Expanding the Hyper-Enabled Operator Technology across the Special Forces Enterprise

Scott Flanick, Andrew Davidson, Ashley Yoo, John David Mote, and Vikram Mittal

Department of Systems Engineering
United States Military Academy
West Point, NY 10996, USA

Corresponding author's Email: Scott.Flanick@westpoint.edu

Author Note: Cadets Davidson, Flank, Mote, and Yoo are 4th year students in the Department of Systems Engineering at the United States Military Academy. Dr. Vikram Mittal, Assistant Professor in the Department of Systems Engineering, is the Capstone group's advisor and provided instrumental guidance and assistance to the cadet team in completing this project.

Abstract: The Hyper-Enabled Operator (HEO) system is the next-generation Special Forces system that will increase the survivability and lethality of operators by providing the right person with the right information at the right time. This system was originally intended for direct-action operators; however, the need for information is common to many Special Forces jobs, including joint terminal air controllers, helicopter pilots, helicopter crew chiefs, intelligence officers, psyops officers, civil affairs officers, and vehicle drivers. This analysis set out to determine the applicability of HEO technology to these eight different positions. First, the HEO system was analyzed to identify the technologies that will play a role in the system. Stakeholder analysis then provided insights into each job, allowing for the determination of their capability gaps. These capability gaps were then aligned against HEO technology. The analysis revealed that several high-level requirements should be added to the HEO system to make it adaptable across the Special Forces enterprise.

Keywords: Adaptability, Special Forces, Military Technology, Hyper-Enabled Operator

1. Introduction

Soldiers have always been issued equipment that allows them to achieve a technical advantage over adversaries in combat. This equipment ranged from stone tools and bronze swords, to the tanks and helicopters used in modern combat. As combat became more dynamic and complex, so does the associated technology. The most cutting-edge technology is currently being developed by United States Special Operations Command (USSOCOM) to protect their operators during direct-action missions. This system, the Hyper-Enabled Operator (HEO) System, uses advanced technology to enhance an operator's situational awareness while reducing their cognitive load. The HEO system is intended for usage during kinetic operations, especially room clearing operations. However, only a small portion of USSOCOM are involved in these mission sets. USSOCOM includes a wide array of jobs ranging from pilots to civil affairs to medics. The technology associated with HEO can be extended to enhance other members of the USSOCOM enterprise.

This paper examines applying the technologies used in the HEO system to eight different duty positions that are part of the USSOCOM enterprise. The analysis performs an initial assessment of the HEO system to identify the associated technologies. Interviews were conducted with different members of the Special Operations Forces (SOF) community to derive the capability gaps. These gaps were then mapped to the associated technology to determine which technologies were relevant to each duty position. These mappings provide insight into high-level requirements that can be incorporated into the HEO system to assure applicability across the USSOCOM enterprise.

2. The Hyper-Enabled Operator

2.1 Overview of the Hyper-Enabled Operator

The HEO program is a follow-on effort to the Tactical Assault Light Operator Suit (TALOS) project, which was a USSOCOM initiative to enhance an operator's survivability and lethality (Altman, 2019). TALOS was intended to protect the first operator through the door during room clearing operations. In its current form, it is a powered-armored exoskeleton with augmented situational awareness. The TALOS project ran into numerous design challenges, especially related to the immaturity of the exoskeleton technology. USSOCOM decided to move away from the original TALOS design to focus on what advancements can be made without the use of the exoskeleton.

This follow-up effort – the Hyper Enabled Operator (HEO) project – seeks to augment an operator's survivability and lethality while avoiding the need of an exoskeleton. It accomplishes this goal by providing better threat recognition, managing the operator signature, enhancing the operator's situational awareness, and reducing their cognitive load. The main objective of the HEO system is to provide the right information to the right person at the right time without overloading them. The HEO project is currently in its conceptual phase. It is envisioned as a system of cutting-edge electronics—including sensors, processors, and augmented reality—that can provide USSOCOM warfighters a tactical edge.

2.2 Extending the System Across the Special Forces Enterprise

USSOCOM performs a wide array of mission sets such as counter-terrorism, foreign internal defense, covert operations, direct action, hostage rescue, high-value targets/man hunting, intelligence operations, mobility operations, and unconventional warfare. The combatant command encompasses 69,000 different people, since USSOCOM must have the capability to perform these wide arrays of missions in addition to provide the logistics, sustainment, and transportation support required for their missions (USSOCOM, 2019).

