

Stuart B. Nightenhelser

Professional Competencies:

Forensic scientific analysis of:

- Motor vehicle collisions involving automobiles, trucks, commercial vehicles, farm equipment, motorcycles, bicycles and pedestrians.
- Railroad grade crossing incidents, train-train collisions and incidents in railroad yards, including analysis of train lighting, locomotive event recorder output, train braking and stopping distance, and sight triangle obstructions.
- Incidents involving lighting and reduced light, as well as reflectance and retro-reflectance of scene materials.
- Human factors areas including human perception and reaction; human visual acuity and depth perception throughout the visual field; color vision and night vision; visibility; analysis of object size and brightness versus the viewing background, and their relationship to visibility; and glare effects on human vision.
- Effects of environment and atmosphere on visibility, such as low light, fog, smoke, glare, reduced brightness contrast, visual clutter, and visual cues such as relative motion, repetitive motion, changes in lighting, and line of sight measurement.
- Incidents involving physics and mechanics of motion.
- Photogrammetry, photographic and video image analysis and measurement.



Product Design Engineer with expertise in:

- Program management, system safety, risk-based hazard management.
- Product design, development and test.

Related experience:

- Machine vision and imaging system development.
- Construction of high-accuracy 3D scene data from stereo image pairs.
- Development and coding of autonomous algorithms for detection, classification and identification of scene objects and features using multi-spectral sensor data.
- Computer modeling and simulations.
- LADAR/LIDAR system specification and development.
- Mathematical characterization of image contrast and object detection thresholds under differing circumstances of lighting, weather conditions, surface wetness, and seasonal and diurnal changes in scene spectral content.

Employment History:

Wolf Technical Services, Inc., Indianapolis, IN

Program Manager, Physicist and Accident Reconstructionist (1993 to Present)

Mathematical analysis and reconstruction of incidents involving automobiles, trucks, trains, motorcycles, bicycles and pedestrians. Areas of emphasis include speed determination; analysis of pre-impact motion, collision dynamics, and post-impact motion; crush analysis; evidence collection and interpretation; bicyclist and pedestrian collision dynamics; mathematical photogrammetry to extract accurate dimensional data from photographs. Special emphasis on optics and lighting, and on areas of human factors including human vision and visibility; mathematical comparison of scene contrast values to detection thresholds for the human visual system; accounting for human visual acuity and spectral responsivity; glare and weather effects on visibility; driver expectation, and the increased stimulus required to overcome driver expectation. Analytical expertise includes measurement and analysis of lighting levels and object/background brightness as they relate to visibility; visual acuity and visibility under conditions of darkness, fog, glare and low scene contrast; and sight obstruction and line of sight determination.

Analysis of railroad grade crossing collisions, including interpretation of event recorder output, stopping distance calculations, calculation of federal sight distance guidelines, lighting and night visibility analysis, and measurement of line of sight distances in the sight triangle. Photogrammetry techniques used to measure, from incident scene photographs, line of sight restrictions in existence at the time of the incident, prior to growth or removal of vegetation. Analysis of train-train collisions and other yard incidents involving moving equipment. Analysis of railroad yard incidents and trip and fall incidents related to adequacy of lighting and reduced visibility and conspicuity in railroad yards.

Program management responsibility for Wolf's government contracted research and development activities, and for commercial product development programs. Responsible for the execution of all technical, financial and schedule aspects of the programs in accordance with Wolf's quality management system and processes, and for interfacing directly with government points of contact in the technical, financial and contracting areas. Also responsible for oversight of engineering activities on government programs, and for acting as lead engineer on selected programs. Program technical areas include electromechanical products, biomedical devices, optical systems, and robotics.

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General Dynamics Convair Division, San Diego, California

Senior Engineering Specialist (1983 – 1992)

Development of electro-optical-mechanical imaging systems for laser-guided cruise missiles and other smart bombs, development of algorithm techniques for image processing, and systems performance evaluation during captive-carry flight testing.

Work with laser radar sensors involved autonomous processing of continuous three-dimensional images to extract scene features, for comparison with pre-processed aerial photography and dimensional data bases, for target detection and identification. Developed image processing algorithm techniques for use on both laser radar and synthetic aperture radar imagery, and utilized image understanding and photogrammetry in extracting and precisely measuring scene features. Key to the success of these techniques were: the understanding and correction of distortions in both the laser imagery and aerial photography; the understanding of the nature and appearance of scene features in the imagery, and their precise measurement, in both types of images; and comprehension of the human vision and feature recognition process, because human pilots participate in the navigation process, and because a ground-based human operator processes the aerial imagery. Computer modeling and simulation of imaging techniques and image processing algorithms were also integral parts of this work.

Naval Avionics Center, Indianapolis, Indiana

Research Physicist (1980 – 1982)

Laboratory analysis and performance characterization of electro-optical imaging devices used in the DSMAC guidance system, which delivered extreme accuracy in the Navy's TOMAHAWK cruise missile on several occasions in Middle East conflicts. The sensors used were designed to match the spectral responsivity of the human visual system to aid in comparing collected imagery with satellite reconnaissance photographs and to avoid contrast reversals between the various scene materials.

Work involved testing and analysis of optical sensing devices; analysis of brightness and visual contrast of scene materials under both sunlight and artificial illumination; analysis of brightness contrast and color contrast between numerous natural and manmade scene materials; comparison of system performance to the human visual system and aerial photography systems used for reconnaissance; and laboratory testing of the performance of the variable focal length lens used with the sensing optics. Computer modeling and simulation of optical imaging sensors and the human visual system was an integral part of the analysis.

Education:

Butler University, Indianapolis, Indiana, 1982
Bachelor of Science in Physics and Mathematics
Minor in Chemistry

Indiana Transportation Museum, 1994
Brakeman Training

University of Wisconsin College of Engineering, 2004
Effective Roadway Lighting

Patents and Publications:

US Patent No. 9,937,893 B2; Magnetically Actuated Personnel Restraint System.

Numerous classified papers on optical sensing, electronic imaging and image processing.

Current and Past Professional Memberships and Affiliations:

Illuminating Engineering Society (IES)
Optica, formerly Optical Society of America (OSA)
American Institute of Physics (AIP)
Ohio Traffic Accident Reconstruction Association (OTARA)
Society of Automotive Engineers (SAE)
Society of Photo-Optical Instrumentation Engineers (SPIE)
National Association of Railroad Safety Consultants and Investigators (NARSCI)
Indiana Transportation Museum (ITM)
SAFE - Wright Brothers Chapter, Individual and Corporate Member
National Defense Industrial Association (NDIA)