

# REPORT DOCUMENTATION PAGE

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<b>14. ABSTRACT</b> The Hacking for Defense (H4D) Project at Stanford University supports the Office of Naval Research priorities and objectives as part of the ONR NEPTUNE Program. Stanford's H4D Project conducted a series of H4D "boot camps" -education and training exercises; developed and taught graduate level H4D courses; and provided opportunities to accelerate and further advance new concepts, technologies, and commercial ventures to address defense cyber security and energy network challenges.					
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## **Office of Naval Research (ONR)**

### **FINAL REPORT**

**Award # N00014-17-1-2919**

**NEPTUNE: Stanford University Hacking for Defense**

**(PI: Arunava Majumdar)**

#### **A. Major Goals**

**Describe the major goals of the project. Major goals are determined by agreement between the researcher and the sponsor. 8k characters**

There are four major goals of the project: 1) Hacking for Defense (H4D) University Course Development and Execution; 2) Educate NEPTUNE colleges on Hacking for Defense; 3) Military and veteran engagement; and 4) Develop an H4D-NEPTUNE accelerator capability.

#### **1. Hacking for Defense (H4D) University Course Development and Execution**

Under the NEPTUNE Office of Naval Research (ONR) grant, Stanford University holds a Hacking for Defense course focusing on cyber-physical security and energy network challenges facing the Department of Defense (DoD) and intelligence communities (IC). The H4D Cyber Security and Energy Networks course is taught during the Spring Quarter by NEPTUNE program supported faculty and instructors. Up to eight teams, each consisting of 4-5 students, will address problems related to cyber security and energy networks drawn from problems submitted by US DoD and other government organizations.

The goals of the course are to generate student mastery in the H4D lean problem-solving methodology, give them exposure to working on real-world problems and government organizations, and enable them to inform, if not solve, cyber security, energy network, and other national security problems submitted by DoD/IC and other government sponsors. As such, H4D coursework advances science and engineering education by giving students robust methodological tools and practical applications for these tools that contribute to national security.

The H4D course is held to advance key NEPTUNE Program objectives to include:

- Instilling lean innovation methods and thinking in the next generation of students, with an emphasis on the military-affiliated student population (for more see point 2 below)
- Engaging talented students to solve defense related energy challenges.
- Promoting pathways to advance new concepts and technologies to market- and defense-ready products meeting DoD requirements.

A core tenant of the H4D course is to teach students "beneficiary discovery". This requires the class to "get out of the building" and talk to a wide range of beneficiaries, end-users, industry experts and other

individuals whose insights and experience can lead to a better understanding of the problem and, ultimately, to developing potential solutions.

Each week student teams are guided through a rigorous process that involves interviewing 10-15 people. Through these interviews, students will test hypotheses about possible solutions, and discover factors contributing to the problem that oftentimes were not evident when the government sponsor drafted the problem statement. Armed with these insights, students refine their understanding of the problem and begin to understand what a solution looks like. In addition, through systematic analyses and continual updating of the key components of the Mission Model Canvas, student teams discover not only what is required to solve a problem, but additional factors that affect the viability of a solution being manufactured and how it can be effectively and efficiently deployed.

## **2. Educate NEPTUNE colleges on Hacking for Defense**

Current universities participating in NEPTUNE are performing world-class cyber-security and energy research while exploring models for effectively linking academic research with deployed solutions that meet the needs of men and women in uniform. Stanford Hacking for Defense helps provide this linkage through conducting educational workshops for students and educators.

Similar to the Stanford-based Hacking for Defense course, workshops conducted will help students, educators, and government and uniformed personnel at other NEPTUNE schools to:

- Encourage them to use lean methods to develop their research concepts to solve defense challenges;
- Engage talented students, professionals, and entrepreneurs in classes and events developing new concepts, technologies, and startup companies to solve defense related energy challenges;
- Promote pathways to advance new concepts and technologies to market- and defense-ready products meeting DoD energy requirements.

The NEPTUNE grant will fund a Student Summits and an Educator's Courses each fiscal year.

Student Summits target educators and students at NEPTUNE schools. The objectives are to help those individuals learn Lean concepts and terminology and the importance of framing their research to address real defense challenges, as well as develop minimum viable solutions to meet those challenges.

The Educator's Course is designed to teach educators on how to prepare and execute a Hacking for Defense course at their college or university. The Educator's Course provides materials to support both the preparation and execution of those courses.

Both the Student Summit and Educator's Courses are conducted using the non-profit Hacking for Defense, Incorporated and campus-based resources.

