**Image intensifier (I²) assembly** – An electro-optical device that detects and amplifies light to produce a visual image. The components include:

**Objective lens** - Photons enter the monocular assembly through the objective lens (an optical element that gathers light, and can be focused for the distance of an object). The objective lens contains a "minus-blue" coating which filters out light from the aircraft instrument panel. The image is inverted due to the shape of the objective lens, and then projected onto the photocathode.

**The photocathode** releases electrons proportional to the amount of incoming photons. The electrons are accelerated by an electrical field in the direction of the phosphor screen.

**Microchannel Plate** - This electrically-charged plate consists of millions of microchannels which are coated with an emissive material on the inside of the channel walls. The microchannels are cut at approximately five to eight degrees, to ensure that the incoming electrons strike the channel walls. Upon contact, the primary electrons cause the release of electrons from the emissive material which, in turn, strike the walls and release additional electrons. This amplification of electrons exit the microchannel plate in the same pattern that the original electrons entered.

**Phosphors Screen** - A very thin layer of phosphor is applied to the input of the fiber optic inverter & emits light when struck by electrons. The electrons strike the phosphor screen causing the phosphor to glow, creating a visible image.

**Fiber Optic Inverter** - The image is then re-inverted (upright) by the fiber optic inverter where the image is displayed.

**Eyepiece Lens** - The image is focused to the individual eye by the eyepiece lens.
NIGHT VISION GOGGLES

OPERATIONAL DEFECTS

These defects relate to the reliability of the image intensifier and are an indication of instability. If identified, they are an immediate cause for rejecting the ANVIS. When a defect has been identified, record the specific nature of the problem on the maintenance forms and return the ANVIS to the NVG maintainer for repair. Do not fly with an ANVIS that has an identified operational defect.

Return the ANVIS to the NVG maintainer.

**Flashing, Flickering, or Intermittent Operation** - The image may appear to flicker or flash. This can occur in either one or both monoculars and is most commonly seen when adjusting the eyespans knob(s). If there is more than one flicker, check for loose wires, loose battery cap, or weak batteries. Indicate the rate of flashing or flickering on the maintenance forms.

**Edge Glow** - Edge glow is a bright area (sometimes sparkling) in the outer portion of the viewing area. Edge glow is sometimes caused by an emission point (or series of emission points) just outside the field of view or by a defective phosphor screen that permits light feedback to the photocathode. To check for edge glow, block out all light by cupping a hand over the objective lens. If the image monocular assembly is displaying edge glow, the bright area will remain visible.

**Emission Points** - A steady or fluctuating pinpoint of bright light in the image area and does not go away when all light is blocked from the objective lens of that monocular. The position of an emission point within the image area does not move. Make sure any emission point is not simply a point light source in the viewed scene. Place a cupped hand over the lens to block out all light. If the bright spot remains, return the ANVIS to the maintainer to be checked for tolerances.

**Shading** - Each monocular should present a full circle. If shading is present, a full circular image will not be seen. Shading is indicative of a dying photocathode caused by a defective vacuum seal of the image intensifier. Shading is very dark and images cannot be seen through it. Shading always begins on the edge and migrates inward eventually across the entire image. Shading is a high contrast area with a distinct line of demarcation. Do not confuse shading with variations in output brightness.

**NOTE**: Make sure the shading is not the result of improper tilt, eyespan adjustment, or vertical adjustment.
NIGHT VISION GOGGLES

COSMETIC BLEMISHES
These are usually the result of manufacturing imperfections that do not affect image intensifier reliability, and are not normally a cause for rejecting the ANVIS. However, some types of blemishes can get worse over time. Cosmetic blemishes are not a cause for rejection unless they become severe enough to interfere with the ability to perform the mission. When a blemish is a cause for rejection, record the specific nature of the problem on the maintenance forms, identify the position of the blemish by using the clock method and approximate distance from the center (e.g., 5 o'clock toward the outside, 2:30 near the center, or 1:00 midway), and return the ANVIS to the NVG maintainer for repair.

Bright Spots - These are signal-induced blemishes in the image area, caused by a flaw in the film on the MCP. A bright spot is a small, non-uniform, bright area that may flicker or appear constant. Cup your hand over the lens to block out all light. If the bright spot remains it is considered an emission point and an operational defect. Bright spots go away when the light is blocked out.

