Spatial Disorientation Countermeasures Training System

EXHIBIT FACT SHEET

The Naval Safety Center cites Spatial Disorientation (SD) as the principal contributing factor in Class A aviation mishaps. Across the services, SD related mishaps result in average annual losses of 25 lives and $400 million in aircraft. To address this significant threat to pilot safety and operational effectiveness, the Naval Medical Research Unit Dayton (NAMRU-D) is leading the Navy's reinvestment in research to identify causes of, and countermeasures for, pilot SD. Although many of the past explanations for SD have concentrated on isolated vestibular illusions as primary causal factors, the growing consensus among SD researchers is that disorientation in the cockpit is most likely generated from conflicting visual and vestibular cues that confound cognitive processing of pilot spatial strategies. This revised interpretation of causal factors has helped researchers at NAMRU-D to identify and classify common SD events, which has further led to the specification of vestibular, cognitive, and visual components of SD.

NAMRU-D's Aeromedical Directorate is working to counter the deadly threat of SD by developing, validating, and upgrading simulator-based SD recognition and avoidance training scenarios and supporting courseware. NAMRU-D's in-house flight simulation software engineers have

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successfully developed multiple scenarios which allow for the empirical study of spatial disorientation, in addition to the development of training countermeasures. Within the last year our SD researchers have completed two studies involving a total of 38 pilots and four different flight scenarios. This work was sponsored by NAVAIR PMA-205 (Aviation Training Systems) and the Defense Health Program. One of these studies focused on the Black Hole Illusion (BHI) and Control Reversal Error (CRE). The BHI is a form of SD that can occur during night approaches to runways in visually sparse environments. With few depth cues, pilots often feel they are too high and erroneously descend to a lower, shallower approach path. If unlit high terrain or obstacles are near the approach path, the results can be fatal. To determine if the BHI could be reliably created in a simulator, the SD lab developed day and night landing scenarios, and a short six-minute training video explaining BHI and how to deal with it. In daytime conditions participants flew near perfect approaches, but in night scenarios 92% of them flew significantly low BHI approaches. On average they were 148 feet too low when only 1.5 nautical miles from the runway. After watching the training video, the night approach deviation (148 feet) was reduced to just three feet.

Night Vision Spatial Disorientation

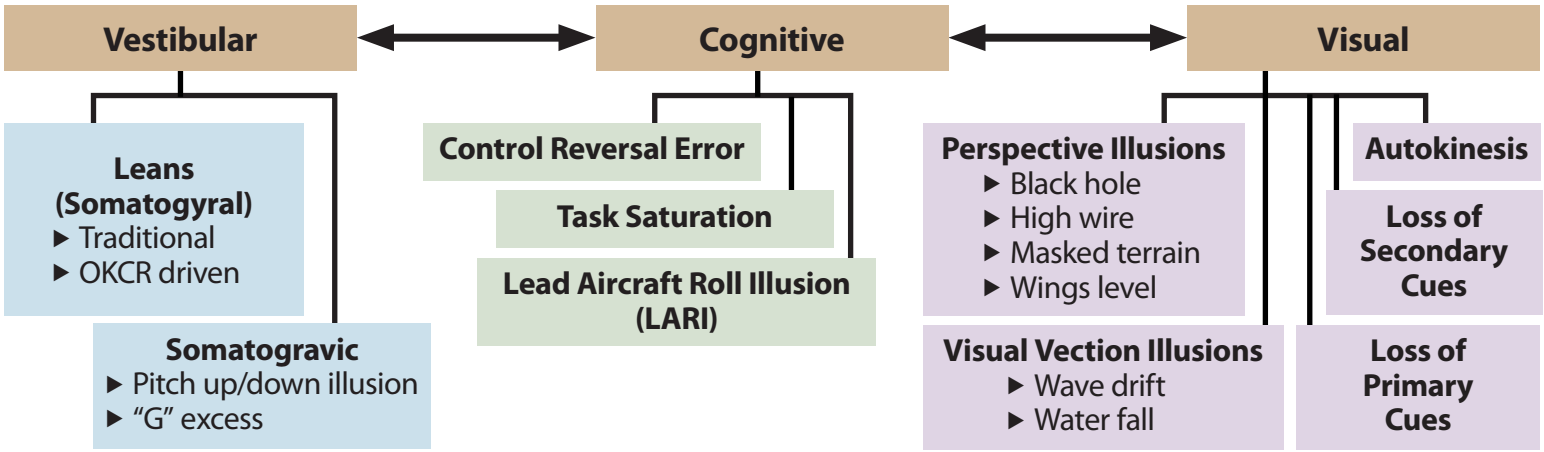
Even with the use of the most advanced Night Vision Goggle (NVG) technology, SD remains a significant night-time danger. To help in understanding the causes of misperceptions and illusions that lead to SD in pilots using NVG devices, NAMRU-D has partnered with Naval Air Systems Command to develop a reconfigurable NVG simulation display system to study the effects of SD while using NVGs within a synthetic simulation environment. In particular, NAMRU-D will be developing SD scenario content, including classic sensory spatial illusions such as BHI and Autokenesis effect, using modern NVG stimulation display technologies and customized terrain databases.

NAMRU-D's Spatial Disorientation Capabilities

NAMRU-D's unique team of scientists has extensive DoD R&D experience in the field of aviation human factors, and many are former or current Naval officers in a flying status, who are professionally familiar with military flight environments. Because NAMRU-D is conveniently located on Wright-Patterson Air Force Base, these scientists have the opportunity to regularly collaborate with colleagues at USAF 711th Human Performance Wing.

NAMRU-D has an extensive flight simulation capability with several cockpits and a suite of five different visual systems that can create daytime and nighttime flight environments, including the ability to simulate flight with NVGs. These simulation systems include full flight parameter and pilot performance data recording modules.

Spatial Disorientation Components



For further information on this exhibit, or on opportunities with Naval Medical Research Unit Dayton (NAMRU-D), please contact us by e-mail at namrudinfo@wpafb.af.mil, by telephone at (937) 938-3877, or by mail at 2624 Q Street, Bldg. 851, Area B, Wright-Patterson AFB, OH 45433.