

[T] = Terrain Avoidance

What Does It Take to Use NVGs?

JAMES WILLIAMS

So the darkness shall be the light ...

- T.S. Elliot.

Even in the darkest night there is light. Last year, *FAA Safety Briefing* looked at the technology of Night Vision Imaging Systems (NVIS) and Night Vision Goggles (NVG) (Jan/Feb 2014). We reported that a great deal can be done with just a little bit of light.

We also learned that these wonderful appliances still have very distinct limitations. While researching the technology, we heard raves about the effectiveness of night vision systems. Though casual users couldn't easily see (so to speak) the drawbacks apart from limited field of vision (FOV), the fact is that serious issues remain.

Rules of the Road

Before we delve into details on the drawbacks, let's start by reviewing rules for the use of NVGs.

First, in order to act as a PIC while using NVGs you must be properly trained in accordance with the requirements of 14 CFR 61.31(k). The training

includes both ground and flight portions, and some of the topics covered include aeromedical factors, visual illusion, NVG performance, scene interpretation, preflight of aircraft lighting, proper piloting techniques, and emergency procedures.

Second, the aircraft must be approved for NVG use. This is either done as part of the Type Certificate (TC) of the aircraft or by the addition of a Supplemental Type Certificate (STC) to the aircraft. Requirements typically include filters on annunciators and other cockpit lighting, which allow you to read cockpit instruments without reducing the effectiveness of the NVGs. (Note: See *Vertically Speaking* for more information on cockpit issues.)

To get a better idea of what the training encompasses, we consulted Aviation Safety Inspector (ASI) Shawn Hayes, who serves as the NVG focal point for GA operations. "The regulations don't require minimum training times," he explained. "It's all based on the proficiency of the person being trained." Hayes also stressed that GA owner/operators need to

remember that it may take a while to get comfortable and, more importantly, proficient in operating with NVGs. “Remember, currency does not equal proficiency — especially with NVGs,” he cautioned.

The currency concept will be familiar to instrument-rated pilots. Hayes outlined the requirements stated in 14 CFR 61.57(f)(1)(i)-(v). “The specific requirements for currency, or night vision goggle operating experience, are pretty straightforward,” he observed. The rules require operating as PIC while carrying passengers in the two calendar months preceding the month of the flight in airplanes, helicopters, and powered lift aircraft.” Hayes continues, “If those requirements are not met, then the person has another two calendar months (for a total of four calendar months preceding the month of the flight) while acting as PIC and not carrying passengers.”

To summarize, a pilot seeking to maintain NVG currency has a window of two months beyond the currency to carry passengers in order to regain legal currency. After that, the pilot needs to take a NVG Proficiency Check with a qualified person as listed in 61.57(g). Again, though, Hayes emphasizes that “currency does not equal proficiency, especially with NVGs.”

Getting to Proficient

To get information on what constitutes proficiency, I consulted ASI Ray Johnson, a long-time NVG user. In fact, Johnson has used NVGs since 1972, when these devices were introduced for widespread use with the Army’s AN/PVS-5. Johnson maintains his own NVG knowledge by serving as a rotorcraft expert in the Flight Standards General Aviation and Commercial Division. “I feel safer flying with NVGs than I do without them,” Johnson says. “When I started using them again, I felt comfortable within two weeks. That’s because I had a lot of experience with NVGs, which taught me about good scanning techniques.”

Johnson went on to outline some of the issues that first-time NVG users can encounter.

Field of View and Contrast

“The first time you slap on a pair of goggles, you notice it is very similar to holding a pair of toilet paper tubes up to your eyes.” Johnson said. “Your field of view is limited, and that has a dramatic effect on your situational awareness. To counter this limitation, it’s imperative for the pilot to learn correct, effective scanning techniques for terrain contrast.”

The term “terrain contrast” refers to the reflectivity of two or more surfaces. It’s important in NVGs,