## **3. Military-affiliated engagement**

Stanford H4D aims to recruit the military-affiliated community (e.g. veterans, active and reserve military members, and ROTC cadets) into its Spring Quarter Hacking for Defense course as well as in NEPTUNE educational events. The goal is to create an enduring culture of innovation within the military-affiliated community to support gainful employment within the community and, more broadly, defense innovation.

## **4. Develop an H4D-NEPTUNE accelerator capability**

The H4D-NEPTUNE accelerator capability will begin being funded in September 2013. The effort will simultaneously increase the number of commercial-oriented start-ups and nontraditional companies working in defense related fields. It will also grow a professional workforce emphasizing military veteran involvement with knowledge in both defense mission needs and the commercial marketplace. At Stanford, this effort will create concept-to-adoption pathways for cyber-physical security, energy network, and other national security technologies and products to reach defense systems and operators. The H4D accelerator capability, like H4D courses, will be an intense process of rapid and immersive learning aimed at accelerating the life-cycle of Hacking for Defense course teams. The H4D accelerator

capability will support early-stage, growth-driven teams that emerge from the H4D class through education, mentorship, and financing.

The H4D accelerator capability will combine the expertise of academic and industry leaders at Stanford with industry and defense experts. In addition, it will provide structure, mentorship and funding support for best concepts and technologies developed in H4D classes. The support will be aimed at teams, with a working prototype or prototype concept of an innovative technology, that need to validate and vet their business and mission models with DON and other DOD sponsors, as well as potential commercial partners. The key to the accelerator capability is mentorship. The H4D accelerator capability will combine mentorship opportunities from academia, industry, and defense by placing H4D teams with mentors in each of these areas either at Stanford University labs and/or in Silicon Valley incubators and labs.

The H4D Neptune accelerator capability aims to have a positive impact on the NEPTUNE ecosystem by taking great concepts developed in class and giving them the mentorship-driven, financial, and learning-by-doing support to fully develop the mission solution. Through partnerships with Stanford's Precourt Institute and local energy accelerators, the H4D accelerator capability will build NEPTUNE's internal capability of solving cyber-physical security and energy network-related problems.

One purpose of the accelerator is to bridge the funding gap between the H4D class and available follow on funding from government and commercial sources. H4D teams will be in the accelerator capability for four months as part of a cohort of other companies and receive a monthly stipend totaling between \$25-50k. The funding will enable teams to implement a small pilot test to further test their business and mission models. In addition, the accelerator capability will connect these teams with the cyber security and energy ecosystem

#### **B. Accomplished under goals**

**A description of what was accomplished under the goals during the reporting period. 8k character limit.** Stanford had the pleasure of hosting Rich Carlin and Whitney Tallarico for a site visit on 4 December 2017. The visit situated and aligned Stanford's contribution to the NEPTUNE program.

##### **1. Hacking for Defense (H4D) University Course Development and Execution**

The Hacking for Defense course streamlined the pathways for cyber-physical security, energy network, and national security technologies and products to reach defense systems and operators. The Hacking for Defense syllabus was written to incorporate the cyber-physical- and energy network-specific focus.

Term	Syllabus	Website	Number of Student teams Applied	Number of Student teams Selected	Number of government Problems Offered
Spring 2018	<a href="#">Syllabus 2018</a>	N/A	7	6	16
Spring 2019	<a href="#">here</a>	<a href="#">here</a>	17	8	25
Spring 2020	<a href="#">here</a>	<a href="#">here</a>	16	8	23
Spring 2021	<a href="#">here</a>	<a href="#">here</a>	14	10	18



The teams that were accepted into the course are listed below to include a description of their solution, their problem sponsor, and links to their final presentations and videos.

