In the last 15 years, I've seen the world of nighttime operations change dramatically. Forward Looking Infrared (FLIR) revolutionized our ability to search in dark environments, but FLIR wasn't an answer to the risks associated with flying in dark environments. In fact, glare from the FLIR's display made the pilot's job even more difficult. Some of those flights were just downright scary.

The San Diego Police Air Support Unit started using Night Vision Goggles (NVGs) several years ago. There was no particular incident that moved us in that direction, the opportunity to acquire them just presented itself. We originally didn't think they'd be of much use. Someone even thought that they were nothing more than a poor man's FLIR, only to be used by the Tactical Flight Officer. We knew nothing about incompatible lighting, NVG limitations, training, etc.

Like FLIR, NVGs are military trickle-down technology. Originally designed for military applications, they have clear parallel benefits for airborne law enforcement operators. Most of the lessons learned about NVG operations were learned by Army aviators decades ago. Early generation NVGs (Generation 0 and 1) were contributing factors in several nighttime accidents. Their performance was relatively low, and their displays distorted the image, sometimes significantly.

Generation 2 goggles, like the early-model PVS-5s had better performance and much less optical distortion. New technology, a coin-sized microchannel plate, multiplies the number of electrons that strike it and thereby increasing the amount of optical information that can be processed. But the PVS-5s were bulky and reminiscent of one of those face-huggers on "Alien." Their fully enclosed design prevented a pilot from being able to clearly see the instrument panel. One former Army aviator told me that the only way he could interpret his instruments while wearing the PVS-5s was to memorize where the numbers were on the gauges and look for the fuzzy needle's clock position. The gauges were so out of focus that there was no way to actually read them. Another attempt at solving this problem was to focus one of the tubes outside the
cockpit at infinity, and the other on the instrument panel. I can only imagine the intensity of the headache at the end of the flight.

In years since, we’ve seen the introduction of Generation 3 goggles like the ANVIS (Aviators Night Vision Imaging Systems) 6s and 9s (F-4949s). Their performance is significantly better than the older technology, and their open design enables the pilot to see around the goggles to view the instruments. The manufacturers continue to get more performance out of the microchannel plate and the internal electronics of the goggle.

NVG Limitations and Misconceptions

An occasional problem associated with NVGs is a phenomenon known as "blooming." Blooming appears to the aviator as a halo around visible light sources. This can cause the goggles to gain-down, which means they have less performance. The internal circuitry of the goggle does this automatically to protect the intensifier tubes. When this happens, the surrounding terrain and obstructions that were barely visible may no longer be visible at all. And the halo around the offending light source can block the pilot’s view of obstructions near the light source. This is usually only a problem when flying low-level in very dark environments (such as when landing or taking off from an off-airport site). When operating low-level, the pilot’s view of the outside world is more horizontal, and with the exception of other aircraft, that’s where all the obstructions are.

Newer technology has significantly reduced blooming. The power supply (the battery pack mounted on the back of the pilot’s helmet) is “auto-gated,” which means it’s turning itself on and off at a very rapid rate. This, combined with a change in the thickness of a thin film attached to the microchannel plate (an ion barrier) reduces blooming. Some goggles have no film layer at all. I recently performed a side-by-side comparison of a new set of goggles with a thin film layer, and a new set of goggles with no film layer. Blooming was noticeably less on the goggles with no film layer. But in my opinion, the other goggles were perfectly acceptable. Deciding which goggle is better should not be based solely on blooming. Some say that by removing the film layer completely, the life of the intensifier tubes is shortened.

Another limitation of NVGs is their field of view. The Generation 3 goggles available today are limited to 40 degrees. Stare through a set of toilet paper rolls for a few minutes and you’ll get a pretty good idea of what 40 degrees is. It’s not quite that bad, but you’ll get the point. It’s important to understand that when you’re using NVGs you’re not looking through them, you’re looking at them. After the image is intensified, it’s displayed on two phosphorus screens—essentially TV screens right in front of your eyes. Some pilots initially find this view of the outside world somewhat claustrophobic, but training and good scanning procedures usually alleviate this.

I’ve also heard some say that flying with NVGs is comparable to instrument flight on the scale of VFR and IMC conditions. They argue that pilots should have an instrument rating to fly with NVGs because they could find themselves in environments that are so dark that NVGs cannot provide them with enough visual cues to maintain control of the aircraft. Or, they’d have to resort to instrument flight if the goggles failed while flying in very dark environments. I think an instrument rating is a good thing to have, but that argument already exists for pilots flying without NVGs.

