U.S. ARMY

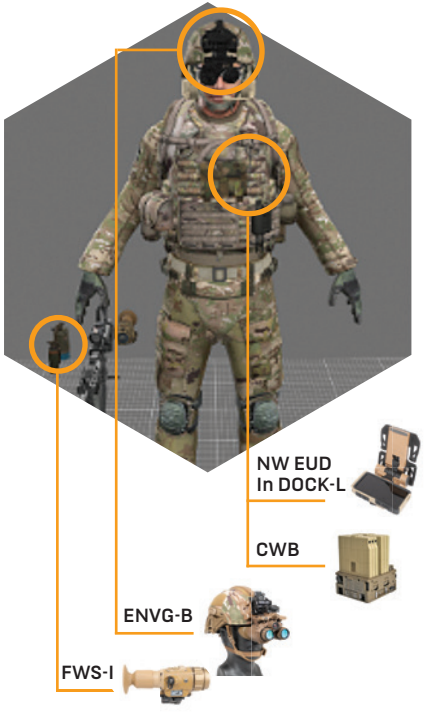
# PEO SOLDIER TECHNOLOGY COMPENDIUM

PROGRAM EXECUTIVE OFFICE SOLDIER

# TABLE OF CONTENTS

# SQUAD AS A PLATFORM TECHNOLOGIES






| PRODUCT | POWER | SENSORS | MICRO DISPLAY | WAVEFORMS | KEY INTERFACES |
|---|---|---|---|---|---|
| ENVG-B | 4 AA lithium batteries | I^2 White Phos High FOM (I2 Resolution: 2300-2500 Figure Of Merit/32 SNR); Thermal Focal Plane Array with minimum active area of 640 (h) x 480 (v) pixels | 1280 X 1024 AMOLED | ISW | ENVG-B Battery Pack Hot Shoe, Male/Female; ENVG-B Goggle Hot Shoe, Male/Female |
| NETT WARRIOR (With DockLite) | Lithium-Ion Internal Battery in EUD (non-removable) and external power connections to CWB battery | | EUD Display 1280X 1024, AMOLED | WIFI, BLE 5.X, ISW (AES 256), 4G/LTE (via hot spot), and NFC | USB PD/NW PAN |
| FWS-I | 3 AA lithium batteries | 640 x 480 thermal Focal Plane Array | 640 X 480, AMLCD | ISW | 9 or 12 pin (early models have 9) |
| CONFORMAL WEARABLE BATTERY (CWB) | Lithium-ion | Temperature/ Charge | State of Charge (SOC) Informal Character Display (ICD) | N/A | SM Bus 1.1/Glenair 807-309-06ZNU6-6PY (6 Pin) or 7DY (7 pin) |

# SQUAD AS A PLATFORM INTEROPERABILITY (SL/TL)

EUD
w/ TAK App

DOCK Lite
with ISW

Sends AR Overlay
PLI & Heading Via
ISW to ENVG-B

ENVG-B with ISW

Sends video to
ENVG-B

FWS-I with ISW

DAPS

Communicates
with Squad

Squad/Team Leader

SAFC

NGSW

Conformal
Battery

PLI GPS

Power

Data Hub

Sends Data & Voice to Platoon or Higher

Leader Radio

Flame Resistant (FR) clothing refers to garments that are specifically designed to protect the wearer from flames and thermal injury.

FR materials are designed to withstand much higher flame and thermal loads than typical non-FR materials. Fibers such as meta-aramids and para-aramids, modacrylic, and FR Rayon have inherent FR qualities and are commonly used to make materials for FR uniforms. Other fibers, such as cotton and nylon, are not inherently FR, but with the addition of special chemicals, can be rendered FR, often with similar FR characteristics to inherent FR materials. FR qualities include self-extinguishing once a flame source is removed, as well as not melting or dripping, since all of these can significantly impact burn injury during a flame exposure event.

FR clothing is routinely tested as a stand-alone material and as a clothing system, both to quantify the burn injury performance and ensure that protective attributes are meeting requirements.

When designing new FR combat clothing, key factors include durability, strength, wick-ability, fast drying, colorfastness, breathability, and FR/color/strength durability through numerous launderings.