Photo by Senior Airman Austin Knox

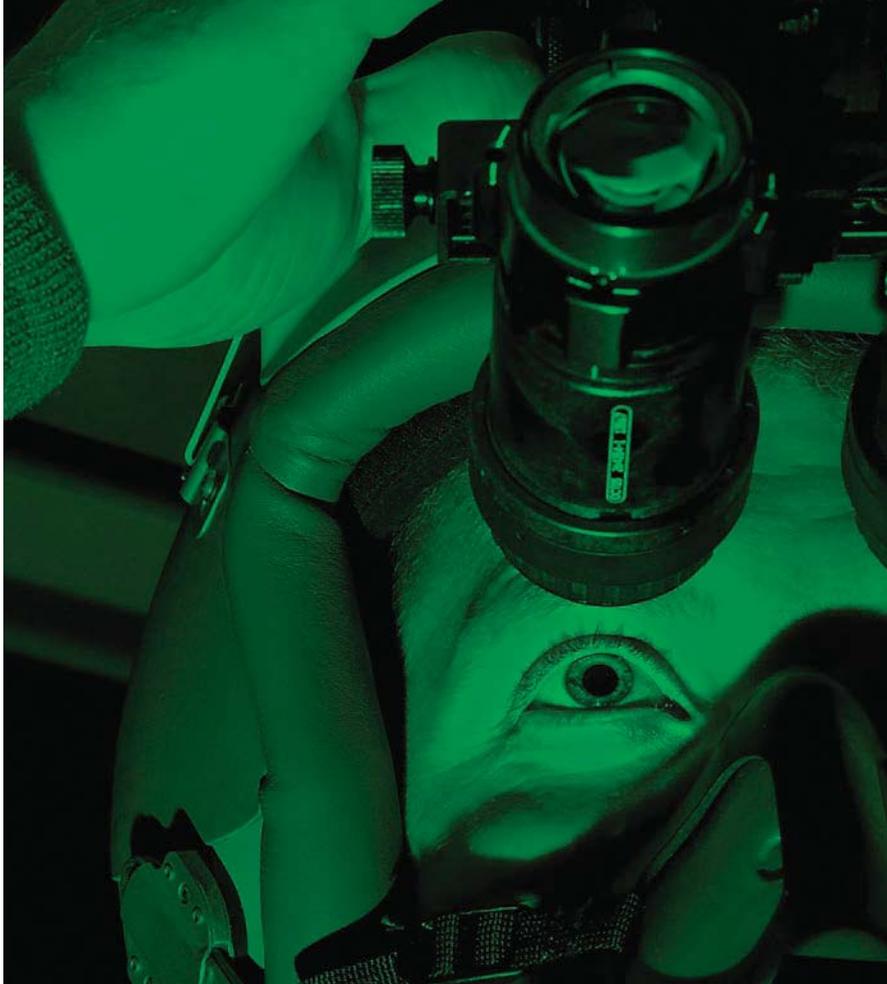


Photo by Airman 1st Class Benjamin Wiseman





because all vision — aided or unaided — is based on the reflection of light. With less visual information (the FOV issue again), contrast between surfaces

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is important. Johnson explains that when over water and with no land in your field of view, NVGs do not provide very good contrast in the image they provide.

“The 20/40 vision you get with NVGs won’t let you see wires because they tend to blend with their surroundings.” He warns that “Bad things can happen if you stop scanning.”

Depth Perception

Another NVG issue – one that provokes debate – is depth perception. Early U.S. Army studies showed that NVG use essentially eliminated depth perception. Later studies, however, showed that stereo vision is indeed present when using NVGs.

Still, there are other issues. According to FAA training information, NVG users tend to overes-

timate distance and underestimate depth. That’s because loss of detail, which arises from the fact that the NVG user is viewing an object on a screen, can make users think objects are farther away. In addition, an object’s reflectivity will change how it appears in the NVG. Shiny or reflective objects will appear closer, while dull objects will appear farther away than they are. And, of course, any light source will tend to appear closer than it is. Any of these false perceptions can create a dangerous situation. Hayes summarizes with this comment: “The bottom line is that distance estimation and depth perception is reduced while using NVGs.” This reality is one more reason for the extensive training required to use NVGs.

Focus

Focus matters a lot too. In fact, Johnson states unequivocally that “everything else is secondary” to this task. “If your goggles aren’t focused properly before you go out to the aircraft, you’re setting

yourself up for failure. Everything that happens between the time you leave the focusing lane and the time you put the goggles on in the aircraft works to degrade your visual acuity.” By properly focusing your NVGs, you ensure that your eyes don’t have to adjust to bring the displayed image into focus. Improper focus makes a noticeable difference in eye strain and fatigue. Johnson cautions, though, that even with the best focus, eye fatigue is very possible during long periods of NVG use. In addition, the additional weight of the goggles themselves, plus the power packs and counter weights, can accelerate fatigue by putting extra strain on the pilot’s head and neck.

How Do I Start?

After covering all of these real concerns, you might be wondering if it’s worth using NVGs. The answer is that it depends.

Ray Johnson stresses that training – *proper training* — is critical to using NVGs safely, and recurrent training is required to maintain those skills. His bottom line is that NVGs are a great appliance, but “if you can’t afford to build and maintain the skills to use them safely, then it is best to leave them in the case.”

If you decide you can indeed afford to make the necessary investments in pilot training (both initial and recurrent) and aircraft equipage, Hayes offers this advice: “Do your homework. Be sure that the instructor giving you NVG training is properly endorsed by the regulations to provide that training.” (Note: see FAA Notice 8900.320 for more information.) Hayes also suggests a form of “benchmarking” that pilots should use for any kind of training: “Ask questions, and check with people who have already taken this step. See what pitfalls they may have encountered. Learning from other people’s mistakes can help make your transition into aided flight much more safe and seamless.”

With proper training and proficiency, NVGs can be a powerful safety and operational tool. Without it they can be a disaster waiting to strike. “I was surprised at how dramatically NVGs increased my overall situational awareness on nearly every night flight,” Johnson stated. “But be aware of the limitations of NVG operations.” 

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Like any piece of technology NVGs need to be tested to make sure they are performing up to acceptable standards.

EFVS and SVS

Other ways of seeing in the dark include Enhanced Flight Vision Systems (EFVS) and Synthetic Vision Systems (SVS). Each works differently, but they provide similar results. EFVS systems usually provide a picture of the outside world derived from either Forward Looking Infrared (FLIR) or millimeter wave radar. FLIR is also considered a night vision technology, but is generally more expensive than Image Intensifier (I²) technology. It does have the benefit of being able to see through clouds and other obstructions where I² systems cannot.

SVS is a view of the outside that is generated based on GPS positioning and a topographical database. SVS is by far the most accessible of the technologies, as it has been built into many avionics suites and even into mobile apps. But SVS is a “garbage in, garbage out” system, meaning that it’s only as good as the database it runs on and the GPS location data it has. Both must be completely accurate for the system to be accurate.

As databases get better and GPS accuracy improves with programs like Wide Area Augmentation System (WAAS) and Local Area Augmentation System (LAAS), SVS has tremendous potential to offer safety improvement at a reduced price.