

# Success Story

**TOPIC NUMBER: N101-026**

**SBIR INVESTMENT: \$2,458,497**

**PHASE III FUNDING: \$2,980,000**



## MULTI-AXIS VIBRATION REDUCTION AND INCREASED COMFORT

*Safe, Inc.'s Multi-Axis Vibration Reducing and Increased Comfort (MAVRIC) seating system significantly reduces fatigue and discomfort affecting the pilot and crew of propeller-driven aircraft.*

**SAFE, Inc.**

POC: Bob Gansman  
480-820-2032  
Tempe, Arizona 85282

<http://www.safeinc.us>

## THE CHALLENGE

Propeller-driven aircraft generate noise and vibration that cause aircrew fatigue and discomfort during extended missions. The vibration can even contribute to long-term physical harm to crew members over a career of flying. Because of this challenge, a SBIR solicitation was released to devise innovative solutions to reduce high-frequency vibratory input to seated occupants while ensuring they could still perform mission tasking onboard propeller-driven aircraft, specifically the E-2D Advanced Hawkeye. To meet this challenge, Safe, Inc. developed the Multi-Axis Vibration Reducing and Increased Comfort (MAVRIC) seats to alleviate crew discomfort, acute pain and fatigue caused by the unique vibrations and seating ergonomics of the aircraft.

## THE TECHNOLOGY

The high-vibration environment of E-2D aircraft can cause physical strain on the crew that accumulates with mission duration. Safe designed the MAVRIC cabin and pilot seats featuring integrated vibration isolation to reduce the discomfort and fatigue experienced by pilots and crew members. The program aims to create two distinct seats for the E-2D: one for the pilots and another for the cabin crew. The MAVRIC pilot seating system has already undergone aircrew evaluations at Point Mugu and flight tests at the Naval Air Station Patuxent River. MAVRIC is also being tested on a human-rated vibration table, which simulates aircraft vibrations, at Wright-Patterson Air Force Base. Testing and evaluation have demonstrated that the MAVRIC seating system significantly reduces vibration experienced by occupants, reduces fatigue, and improves mission endurance.

## THE TRANSITION

In 2020, Safe was awarded a \$2,980,000 Phase III cost-plus-fixed fee contract from Naval Air Systems Command (NAVAIR) to continue further research and development of the MAVRIC system including user evaluations, flight testing, and qualification testing of the final designs.

## THE NAVAL BENEFIT

E-2D aircraft equipped with aerial refueling have demonstrated the capability to provide airborne command and control in excess of eight hours. The ergonomic improvements of the MAVRIC seating system enable the crew to focus on the mission and tasks without pain and fatigue. The crew of E-2D aircraft are required to wear a 44-pound parachute survival ensemble backpack while seated. The MAVRIC seat adjusts to raise or lower the backpack, reducing shoulder weight and increasing mobility. The seat reclines without lifting the occupant's feet from the floor, providing a comfortable recline position during extended flights. The MAVRIC's seat cushion is contoured to alleviate pressure points during long missions, allowing pilots to endure extended periods of sitting without discomfort, and supporting greater mission endurance. MAVRIC retrofits to the airframe without requiring aircraft modifications.

## THE FUTURE

MAVRIC's reduced-felt vibrations and better ergonomics provide improved situational awareness and better mission performance for crew, especially on long duration missions. In addition to MAVRIC, Safe is developing a passive anti-resonance (PAR) vibration isolator system, which isolates an entire helicopter seat at its floor attachments, and innovative seat restraints for troops aboard rotorcraft. Safe is also developing the Crash Safety Data Recorder, which measures and records rotorcraft crash dynamics to improve design standards for crash protection technology such as seats and restraints.

**"Initiatives like the MAVRIC seat are addressing critical aeromedical factors that pose a threat to optimal human performance in the E-2 Hawkeye. Whole-body vibration mitigation, improved ergonomics, and enhanced comfort protect aircrew performance, improve safety, and enable the Hawkeye to continue meeting the growing demand for its unique capabilities."**

LT Chad Milam, Aeromedical Safety Officer, Airborne Command and Control & Logistics Wing