OBJECTIVE: Replace Generation III Night Vision Goggles with equivalent performance camera sensor to achieve wider field of view and integrate day and night HUD into visor projected helmet mounted display.

DESCRIPTION: Currently, the aviation heads up display (HUD) modifies the Generation III Night Vision Goggles to provide symbology overlay for aircraft instrumentation. This forces the Army to field two HUD displays, one for day use, another for night operation. The SBIR topic “Next Generation Aviation Helmet Mounted Display”, A18-089, is developing a low cost replacement for the current day display which offers a wider field of view to the pilots. This technology is incompatible with the fielded night vision goggles because the visor cannot be closed while wearing the NVGs. A digital night vision sensor is required for integration into the Visor Projected Helmet Mounted Display (VPHMD) such that a single display can be used in both day and night conditions. The night vision camera sensor must be equivalent to generation III NVG performance and operate on existing voltage and current available from the fielded HUD computer display power supply. The sensor shall not require cooling or active illumination to perform, and shall offer 60hz frame rate in high resolution. Weight is critical to head mounted avionics, so the total weight of the VPHMD cannot exceed the weight of the Generation III NVGs (590 grams) modified with the HUD display (additional 145 grams), and the moment arm of the replacement weight cannot exceed that of the existing fielded NVGs modified with the night HUD.

Camera companies around the world are working towards real time high definition ultra-low light sensors which may be capable of achieving equivalent operational performance to Generation III NVGs IAW MIL-PRF-A327945, paragraph 3.5.3.5, i.e., “The brightness gain (see 3.6.10) shall not be less than 5,500 fL per fL (footlamberts)”.

This solicitation intends to identify low level light sensor solutions that can be integrated with the VPHMD with the least amount of weight and power consumption, and verify the brightness gain equivalence to Generation III NVGs. This topic aligns with modernization priority for Soldier Lethality.

PHASE I: This effort shall identify an existing low level light sensor capable of being integrated into the VPHMD with minimal size, weight, and power consumption. A laboratory demonstration is required to demonstrate breadboard operation of the sensor and prove brightness gain equivalence to Generation III NVGs. A test report is required documenting the results of the laboratory demonstration and the brightness gain actually achieved by the sensor. The contractor shall write and deliver a plan for a Phase II integration of the sensor into the VPHMD. The integration plan shall project cost, size, weight, and power consumption of the sensor to be integrated into the VPHMD based on the breadboard build prototype.

PHASE II: The contractor shall partner with the day display vendor winner of SBIR topic “Next Generation Aviation Helmet Mounted Display”, A18-089 to deliver a sensor solution which provides night video input to the VPHMD. A total of not less than eight sensors with all interface hardware shall be built and delivered. An interface control document shall be provided to the Government and the VPHMD vendor detailing mechanical and electrical interface to the VPHMD. The VPHMD vendor shall have project management control of weight/space/power assignment of the sensor integration. The contractor shall host a Preliminary Design Review and perform a Critical Design Review (CDR) at the Government’s facility in month eleven. Critical Design Review (CDR) shall serve as the first milestone at the end of year one. Both design reviews shall make projections for weight/space/power requirements of the sensor. CDR shall present a cost projection for the sensor. Design reviews shall address VPHMD top level requirements for environmental compliance (rain, dust, electromagnetic interference, etc.), automatic shutoff when exposed to bright light and rapid recovery when light is no longer on sensor, durability, and interface to VPHMD. Delivery of sensors to the VPHMD vendor for integration shall serve as the 2nd year milestone. The contractor shall provide technical support to the VPHMD vendor by phone and travel to the VPHMD vendor site for first integration build activity. The contractor shall design the sensor as a replaceable module within the VPHMD by a soldier in the field using a standard Army electrical toolbox. The contractor shall provide final measured sensor capability and weight/space/power information to the VPHMD vendor so that the product specification for the VPHMD can be updated. The contractor shall perform a bench demonstration of the first sensor built to verify space/weight/power, functions, and capability. Deliverables will include briefing slides for the design review, meeting minutes for bi-weekly status telecons and design reviews, a test plan for sensor performance demonstration showing compliance to VPHMD integration requirements, test report documenting test accomplishments, data for
updated VPHMD performance specification reflecting measured sensor performance, and a report detailing projected cost of the final sensor design as a function of quantity from a minimum of 50 and up to 1000 at a time. A preliminary technical data package for the sensor module shall be delivered.

PHASE III DUAL-USE APPLICATIONS: Develop production processes for sensor prototypes built and delivered in Phase II. Update the VPHMD item specification to reflect final production process weight and performance impact based on production configuration sensor. Build thirty six (36) production representative sensors to supply to VPHMD vendor for final operational testing on multiple US Army helicopter configurations. Provide technical data package for sensor module. Sensor may migrate into ground soldier night vision equipment. Primary commercial application of sensor will be replacement of expensive commercial night vision systems used for hunting, cameras for photography, police and firefighting applications.

REFERENCES:

1. SPI Infrared: x20.org/cmos-night-vision-sensor-hfis-x26
2. SiOnyx: sionyx.com/resources/blogs/sionyx-night-vision-is-the-technology-to-beat

KEYWORDS: HUD, Helmet Mounted Display, Night Vision