2018	Acquiforce - "Enable program managers to make better, faster program decisions with fewer documents." Problem Sponsor – Congress's 809 Panel
	Intelgrids – Enable NAVFAC Base Utility Managers to more effectively communicate with their power utility to ensure comprehensive understanding and optimization of costs, restrictions, and opportunities. Problem Sponsor: Naval Facility Expeditionary Warfare Center
	Polaris - In a future conflict, fewer downed pilots will be rescued because the survival radio is cumbersome, dies quickly, and provides limited situational awareness. Problem Sponsor: Air Force Research Lab
	Sea++ - Commanding officers need to understand how cyber vulnerabilities will impact their missions. Problem sponsor: MITRE (in collaboration with the Office of Naval Research).
	TrackID - Create a system for special operations to efficiently account for personnel through the whole mission lifecycle - from planning to exfiltration. Problem sponsor: SOCOM
	Theia – Develop machine-learning software for imagery analysts to detect anomalous activity in aerial and satellite images in order to prioritize relevant geographic areas for further analysis. Problem sponsor: US Air Force, 9th Intelligence Squadron
2019	<b>Team Embargo.NK.</b> Problem: Influence Through the Levels of War (sponsor: UN Command Security Battalion): Develop a secure, convenient and integrated way to communicate with all involved forces at the United Nations Command Security Battalion–Joint Security Area (UNCSB-JSA) on the Korean border. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team Learn2Win.</b> Problem: Formal Training Unit (FTU) - Next: Changing the Future of Air Combat Command Training (sponsor: US Air Force): Combat Air Force (CAF) instructors need improved and expedited training procedures in order to reduce phase duration and information loss of trained student personnel. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team Common Ground.</b> Problem: Enforcing United Nations Security Council Resolutions on North Korea (sponsor: Office of the Secretary of Defense): Develop an approach for the Office of the Secretary of Defense to enforce United Nations Security Council international maritime resolutions in order to better compel an end to North Korea's nuclear weapons program. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team PredictiMx.</b> Problem: So Many Data Sources, So Little Time (sponsor: US Marine Corps): Develop a solution to assist maintenance control chiefs in aggregating disparate data sources and manpower capacity in order to maximize readiness levels. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team IntelliSense.</b> Problem: Maintaining Vessel Coverage (sponsor: United States Coast Guard): Provide a solution that provides Coast Guard Operations Specialists a way to track vessels to more successfully interdict drug traffickers. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team DeepFakes.</b> Problem: Is that video real or fake? (sponsor: CIA+In-Q-Tel): Develop a framework for detecting fake media (e.g. image or video) or develop a tool to embed information to mark the authenticity of media. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team Panacea.</b> Problem: How did you do that? (sponsor: Veteran's Health Administration): The Veterans Health Administration (VHA) Diffusion of Excellence Team needs to establish criteria to deem an existing or developed practice "best" in order to make data-driven decisions around implementation strategies for VAMCs. <a href="#">Final Presentation</a> <a href="#">Final Video</a>
	<b>Team Gutenberg.</b> Problem: Semi-Supervised Learning for Text Analytics Models (sponsor: Office of the Director of National Intelligence): Provide recommendations on how to quickly labeling training sets for entity extraction and entity linking models. <a href="#">Final Presentation</a> <a href="#">Final Video</a>

2020	<b>Team Anthro Energy:</b> <a href="#">Stretchable Batteries</a> (Office of the Chairman of the Joint Chief of Staff) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Time Flies:</b> <a href="#">Eat, Sleep, Fly, Repeat</a> (United States Air Force) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Omniscient:</b> <a href="#">Surfacing Exploitable Data</a> (United States Air Force) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Helmsman</b> ( <a href="#">presentation</a> , <a href="#">video</a> ): <a href="#">Hide My Signature</a> (Joint Artificial Intelligence Center) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team ElectionWatch:</b> <a href="#">Improve Election Security and Safeguard the Information Environment</a> (Cyber Command) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Protocol One:</b> <a href="#">Identification of Protected Civilian Facilities</a> (Joint Artificial Intelligence Center) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team AV Combinator:</b> <a href="#">How Can the U.S. Government Best Accelerate Autonomous Driving?</a> (In-Q-Tel) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Seawatch:</b> <a href="#">Gone Fishing: Tracking China's Flotilla in the South China Sea</a> (Special Operations Command Pacific) ( <a href="#">presentation</a> , <a href="#">video</a> , <a href="#">slides</a> )

2021	<b>Team Project Agrippa:</b> <a href="#">Indo-Pacific Strategy</a> (Office of Naval Research) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team SilkNet:</b> <a href="#">Teaming for the Win</a> (Army Soldier Center and Army Research Lab) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Flexible Fingerprints:</b> <a href="#">Combating Malicious Cyber Actors' Use of Disposable Infrastructure</a> (National Security Agency) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Mongoose:</b> <a href="#">Open-Source Cybersecurity Tools</a> (National Security Agency) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Fleetwise:</b> <a href="#">Sorry, You Just Don't Meet My Standards</a> (Air Force) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team AngelComms:</b> <a href="#">Replacing Radios</a> (Defense Innovation Unit / In-Q-Tel) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Radicalization Inoculation:</b> <a href="#">Radicalization Inoculation</a> (Army) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Salus:</b> <a href="#">Next Generation of Cybersecurity</a> (Defense Logistics Agency) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team NeuroSmart:</b> <a href="#">In the Red Zone</a> (Army Research Lab) ( <a href="#">video</a> , <a href="#">slides</a> )
	<b>Team Engage:</b> <a href="#">In the Red Zone</a> (Army Research Lab) ( <a href="#">slides</a> )