Army Combat Shirt Type II and III

# MODERN COMBAT HELMET



Modern Combat Helmets are made from materials like Kevlar® and UHMWPE (Ultra-high-molecular-weight polyethylene). The manufacturing process involves cutting, layering, and compression molding these materials into a solid structure. After molding, the helmets are trimmed, smoothed, coated, and painted. They are then fitted with padding, suspension systems, and accessory mounts. Rigorous quality control, including inspections and ballistic testing, ensures the helmets meet protection standards before packaging and distribution.

Modern Combat Helmet contains a suspension system, this includes helmet pads to create standoff, provide stability, and meet or exceed blunt impact. There are chin straps located towards the front of the helmet allowing the helmet to stay relatively stable during the mission.

Retention systems as H-Nape and "X" Nape reside in the back of the head to keep the helmet from moving when NVGs are attached to the front of the helmet. The H shape provides excellent stability and even distribution of weight and was introduced for female soldiers. The "X" shape is a lighter design and is easier to adjust quickly due to the simpler design.

# HARD ARMOR PLATE



Hard Armor is comprised of composite layers of ceramic and Ultra-High-Molecular-Weight Polyethylene (UHMWPE). The ceramic strike face and Spall shield effectively shatter incoming bullets. Spall protection plays a crucial role in reducing trauma from ballistic impacts, as the coating is to prevent the small fragments (spall) that break off from the armor plate upon bullet impact from causing injury. The UHMWPE backer absorbs the residual energy, preventing penetration.

| Front Vital Torso Protection<br>ESAPI Gen III | Side Vital Torso Protection<br>ESAPI Gen III | Front Vital Torso Protection Plate<br>XSAPI Gen II | Side Vital Torso Protection<br>XSBI Gen III | Spall Shield |
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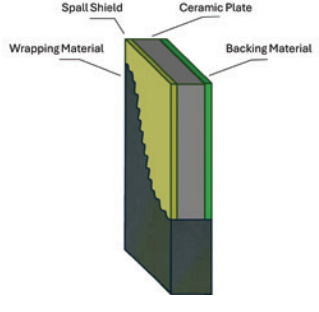
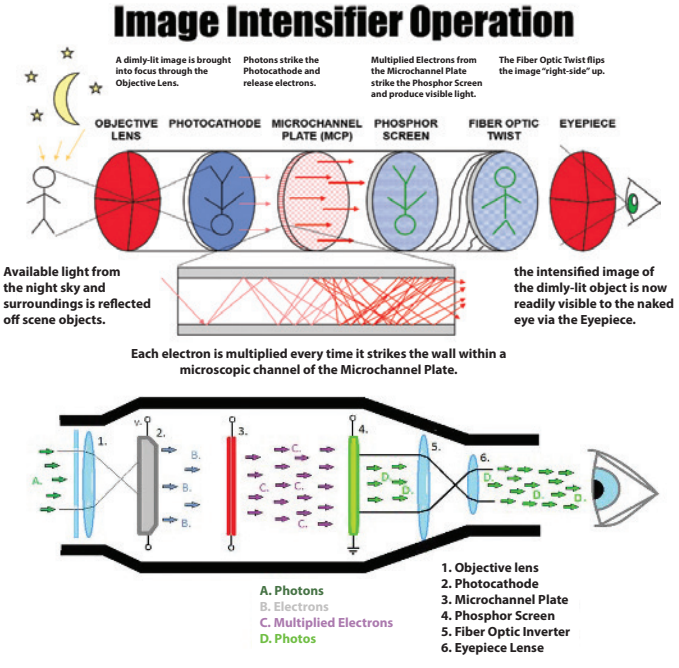
|  |  |  |  |  |

Hard Armor penetration mechanics relies on an ultra hard ceramic face to defeat armor piercing projectiles by deforming and dissipating the kinetic energy before complete penetration can occur.

