



Air Force Research Laboratory



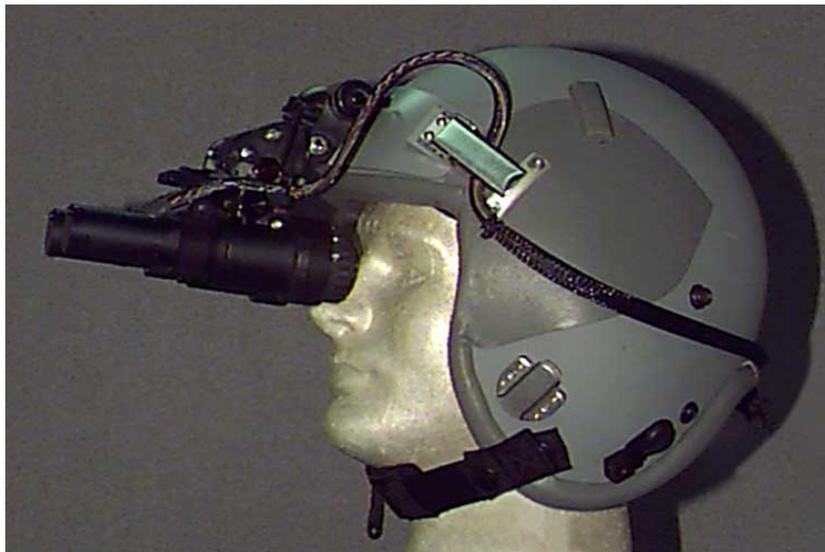
Night Vision Device (NVD) Training Research



The Night Vision Program of the Warfighter Training Research Division of the United States Air Force Research Laboratory (AFRL/HEA) was established to meet the operational training requirements of aircrew using night vision devices, especially night vision goggles (NVGs). The "Fly by Night Training Team" has developed training materials, conducted instructor training, and provided technical support for operational units, flight test organizations, and acquisition programs.

Review and analysis of existing training systems identified a number of limitations inherent in existing NVG simulations that could not be overcome with the "stimulation" approach. Therefore, AFRL/HEA, with input from operators and subject-matter experts, developed the Night Vision Training System (NVTS) in which a complete simulation approach has been adopted. The goal of the NVTS program is to produce high fidelity, deployable, low-cost, NVG simulation that will enable mission training, preview, and rehearsal whenever and wherever necessary. NVTS is a research and development effort that will continue development and transition to users.

The NVG imagery is based upon the modeling of the unique two-dimensional NVG effects such as halos, gain response based on an accurate characterization of goggle sensitivity, gain, resolution, color, and field of view. The imagery is presented through a head tracked CRT-based display mounted in an actual NVG shell. This approach allows for the correct eye-point for all crewmembers. Each display requires at least one channel of imagery. The three-dimensional world incorporates high resolution material-classified imagery, and accurate per-textel radiometric response of surface



NVTS Helmet-Mounted Display



Simulated NVG image

reflectance and aspect. The current approach results in a single database which will support completely correlated visible and multiple sensor simulation. Current collaboration partners include the USN, USMC, USAF, AFRL/HEA, NAWCAD, NAWCTSD, Aechelon Technology, SGB Enterprises, n-vision, Photon Research Associates, Silicon Graphics, and Surface Data.

Features of the Current NVTS:

- Correlated photographic and material-classified database covers 380 nautical miles by 420 nautical miles of the Nellis training range. This database was derived from multi-spectral satellite imagery, aerial photography, material spectral response data, and DTED elevation data. The database includes insets with sub-meter resolution imagery and full three-dimensional cultural feature extraction.
- The NVG sensor simulation uses a physics-based approach to provide an accurate in-band, radiometric response for reflectance and aspect of the material-coded texel under illumination. As the illumination level and angle change in the simulation, the amount of light reflected from each texel to the viewpoint changes in real time.
- Combat effects have recently been modeled and include several types of explosions, wood and oil burning smoke, missile trails, flares and tracers. All of these effects include near- and in-view effects for haloing, gain, noise, and appearance.

- High-resolution helmet-mounted displays present the simulation to the user. These displays incorporate miniature cathode ray tubes (CRTs) mounted inside NVG shells to provide the same form, fit, and function of actual NVGs, with the same weight and center of gravity as the NVGs being modeled. The CRTs use the same phosphor as current NVGs in order to provide the same color and decay characteristics. Current HMDs have a display resolution up to 1700 pixels by 1350 lines, non-interlaced, refreshed at 60Hz.

Future Developments:

- Dynamic shadowing
- Multiple illumination sources
- Weather and atmospheric effects
- Seasonal variations
- Water effects
- Increased gaming area
- Transition to other platforms
- Training evaluations

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