#### Outcome:

2018	2019	2020	2021
The 6 teams in the Stanford Hacking for Defense course spoke to 620 stakeholders during 10 weeks. Team outreach and prototyping was supported by a reimbursement process that covered the cost of student travel for beneficiary discovery and prototype development. Teams used the funding to	The 8 teams in the Stanford H4D course spoke to over 820 stakeholders during 10 week-quarter. By the end the class, all of the teams realized that the problem as given by the sponsor had morphed into something bigger, deeper and much more interesting. Team outreach and prototyping was supported by a reimbursement process that covered the cost of student travel for beneficiary discovery and	We had the privilege of having 10 Senior Defense Leaders (all videos <a href="#">here</a> ), to include: <a href="#">Admiral Ellis</a> , <a href="#">General McChrystal</a> , <a href="#">General Petraeus</a> , <a href="#">General Brooks</a> , Secretary <a href="#">Bill Perry</a> , Secretary <a href="#">Condoleezza Rice</a> , Secretary <a href="#">Mattis</a> , <a href="#">Chris Moran</a> (Lockheed Martin Ventures), <a href="#">Anne Neuberger</a> (Director of Cybersecurity at the NSA), <a href="#">Lisa Herschman</a> (Chief Management Officer, DoD)  The 8 teams in the Stanford H4D course spoke to over 1,000	The 10 teams in the Stanford H4D course spoke to 1,142 stakeholders during 10 week-quarter. By the end the class, all of the teams realized that the problem as given by the sponsor had morphed into something bigger, deeper and much more interesting. Team outreach and prototyping was supported by the

<p>travel to Beale AFB, San Diego, Naval Postgraduate School, and Fort Bragg.</p> <p>The final presentations were held on 5 June. The event was attended or streamed by 155 people.</p> <p>4 of the 6 teams plan to continue working on their solutions (Acquiforce, Polaris, Sea++, and Theia) following the course. They will represent the first cohort to enter the H4D-NEPTUNE Accelerator Capability.</p>	<p>prototype development. Teams used the funding to travel to Beale AFB, San Diego, Naval Postgraduate School, and South Korea.</p> <p>The final presentations were held on 4 June. The event was attended by 78 and streamed by 94 people.</p> <p>Five of the 8 teams plan to continue working on their solutions (Learn2Win, DeepFakes, IntelliSense, Gutenberg, and Panacea) following the course. Learn2Win, DeepFakes, and Panacea will represent the first cohort to enter the H4D-NEPTUNE Accelerator Capability.</p>	<p>stakeholders during 10 week-quarter. By the end the class, all of the teams realized that the problem as given by the sponsor had morphed into something bigger, deeper and much more interesting. Team outreach and prototyping was supported by a reimbursement process that covered the cost of student travel for beneficiary discovery and prototype development.</p> <p>The final presentations were held on 5 June. The event was streamed by 435 people.</p> <p>7 of the 8 teams plan to continue working on their solutions following the course. 6 will represent the second cohort of the ONR-funded H4DLabs Accelerator.</p>	<p>NEPTUNE grant via a reimbursement process that covered the cost of student travel for beneficiary discovery and prototype development.</p> <p>The final presentations were held on 1 June. The event was streamed by 245 people.</p> <p>9 of the 10 teams plan to continue working on their solutions following the course. 4 will represent the third cohort of H4XLabs sponsored by Lockheed Martin.</p>
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## 2. Educate NEPTUNE colleges on Hacking for Defense

