



WINGMAN

(Wireless Integrated Navigation and Geospatial Mapping with Awareness Network)

ELECOMP Capstone Design Project 2026-2027

Sponsoring Company:

Cranium Inc.

864 Nittany Court
Allentown, PA, 18104

Company Overview:

Cranium is a startup technology company that proposes a ruggedized, AI-enabled Helmet platform designed to deliver real-time detection and localization of tactical anomalies via multimodal sensor fusion. By processing acoustic, thermal, visual, and RF cues directly at the edge, the system enhances operator survivability and situational clarity.

Technical Director:

Mark Mulder

Chief Product Office (CPO)

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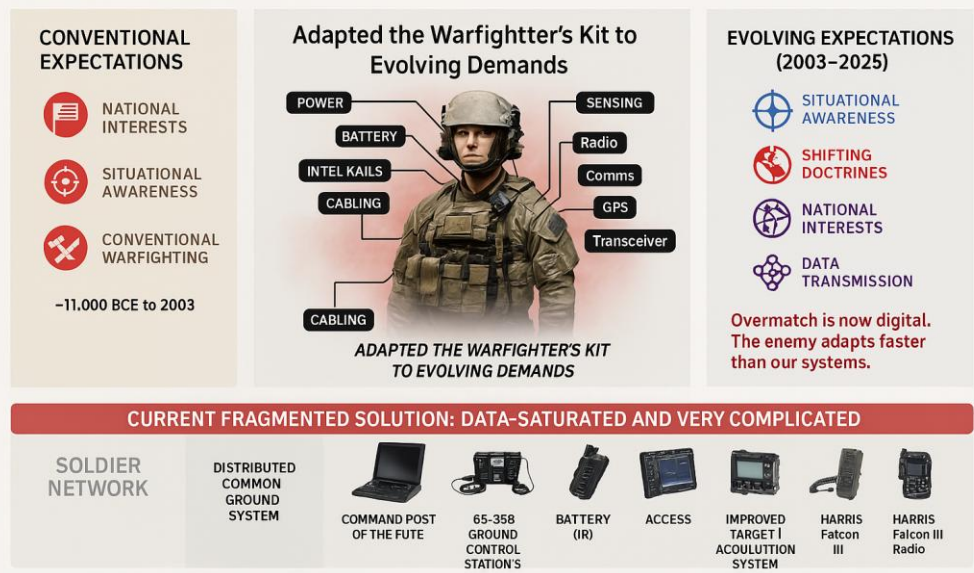
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Project Motivation:

The Problem – Data: The Silent Enemy



Our Special Forces Warfighters, Elite Law Enforcement Officers, and First Responders are woefully unprepared for the environments we ask them to enter. We now have an abundance of sensor, communication, and computational data available to them to enhance their capabilities and likelihood of mission success and survival. However, that data is delivered through disparate systems (i.e. multiple pieces of equipment) making it fundamentally impossible to monitor all of them simultaneously ... all while trying to survive on the battlefield, in a gang drug-house raid, or in a burning building.

The net result is a failure to deliver that data where it is needed, to whom it is needed, and when it is needed. Failure to deliver in any one of these ways is a total failure ... and we've managed to build a system that fails at all three. In short, we have failed the best people our society has to offer, and that is simply not acceptable.



Anticipated Best Outcome:

The Cranium Capstone Team would create and maintain a 2D map of the current room and any previous rooms visited by the local node using COTS hardware for the processing module (e.g. Jetson Nano), vehicle (e.g. Jetbot) and minimum sensors (e.g. 1D range finder and triangulation receiver). The processor for each Jetbot will create a map dot of current position for self and location of all other nodes, and will have access to location history for all nodes available for bread-crumbing (enabling any one Jetbot to navigate another, or leading a Jetbot out of the room layout without the benefit of the map).

Stretch Goals: Increase the data sharing to create fused maps using data from other nodes, move the map to 3D, and expand the sensor suite.

Project Details:

The Cranium Technical Director will work with the Cranium Capstone Team to design a simple three or four room layout with one hallway which the Jetbots will navigate and map.

While mapping the rooms, the Jetbots will also record a plot map of their individual travels in order to create a breadcrumb trail that a Jetbot could use to exit the room layout in the event of mapping sensor failure.

