

LIGHTNING LABS:

Innovation and Experimentation

MAJ JASON HINDS
CPT MAHDI AL-HUSSEINI
1LT EMILIANO CONCHA-TORO
1LT CORAL MARQUEZ

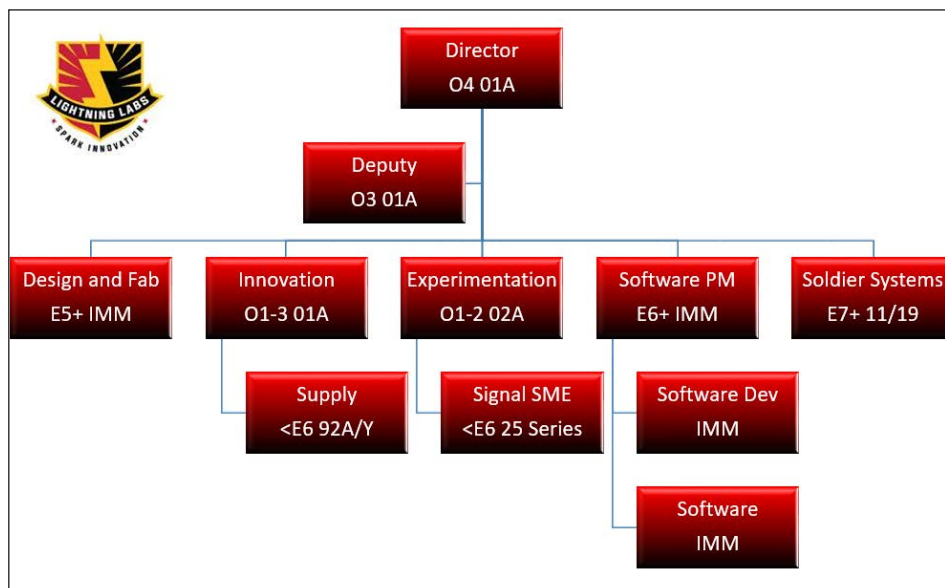
CPT Jon Voss had a problem. Serving as the embedded behavioral health specialist in the 25th Infantry Division (25ID) Division Sustainment Brigade (DSB), he observed Soldiers missing major training events due to in-person behavioral health appointments. CPT Voss thought that 25ID Soldiers should be able to receive important medical care regardless of their location in the world at their time of need. He walked into Lightning Labs with a simple idea to develop and grow a telehealth network, a model regularly practiced in the civilian medical world. Lightning Labs connected CPT Voss with medical student teams at the University of Hawaii at Manoa and coordinated for the students to work alongside him to refine the solution, conducting field research during a combined and joint exercise in the Philippines that resulted in a Soldier solution to a Soldier-identified shortfall.

Lightning Labs Mission, Priorities, and Process

Lightning Labs is 25ID's first innovation and modernization program, dedicated to promoting Soldier-driven innovation while strengthening relationships with academia and industry partners. Innovation and modernization activities require time, effort, and investment to be successful. Lightning Labs is fortunate to possess all three. Our innovation facility was established in a command that supports risk-taking and strives to advance land power in the Indo-Pacific. Our mission is shaped by the unique geography of the Indo-Pacific region, its vast expanse, and its disconnected nature. With complex terrain, massive urban areas, rough mountains, and extensive jungles, our challenges to building readiness are different from other Army divisions.

Lightning Labs' priorities are defined by the challenges our theater presents. In crisis or conflict, we expect to be isolated for significant periods of time. This operational assumption drives senior leader risk calculus and shapes our desire to possess capabilities that increase endurance, reduce supply consumption, and disaggregate capabilities to lower levels, ultimately providing effective ground forces ready to fight and win if needed.

Figure 1 — Future Lightning Labs Force Structure



Lightning Labs' priorities focus on:

1. **Joint sensor-to-shooter integration and battlefield visualization**, such as our work to enhance joint targeting with other Department of Defense partners
2. **Diversified data transport**, like our work with Secure Transit through Untrusted Networks (STUN), which provides subordinate units another resource to protect their communications
3. **Distributed and disaggregated command and control (C2)**, like our work to expand the communications bubble using an RQ-7 Shadow
4. **Distributed sustainment**, like our work with the U.S. Army Combat Capabilities Development Command (DEVCOM) to develop a zero water footprint
5. **Multidomain effects**, like our work on the electromagnetic "Tripwire" sensing system
6. **Soldier systems**, like our work on a jungle-specific Fighting Load Carrier

Lightning Labs encourages talented Soldiers to use their unique skills to solve problems. Examples include power storage and generation, software development, and evaluation and testing of emerging systems from the U.S. Army Futures Command (AFC). Talented Soldiers, leaders, equipment, and funding must be secured from inside the division, and this comes with an opportunity cost.

