Modifying Your Cockpit Lighting for Night Vision
The introduction of night vision goggles into civilian aviation imposes additional demands not only on the pilot but on the aircraft itself. In addition to the expense of procuring goggles, the pilot is required to obtain specialized training in goggle utilization. The goggles, although greatly beneficial to the pilot in enhancing his night vision capabilities, do require that the cockpit instruments and displays be modified in order to be compatible with goggle usage.

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During the past few years, the Federal Aviation Agency (FAA) has been acutely aware of the need for regulations governing the use of goggles and the peripherals, including cockpit illumination. In order to ensure goggles safety by qualified users, the FAA has issued a policy statement in Change 16 to Order 8300.10, Safety Inspector's Handbook, and in Volume 2, Chapter 1 of the Advisory Circular. In essence, the FAA requires a Supplementary Type Certificate (STC) for "flight deck lighting changes to support night vision goggle use or any approval related to night vision goggles."

In order for the cockpit lighting to be compatible with goggles, the illumination of the cockpit's instruments and displays will require modification. The modification dictates that the inherent infrared associated with the illumination be eliminated, leaving only visible light available to the pilot or flight crew. This elimination of the infrared permits the goggles to acquire miniscule amounts of infrared available outside of the cockpit. The infrared available from the night sky added by the goggles' gain control amplification allows for maximum visibility in a nighttime environment.

The elimination of the infrared within the cockpit can be accomplished in a number of ways. Current methods of modification include the use of "open ring" bezels, and the addition of adjunctive lighting systems that may include flood lighting, postlight modification and the modification of the instrument or display itself. Some of these methods require that the cockpit's integral illumination be eliminated so these secondary lighting alternatives can be effective. Most of these secondary lighting alternatives filter the light source with an NVIS Green filter that not only retards the infrared but changes the lighting color to green. Where postlights are utilized, instruments traditionally are without inherent lighting, so the postlights are thus utilized to provide reflective illumination. In this instance, the postlight can be modified with a filter that retards the infrared but also permits the choice of green or white lighting.

The method of choice is to filter the lighting of the instrument. Currently, there are filters, such as SHADOWSTM, that permit modification of the instrument's lighting by removing the instrument's cover glass and replacing it with an infrared retardant filter. This modification
process is gradually being accepted by the FAA through the use of "process specifications". There is such a vast assortment of instruments of varying designs and manufacturers that the acquisition of "process specifications" for all instruments becomes a long and arduous task.

An alternative used with great success during the past year in achieving a number of STCs for law enforcement and EMS operators is the use of external filters (SHADOWS SCREENS™) for both instruments and displays. For flight and engine instruments, infrared retardant filters constructed of glass or polycarbonate can be employed. The filter selection is predicated on the light source, whether incandescent, fluorescent, LCD or LED. The filters can be mounted in an aluminum frame and affixed over the instrument's bezel utilizing the existing mounting screws. The frame for the filter is approximately 0.100" thick, and when placed in position, minimizes any reduction in the cone of visibility. Mechanical or electrical modification to the cockpit or airframe is not required, thus eliminating costly installation charges. In addition, the external filter approach allows the instrument to remain generic, thereby eliminating the need for a special maintenance program and retaining the advantages of local repair and/or overhaul.

A distinct advantage of the infrared retardant filter is the utilization of the instrument's inherent white lighting. Retaining the white lighting eliminates the need for repainting dials or warning flags that are generally affected by the saturated green illumination of the NVIS Green filters. In addition, the transmission of visible lighting with the infrared filters is two and half times greater than transmission with green filtered lighting. This advantage is particularly noticeable when a pilot or crew comes off of the goobles to view the instruments. The transmission advantage of the infrared retardant filter permits immediate recognition of the instrument's function without any adjustment of pupil dilation which often occurs with the lower transmission of green lighted instruments.

Those considering the use of infrared retardant filters as the modification method should be forewarned that there are a number of infrared filters available for instrument modification and all of them exhibit some degree of a light blue tint. Some of these filters have a deeper blue coloring than others. The deeper the color, the less transmission is available and the day time visibility can be greatly diminished.

