REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHD-27-11

Laser Dazzle and Light Filter Impacts on Human Visual Performance

PROJECT DESCRIPTION: Laser dazzle and retinal injuries are quickly becoming unique threats to aircrew as lasers become cheaper, more optimized, and increasingly prevalent around the world. Even below the power thresholds required for retinal damage, laser dazzle—or the temporary effects of irradiance on human vision—is distracting and debilitating enough to significantly affect pilot performance. To address this, laser eye protection (LEP) has been developed to block certain wavelengths of light while preserving visual performance. However, aircrew acceptance remains low due to reduced light transmission and shifts in color perception.

This project aims to study the impacts of laser dazzle on aircrew visual performance, along with the tradeoffs associated with wearing LEP. Human studies will be performed to measure the impact of dazzle and LEP on contrast sensitivity, visual acuity, color perception, and dazzle extent. Additionally, the project will examine how the human visual system adapts to shifts in color perception caused by light filters under varying ambient environmental lighting conditions. The results of this project will contribute to LEP prototype designs and laser dazzle model development.

LEARNING OBJECTIVES: Under the guidance of a mentor, you will gain hands-on experience to complement your education and support your academic and professional goals. Along the way, you will engage in activities and research in several areas, including but not limited to:

1. Gain a foundational understanding of human vision psychophysics through research involving human subjects.
2. Gain hands-on experience with laser optical design and software development.
3. Develop an understanding of how to statistically evaluate human-use data for model development.

ACADEMIC LEVEL: Undergraduate**,** Master's; Doctoral
DISCIPLINES NEEDED: Optometry, Psychology, Vision Science, Programming, Optics
RESEARCH LOCATION: JBSA Fort Sam Houston, Texas
RESEARCH MENTOR: Zachary Brawley, Ph.D.
Materials Science and Engineering, Texas A&M University, 2023



Dr. Zachary Brawley is a Research Engineer at the Air Force Research Laboratory (AFRL), where he serves as a Principal Investigator. He earned his B.S. in Physics from the University of Central Arkansas in 2017, where he studied plasmonic substrates for sensor applications. Before graduate school, he worked at the Naval Research Laboratory developing fiber optic sensors. Dr. Brawley received a doctoral fellowship to pursue his Ph.D. at Texas A&M University in 2018, where his research centered on nanophotonic/molecular interactions, creating hybrid states that can alter chemical reactions. During his graduate studies, he also interned with Northrop Grumman Space Systems, advancing materials research for aerospace applications. Following his doctorate, he gained industry experience as a semiconductor wafer process engineer before joining AFRL. Dr. Brawley joined AFRL

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in 2024, where he leads research efforts studying the effects of lasers and light filters on human visual performance. Dr. Brawley has authored and co-authored 15 scientific articles, 4 technical reports, and has presented at numerous optical and defense conferences.

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