Talented Soldiers exist in every formation, and cultivating a culture where these unique talents can be applied to solve complex or discrete challenges is critical, especially when the manpower comes from within.

The Lightning Labs structure is entirely developed and funded by 25ID and outside support from the Army's broader innovation enterprise. Expanding integration and resourcing from the AFC enterprise benefits everyone and can help take tactical-level innovation and experimentation to new heights. We've embedded DEVCOM Field Assistance in Science and Technology (FAST) advisors at the division level. These advisors help align the tactical challenges we identify to broader AFC efforts. Connecting to the AFC innovation enterprise is critical to empowering and synchronizing efforts, ultimately spreading successes across the broader Army.

Process

When 25ID Soldiers identify a challenge or unique problem, they are encouraged to present it to Lightning Labs. This direct interaction with 25ID stakeholders and Soldiers is critical to supporting tactical innovation. Before a problem's solution can be identified, we must first identify the problem's root cause to ensure we're solving the correct issue.

Soldiers serve as our subject matter experts (SMEs). We work with the SME and develop a succinct problem statement. Lightning Labs shares the problem statements with the AFC innovation enterprise because other organizations may have solved this exact or a similar problem — or have key insights to share. Additionally, sharing these problem statements often allow us to access the AFC enterprise's resources, which can close the gap between tactical problems and institutional solutions. If we're lucky, a solution for the Soldier's problem already exists, and Lightning Labs is able to help identify sourcing and implementation solutions for the Soldier or identifying unit.

Sourcing Solutions

If a solution to solve a problem doesn't exist, Lightning Labs will work with the Soldier SME to solicit solutions internally, within the Army and DoD, and then to external entities. Every avenue has benefits and limitations, and Lightning Labs helps guide the active stakeholder to the correct approach.

Innovative Soldiers

It's important to note that divisions naturally possess many innovators throughout our formations. At Lightning Labs, we employ a logistical specialist and an Army musician as software developers, a medical evacuation (MEDEVAC) pilot as an intellectual property expert, and an Infantry officer as an engineering project lead. 1LT Emiliano Concha-Toro, an Infantry officer, joined the Lightning Labs team with a wealth of recent field and jungle experience. He identified operational limitations with the Integrated Tactical Network (ITN) system of systems, which directly led to the development of a solution using an RQ-7 Shadow Echo and division-organic machine shops. This solution will eventually increase C2 for a ground maneuver force in the jungle. Innovative individuals, such as 1LT Concha-Toro, help shepherd Soldier SMEs and their problem to potential solutions.

One resource Lightning Labs successfully integrated into our endeavors is the division's support battalion Allied



25th Infantry Division Soldiers test mount the Shadow Echo, a partnered project with the 225th Brigade Support Battalion's Allied Trades Shop. The Shadow Echo hopes to expand infantry brigade combat team command and control bubbles through vertical relays.

Trade Shops. The Soldiers in our Allied Trade Shops are experts in machining and welding and often possess industrial certifications and real-world experience. In the previous case, 1LT Concha-Toro worked with the Allied Trade Shops to manufacture the AN/PRC-171 Leader Radio mount to an RQ-7 Shadow. This simple solution, while still in final testing, is easy to replicate and has negligible financial and manpower costs.

Tactical Partnerships

One of Lightning Labs' partnerships is with the 3rd Infantry Division Marne Innovation Center. A recent example of this collaboration, originally identified by 1LT Ross Barber, a cyber officer assigned to 25ID's 2nd Infantry Brigade Combat Team, is the Lightning Labs' Tripwire program. This system scans for passive and active electromagnetic signals and produces an electromagnetic "heat map," allowing commanders to visualize the electromagnetic output of their formations that could be exploited and targeted in future conflicts. Our partnerships with the Marne Innovation Center allow both innovation organizations to focus on their strengths and collaborate to improve the overall product. Inter-division interoperability allows organizations to share solutions and experimental findings, benefiting the broader Army.