Both the TALOS and HEO systems were originally designed to protect the first operator through a door in a hostage rescue mission. However, only a small percentage of USSOCOM would benefit from this expensive technology. As such, USSOCOM wants to extend the technologies used in the HEO system across the USSOCOM enterprise, such that numerous warfighters could benefit from these advancements.

3. Methodology

The overall goal of this project is to align the HEO technologies with non-direct-action members of the Special Operations Community. This project was decomposed into three steps – technology assessment, stakeholder analysis, and aligning technologies to needs, as shown in Figure 1.

The first step in this analysis is assessing the technology that is under development for the HEO project. In 2018, USSOCOM put out a Broad Agency Announcement (BAA), asking companies to submit proposals to address how to fill certain capability gaps for their warfighters. Over 200 companies submitted white papers to this BAA. These proposals ranged from augmented reality devices to fully autonomous systems. These proposals were reviewed and grouped to understand what technologies are available to hyper-enable an operator.

The second step in this analysis is stakeholder analysis, which centered on interviewing members of the SOF community. The interviews focused on eight duty positions recommended by USSOCOM. These eight positions are intended to be representative of the breath of USSOCOM missions. Prior to the interviews, a set of vignettes were developed to capture a generalized mission set for a given duty position. The vignettes allowed for a discussion of the different stages of the mission and the possible shortcomings of current technology at each stage. Interviews were conducted with members of each duty position. The interviews were then further analyzed to identify what capability gaps exist for each duty position.

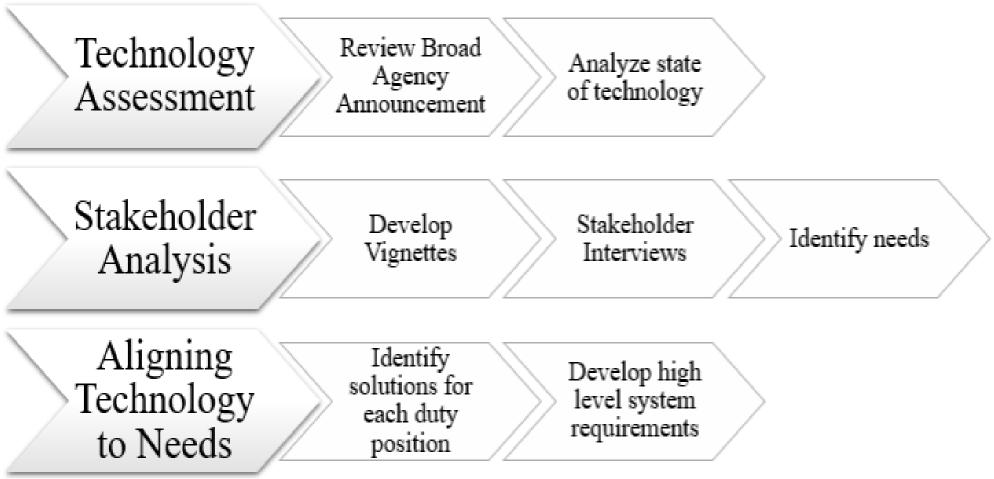

Figure 1. Methodology for aligning HEO technology to different duty positions in USSOCOM

The third step involved aligning the technologies identified in the first step with the needs of the second step. For each duty position, the needs were analyzed to identify if technology from the HEO program would fill the capability gap. These needs and technologies were compiled for the different duty positions to identify high-level system requirements that can be integrated into the HEO program to allow the system to be applicable to a wide-array of members of the SOF community.

4. Technology Assessment

The technology assessment stage was performed by analyzing the responses from industry to the Broad Agency Announcements pushed out by USSOCOM for the HEO project in late 2018 (SOF AT&L-ST, 2018). A review of the responses identified 31 different technologies that will allow for hyper-enabling an operator. These 31 technologies were grouped into 5 larger categories -- sensing, algorithms and processing, communication, human-machine interface, and system level technologies. A hierarchy of these technologies are shown in Figure 2. These technologies are fully detailed in the work done by another Capstone group (White et al., 2019).

The five top-level technologies correspond to the HEO goal of ensuring that the right information is given to the right person at the right time to allow them to be more effective. The sensing technologies allow for the collection of threat information creating more standoff between the operator and the threat. The algorithm and processing technologies allow for the collection of data and converting it into actionable intelligence. The communication technologies further allow the operator to get the information necessary from other members of their team as well as higher headquarters. The human-machine interface technologies allow the operator to receive the actionable intelligence and communication information. The system-level technologies then enable the operator with increased survivability and lethality.