Black Spots - These are cosmetic blemishes in the image intensifier or dirt or debris between the lenses.

Chicken Wire - An irregular pattern of dark lines throughout the image area, or in parts of the image area. Under the worst case condition, these lines will form hexagonal or square-wave shaped lines.
NIGHT VISION GOGGLES

**Fixed-Pattern Noise (Honeycomb)** - This is usually a cosmetic blemish characterized by a faint hexagonal pattern throughout the viewing area that most often occurs at high-light levels or when viewing very bright lights. The pattern can be seen in every image intensifier if the light level is high enough.

**Output Brightness Variation** - This condition is evidenced by areas of varying brightness in or across the image area. The lower contrasts do not exhibit distinct lines of demarcation nor do they degrade image quality. Do not confuse output brightness with shading.

**Image Disparity** - This condition may exist when there is a difference in brightness between the two image-intensifier assemblies within the same binocular.
NIGHT VISION GOGGLES

Binocular Variations. There are two models of binoculars.
- AN/AVS-6(V)1. the fore-&-aft slide assembly is centered on the PAS.
- AN/AVS-6(V)2. the fore-&-aft slide is offset on the PAS.
- Both Models. Larger eyepieces to provide 25mm of eye relief instead of 15mm. & the PAS has two eyes-pan knobs to enable independent eye-span adjustments.

Power Packs. Power pack attaches to the back of the helmet & contains the system power switch. On some dual-battery packs, there is a new circuit card inside that will make the low-battery indicator blink.
- G1 / G2 – produce a steady low-battery indicator.
- G3 / P/N 5008900 – contain the blinking circuitry.

Low-Battery Indicator: The ANVIS incorporates a red LED at the base of the mount that comes on when active battery voltage drops to 2.2 - 2.4 Vdc.

Environmental Data.
- Operating Temp: -32°C to +52°C
- Illumination Required: starlight to moonlight

ANVIS Performance by Type.

<table>
<thead>
<tr>
<th>Types</th>
<th>1 &amp; 2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
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<tbody>
<tr>
<td>Name</td>
<td>(V)1</td>
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<td>(V)1A</td>
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<td>High Light (acuity)</td>
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<td>/33</td>
<td>/28</td>
<td>/25</td>
<td>/23</td>
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<tr>
<td>Low Light (acuity)</td>
<td>/120</td>
<td>/105</td>
<td>/85</td>
<td>/70</td>
<td>/62</td>
</tr>
</tbody>
</table>

- Cell Life Until low-battery indicator turns on
  - 100F 10-22 Hours
  - 70F 10-22 Hours
  - 0F 5-10 Hours
  - -22F 1-3 Hours

Mechanical Data.
- Breakaway Force: 10G-15G
- Counterweight: 0 to 22 ounces.
- Binocular Weight
  - 15mm – 19.4 ounces
  - 25mm – 20.8 ounces

Optical Data.
- Obj Focus Range: 11 (±1") to = or >180'
- Eyepiece Focus Ring: ± 2 to 6 dipters
- Magnification: Unity (1:1)
- Acuity: Based on type (20/40 typ.)
- Astigmatism: Doesn’t correct for it
- Field-of-View: 40 vs. 200 deg unaided.
- Amplification Light 3500-2000 ....
- green-Monochromatic..........................Color
NIGHT VISION GOGGLES

