Topic: N172-120

Intelligent Automation, Inc.

Mitigation of Helmet Vibration

E-2D Hawkeye, crew members experience significant helmet vibrations which frequently results in fatigue, reduced performance, missed radio communications, and even hearing loss. MAD-LRA is a small add-on device that monitors for resonance and changes its stiffness to reduce helmet vibrations. MAD-LRA can be attached to an existing helmet with minimum impact to weight and decreasing pilot's fatigue. IAI is a technology and innovation company that has been providing advanced warfighter solutions for over 30 years.

Technology Category Alignment:

Biomedical (ASBREM)
Air Platforms
Materials & Manufacturing Processes

Contact:
Lee Brindel
lbrindel@i-a-i.com
(301) 795-4452
https://www.i-a-i.com/
SYSCOM: NAVAIR
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Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0269

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2021-048

Topic # N172-120

Magnetorheological Active Damper with Linear Resonating Actuator (MAD-LRA) and Magnetorheological Impact Foams (MIF) for Mitigation of Helmet Vibration

Intelligent Automation, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-231

Transition Target: E2-D Hawkeye Helmet

TPOC:
(301)342-9213

Other transition opportunities:
Easily be installed on other aviator helmet and safety equipment. Installed on other systems, components that experience resonate vibrations.



Photo courtesy of US Navy

Notes:
MAD-LRA = Magnetorheological Active Damper with Linear Resonating Actuator
MIF = Magnetorheological Impact Foams (MIF)

WHAT

Operational Need and Improvement: Due to the unique nature of the E-2D Hawkeye fixed speed rotary engine systems, E-2D crew members experience more frequent and intense helmet vibrations which frequently results in higher workload, fatigue, missed radio communications, and even hearing loss.

The US Navy seeks to mitigate helmet vibration in the HGU-68/P helmet system used by E-2D aircrew members.

Specifications Required: MAD-LRA will need to reduce the resonant frequencies experienced by aircrew members wearing HGU-68/P helmets in an E-2D flight configuration. IAI has identified these frequencies by modeling various helmet sizes using and head models.

Additionally MAD-LRA cannot increase workload or interfere with aircrew activities due to significant changes in size or weight of the helmet.

Technology Developed: IAI has developed MAD-LRA, a small add-on device that monitors for resonance and electronically adjusts its stiffness to reduce helmet vibrations. MAD-LRA can be attached to an existing helmet with impact to weight and decreasing pilot's fatigue.

IAI has developed a specific magnethorheological material for this application that adjusts stiffness using small electrical currents, and packaged in a small formfactor that can easily be added to aircrew safety equipment without impacting performance.

Warfighter Value: MAD-LRA has demonstrated the ability to reduce vibrations in E-2D aircrew helmets. This will reduce workload, fatigue and provide should reduce the potential for hearing damage. The device can be added to existing safety equipment so it can be deployed rapidly to the fleet.

Additionally this technology can be added to other safety equipment such as masks, or even other systems that experience frequent resonant vibrations.

WHEN

Contract Number: N68335-19-C-0269

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Mature Hardware Completed	N/A	Functional Production Prototype	TRL 5	March 2020
Testing in reverberation chamber Low Measure reduction of vibrations on the test apparatus TRL-6 11/2020	N/A	Measure reduction of vibrations on the test apparatus	TRL 5	November 2020
Human Subject Testing Low Measurable reduction of vibrations by pilots	Low	Measurable reduction of vibrations by pilots	TRL 6	August 2021
Productization – EMI hardening and miniaturization	Med	Manufactured and deliverable hardware	TRL 6	August 2021

HOW

Projected Business Model:
IAI is developing production facilities to produce MAD-LRA devices and sell them directly to the Navy and through distribution via safety equipment manufacturers such as Gentex the manufacturer of the HGU-68/P helmet system.

Company Objectives: IAI is developing customized manufacturing techniques to manufacture MAD-LRA materials and enclosures for larger scale production. IAI will manufacture MAD-LRA devices in 25,000 square foot manufacturing facilities.

Once the manufacturing processes have been identified, IAI will begin to scale the size of the devices for additional military and commercial applications.

Potential Commercial Applications:
Successful technology development will benefit military, commercial customers, and consumers by reducing vibrations in safety equipment. Commercial heavy equipment manufacturers, and safety equipment manufacturers will be able to use this technology where operators work around vibrating machinery.

Consumer based applications include adding MAD-LRA to sporting equipment such as racing helmets and recreational aviator hearing protections.

Contact: Lee Brindel, Associate Director Technology Transition
lbrindel@i-a-i.com 3017954452