For any hardware that the Cranium Capstone Team desires to use but is not specified by the Cranium Technical Director, the system must use American-made COTS components with full sourcing disclosed to and approved by the Cranium Technical Director prior to acquisition.

The system that the Cranium Capstone Team develops will be the precursor to the mapping system that is integrated in the Helmet. Therefore, several of the key design considerations are:

- Precision Matters
 - We are equipping elite Warfighters, Law Enforcement Officers, and First Responders in mission critical and high-risk situations. They must be able to rely on the precision of the data provided to them.
- Dynamic Mapping to Adapt to Changing Conditions
 - Our Users are entering situations where there are closed and opened doors, breached walls, and collapsing infrastructure. As such, the maps need to learn (i.e. reflect changing conditions by managing conflicting data that was previously collected).



- Speed and Efficiency Count
 - A plot map must be established and relayed quickly to all available nodes. The Jetbots can each use up to four 1D range finder sensors in order to expedite point data acquisition.
- Minimize Weight
 - Weight within the Helmet increases User neck strain. Increased weight in the Helmet increases the inertial mass of the Helmet, making it more difficult for the User to run, jump, and dive when critically necessary.

Please note that cost is not a primary design consideration. We are delivering a critical technology to our elite Warfighters, Law Enforcement Officers, and First Responders. Our target Customers understand that this comes at a cost. While we always want to be conscious of cost, optimizing performance is the primary design consideration.



Composition of Team:

2 Computer Engineers, 1 Electrical Engineer **(US CITIZENSHIP REQUIRED)**

Skills Required:

Computer Engineering Skills Required:

- Embedded software
- Autonomy topics (SLAM, path planning)
- Edge Computing
- C/C++
- Driver/Library Development
- OpenCV

Electrical Engineering Skills Required:

- COTS hardware integration
- System architecture definition
- Datasheet analysis
- Sensor hardware interfacing



Anticipated Best Outcome's Impact on Company's Business, and Economic Impact

The Cranium Capstone Team will be integral in the development of future mapping and breadcrumbing implementation. We are in a race to a future that science-fiction has been speculating about and dreaming of for decades. We are now at the tipping point in history where science-fiction will transition to reality. This is a tough challenge, but it now within the realm of what's possible. You will be a part of making this a reality!

Broader Implications of the Best Outcome on the Company's Industry:

When we deliver a Cranium Helmet to our nation's best Warfighters, Law Enforcement Officers, and First Responders, you will be contributing members of the team responsible for helping deliver the critical information they need to quickly and effectively do their jobs, and come home safely!



Appendix A: AI Use Policy – [Insert Project Name]

Allowed

- Students may use AI tools for
 - ☒ brainstorming support
 - ☒ concept development
 - ☒ literature and publicly available documentation review
 - ☐ software development
 - ☐ debugging
 - ☐ data analysis
 - ☒ test development
 - ☐ non-proprietary paragraph editing
 - ☒ non-proprietary single-slide formatting
 - ☐ preparation of project deliverables
 - ☒ note taking or transcription of meetings
 - ☐ Others: (none)

Not Allowed

- Using AI in violation of university policies, applicable laws, or course-specific rules identified by capstone instruction team and project-specific rules identified by the technical directors.
- Entering proprietary, confidential, personally identifiable, security-sensitive, or otherwise restricted information into an AI system without authorization.



- Submitting AI-assisted work without understanding, reviewing, verifying, and appropriately disclosing its use.
- Submitting entire documents or presentations to an AI system for editing or formatting.
- Any unchecked items from the allowed list above.

Requirements

- If any use is allowed, AI tools may only be used to enhance, but not replace, students' technical reasoning, engineering judgment, and understanding. Students must be able to explain, justify, and defend all submitted designs, code, analyses, test results, documentation, and conclusions.
- During the first two weeks of the project, the student team shall work with the Technical Directors to: identify any proprietary or confidential information that may be involved in the project; determine what information may or may not be shared with AI systems; identify the AI tools, models, accounts, and configurations approved for project use; and document any project-specific restrictions or approval requirements.
- Students shall transparently document the uses of AI using the URI CYPHER AI Usage Marking guidelines (<https://web.uri.edu/cypher/ai-marking/>). A workshop is planned for September to familiarize students with these guidelines.
- Students retain full professional responsibility for all design decisions, analyses, implementations, testing, documentation, presentations, and final deliverables, regardless of whether AI tools contributed to the work.