Night Vision Systems Test House (NVSTH)

The Night Vision Systems Test House provides a safe controlled spectrally correct environment for electro-optic assessments of systems in fast-jet and rotary wing aircraft. Under specified illumination and aircraft conditions, aircraft cockpit lighting compatibility with Night Vision Goggles (NVG) can be subjectively and objectively mapped.

Comparative NVG performance trials, NVG laser filter appraisals and customer defined assessments can be conducted at various ambient illuminations with cut-out targets painted to simulate skin, bark foliage, sand, light stone and fresh snow conditions. Localised ground level sunlight intensity levels can also be simulated.

The wide range of repeatable ground test currently available and the constant development and improvement of procedures ensure the NVSTH can provide cost effective electro-optical solutions to a multitude of conceivable scenarios.

Capabilities

The Night Vision Systems Test House (NVSTH) is constructed in a Hardened Aircraft Shelter (HAS) measuring 36m x 22m x 8m and is capable of housing all rotary and fast jet aircraft as well as some of the smaller fixed wing. As all sources of external light have been excluded, the HAS can be used for complete blackout conditions. The facility can produce calibrated and controlled night sky illumination from overcast starlight at 3.9 x $^{10\text{-}4}$ NVIS Radiance, to full moon light conditions at 15.0 x 10E^{-2} NVIS Radiance. This is achieved using the following in isolation or combination.

- The NightSky projector
- Apex moon
- Horizon moon

The facility is able to carry out a wide range of repeatable ground tests, providing cost effective electro-optical solutions to a multitude of conceivable scenarios using:

- MIL-STD-3009
- NightSky canopy comprising Apex moon and projector suspended from the ceiling used to generate night sky conditions. (1 Lux – 0.9m Lux)

- Horizon moon capable of simulating low elevation moonlight
- Daylight illumination (up to 100,000 ft L)
- Resolution targets supporting the standard USAF test patterns
- NVG performance test set
- IR collimator for system boresight and MRTD/MDTD measurements
- Spectroradiometer (350-1050 nanometers)
- Thermal imaging capability (-30 to 1000 °c), with thermal sensitivity of 0.08°c

The NightSky projector

The NightSky projector consists of a large canopy projector suspended from the ceiling. Four temperature-controlled sources emit spectrally correct light for overcast starlight and similar low light conditions.

Apex moon

The moon is mounted on a steel track inside the canopy and is capable of producing illumination levels from overcast starlight to twilight. The moon's position and angle are also controllable, enabling the reproduction of a large number of representative skies.

Horizon moon

The horizon moon complements the Apex moon. This free standing source can be positioned anywhere within the facility to simulate low elevation moonlight.

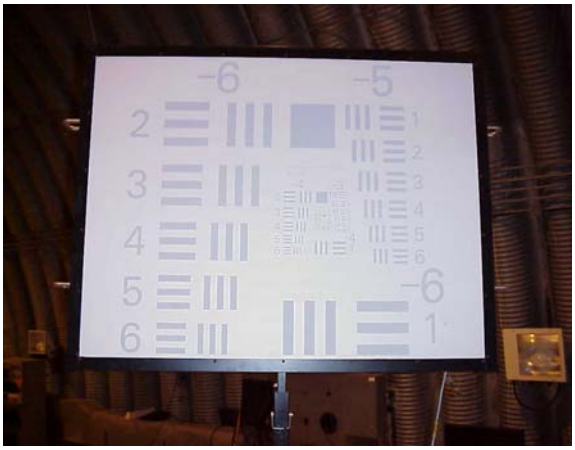
Night vision assessment procedures

The trials aircraft is positioned under the canopy projector, the moon placed in the required position and the illumination levels set to the required level. Repeatable objective testing to establish the aircraft's compatibility with a specific type of NVG may be performed. The principal aspects examined during these evaluations are:

- NVG visual range determination – cruise lighting
- NVG visual range calculations – caution and warning lights
- Reflections
- Establishing lighting compliance with MIL-STD-3009
- NVG checks
- Cultural lighting – sodium
- Thermal imaging- measurement

