

# Night Vision



## THE NEED FOR TRAINING

Night Vision enhancement technology – once the sole purview of the military – is rapidly becoming more common within the civil aviation community. Regardless of how and where they are used, the benefits and challenges associated with this technology have remained relatively unchanged since the introduction of NVGs (night vision goggles). Yet, it is interesting to note that some “lessons” need to be “re-learned,” despite the extensive amount of experience with night vision.



One of the key lessons learned by the military, is that adequate training is required to completely leverage benefits while also mitigating the associated risks and limitations of enhanced night vision flying. We'll focus here on training programs.

### The Changing NVG Training Environment

Night Vision Goggles have been in used in aviation for over three decades. The first generation NVG, incongruously known as Generation II, demonstrated that the operational envelope of helicopter operations could be significantly enhanced by allowing pilots to conduct safe and efficient missions in low light environments. However, serious limitations were associated with the early implementation of these systems, resulting in a number of flight accidents. This was due in part to a combination of limited resolution and poor human factors design of these early

devices. Consequently, NVG acquired the stigma of being high risk in helicopter operations.

Based on the lessons learned from those experiences, manufacturers developed the next level (Generation III) systems, which represented a lighter, more efficient light amplification device with better resolution than previous Aviator's Night Vision Imaging Systems (ANVIS). Aviators were now able to effectively operate under a wide variety of night lighting conditions that ranged from bright moonlight to dark overcast nights.

### How It Works

The majority of light energy in the night sky is not visible to the human eye. The NVG capitalizes on this abundant energy by allowing image intensification using the available light energy, resulting in astounding visual sensitivity at night.

The principal component of the NVG, the image intensifier, works as a light amplifier. A photon strikes the front surface of the photocathode, releasing an electron via photoelectric emission (this is the conversion of light energy to electrical energy.) The increased number of electrons hit a phosphor screen, subsequently emitting light. The image produced is monochromatic green and inverted (upside down). A fibre optic bundle rights the image, displaying it

in the correct vertical sense which is then relayed to the eyepiece lens. This image gives the user a defined view of the night scene that would not otherwise be visible.

### Limitations

NVGs provide the capability to operate expensive air assets at night in a safer and more effective manner. The NVGs achieve this by allowing operators an expanded acuity from 20-200 (legally blind) under unaided VFR to approximately 20-25 with NVGs. There are limitations, however.

Most common NVGs only allow 40° of instantaneous field of view (FOV). However, to effectively operate the aircraft, the crew requires a field of approximately 210-240° and spatial orientation information. To accommodate the limited instantaneous FOV available with NVGs, the crew compensates by conducting a continuous horizontal and vertical scan pattern that gives the equivalence of full FOV. To supplement the limited spatial orientation information available in the NVG, the crew use unaided vision by looking under or around the NVG to gain the required information from the flight instruments. These design characteristics of the NVGs increases the base level of workload and, hence, fatigue. This has the effect of decreasing the available capacity for performing high gain tasks, or managing complex situations. However, all of this can be easily overcome through effective training – an essential element of any NVG implementation program.

### Training Methodologies

The importance of having a standardized training program for the use of NVGs during flying operations cannot be overstated. Any military using NVGs has well-defined initial training requirements and specific continuation training requirements since NVG flying is a perishable skill that must be maintained to a high standard.

In the United States' civil aviation sector, the Federal Aviation Administration (FAA) has implemented strict training requirements. An initial NVG program requires academic and on-the-ground practical





sessions prior to actual NVG training flights.

Until recently, NVG training has been conducted in the traditional manner using ground school lectures followed by flight training. There is a cost associated with this training that includes more than the actual training course expense. While aircrew are partaking in NVG training, they are not available for commercial or operational flights. The effects of these elements (cost of training and lost revenue or the need for back up crews to cover operational tasks) can be a deterrent for some organizations that are considering whether to introduce or expand the capability to operate using NVGs.

Industry is actively addressing the financial and operational needs of organizations by migrating to advanced modes of instruction. Computer Based Training (CBT) and synthetic 3D environments that include both theoretical and practical elements can provide the same level of proficiency remotely, thus making a portion of the training more accessible and affordable.

This new approach can offer the convenience of completing academic and practical sessions anywhere, anytime, at the convenience of the organization and the student – while at the work site or during inclement flying conditions. Con-



Training screens.

tinuation training can be achieved using the same media, offering content that reaffirms critical knowledge that must be retained. It also provides any NVG-related information that has been updated since the last training session. The convenience of these training media is that the only element of the NVG training tied to a specific location (the organization's or the training company's) is the flying portion. The result will be a more efficient training program with minimal operational impact.

NVG flight simulators can also be a valuable training enabler, especially in scenarios that are considered risky, such as flight in deteriorating weather and poor lighting conditions. The significant impact of using simulators is that they permit crews to use their actual NVGs in the simulator to receive the same level of training

as in the actual aircraft plus the added value of practicing what cannot be done safely in the aircraft, that is, recovery and emergency flying scenarios in less than ideal weather conditions in a completely safe environment.

The benefits of using the advanced NVG training technologies include: faster and more flexible training that can overcome training barriers; increased operational readiness; decreased operational costs; increased mission safety and performance; and improved operator health and performance.

## Best Practices Summary

The safe and effective use of NVGs is predicated on the establishment of a thorough training plan for initial training and continuation training. Without a coherent training program, organizations will be faced with an unacceptable level of risk in their operations. The following key best practices are worth considering:

- Ensure pilots receive adequate training in both instrument and NVG flying at the *ab initio* stage;
- Establish a regular continuation training program that includes simulation training;
- Conduct regular evaluations of aircrew to determine their level of proficiency to fly using NVGs in their respective operational profiles;
- Establish minimum flight requirements to ensure crews maintain an acceptable level of proficiency;
- Ensure crews can conduct "blind cockpit" (eyes closed) drills on a regular basis to ensure that they can locate critical controls and the switches without having to look for them; and
- Establish a program to monitor the impacts of crew fatigue.

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