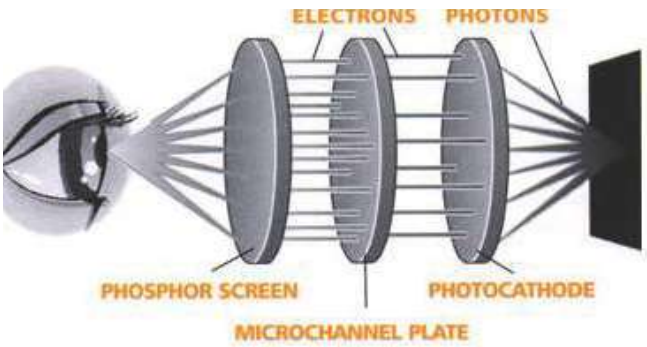
The first thing that comes to your mind when you read the words "Night Vision" is probably a spy or action movie that you may have seen on TV in which a team of soldiers strap on their pairs of night vision goggles searching for enemy in a dark moonless night. You can certainly see in the dark with those goggles. In fact, with proper night vision equipment, you can see a person standing over 200 yards (183 metres) away on a dark and cloudy night.

Night vision technology is of two types: image enhancement and thermal imaging.

IMAGE ENHANCEMENT (LIGHT AMPLIFICATION)

Image enhancement or light amplification is the technology that is mostly used in the night vision devices that we use such as binoculars and goggles. It collects small amount available visible light, such as moonlight or starlight, from the surrounding area and convert the light energy (photons) into electrical energy (electrons). These electrons then pass through a thin disk that is about the size of a quarter and contains over 10 million channels. After traveling through the disk, these electrons strike the walls of channels as a result of which thousands of more electrons are produced and released. These multiplied electrons hit a screen that is coated with phosphors. They continue to maintain their position in relation to the channels they pass through. This provides a perfect image since the electrons stay in the same alignment as the original photon. The phosphor, due to the powerful energy of electrons, reaches an excited state and starts releasing photons. These phosphors then create the green image on the screen that characterizes the night vision.



[The image intensifier tube changes photons to electrons and then back again]

All image intensified night vision products on the market today have one thing in common: they produce a green output image just like the one pictured below.

[Night visions images are known for their eerie green tint]

However, that is all what they have in common. The night vision technology is further categorized into a number of generations; each generation reflects the level of technology used. The higher the generation, the more sophisticated the night vision technology.

Generation 0 - The earliest night vision products

date back to the 1950's. The technology used at that time was image conversion, rather than intensification. They required a source of invisible infrared (IR) light mounted on or near the device to illuminate the target area.

Generation 1 – Then came the "starlight scopes" of the 1960's during the Vietnam War. They had three image intensifier tubes that were connected in a series. These systems are larger and heavier than Gen 2 and Gen 3. The Gen 1 image is clear at the center but may be distorted around the edges.

Generation 2 – Some major improvements in the image intensifier tubes were made which resulted in the development of Gen 2 night vision devices in 1970's. Microchannel plate (MCP) electron multiplier was what made it possible to develop the Gen 2 devices. It provided such an enormous gain that need for back to back tubes was totally eliminated. The image quality and size was also improved. The MCP enabled development of hand held and helmet mounted goggles.

Generation 3 – While there is not much difference in the Gen 2 and 3 devices as far as the technology is concerned; the Gen 3 night vision devices have even better resolution and sensitivity. Two major advancements characterized development of Gen 3 in the late 1970s and early 1980s: the gallium arsenide (GaAs) photocathode and the ion-barrier film on the MCP. The GaAs photocathode enabled detection of objects at greater distances under much darker conditions. The ion-barrier film increased the operational life of the tube from 2000 hours (Gen 2) to 10,000 (Gen 3), as demonstrated by actual testing and not extrapolation.

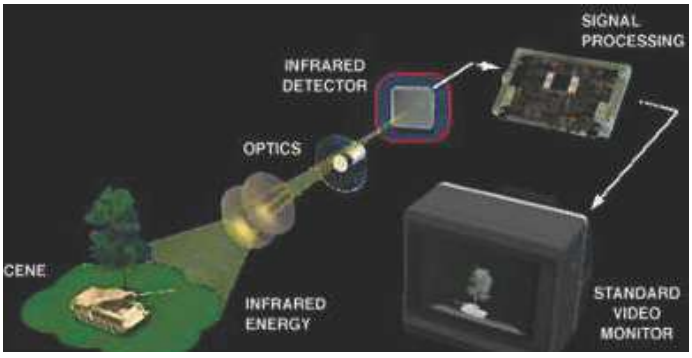
Generation 4 – The Gen 4 devices show the most significant overall improvement in both low and high level light environments. This is due to the "film less or gated" technology they use. It reduces the background noise thereby enhancing the signal to noise ratio by removing the ion barrier from the Microchannel plate (MCP) that was added in the Gen 3 technology. Removing the ion film actually allows more electrons to reach the level of amplification so that the images are significantly less distorted and brighter.

Thermal Imaging (infrared light)

The second type of night vision technology is thermal imaging. It operates by capturing the upper portion of the infrared light spectrum which is emitted as heat by objects instead of being simply reflected as light. It is also important to note that hotter objects such as warm bodies emit more heat than the cooler ones like trees and buildings. This technology uses the infrared radiation to remotely determine the temperature of objects.

Let's see how thermal imaging works:

First of all, there is a special lens that focuses the infrared light emitted by all of the objects in its range. This focused light is then scanned by a phased array of infrared detector elements. These detector elements create a very detailed temperature pattern called a thermogram. It only takes about one-thirtieth of a second for the detector array to obtain the temperature information to make the thermogram. This information is obtained from several thousand points in the field of view of the detector array. The thermogram created by the detector elements is translated into electric impulses. The impulses are sent to a signal-processing unit, a circuit board with a dedicated chip that translates the information from the elements into data for the display. The signal-processing unit sends the information to the display, where it appears as various colors depending on the intensity of the infrared emission, then the combination of all the impulses from all of the elements creates the image.



[The basic components of a thermal-imaging system]

Types of Thermal Imaging Devices

Most thermal imaging devices scan at a rate of 30 times per second. They can sense temperatures ranging from -4 degrees Fahrenheit (-20 degrees Celsius) to 3,600 F (2,000 C), and can normally detect changes in temperature of about 0.4 F (0.2 C).

[It is quite easy to see everything during the day]

[...but at night, you can see very little]

[Thermal imaging lets you see again]

Thermal imaging devices are of two types:

Un-cooled – The most common type of thermal imaging device is un-cooled. In the un-cooled system, the infrared-detector elements are contained in a unit that operates at room temperature. This type of system is completely quiet, activates immediately and has a built in battery.

Cryogenically cooled – This one is more expensive and more susceptible to damage from rugged use; these systems have the elements sealed inside a container that cools them to below 32 F (zero C). The advantage of such a system is the incredible resolution and sensitivity that result from cooling the elements. Cryogenically-cooled systems can "see" a difference as small as 0.2 F (0.1 C) from more than 1,000 ft (300 m) away, which is enough to tell if a person is holding a gun at that distance!

A benefit for the *mujahideen*

Night vision is an advantageous technology for military and guerilla operations. We have witnessed over the years the crusaders using this technology to full capacity, and taking advantage of the night to harass the *muslimeen*. The *mujahideen* are now fielding such tools to assist them in foiling the crusader advantage and now that the equipment is widely available, both commercially and through war booty, we can expect to see more *mujahideen* using night vision in their strategies.