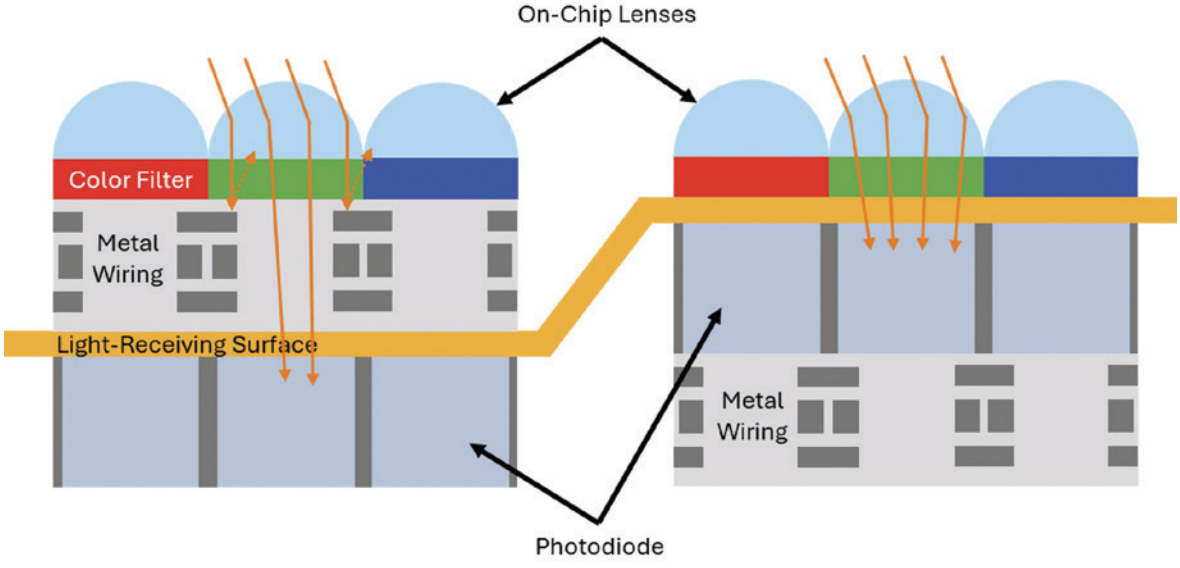
The development of high-performance fibers has been the most important driver for advancements in ballistic protection. The most popular fiber types used for this purpose are para-aramid fibers, like Kevlar® and ultra-high molecular weight polyethylene. Soft armor provides protection to the torso and extremities (neck, shoulder, lower back, groin, and knee and elbow joints).

Ballistic protective and cover materials used; (A) Para-aramid felt (one layer); (B) Ultra high molecular weight polyethylene felt (one layer); (C) Silk fabric (two layers); and (D) Cover material.

An image intensifier tube amplifies available light energy in an optical system such as Night Vision Goggles, allowing the Soldier to see in low-light level conditions. Image intensifier tubes operate by converting photons of light into electrons, amplifying the electrons (usually with a microchannel plate), and then converting the amplified electrons back into photons for viewing.



Similar to cell phone complementary metal-oxide-semiconductor(CMOS) cameras, a low light camera sees in the visible, but is optimized for sensitivity in the Near Infrared waveband, that is outside of what is visible to the naked eye.




State-of-the-art frontside illuminated sensors (left) perform excellently in low-light conditions, but the design of backside-illuminated pixels (right) offers significantly improved quantum efficiency.

Thermal Imagery or Forward-Looking Infrared works by detecting an objects heat or electromagnetic radiation. All objects emit electromagnetic radiation as a function of their temperature. This radiation is invisible to the naked eye but can be detected with special infrared detectors. These detectors are sensitive to different wavelengths of radiation, which is why thermal sights come in various styles and sizes. Sights are designed to detect a specific range of wavelengths.

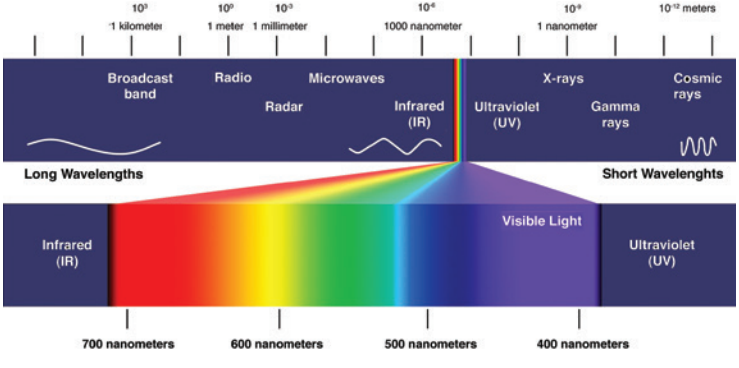
Thermal sights detect objects based on their heat signature, even in complete darkness! The most common type of thermal sight detects long-wave infrared radiation, also known as LWIR. This type of radiation falls between 8 and 14 microns on the electromagnetic spectrum. In contrast, visible light falls between 400 and 700 nanometers on the spectrum.