I acknowledge (and in no way minimize) the fact that inadvertent flight into IMC conditions is a killer, whether those conditions were caused by clouds or darkness. But you address this issue in the same manner that you address it for pilots who fly at night without NVGs, through training. You teach them to recognize the conditions that might be too dark or too hazardous for NVG operations. Try flying over a large, calm body of water or over the desert on an overcast night, when there is no moon or cultural lighting (reflected lighting) and you’ll see what I mean. (Actually, don’t try it, just take my word for it.) NVGs have limitations, and pilots need to learn about them before they fly with goggles.

Some people believe that there is no depth perception when using NVGs. That’s simply not true. There is depth perception—but there is no three-dimensional viewing. There is a difference. Your brain interprets the two-dimensional images displayed by the goggles and perceives depth based on visual cues. But there are some optical illusions that can throw you a curve. For instance, it can be extremely difficult, and sometimes impossible to judge your distance from certain
light sources. The intensity of the light, its frequency (color) and its focal direction can make some light sources look farther away, or closer than they actually are. It's very deceiving and can be a problem when trying to judge your distance from other aircraft, towers etc. There are other examples but the point is, pilots must learn about these things in training.

Training and Recurrent Training

Like all other flight technology, you need to know how to use your equipment to be safe and effective. If you're contemplating the use of NVGs in your operation, you should consider initial and recurrent training mandatory, and you should get this training from a reputable, experienced entity. Just because someone flew with goggles in the military many years ago, doesn't mean they're automatically qualified to teach NVGs operations. You should adopt strict policies and procedures for NVG operations as well as minimum flight requirements to ensure that pilots are proficient with NVGs, not just current.

Cockpit Lighting

Cockpit lighting has been a source of headaches for NVG operators from day-one. Incompatible lighting generated from inside the cockpit (backlit gauges, radio displays, master-caution lights etc.) can cause the goggles to gain-down and perform even worse than external light sources can. Nothing gets your attention more than a red, radar-attimeter altitude-warning light going off in your face just as you're about to land in a very dark environment. Until recently, the lighting for most radios and instruments was not designed to be compatible with NVGs. But the market is responding to our needs and you can get just about everything you need installed with NVG compatible lighting.

The Legalities of NVG Operations

Part 135 operators can apply for an STC to use NVGs – many EMS operators have. But the FAA has not authorized NVGs for Part 91. As a member of the Radio Technical Commission for Aeronautics committee (RTCA Committee) I have been involved in the process of creating the initial draft of rules and regulations for NVG operations for Parts 91 and 135. So I have some insight into the FAA's mentality. I'll tell you right now that the FAA simply does not want Joe Blow flying around in his Cessna 150 with NVGs under Part 91. But the problem is – most airbone law enforcement operators also operate under Part 91 – even though we're Public Aircraft. So what's the bottom line?

Technically, the Pilot in Command can only fly with NVGs on Public Aircraft missions. That's it – you can use NVGs but you cannot have any passengers on board whose presence is not required or associated with the mission. So if your friend is in the backseat on a ride-along, you're not supposed to use NVGs because you lose your Public Aircraft status when passengers are on board. If your friend is a paramedic, and you're responding to an injured hiker call, you can use NVGs if your paramedic-friend is going to provide medical assistance. Search and Rescue missions are Public Aircraft missions and your friend's presence is now associated with the mission. I spoke with my local FSIO and they told me that they consider law enforcement personnel in the back seat to be non-flying crew members who are there for a reason – a familiarization flight. Under that premise, you could legally use NVGs. But do yourself a favor and check with your FSIO first. We all know that there is a long history of FSIOs interpreting Public Aircraft missions differently.

I could go on and on about NVG operations, but there's far too much information than can be addressed in one article. I want to emphasize this – I have worked nights for many, many years because that's where most of the activity is, and it's still fun. I put my NVGs on as soon as I see the glow from the setting sun disappear and I don't take them off until I'm on the ground. I wear them over a well lit city and in very dark mountains, and I've become very comfortable with them. If I have to land at an unfamiliar or familiar off-airport site, or if my engine quits at night – I have a lot more options available to me simply because I can see better.

I still hear some people use the early accident history of NVGs as a reason for not acquiring them. In 1910, I'm sure that most people felt the same way about airplanes too. But the world has moved on and the night vision technology available today is far superior to what was used in the 70's and 80's. Are they a panacea for nighttime operations? No – but they're a big step in that direction.

Fly safe!