2018	<p>A NEPTUNE Student Summit was held at Naval Postgraduate School from 22-24 MAY. The Student Summit consisted of 24 students and educators. Over half were affiliated with the military. The activity was subcontracted to Hacking for Defense, Incorporated. The Summit sought to teach NEPTUNE school educators, students, and NEPTUNE-affiliated government personnel Lean methods to enable them to apply the methods to their research for the purpose of solving national security challenges. The topics covered were: Problem Curation, Beneficiary Discovery, Mission Model Canvas, and an Experimentation Primer and discussion of MVPs.</p> <p>A post-Summit survey consisting of 12 respondents (50% response rate: 7 students and 3 educators) reveals that there is much room for improvement for the 2019 Student Summit. On a 5-point Likert Scale (Poor, Fair, Good, Very Good, Excellent), participants were asked how they would rate the Student Summit overall. The responses are as follows: Poor – 0, Fair – 2, Good – 6, Very Good – 4, Excellent – 0. The reason for the low marks is due to the lack of aligning the product-based content with the research focus of the educator/student audience.</p> <p>Lessons learned from the Summit are already being incorporated into revisions for the 2019 Student Summit.</p>
2019	<p><b>Pre-ONR-H4X Summit Webinars</b></p> <p>Stanford executed 3 webinars with an average of 56 students/faculty. The purpose of the webinars was to provide prerequisite information leading up to Challenge Summit. The first webinar (2/27/19) introduced NEPTUNE-affiliated faculty and students to the new approach ONR was taking with H4X in the NEPTUNE 2.0 grant cycle. The second webinar (3/8/19) gave participants a background on the H4X process. The third (4/12/19) introduced students to the importance of curating their research problems to meet warfighter needs.</p> <p><b>Challenge Summit Overview</b></p> <p>The Office of Naval Research Hacking for Defense Challenge Summit was held by the Precourt Institute for Energy at Stanford University on May 28-30, 2019. 73 people attended the Summit, representing 14 different</p>



	<p>universities to include: Stanford University, UC Davis, MIT, Clarkson University, Washington State University, University of Utah, Purdue University, Naval Postgraduate School, Arizona State University, U.S. Naval Academy, University of Rhode Island, Penn State, Washington University St. Louis, and Carnegie Mellon University. In addition, representatives from the Naval Information Warfare Systems Command (previously SPAWAR) and ONR represented the Navy.</p> <p>Attendees were divided into 8 teams. Each team was assigned their own unique research problem by ONR from a pool of problems submitted by Principal Investigators prior to the event.</p> <p><b>Challenge Summit Content</b></p> <p>Over the three days, participants were taught the four core elements of H4X: problem curation, beneficiary discovery, experimental iteration, and the Mission Model Canvas (MMC). After learning each of the elements, teams applied these techniques to their group research problems during hands-on working sessions on refining the research statement, preparing and conducting stakeholder interviews, completing the MMC, and designing thought experiments to use during interviews. Three facilitators (Jeff Decker, Drew Gorham, and Nick Ueng) rotated amongst the teams to assist them with the tasks and answer questions. Participants learned that the success of the H4X process comes from rapidly testing their research hypotheses and problem knowledge with stakeholders and re-framing the research problem in an effort to “discover” where uniformed personnel needs align with academic research.</p> <p>At the end of the Summit, each team produced a draft of the MMC, which they presented to the larger group of attendees on the final day.</p> <p>Faculty participants attended two panel discussions that were moderated by Tom Byers; and an informational brief on the NEPTUNE 2.0 grant was delivered by ONR Code 33 Program Manager Maria Medeiros.</p> <p><b>Conference Survey Results</b></p> <p>Participants were given a 4-question post-Summit survey to determine the value of the event. 33 participants responded representing 45% of the attendees.</p>
2020	<p><b>NEPTUNE Challenge Summit Overview</b></p> <p>The NEPTUNE Challenge Summit scheduled at UC Davis in May 2020 was cancelled due to COVID-19. Instead, Stanford conducted a series of three webinars. One webinar took place on 5 May 2020. The others are scheduled for 25 June 2020 and 30 July 2020.</p> <p>The 5 May webinar was attended by 52 people from all 7 NEPTUNE schools. The purpose of the session was to help NEPTUNE projects transition their research from lab to market. The session introduced NEPTUNE faculty and students to the Naval Accelerator, Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research programs in the Navy and Air Force.</p> <p>Participants were polled on the helpfulness of the session. 40% Strongly Agreed and 60% Agreed that the session was helpful to transitioning their research.</p> <p><b>Pre-NURP Summit Webinars</b></p> <p>Stanford executed two webinars with an average of 34 participants. The purpose of the webinars was to provide prerequisite information leading up to Challenge Summit. The first webinar on 19 Sept 2019 introduced NURP personnel to the new grant requirements ONR expected from universities and mentors. The first webinar also introduced NURP PIs, students, and Navy mentors to the H4X methodology. The second webinar on 2 Oct 2019 introduced NURP participants to the importance of curating their research problems to meet Navy operational needs.</p> <p><b>NURP Challenge Summit Overview</b></p> <p>On 5-6 November 2019, 23 graduate students, university educators, subject matter experts, and government mentors and sponsors met at the University of Rhode Island for the NURP Summit. The goal of the Summit was to introduce NURP PIs, students, and warfare center mentors to the H4X methodology to better enable them to incorporate Navy undersea use-cases into their research for the purpose of advancing basic research into applied research, and, later, accelerate the technology transfer into the market. Attendees were introduced to the H4X methodology and then divided into 7 teams. Each team was assigned their own unique research problem by ONR from a pool of problems submitted by Principal Investigators prior to the event. The 7 research problems addressed the following topics:</p> <ol style="list-style-type: none"> <li>1) Unmanned Undersea Vehicle (UUV) developers need better optical sensing capabilities for improved underwater intelligence gathering.</li> </ol>