DoD Enterprise-Level Partnerships

While division innovation labs regularly collaborate, it's impossible to discuss Army innovation without addressing the impacts of AFC and DEVCOM. These close relationships benefit all involved parties. Lightning Labs advocates on behalf of jungle and Indo-Pacific problem sets, while AFC and DEVCOM provide enterprise-level oversight, resources, relationships, and years of experience. Regular meetings with the Maneuver Battle Lab from Fort Moore, GA, help Lightning Labs inform the AFC enterprise of our tactical requirements and aid us in finding viable and vetted solutions. Lightning Labs recently partnered with Program Executive Office (PEO) Soldier and the office of the Assistant Secretary of the U.S. Army for Installations, Energy and Environment to field test the All-Terrain Electronic Mission Module (ATeMM), which is a battery charging trailer that can be towed behind the Infantry Squad Vehicle (ISV). The ATeMM may significantly reduce battery storage and power consumption challenges experienced by light maneuver formations. Testing will continue into the summer of 2024.

Academic Partnerships

The National Security Innovation Network, a DoD-sponsored program, provides a conduit for military problem sets to receive university resourcing. A multitude of academic resources exist, often providing fully funded options that can attempt to solve a unit's problem. As an example, Lightning Labs' Educational Partnership Agreement with the University of Hawaii aligns local research capacity towards tactical problems, regularly providing us potential solutions and support. Simply put, a problem identified by an Army division could feasibly end up being solved by university students via a DoD-funded program.

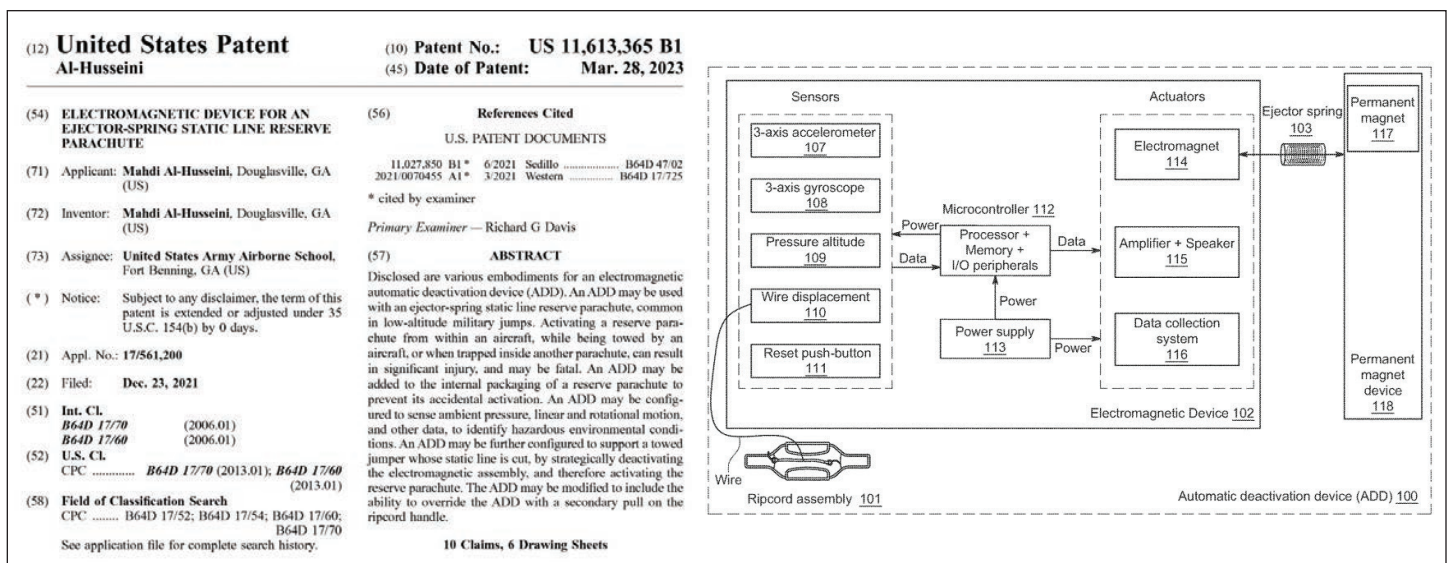


Figure 2 — Patent No. 11,613,365 - Lightning Labs Support to the U.S. Army Airborne School

To date, 16 Lightning Labs problem sets became academic research projects through Hacking for Defense (H4D), graduate capstone projects, and X-Force internships. Public, private, and military universities supporting Lightning Labs research efforts include Stanford, the University of Chicago, Arizona State, and the Naval Post Graduate School. The University of Hawaii at Manoa remains 25ID's primary academic partner, supporting 11 problems sets since 2022. Some of these recent partnerships include work on our Expeditionary Tele-Behavioral Health (ETBH) initiative and a flight scheduling and maintenance software program. These solutions are still prototypes; however, they will solve real challenges identified by our Soldiers and will increase 25ID's combat readiness.

