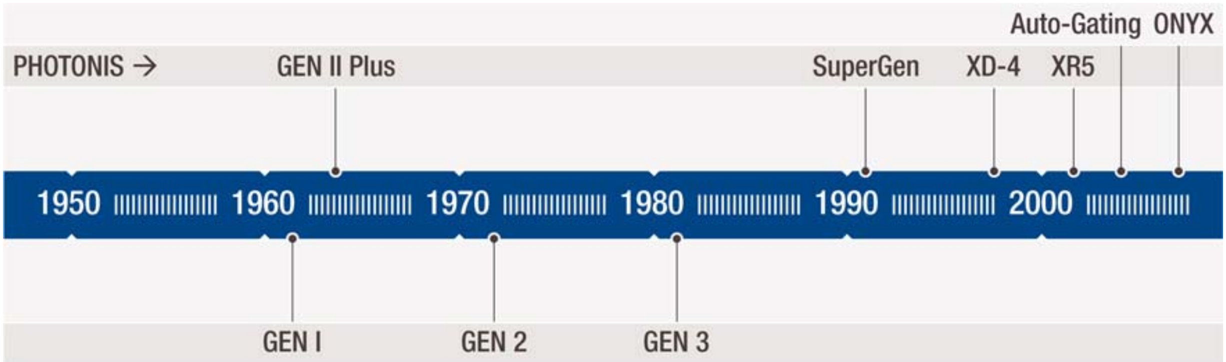
Development of Night Vision

The first night vision devices were introduced during World War II. Generation 0 devices did not actually amplify ambient light, but rather allowed a user to see near-infrared light. These so-called active devices required the use of a large infrared light source to illuminate targets, and consequently were easily detectable by opposing forces using similar equipment.

The first true passive image intensifiers, known as Generation 1, were introduced in the 1960s. These devices eliminated the need for external infrared illumination, as they intensified ambient light. These “Starlight Scopes” as they were once referred to, were extremely bulky since they required several vacuum tubes coupled together to intensify an image. Despite having multiple stages of amplification to get high gains, these devices still only provided limited imaging due to low signal to noise ratio, low resolution and high distortion.



History timeline of Image Intensifiers

By the 1970s, night vision experienced a technological breakthrough when Generation 2 image intensifier (I2) tubes were first designed with an MCP. The MCP eliminated the need for multiple stages of amplification and allowed the tubes to reach high gains with good low light level performance, increased tube life, lower power consumption and almost no distortion, all in a small and lightweight housing. These achievements allowed the development of the first truly man-portable NV devices; however, these devices were still bulky (25 mm inverter tube) and heavy. The subsequent introduction of inverting fiber optics (twister) allowed the development of the world standard 18 mm tube format (as we know it today), small and light weight for fully man-portable devices.

A starlight scope with external illumination aboard a Bell UH-1 “Huey” helicopter, circa 1961

In the 1980s, Generation 3 tubes introduced the use of new photocathode material made from gallium arsenide (GaAs). These tubes promoted significant increases in the cathode’s quantum efficiency (QE), measured as the ratio of photons hitting the photocathode and actually converted into electrons (useful photons) by all incoming photons. While the idea of using higher QE photocathode was good on the paper, it came with real drawbacks linked to the “fragility” of this GaAs layer. It became quickly obvious that in order to keep an equivalent lifetime as that of standard Gen 2 tubes, the Gen 3 technology required adding an ion barrier film on the MCP, also called Electron Barrier Film (made of $Si0_2$ or Al_2O_3), that blocked a great deal of the useful photo-electrons produced by the “better” photocathode. When considering the multi-stage process and therefore the global performance of the tube, the Gen 3 tube did not perform much better than its Gen 2 counterpart, but instead introduced added drawbacks such as very large halos and higher power consumption.