low-pressure environment and/or withstand rapid pressure changes.
501	High Temperature	Use high temperature tests to obtain data to help evaluate effects of high-temperature conditions on material safety, integrity, and performance.
502	Low Temperature	Use low temperature tests to obtain data to help evaluate effects of low temperature conditions on materiel safety, integrity, and performance during storage, operation, and manipulation.
503	Temperature Shock	Use the temperature shock test to determine if materiel can withstand sudden changes in the temperature of the surrounding atmosphere without experiencing physical damage or deterioration in performance.
504	Contamination by Fluids	Use contamination by fluids test to determine if materiel (or material samples) is affected by temporary exposure to contaminating fluids (liquids) such as may be encountered and applied during its life cycle, either occasionally, intermittently, or over extended periods.
505	Solar Radiation (Sunshine)	This method has two purposes, (1) to determine the heating effects of direct solar radiation on materiel, and (2) to help identify the actinic (photodegradation) effects of direct solar radiation.
506	Rain	Determine the following with respect to rain, water spray, or dripping water: (1) The effectiveness of protective covers, cases, and seals in preventing the penetration of water into the materiel; (2) The capability of the materiel to satisfy its performance requirements during and after exposure to water; (3) Any physical deterioration of the materiel caused by the rain; (4) The effectiveness of any water removal system; and (5) The effectiveness of protection offered to a packaged materiel.
507	Humidity	Determine the resistance of materiel to the effects of a warm, humid atmosphere.
508	Fungus	Assess the extent to which materiel will support fungal growth and how any fungal growth may affect performance or use of the materiel.
509	Salt Fog	Determine the effectiveness of protective coatings and finishes on materials. It may also be applied to determine the effects of salt deposits on the physical and electrical aspects of materiel.

Method Number	Title	Purpose
510	Sand and Dust	Dust (< 150µm) procedure – evaluate the ability of materiel to resist the effects of dust that may obstruct openings, penetrate into cracks, crevices, bearings, and joints, and to evaluate the effectiveness of filters. Sand (150 to 850µm particle size) procedure – performed to help evaluate the ability of materiel to be stored and operated in blowing sand conditions without degrading performance, effectiveness, reliability, and maintainability due to abrasion (erosion) or clogging effects of large, sharp-edged particles.
511	Explosives Atmosphere	Demonstrate the ability of materiel to operate in fuel-air explosive atmospheres without causing ignition or demonstrate that an explosive or burning reaction occurring within encased materiel will be contained and will not propagate outside the test item.
512	Immersion	Determine if materiel can withstand immersion or partial immersion in water (e.g., fording), and operate as required during or following immersion.
513	Acceleration	Assure that materiel can structurally withstand the steady state inertia loads that are induced by platform acceleration, deceleration, and maneuver in the service environment, and function without degradation during and following exposure to these forces. Acceleration tests are also used to assure that materiel does not become hazardous after exposure to crash inertia loads.
514	Vibration	Performed to (1) develop materiel to function in and withstand the vibration exposures of a life cycle including synergistic effects of other environmental factors, materiel duty cycle, and maintenance. This method is limited to consideration of one mechanical degree-of-freedom at a time. Refer to Method 527 for further guidance on multiple exciter testing. Combine the guidance of this method with the guidance of Part One and other methods herein to account for environmental synergism. (2) Verify that materiel will function in and withstand the vibration exposures of a life cycle.
515	Acoustic Noise	Determine the adequacy of materiel to resist the specified acoustic environment without unacceptable degradation of its functional performance and/or structural integrity.
516	Shock	Performed to provide a degree of confidence that materiel can physically and functionally withstand the relatively infrequent, non-repetitive shocks encountered in handling, transportation, and service environments. This may include an assessment of the overall materiel system integrity for safety purposes in any one or all of the handling, transportation, and service environments; determine the materiel's fragility level, in order that packaging may be designed to protect the materiel's physical and functional integrity; and test the strength of devices that attach materiel to platforms that can crash.

Method Number	Title	Purpose
517	Pyroshock	Performed to provide a degree of confidence that materiel can structurally and functionally withstand the infrequent shock effects caused by the detonation of a pyrotechnic device on a structural configuration to which the materiel is mounted; and experimentally estimate the materiel's fragility level in relation to pyroshock in order that shock mitigation procedures may be employed to protect the materiel's structural and functional integrity.
518	Acidic Atmosphere	Determine the resistance of materials and protective coatings to corrosive atmospheres, and when necessary, to determine its effect on operational capabilities.
519	Gunfire Shock	Performed to provide a degree of confidence that materiel can structurally and functionally withstand the relatively infrequent, short duration, transient, high rate repetitive shock-input encounter in operational environments during the firing of guns.
520	Temperature, Humidity, Vibration, and Altitude	Determine the combined effects of temperature, humidity, vibration, and altitude on airborne electronic and electro-mechanical materiel with regard to safety, integrity, and performance during ground and flight operations. Some portions of this test may apply to ground vehicles, as well. In such cases, references to altitude considerations do not apply.
521	Icing/Freezing Rain	Evaluate the effect of icing on the operational capability of materiel. This method also provides tests for evaluating the effectiveness of de-icing equipment and techniques, including prescribed means to be used in the field.
522	Ballistic Shock	This method includes a set of ballistic shock tests generally involving momentum exchange between two or more bodies, or momentum exchange between a liquid or gas and a solid, performed to provide a degree of confidence that materiel can structurally and functionally withstand the infrequent shock effects caused by high levels of momentum exchange on a structural configuration to which the materiel is mounted; and experimentally estimate the materiel's fragility level relative to ballistic shock in order that shock-mitigation procedures may be employed to protect the materiel's structural and functional integrity.

Method Number	Title	Purpose
523	Vibro-Acoustic/ Temperature	Performed to determine the synergistic effects of vibration, acoustic noise, and temperature on externally carried aircraft stores during captive carry flight. Such determination may be useful for, but not restricted to, the following purposes: (1) To reveal and correct design weaknesses (Test, Analyze, and Fix (TAAF) test); (2) To determine whether a design meets a specified reliability requirement (Reliability Demonstration test); (3) To reveal workmanship or component defects before a production unit leaves the place of assembly (Screening test); (4) To estimate the Mean Time Between Failure (MTBF) of a lot of units based upon the test item's time to failure of a small sample of the units (Lot Acceptance test); and (5) To determine the relative reliability among units based upon the test item's time to failure of a small sample of the units (Source Comparison test).
524	Freeze-Thaw	Determine the ability of materiel to withstand the effects of moisture phase changes between liquid and solid, in or on materiel, as the ambient temperature cycles through the freeze point; and the effects of moisture induced by transfer from a cold-to-warm or warm-to-cold environment.
525	Time Waveform Replication	Performed to provide a degree of confidence that the materiel can structurally and functionally withstand the measured or analytically specified test time trace(s) to which the materiel is likely to be exposed in the operational field environment; and experimentally estimate the materiel's fragility level in relation to form, level, duration, or repeated application of the test time trace(s).
526	Rail Impact	Replicate the railroad car impact conditions that occur during the life of transport of systems, subsystems, and units, hereafter called materiel, and the tiedown arrangements during the specified logistic conditions.
527	Multi-Exciter Testing	Performed to provide a degree of confidence that the materiel can structurally and functionally withstand a specified environment, e.g., stationary, non-stationary, or of a shock nature, that must be replicated on the test item in the laboratory with more than one motion degree-of-freedom consideration.
528	Mechanical Vibrations of Shipboard Materials	Specifies procedures and establishes requirements for environmental and internally excited vibration testing of naval shipboard equipment installed on ships

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