Sharing Innovative Ideas

Lightning Labs protects intellectual property. Through collaboration with the Army Research Lab, Lightning Labs filed and paid for nine patent applications over the last year, with six more in development. Examples include a retrofittable power mirror system for the Heavy Expanded Mobility Tactical Truck (HEMTT) ground fleet, an intelligent aircraft formation flight heads-up display (HUD) system, and a military freefall grouping visualization tool. Documenting and publishing Soldier innovation initiatives through patents and papers further provide Soldiers with tangible and lasting recognition of their ingenuity.

A Way Forward

Division innovation organizations, such as Lightning Labs, provide valuable insight at the tactical and operational levels. This helps connect them with the broader AFC innovation enterprise, but they require funding and resources to truly be successful. Lightning Labs will continue pursuing academic and partnerships to streamline logistical hurdles, focusing on the tactical and operational challenges in the Indo-Pacific. A stronger connection to the AFC innovation enterprise is absolutely necessary; for example, we have asked DEVCOM and AFC to consider deploying dedicated liaisons to work with division- and corps-level innovation labs to connect Army-level resources to grass root problems. This partnership can further streamline actions and ensure that unit-identified problems receive enterprise level support.

Conclusion

The Indo-Pacific region has many unique challenges not shared by Army formations outside of this region. Lightning Labs is a valuable resource for 25ID Soldiers and leaders to innovate and solve unit-identified problems, regardless of the scale. As a dedicated innovation facility, Lightning Labs connects to the broader Army innovation and modernization enterprise, gaining efficiencies and tapping into additional resources which can be applied to solve some of these challenges. Lightning Labs' proximity to the Soldiers who identify problems, and its ability to connect to the broader innovation and modernization enterprise, provide tailored solutions to land forces and enhance realistic options for readiness. Lightning Labs is a big part of the Army's future in the Indo-Pacific and will undoubtedly play a key role for 25ID in years to come.

MAJ Jason Hinds currently serves as the director of Lightning Labs, the 25th Infantry Division's Innovation and Experimentation Element focused on advancing tactical capabilities through employment of new technology and novel concepts in a realistic environment with end-users. His previous assignments include serving with the Research Analysis Center, U.S. Army Garrison Wiesbaden, the 101st Airborne Division, and 3rd Armored Cavalry Regiment. MAJ Hinds is a graduate of the Command and General Staff Officer Course; he earned a Bachelor of Science in aerospace engineering from Embry-Riddle Aeronautical University and a Master of Science in operations research from Kansas State University.

CPT Mahdi Al-Husseini is an HH-60M Black Hawk pilot currently serving as an active-duty aeromedical evacuations officer stationed at Wheeler Army Airfield, HI. He graduated with his Bachelor of Science in biomedical engineering and Master of Science in computer science from Georgia Tech, and is further enrolled at Stanford and Purdue, where he studies aeronautics and electrical engineering respectively. CPT Al-Husseini is a registered patent agent, professional engineer, and inventor with more than 30 patents and patent applications, several of which have been acquired by the military and industry. He further supports 25ID as its director of innovation.

1LT Emiliano Concha-Toro currently serves as the Lightning Labs innovation and outreach officer, specializing in maneuver-centric problem sets. He previously served as a platoon leader in A Company, 1st Battalion, 27th Infantry Regiment, 2nd Infantry Brigade Combat Team, 25ID, which provided him the necessary experience to understand the demands of maintaining mission readiness at the Soldier level. His purpose at Lightning Labs is to solve maneuver Soldier issues and to advocate for a better understanding of the limitations power consumption at the tactical edge. 1LT Concha-Toro is currently on assignment to the 3rd U.S. Infantry Regiment (The Old Guard). He earned a Bachelor of Science in physics from the U.S. Military Academy at West Point, NY.

1LT Coral Marquez currently serves as a brigade intelligence support element platoon leader with D Company, 65th Brigade Engineer Battalion, 2/25ID. She earned a Bachelor of Science in mechanical engineering from the University of Texas at San Antonio.