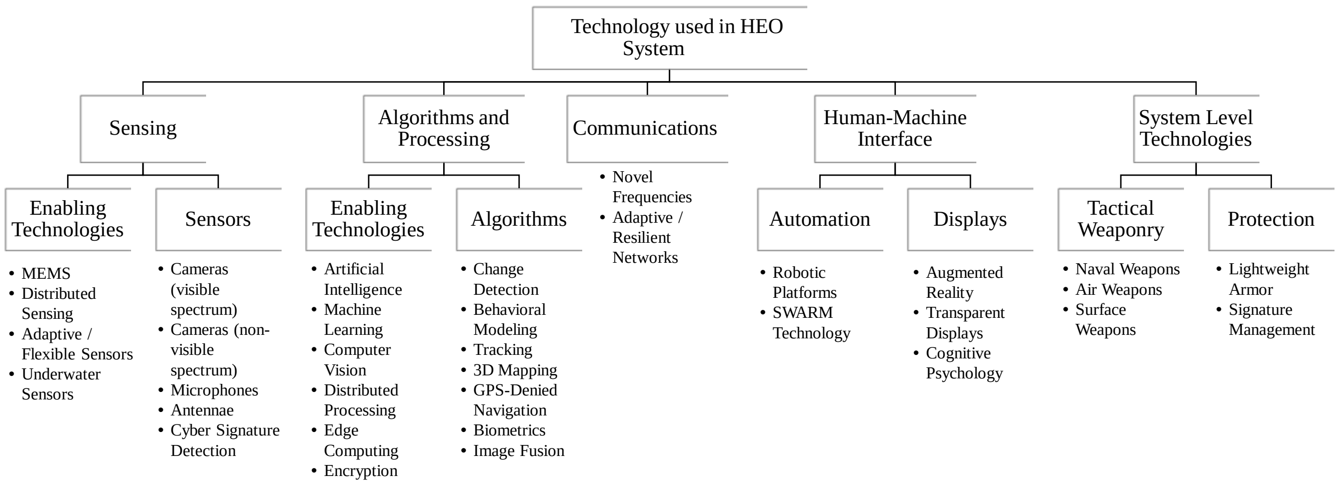

Figure 2. Technology Hierarchy for the HEO System

5. Stakeholder Analysis

The stakeholder analysis aimed to identify opportunities to apply HEO technology to the needs of multiple jobs and duties within Special Operations. Ideally, the project would incorporate every Special Forces role, but with strict time constraints the research needed to be narrowed down to eight positions: joint terminal air controllers (JTAC), 160th Special Operations Aviation Regiment pilots, SOAR crew chiefs, combat medics, intelligence officers, psychological operations (psyops) officers, civil affairs officers, and ground vehicle drivers. Realizing these positions are not all encompassing, the breadth of their jobs will incorporate the technologies that other Special Forces operators also use.

For simplification, this section only highlights the stakeholder analysis for the JTAC and the combat medic. The results for the other jobs are included in the subsequent sections.

5.1 Joint Terminal Air Controller

JTACs control the air space for Special Forces units and are responsible for all air assets. They are a critical part of all Special Force's units and essential for mission success. (Webb, 2012). The job requirements for a JTAC include: operating communications, digital networks, precise targeting, planning with land commanders on air and space capabilities, planning and controlling air resources to support maneuver units, issuing weapon release clearance, and conducting operations with combat maneuver units (Thompson, 2014).

The JTAC interview identified multiple holes in their current technological capabilities that could greatly improve their lethality, survivability, and situational awareness. Figure 3 displays the use case that captures the flow of information through the HEO system that would benefit the JTAC. With the HEO system, JTACs would be able to communicate with a common network, receive threat detection to improve situational awareness, receive environmental data like GPS location of friendly and enemy positioning, and most importantly have verbal and non-verbal communication with air assets and ground forces to improve situational awareness to best utilize air assets.

A primary capability gap is the lack of adaptive and resilient networks. Radio communication is the essential tool that JTAC's use to utilize air assets in a timely and precise manner. When the communication networks are down, the JTAC's purpose becomes wasted. The JTAC also identified that a lack of a mutual network with green forces often allows for unintentional blue/green fighting (Blue as in US forces, green as in US Ally forces). The lack of a resilient network that can withstand enemy attacks in communication restricted areas is a capability gap the HEO system could potentially close.

