NCER

Collimation error demonstration kit

Fig. 1. NCER simulator

What are collimation errors?

Two optical channels of ideal binocular night vision goggles are parallel. Collimation error is a misalignment between channels of NVD when this condition is not fulfilled. Device can be misaligned in several ways:

- Channels converge – Optical axis of axis are crossing each other in front of device.
- Channels diverge – Optical axis of axis are crossing each other behind device.
- Channels dipverge – one channel is pointing higher than the other.

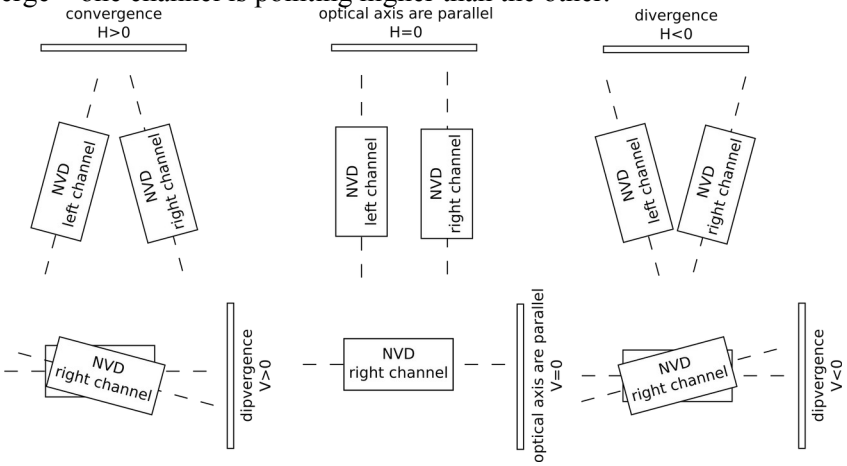


Fig. 2. Binocular goggles alignment.

Why so important?

In normal life human brain can analyse images from two eyes and fuses them into one sharp image of scenery of interest. However, human brain can easily perform image processing of two images generated by binocular NVGs only in two cases:

1. optical axis of both channels of NVGs are parallel (typical life: case of long distance targets),
2. optical axis of both channels of NVGs are converging (typical life: case of short distance targets).

If there is a significant collimation error in form of divergence or dipvergence (levels over about 1° that can be easily generated by accidental dropping NVGs) then brain has problems to fuse two images into one sharp image. Human operator of NVGs can experience fatigue, headache, dizziness, nausea or loss of stereoscopic vision or can start seeing double image.

NVGs with significant undetected collimation error are especially dangerous in aviation, because negative effect may not manifest immediately, but occur minutes after the goggles are put on. It means that pilot can start mission seeing relatively well and after some time (from several minutes to one hour) can experience negative effects. This is because for limited time, if the error is small enough, the brain can compensate and merge images into one. However, this is very straining and cannot be maintained for very long.

A long series of night accidents of helicopters and land vehicles have been suspected to be caused by poor performance of NVGs. Significant collimation error is one of main reasons for such poor performance.

However, in spite of scientific literature and regulations (RTCA DO275-12) that confirm importance of keeping collimation error at minimal level (dipvergence, convergence <0,3°), some helicopter pilots or drivers of

military vehicles have doubts about importance of collimation error defect of NVGs, because they have never experienced working with poorly collimated NVGs.

What is NCER?

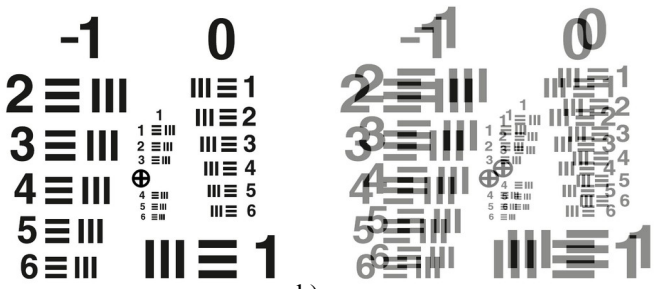
For the purpose of practical demonstration of importance of proper NVG collimation, Inramet has developed NCER, a simple simulator of NVGs with collimation error defect. In detail, NCER is a pair of photometric glasses with special, exchangeable lenses. The lenses introduce collimation error. Each lens has different strength and, if needed, the lenses can be combined to get desired power. By rotating the lens in the frame any type of error (convergence, divergence or dipvergence) can be simulated.

How NCER is operated?

To experience the effects of the collimation error, set desired error by placing the proper lens into the frame. Rotate the lens to adjust error type and simply wear the simulator.

What are results?

Short demo using NCER simulator generates typically shocking effect on students. It changes immediately users of NVGs to people who take great care about proper tests and maintenance and of these devices.



a) b)

Fig. 3. Image seen through NVGs a)initial image b) image that can be seen by some observers after longer time period

Version 1.2

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