A Brownout Solution Is Ready Now

Tactile Situational Awareness System (TSAS) 2.0

Problem/Issue

Helicopter landings are more challenging in "brownout" conditions, in which sand and dust are stirred up by the rotary wing aircraft, obscuring visibility and the pilot's ability to maintain sight of the horizon.

As humans grow and develop, musculoskeletal systems mature to control and coordinate movements subconsciously using input from all of the human senses. Pilots are trained to ignore nearly all of these well developed and extremely accurate sensory responses except that from visual (and aural) stimuli. During times of high mission tasking, at night, or in conditions of low visibility, visual and aural information is available but it may be ignored as the pilot becomes overwhelmed with the sensory stimulation that can be misleading. This overloading of the pilot's senses often results in a loss of situational awareness and may end with catastrophic results.

There are several advanced technology initiatives that have been undertaken within DoD to help alleviate spatial disorientation (SD) / improve situational awareness (SA) in a degraded visual environment (DVE). These developmental systems include Sandblaster, 3D-LZ, HELO (Helicopter Low Level Operations) Product 2 and HALS (Helicopter Autonomous Landing System). All of these developmental systems are under evaluation and they represent a mix of possible solutions using laser, laser-radar, millimeter wave radar or some type of autonomous landing system technologies.

While all have benefits, it will be several years before they reach a TRL (Technology Readiness Level) that will allow them to meet thresholds for initial operational capability conditions.

It should also be noted that each of these advanced technologies when operational are planned to convey information to the pilot through visual and/or aural cues – this, in turn, will continue to add to pilot sensory overload issues that are often found to be the proximate cause in aircraft accidents.

Solution

The Tactile Situational Awareness System (TSAS) 2.0 offered by Chesapeake Technology International (CTI) is a complete solution, has been through government testing, and will enable pilots to maintain their situational awareness when flying in brownout or DVE conditions. It is a life-saving tool, uses today's technology and is immediately available for use.

This technology has been in development for many years through the U.S. Army Aeromedical Research Laboratory (USAARL). The concept is simply that by using a vest to create vibration on a pilot's torso, priority messaging of flight conditions can be communicated to the pilot during periods of high stress and especially when a pilot's visual and aural capacity to handle complex information is saturated.

Early vest concept

USAARL's TSAS technology will employ vibration and contribute to a pilot's awareness of aircraft position, attitude, and rates of movement about all axis. This, in turn, enables a helicopter pilot to maintain a stable hover position when in a degraded visual environment (DVE) and will ensure that the pilot does not experience excursions outside the prescribed flight envelope.

CTI's TSAS 2.0 communicates with the host aircraft's navigation system to determine aircraft location, velocity and acceleration rates over existing data buses, determines if the aircraft is in a potentially dangerous flight regime and passes simple intuitive commands to a pilot via a lightweight vest that the pilot

wears over his/her flight suit. If the host aircraft has a legacy navigation suite that cannot supply adequate data, TSAS has an embedded GPS/INS hardware suite that can supply the required information (or can be additionally used as a supplemental navigation source). The TSAS vest has an integrated set of "tactors" embedded in a standard configuration. As the aircraft begins to develop inappropriate rates of pitch, roll or yaw, TSAS will vibrate or "buzz" the pilot's torso in specific patterns of location and frequency that indicates to the pilot to correct potentially dangerous flight vectors.

CTI provided processor/vest concept

During government testing (10 operational pilots) in an H-60 manned, full-motion flight simulator located at NAS Patuxent River, the use of TSAS 2.0 showed demonstrably an improvement in the ability of a pilot to maintain a hover in severely degraded visual conditions (i.e., from an average of 10 seconds without TSAS to 49 seconds with TSAS over a standard 60 second test period)…. a 79% improvement.

TSAS 2.0 has flown in the NACRA (Naval Aviation Center for Rotorcraft Advancement) UH-1N helicopter with operational test pilots and has also demonstrated a capability that enables a pilot to return to an original hover position when in a severely degraded visual environment.

TSAS 2.0 is currently at Technology Readiness Level (TRL) 6. TSAS 2.0 is able to accommodate a dual piloted cockpit configuration (each pilot receives identical tactile responses) and is night vision goggle compatible. The TSAS 2.0 proof-of-concept processor enclosure shown above weighs 17 pounds and is 16" x 6" x 6" in volume (standard PC-104 form factor). CTI is conducting a TSAS weight reduction program that will provide a 50% reduction in size, weight and power (SWAP).

The Army is currently formalizing TSAS as an aviation procurement requirement through an Initial Capabilities Document (ICD) being staffed through TRADOC (U.S. Army Training and Doctrine Command).

If adequate funding were made available TSAS can attain initial operational capability within 12 months.

Schedule

CTI completed a SBIR (Small Business Innovative Research) Phase II contract for TSAS and delivered flight-worthy systems for testing to its Navy customer.

TSAS 2.0 can be ready for Initial Operating Capability (IOC) in 12 months.

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