Additionally, the JTAC identified that the addition of a transparent/augmented reality display would provide useful information and improve situational awareness. JTACs must always know the proximity of US and Ally forces, and the only current way to do this is through radio communication. The solution the JTAC provided that would reduce cognitive load and improve lethality for the operator was an augmented lens that receives data from friendly forces and displays that information on the JTAC's transparent device. This capability gap would reduce critical minutes off fires by quickly and efficiently transmitting and displaying data necessary for JTAC's to call for fire.

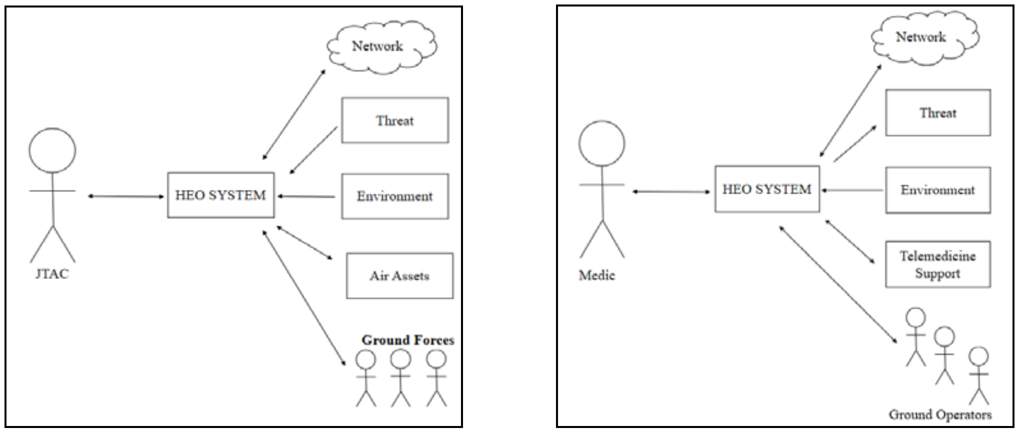

Figure 3. Use Case Diagram for JTAC and Medic

5.2 Special Forces Combat Medic

The combat medic specialist provides emergency medical treatment, limited primary care, force health protection, evacuation in a variety of operational and clinical settings from point of injury or illness through the continuum of military health care. Moreover, a field combat medic provides emergency medical care/treatment at point of wounding on the battlefield or to battle and non-battle casualties during wartime (DA-PAM 611-21, 2018). Although there are different positions for the combat medic specialist, the one most applicable to HEO is the battlefield medic. The battlefield medic's job is to administer emergency medical treatment to battlefield casualties and assist with outpatient care and treatment (DA-PAM 611-21, 2018).

Following the interview, a use case diagram was produced in Figure 3 to visually identify the relationship between the combat medic, the HEO system, and their respective capability gaps. Firstly, the combat medic is unable to access information quickly and efficiently because the lack of a single cloud-based network. In addition to the mission specific information, the combat medics are expected to retain a vast amount of medical and pharmaceutical information thereby increasing their individual cognitive loads. By developing a single cloud-based network, the medic can access critical information during the mission; drastically reducing their cognitive loads. With this additional capability, the "regular" operators could assume this role efficiently, should the medic be unavailable.

The next identified capability gap was the ability to utilize telemedicine support. Telemedicine would allow the medic to communicate with a surgeon at a higher echelon location while remaining on the ground. Providing the ability for the surgeon to see what the medic sees in a low stress environment allows the surgeon to think more clearly and verbally relay critical information improving the medic's ability to assess and treat casualties more efficiently. In a situation which the medic is unavailable, the surgeon would be able to guide other operators through treating other injured soldiers.

Finally, a gap that exists among all the jobs within special operations – communication with the ground operators. Beyond direct-line communication is simply the ability to relay information effectively. This technological needs narrow to having the right information at the right time. Given this capability, operators would be more effective on their missions and be able to better communicate with the higher echelons.

6. Aligning Technology to Needs

6.1 Relevant Technologies

The analysis presented for the JTAC and the combat medic outlined in Section 4 was performed for the other six duty positions. Table 1 displays a compilation of the different technical needs for the 8 different duty positions. Many of the needs overlapped across all 8 duty positions, especially in regard to communication and threat detection. These technical needs were then aligned with the technical solutions discussed in Section 3.