Thermal devices see infrared energy (heat) instead of light that is visible to the naked eye.

FWS-I

ENVG-B

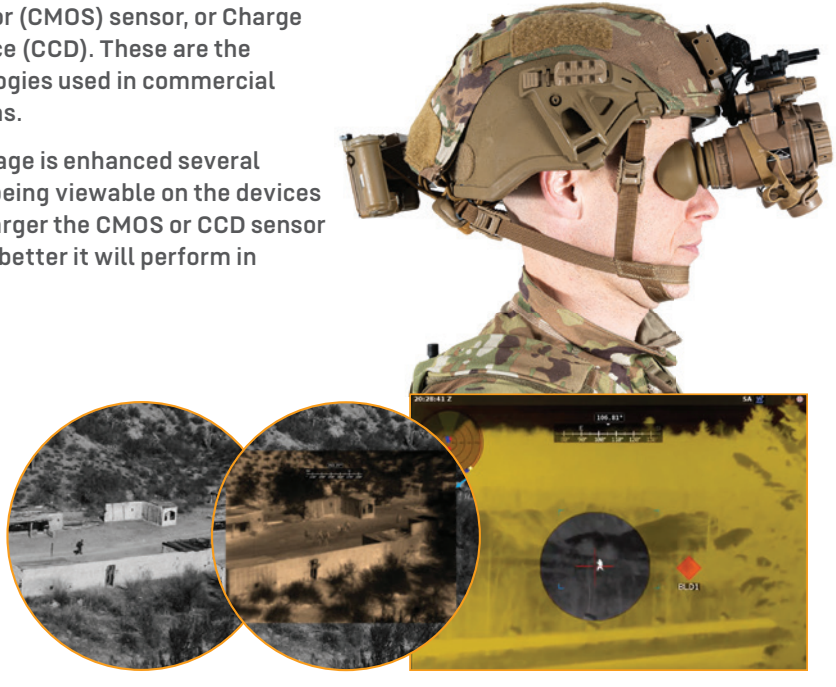
Thermal Image from ENVG-B



Fused Night Vision integrates a Long-Wave Infrared (LWIR) thermal sensor and image Intensification (I2) tubes or digital low light sensors and displays the fused image. Fused Night Vision can be used during low/high light levels, extreme weather and with obscurants.

Sensor fusion combines the positive qualities of the image intensifier and thermal imaging technologies into one device. Such a combination enables a user to view the image as a much greater part of the light spectrum, spanning from visible to near-infrared to long-wave infrared. Digital night vision devices operate differently than analog devices, in that light entering the objective lens is transformed into a digital signal by an image sensor of such as the Complementary Metal Oxide Semiconductor (CMOS) sensor, or Charge Coupled Device (CCD). These are the same technologies used in commercial digital cameras.

The digital image is enhanced several times before being viewable on the devices display. The larger the CMOS or CCD sensor pixel size, the better it will perform in reduced light.



# CONFORMABLE WEARABLE BATTERY



The Conformable Wearable Battery (CWB) uses Lithium-ion technology, and is a Soldier Carried battery, capable of powering Soldier systems up to 12 hours.

The charge time spans from 4-6 hours for one CWB. The CWB Charger outputs can use (UBC, ABC, UBC-L, or SPM) & a power source (solar, vehicle, other batteries, AC/generator).

Currently the CWB resides on the Soldier's back and is engineered to be ballistic safe meaning it can continue to safely provide power after being shot. The Battery is also shock and trauma-resistant, which helps it maintain functionality under physical stress.

- Nominal voltage: 14.8 volts
- Storage temp: -32C to +71C
- Operating Temp: -30C to +60C
- Shelf Life: 3 years @ +21C
- Weight: 2.6 lbs.
- EMI/RFI/EMC Protection

Universal Battery Charger

A microdisplay is, a human worn display—between 0.75- and 1-inch corner to corner. Most micro displays are assembled on a silicon backplane, either deposited directly or transferred, to control the individual pixels. The exceedingly small size of these circuits allows incredibly high-resolution images to be created.