	<ol style="list-style-type: none"> <li>2) Deep-sea weapons designers need acoustic metamaterials to design structures with reduced vulnerability.</li> <li>3) Scientists and payload engineers need more data and physical understanding to design deep-sea composite structures that are reliable and long-term survivable.</li> <li>4) Subsurface Naval vessel operators need safe, energy-dense, and long-lasting batteries in order to increase mission endurance and capabilities.</li> <li>5) Biofouling: Short-term Problem: Vessel maintenance personnel need a more effective way to limit biofouling growth. Long-term Problem: Vessel maintenance personnel need to more frequently clean/groom the ship hull in order to mitigate biofouling growth.</li> <li>6) Mine countermeasure mission planners need to extend autonomous undersea vehicle mission time safely in order to successfully gather intelligence over greater areas.</li> <li>7) Someone in the Navy needs to know what objects are entering the water nearby (using acoustic data) in order to have increased situational awareness.</li> </ol> <p>Within their teams, attendees workshoped their research by incorporating H4X tools to include sessions on Problem Curation, the Mission Model Canvas, and Customer Discovery.</p> <p><u>Participants listed several highlights to the Summit – Participants liked:</u></p> <ul style="list-style-type: none"> <li>• learning that proposals could be improved by going beyond 6.1 looking towards teams to move to Naval readiness</li> <li>• discussions/interviews with SMEs</li> <li>• learning how to write proposals that are more relevant to the Navy</li> <li>• that each group had a guide that stuck with the team the entire time to coach them through using the Mission Model Canvas</li> <li>• facing the possibility that the research can have bigger or smaller effects than previously assumed</li> <li>• discussion/networking amongst peers</li> <li>• considering the broader implications of the research we do</li> </ul> <p><u>Participant listed areas of improvement – Participants would like:</u></p> <ul style="list-style-type: none"> <li>• Funding discussions of all sources along the tech development cycle from R&amp;D to fielding. (I am not tracking anything else on that sticky).</li> <li>• Tweak the MMC for existing projects</li> <li>• More SMEs present during interviews</li> <li>• Basic research examples to make it easier to understand</li> <li>• The scope of the problems statements was more clear</li> <li>• We knew that we were in charge of arranging interviews for the discovery session</li> </ul> <p><u>Key Takeaways</u></p> <ul style="list-style-type: none"> <li>• The H4X methodology holds the promise of improving basic research on Naval problems by encouraging early communication between researchers and end-users. However, building linkages to the operational navy across the research divide is a challenge. NURP mentors can begin to bridge the gap, but the NURP program would also benefit from metrics designed to measure operational value across research areas.</li> <li>• Introduction of new terminology and processes to University researchers proved be a challenge. Some researchers prefer the freedom to “conduct research for research’s sake” and not tie their work to an application. Though the push to operationalize research may drive greater value for the Navy, some research relationships may suffer.</li> <li>• Participants sought a greater understanding of the Naval S&amp;T development pipeline in addition to new approaches to problem solving. H4X provided a baseline to ideate Naval applications for their research and engage those that would use their technology. Adding an overview of the entire Navy S&amp;T pipeline would complete the picture for the research teams.</li> <li>• The teaching team learned the value of providing research examples that were relevant to this audience. The team will update Problem Curation and Mission Model Canvas presentations with examples that are more effective and research oriented.</li> </ul>
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2021	<p>Stanford University supports two ONR programs: 1) the Naval Enterprise Partnership Teaming with Universities for National Entrepreneurship (NEPTUNE) and the Naval Undersea Warfare Program (NURP). Stanford supported these programs by holding a NURP and NEPTUNE Summit where program personnel learned about H4X methodologies and how to apply them to their research.</p> <p>The grant was used to fund NEPTUNE and NURP online webinars (due to COVID). The purpose of all webinars was to provide NEPTUNE and NURP-affiliated students, faculty, and Navy mentors with a foundational understanding of the methodology used in Hacking for Defense, called H4X. H4X is designed to help faculty and students align their research to solving real-world national security problems.</p> <p>Over the year, Stanford conducted 16 events with ONR's NEPTUNE and NURP programs and developed a workbook to assist projects in transitioning their research.</p> <p>9 of the events supported NEPTUNE to include 3 webinars on H4X tools, three hands-on sessions, two "Sponsor Summit" webinars where Navy and Defense Department organizations presented on opportunities that aligned with NEPTUNE projects, and the NEPTUNE Annual Review. Attendee comments regarding the events were:</p> <ul style="list-style-type: none"> <li>• 100% of the attendees felt that the online webinars are helpful to applying their research to Navy problems</li> <li>• Attendees appreciate: <ul style="list-style-type: none"> <li>○ "engaging with more defense customers and technology buyers"</li> <li>○ "discussions and having an example of real problems getting scaled"</li> <li>○ "learning about potential follow-on opportunities"</li> </ul> </li> </ul> <p>In addition, 7 of the events supported NURP to include 3 webinars on H4X tools, three hands-on sessions, and support for the NURP Annual Review. Attendee comments regarding the events were:</p> <ul style="list-style-type: none"> <li>• 80% of the attendees are "highly motivated" and 20% "motivated" by NURP-Stanford activities</li> <li>• Attendees have commented on the value of the program: <ul style="list-style-type: none"> <li>○ "It is a helpful way to find more usefulness to the research we do."</li> <li>○ "Useful to helping me connect with people who will benefit from my work."</li> </ul> </li> </ul>
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### 3) Military and veteran engagement