Today, many cockpits include not only electro-mechanical instruments but also solid-state displays. Regardless of the light source of these displays - CRT or active matrix LCDs, a filter solution is available. In numerous instances, the filter is again mounted in a frame and placed directly over the display's surface. The lighting contractor should provide modification options for consideration. It is imperative that the fit of the frame is such that light leaks from the display are eliminated.

Consulting with your lighting contractor is an important aspect of any modification project. He may offer suggestions based on his previous installation experience so that other options can be discussed and decided upon. These options may include placing and sealing the filter directly to the display's surface with optical adhesive or by possibly replacing the LRU's existing Polaroid filter with one specifically designed as a compatible replacement.

Many of the NAV/COMM displays are modified by replacing the original filter with an infrared retardant filter. It has been found that double filtering (infrared filter over an existing filter provided by the OEM) does not meet the sunlight readability criteria required by the FAA. Replacing the existing filter allows for the modified LRU to be night vision goggle compatible as well as sunlight readable.

If new or updated accessories are being added to your cockpit, check with your lighting contractor or with the manufacturer of the equipment/system in question to determine if an off-the-shelf version is already available NVG compatible. Many system manufacturers are currently considering NVG compatible lighting versions of their equipment due to the increasing demands of the military, law enforcement, and EMS operators. An example is a LRU incorporating NVG compatibility is the Avalex monitor. The Avalex monitor incorporates NVG compatibility off the shelf, saving the aircraft user the added expense of having the modification accomplished after the fact.

An area of the modification process that has yet to be clarified for the civilian aviation market is how military specifications for NVG/ANVIS compatibility come into play. If we believe that truth is a moving thing, we must consider that the mil specs that dominate our NVG thinking are good guides, but only that, good guides. In a number of instances, the mil specs provide modification latitude that is acceptable criteria for military programs but are somewhat restrictive for civilian lighting upgrades. Today's filter and goggle technology has advanced to a point where we are now able to accomplish upgrades that were unheard of only a few years ago or after the mil specs were made public.
The largest area of contention between the dedicated use of the mil specs and today's technology deals with the filtering of illuminated pushbutton switches and master caution/warning displays. The mil specs have recommended chromaticity coordinates that permit diluted color intensities for the aviation red and amber (yellow) colors. The mil spec color coordinates provide a peach or watermelon color for red and orange/lime color for yellow. Today, there are available various modification methods that allow the maintenance of the original red/red and amber/amber colors that are the mainstay for universal caution and warning alert. In addition, the traditional colors provide superior sunlight readability over the mil spec colors.

Many of the latest modifications have included the need for illuminated panels. Panel upgrades are generally determined by their function and location, with a final determination being made by the FAA for that particular airframe model. Should the panels require NVG compatibility, modification is available in green and white lighting. Consult with your lighting contractor to determine if new panels are required or if the existing panels can be modified. Cost and lead time become an important factors.

An AS 350 B3 instrument panel in daylight and darkness.

It should be remembered that modifications to NVG compatible lighting can be an expensive proposition. To control the costs and to establish exactly what you are contracting for, it is important that you consider the following:

- Is there an STC currently available for my particular model airframe? If not, what are the ramifications?
- Where is the modification accomplished? Can it be done locally?
- How long will it take to accomplish the modification?
- Who and where are the various lighting contractors located?
- Are examples of their work available and who are their customers?
- Is specialized aftermarket support required?

When soliciting a quotation for the NVG lighting modification, the lighting contractor should be totally aware of your cockpit configuration. A survey visit by the lighting contractor often pays dividends in the long run. Digital photos are a great aid in cockpit asset accountability and work towards eliminating any cost increase surprises. In return, the lighting contractor should provide you with an itemized listing of the requirements for modification, not just a lump sum cost, so that you will be aware of exactly what you are paying for. Remember, it's your money and your airframe. Be an educated consumer, and don't be afraid to ask questions.

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