Table 1. Operator Support Positions Needs and Possible Solutions

User	Needs	Technical Solution
All	Cloud-based network allowing rapid data sharing between operator and higher echelons	Assured communication, Cloud-based processing
All	Identification of possible threats with substantial standoff	Biometrics, Threat-detection algorithms
All	Increased situational awareness related to terrain	Data-mining, Artificial intelligence, Distributed sensing, 3D mapping
All	Communicate and share data reliably and efficiently with members of team	Assured communication, Novel frequency channels
All	Access and view maps and planning document on-the-fly during a mission	Augmented reality
All	Provide the right information to operator at the right time without increasing cognitive load	Augmented reality, Edge computing, cognitive psychology
Medic	Relay medical guidance from remote medical provider	Augmented reality, assured communication, Biomedical sensing
SOAR Pilot, JTAC	Coordinate air assets and enhance decision making for air control	Distributed sensing, Cloud-based processing
Driver, SOAR Pilot, SOAR Crew Chief	Communicate important vehicle issues allowing for action prior to failure	Distributed sensing, Machine-learning
Driver	Increased autonomy in vehicle to reduce operator requirements	Artificial intelligence
Driver, SOAR Pilot, SOAR Crew Chief	Remove blind spots from field of view, potentially providing automated “ground-guides”	Augmented reality, Cameras, Distributed sensing
Psyops	Increased ability to tap and decipher enemy chatter	Distributed sensing, Antennae

The impact of adding technology from the HEO has the potential to provide numerous new capabilities to operators across the SOF enterprise. For example, a combination of augmented reality with assured communication and biomedical sensing would allow medics to have reach-back telemedicine support from the surgeons that will eventually treat the casualty. This capability will provide an increased likelihood of survival for the casualty.

6.2 High-Level Requirements

Since the HEO system is intended for direct-action operators, it does not currently have the ability to meet all of the needs listed in Table 1. However, since the system is still in the conceptual phase, the addition of several high-level requirements will ensure that the HEO system can adapt to duty positions across the SOF enterprise.

The technical needs and solutions displayed in Table 1 were further analyzed to provide the following summarized list requirements that the HEO system must incorporate to be successful across multiple domains.

- The augmented reality platform shall be customizable utilizing an “app store” concept similar to what is currently used by the Microsoft HoloLens to allow the system to be tailored to the individual’s need.
- The system shall use a flexible architecture with a standard interface that will allows inputs from a number of different types of sensors including cameras, microphones, and antennae.
- The systems shall be able to connect to the cloud to provide documents, images, and information that the operator can access during the mission.

- The communication system shall be able to interface with numerous joint channels including with those used to communicate with airframes, intra-vehicle, intra-team, or higher echelons.
- The system shall allow for manned-unmanned pairing to allow operators to interface with autonomous systems without increasing their cognitive load.

7. Conclusion

The goal of the HEO system is to provide the right information to the right person at the right time without overloading them. Though originally intended for the first operator through the door on a room-clearing operation, the need for information is common throughout the SOF enterprise. As such, the HEO technology can provide useful capabilities to a number of different Special Forces job.

This study first analyzed the different technologies involved in the HEO system. Stakeholder analysis was conducted through interviews with members of the SOF community in eight different duty positions. These eight positions are JTACs, SOAR pilots, SOAR crew chiefs, intelligence officers, psyops officers, civil affairs officers, and vehicle drivers. These interviews provided insights into their jobs, allowing for the determination of their capability gaps. These capability gaps were then aligned against HEO technology, showing the applicability of HEO technology to each duty position. Several high-level requirements were then analyzed to ensure that the system can be adaptable across the SOF enterprise.

8. References

Altman, H. (2019). MacDill Matters: Iron Man suit out at SOCOM, but new innovations still needed for commandos, Tampa Bay Times. Available at: https://www.tampabay.com/news/military/macdill-matters-iron-man-suit-out-at-socom-but-new-innovations-still-needed-for-commandos-20190212/.

DA PAM 611-21: Military Occupational Classification and Structure (2018), Chapter 10C, 68W.

Special Operations Forces Acquisition, Technology, and Logistics Directorate of Science and Technology (SOF AT&L-ST) (2018). Appendix M to Broad Agency Announcement, USSOCOM-BAAST-2015.

Thompson, L. “Guns of the Elite: 160th SOAR Night Stalkers”. *Tactical-Life*. November 19, 2014.

United States Special Operations Command (USSOCOM) (2019). Retrieved on March 6, 2019 from http://www.socom.mil.

Webb, B. TACP (JTAC) Overview. *Special Operations.* January 6, 2012.

White, J., Giovinco, T., Harrison, K., Jurado, J., Rivera, P., & Mittal, V. (2019). Aligning Needs, Technologies, and Resources for Special Operations. Proceedings of the General Donald R. Keith Memorial Conference, West Point, NY.