The level of military-affiliated engagement with the Stanford H4D Project was significant. With regards to the Stanford H4D course:

2018	<ul style="list-style-type: none"> <li>• 27% of the students in the class were military-affiliated (6 veterans, active-duty, reserve, or ROTC out of 22 total students)</li> <li>• 9 senior military officers served as liaisons to the student teams. Military liaisons worked to both connect students to defense and intelligence personnel as well as to help them effectively communicate with the defense sector.</li> <li>• 9 instructors and advisors involved with the course, nearly half (4) are from the military-affiliated community</li> <li>• 6 military-affiliated student mentors</li> <li>• In addition, the class hosted a constant flow of roughly 4 active duty military and intelligence community personnel each week. These personnel did not have any formal affiliation with the course.</li> </ul> <p>There was an even greater military-affiliated engagement rate at the Student Summit. Of the 24 participants, over half were from the military-affiliated community due to NEPTUNE's broad focus on incorporating veterans into their activities.</p>
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2019	<ul style="list-style-type: none"> <li>• 29% of the students in the class were military-affiliated (10 veterans, active-duty, reserve, or ROTC out of 34 total students)</li> <li>• 8 senior military officers served as defense mentors to the student teams. Military liaisons worked to both connect students to defense and intelligence personnel as well as to help them effectively communicate with the defense sector.</li> <li>• 9 instructors and advisors involved with the course, nearly half (4) are from the military-affiliated community</li> <li>• In addition, the class hosted a constant flow of roughly 4 active duty military and intelligence community personnel each week. These personnel did not have any formal affiliation with the course.</li> </ul>
2020	<ul style="list-style-type: none"> <li>• 16% of the students in the class were military-affiliated (5 veterans, active-duty, reserve, or ROTC out of 32 total students)</li> <li>• 10 senior military officers served as defense mentors to the student teams. Military liaisons worked to both connect students to defense and intelligence personnel as well as to help them effectively communicate with the defense sector.</li> <li>• 9 instructors and advisors involved with the course. 89% (8) are from the military-affiliated community</li> <li>• In addition, the class hosted a constant flow of roughly 15 active duty military and intelligence community personnel each week. These personnel did not have any formal affiliation with the course but observed weekly classes and offered input to students.</li> </ul>
2021	<ul style="list-style-type: none"> <li>• 19% of the students in the class were military-affiliated (8 veterans, active-duty, or reserve out of 42 total students)</li> <li>• 10 senior military officers served as defense mentors to the student teams. Military liaisons worked to both connect students to defense and intelligence personnel as well as to help them effectively communicate with the defense sector.</li> <li>• 9 instructors and advisors involved with the course. 89% (8) are from the military-affiliated community</li> <li>• In addition, the class hosted a constant flow of roughly 15 active-duty military and intelligence community personnel each week. These personnel did not have any formal affiliation with the course but observed weekly classes and offered input to students.</li> </ul>