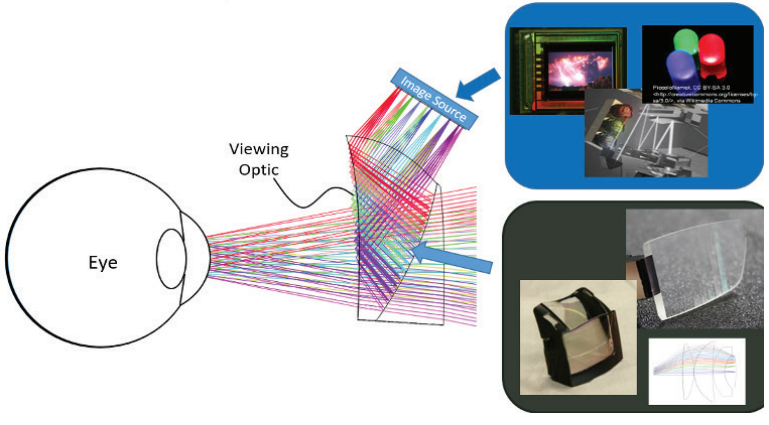
When combined with optics, such as a standard eyepiece, a freeform prism, a waveguide, or an optical combiner, the imagery from the microdisplay is magnified and focused at a comfortable viewing distance for the user.

Microdisplays have been used in various applications such as beam projectors, view finders of digital cameras, projection TVs, night vision devices, weapon sights, and augmented reality/virtual reality (AR/VR) devices.

Microdisplay technologies include Organic Light Emitting Diodes (OLED), Active-Matrix Liquid Crystal Displays (AMLCD), Liquid Crystal on Silicon (LCoS), and Inorganic Light Emitting Diodes (LED).

Near Eye Display is any information display that when placed at its intended viewing distance is close enough to the eye that it cannot be comfortably viewed without the aid of optics.

Near Eye Display = Image source + optics



# INTRA-SOLDIER WIRELESS (ISW) USING ULTRA WIDE BAND (UWB)



Intra-Soldier Wireless (ISW) is a secure high bandwidth wireless personal area network technology (WPAN) that provides on-body wireless networking capability

ISW uses the unregulated Ultra Wide Band (UWB) spectrum. It's low transmission power, makes it an inherently low probability of detection (LPD), low probability of intercept (LPI) capability. It is designed to operate in congested spectrum environments making it jam resistant.

ISW is FCC certified and compliant with the ECMA 368 standard. It uses an Army owned networking protocol called SolNet (Soldier Network). The ISW hardware is a subsystem embedded in a host system and forms an onbody network for multiple devices.

# AUGMENTED REALITY (AR)



Augmented Reality is the process of combining or "augmenting" video or photographic displays by overlaying the images viewed through goggles with useful computer-generated data.

This technology is beneficial to the Soldier as critical information is reaidly visible in the Soldier's field of view. AR can help Soldiers see the positions of others in their squad or platoon, designated pathways across the battlefield, enemy positions, and other data. They can also receive feeds from nearby optical sensors, including low-light and thermal sighting systems.

The NGSW-R Next Generation Squad Weapon (Rifle) is a modular, piston driven, select fire, magazine fed, fully suppressed rifle with 6.8 mm ammunition. Its fully ambidextrous controls are similar to its predecessor, the M4/M4A1 carbine. The NGSW includes a non-reciprocating left side charging handle, two position adjustable gas valve, collapsible/side folding buttstock.

The NGSW will allow Riflemen to engage targets further than the M-4 Carbine and provide a better ballistics hit to the intended target. The piston and the and suppressor both contribute to reduced recoil and the suppressor also serves to reduce both sound and visible flash signatures.

NGSW-AR Next Generation Squad Weapon Automatic Rifle is a lightweight, belt-fed, air-cooled, gas-operated, select fire, suppressed 6.8mm light machine gun that fires from the open bolt position. It has fully ambidextrous controls, a collapsible buttstock, two position adjustable gas valve.

The XM157 (Next Generation Squad Weapon Fire Control System) is designed to increase lethality, allowing the rifleman to effectively engage targets more accurately, in less time, and at a greater standoff distance. The XM157 consists of a 1-8x magnification direct view optic, ballistic calculator, atmospheric sensor suite, and a laser range finder. Combining these features with an in-scope digital overlay produces an adjusted aim-point for the Soldier within the field of view. The system also includes the Army's Intra-Soldier Wireless capability which will enable it to share data with other ISW enabled equipment. The XM 157 currently functions with a thermal optic mounted in front of the XM 157.

While the XM157 was designed to be integrated on the XM7 and XM250, its ballistic calculator gives it the flexibility to be able to be used with the M4A1 and M110A1 which are already in the Army inventory.


Thermal Optic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