WARNING Limitations

- The equipment requires some ambient light (moonlight, starlight, or artificial light, etc.) to operate. The level of performance depends on the level of light.
- Ambient light may be reduced by such factors as passing cloud cover & objects that produce shadows.
- The equipment is less effective viewing into shadows & other darkened areas.
- The equipment is less effective through rain, fog, sleet, snow, smoke, & other reflective material.
- Adjust speed & altitude to prevent over-flying the field-of-view when conditions of possible reduction or loss of vision exist.
- Exercise extreme caution when flying over low-contrast terrain such as snow-covered territory, sandy desert environments, large bodies of water, grassy hills. Under ambient starlight conditions, low-contrast environments degrade visibility, thereby disguising or masking changes in terrain. This is especially true under low light conditions.
- Exercise extreme caution when flying from high ambient light conditions to low ambient light conditions. Under low light condition, the goggles lose some resolution that they have under highlight conditions. Flying from highlight to low light conditions quickly reduces the sharpness & definition of terrain images.
- Some goggles may experience a measurable loss of performance at temperatures above 100F (38 C). This is caused by ambient heat beginning to increase thermonic emissions of the photocathode. If this begins to occur, it will appear as though you are looking through eyeglasses that are starting to fog or develop a slight haze.
- The equipment has a field-of-view limited to 40 deg, which requires appropriate continuous side-to-side head movements.
- If eyeglasses are worn, the upper rims of the eyeglasses can obscure the low-battery indicator & reduce the field-of-view.
- Do not attach the lanyard to the flight helmet. Attaching the lanyard to the flight helmet may cause head & neck injuries in a survivable accident. The only authorized way of attaching the lanyard to the flight helmet is with the use of fastener tape, hook, & fastener tape, pile.
NIGHT VISION GOGGLES

WARNING Electrical/Battery
• Do not carry batteries in pockets containing metal objects such as coins, keys, etc. Metal objects can cause batteries to short circuit & become very hot. Batteries may explode

• On the original type of power pack, make sure the batteries are not expired. If a dead battery is in the compartment opposite the one being used to power the goggles, the low battery indicator will not come on when the voltage of the active battery drops to 2.4 Vdc & may result in system failure. Inspect Batteries before use.

• To insure uninterrupted operation of the ANVIS in the event you lose aircraft power, make sure you have appropriate batteries in the battery compartment & place the ON-OFF-ON switch on the power pack in the ON position.

WARNING Toxic material
• The image-intensifiers phosphor screen in each monocular contains toxic material if it breaks. Don’t inhale, ingest, suck-on, or stick into open wounds. Wash off skin if you contact it. If you inhale/swallow, drink a lot of water, induce vomiting, & call the coroner.

WARNING General Warnings
• Some external lighting below 625 nanometers wavelength (blue-green lighting) cannot be viewed through the ANVIS because of the minus-blue coating on the inside of the objective lenses.

• All crewmembers with access to a set of flight controls must wear the same type of night vision goggles (NVG’s), for example, both pilots wearing ANVIS goggles.

• Aircraft lighting that may not be compatible or acceptable with ANVIS will interfere with ANVIS performance, such as glare on the aircraft windscreen.
NIGHT VISION GOGGLES

TYPES/DEFINITION

PHOTOPIC- Daylight, NVG, or High Light vision. Uses Cone vision. Colors are visible.

MESOPIC- Used at Dusk and Dawn. Uses both Cone and Rod cells for visibility.

SCOTOPIC- Night or Low Light Vision. Uses Rod cells located in the parafovea. Requires use of scanning and off-center viewing to avoid the night blind spot (5 – 12 degrees) due to concentration of Cones in the central fovea. Colors are not visible.

GEOMETRIC PERSPECTIVE- Object shapes effect perception of distance.

LINEAR PERSPECTIVE- Parallel lines converge over long distance.

APPARENT FORESHORTENING- Objects appear elliptical when viewed from various heights and distance.

VERTICAL POSITION- Objects that appear higher on the horizon are further away.

RETINAL IMAGE SIZE- Brains use of an images size to determine distance.

KNOWN SIZE OF OBJECTS- Brain uses the known size of an object to determine distance.

INCREASING/DECREASING SIZE- Objects increase in size as you get closer and decrease as you move away.

TERRESTRIAL ASSOCIATION- Using an object with a known size to determine the distance of another.

OVERLAPPING CONTOURS- The overlapped object is further away.

AERIAL PERSPECTIVE- Using the clarity of an object/objects to determine distance.

FADING OF COLORS AND SHAPES- Objects tend to fade as distance increases.

LOSS OF DETAIL- Far objects are not as detailed.

LIGHTS AND SHADOWS- Light sources cause objects to cast shadows even if they are not seen.

MOTION PARALLAX- Near objects move by the visual field fast while far objects move slowly or tend to stay still. Same visual cue used to determine ground speed during an approach (brisk walk).