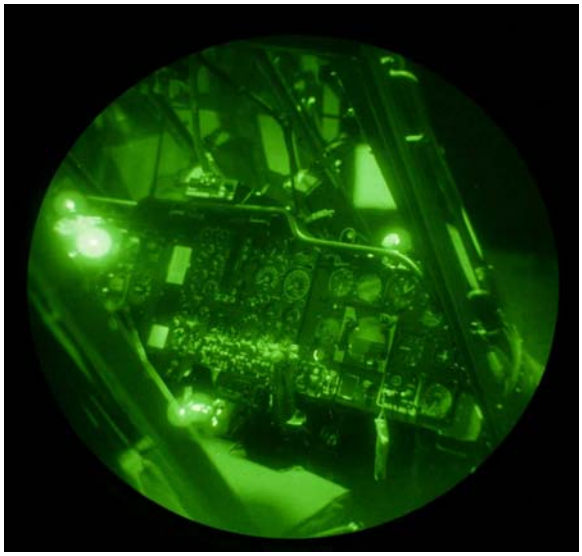
NVG visual range determination - cruise lighting

The five movable resolution targets supporting the United States Air Force (USAF) test pattern, are in turn back-lit to an agreed illumination level ranging from overcast to 1/4 moonlight conditions. The Test Pilot in the aircraft's cockpit, wearing NVGs, identifies the test patterns just discernible for each predefined cockpit setting. The cockpit lighting settings, ranging from no lights to all cruise lights activated, degrade the pilot's NVG imaging capabilities if incompatible. Consequently, measuring the pilot's visual acuity and calculating the corresponding 'NVG Visual Ranges' for each cockpit setting illustrates the influence quantitatively.



NVG visual range calculations – caution and warning lights

With all cruise lights activated, the effect of each cautionary and warning light on the pilot's ability to discern visual cues can be quantified. After switching on the required light, the pilot then identifies the test pattern with the smallest spatial frequency they can resolve. The corresponding 'NVG visual ranges' are calculated and graphically presented, illustrating the influence quantitatively.



Reflections

Reflections observed in the aircraft's canopy whilst wearing NVGs may distract and hinder the pilot. To establish the effect of such reflections, NVG visual range measurements with and without the obstruction present can be made.

Establishing lighting compliance with MIL-STD-3009

The brightness of the light sources seen by NVGs is quantified in terms of NVIS Radiance units. Using Hoffman Engineering's NVG-103 NVIS Inspection Scope, this can be measured for each instrument panel in the aircraft's cockpit. The radiance readings are recorded and compared with the requirements of specification 3009.

Canopy absorption characteristics

The pilot's ability to view distant objects whilst wearing NVGs may be reduced by absorption from the canopy. The canopy transparency, reducing the pilot's overall NVG visual range capability, attenuates light falling within the NVGs spectral response. The amount of light lost due to absorption can be quantified using a Gamma Scientific GS4100A Spectroradiometer with a water-cooled photo-multiplier tube measuring between 350-1050nm.

NVG checks

Prior to conducting and upon completion of any cockpit lighting assessments, the NVG's serviceability must be measured. The Hoffman Engineering ANV-126 Test Set is used to measure the NVGs system gain, resolution, image distortion and spot defect characteristics for each image intensifier tube.

Cultural lighting – sodium

Cultural lighting from sodium sources is also available. One free standing, the other enclosed to produce typical village lighting, as viewed from the air. The "village" can be moved around the aircraft as well as tilted so it can be viewed from any aspect.

Thermal imaging

Thermal characterisation of targets can be carried out using an AGEMA 400 series Dual Thompson thermal imager which houses a Stirling Cycle cooled Mercury Cadmium Telluride (MCT) Long Wave detector, operating in the 8-12micro-meter waveband. The system provides real time colour displays with temperature read-outs, including full presentation data storage capability on 3.5" floppy disks. For quick stand-off measurements, hand held laser temperature guns are used.

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