#### 4) Develop an H4D-NEPTUNE accelerator capability

2018	<p>In preparation for launching the H4D-NEPTUNE accelerator capability in September 2019, the Stanford H4D Project has begun laying the groundwork for the capability in three primary ways:</p> <p>First, H4D formed a partnership with StartX, a Stanford-based Accelerator. StartX will serve as a follow-on to the Spring Quarter course where students enter into a student-in-residence program consisting of 10 weeks of support. StartX will help those teams solidify product-mission fit, find product-market fit in commercial markets, as well as provide logistical support to include disk space, legal support, and IT support. Applications for the H4D-StartX program will be open in July 2018.</p> <p>Second, the Stanford H4D Project is exploring partnerships with other Stanford-based and off-campus organizational support. An example of developing campus-based support for H4D teams includes forging a partnership with the sustainable energy accelerator called TomKat as well as exploring ways that the Office of Technology Licensing can help expedite student team patents or employ Stanford patents to accelerate team prototype development.</p> <p>As for off-campus resources, the H4D-NEPTUNE accelerator capability is developing a “concierge” function whereby it leverages its relationships with Silicon Valley accelerators and incubators, such as Elemental Excelsior, Cyclotron Road, and PCH, to align teams working in specific disciplines with entities with unique subject matter expertise.</p> <p>Third, the Stanford H4D project is also exploring ways to accelerate teams pre-class by partnering with other project-based experiential courses on campus such as Startup Garage, Design for Extreme Affordability, and Lean Launchpad. These partnerships could prove to be invaluable to helping H4D develop and deploy their solutions by either funneling H4D teams into other classes to learn skills such as business model development</p>
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	<p>or pitching to venture capitalists or funnel projects from other courses that are working on a dual-use product into Hacking for Defense to match their prototype to DoD/IC challenges.</p>
2019	<p>The Stanford H4D Project launched H4XLabs, an accelerator capability that provides select student teams graduating from the H4D course at Stanford support beyond the course.</p> <p>The purpose of Stanford H4D activities are to:</p> <ul style="list-style-type: none"> <li>• Instill lean innovation methods and thinking in faculty, students, and government and military personnel;</li> <li>• Engage talented faculty, students, professionals, and entrepreneurs in classes and events to help them develop new concepts, technologies, and startup companies aimed at solving defense-related challenges.</li> </ul> <p>H4XLabs goal is to advance concepts, technology, and ventures arising from Stanford H4D educational, training, and course activities to better meet ONR, Department of Navy, Department of Defense, and Intelligence Community priorities. H4XLabs endeavors to accomplish this by providing a range of services to transition ideas, concepts, and technologies into market-ready and government-deployable solutions. The effort will simultaneously increase the number of commercial-oriented start-up and nontraditional companies working in defense related fields and grow a professional workforce emphasizing military veteran involvement with knowledge in both defense mission needs and the commercial marketplace. Significantly, this effort will create concept-to-adoption pathways for artificial intelligence, cyber security, and energy network technologies and products to reach defense systems and operators.</p> <p><b>Specifications</b></p> <p>H4XLabs will focus on accelerating viable, and Department of Navy-relevant, concepts and technologies coming out of Stanford H4D engagements beginning in in CY2019. Our goal will be to provide support up to five teams, or partially formed teams during this foundational period. The effort includes four tasks (Task execution may overlap).</p> <p><b>Task 1: Team Formation Sourcing and Company Creation Advisory Services</b></p> <p>H4XLabs will provide up to 25 hours of support per month per team of advisory support to the teams identified by Stanford H4D as having relevance to ONR priorities. The goal of Task 1 is to transition teams into businesses by assisting them developing strong ties with the sponsor, identifying pathways to bringing their solution to fruition as a startup, navigating creating a dual use startup.</p> <p>These services will ready teams to begin developing their business model in Task 2 – Pre-Incubation Services. The duration of Task 1 is an ongoing task for H4D teams and identified efforts for the next 5 months.</p> <p><b>Task 2: Pre-Incubation Services - Creating Investment Ready Companies</b></p> <p>Task 2 helps companies become investment-ready by assisting them in developing their business models. These services center around, creating a fundable team, validating Product- Mission Fit (are they creating something that really is needed), validating the technology path and working to get the team to an investable technology readiness level (TRL), and, finally, validating government and commercial paths to adoption of the technology. The outcome of Task 2 will be producing teams that are well positioned to gain government (e.g. SBIR) and commercial (e.g. venture capital, angel investor, and/or incubator/accelerator) support and/or funding. Task 2 will provide up to 4 months of services per team.</p> <p><b>Task 3: Next-Step Funding Services</b></p> <p>Task 3 focuses on coaching and mentoring teams to prepare them for government and commercial funding. Some Next-Step Funding services include assisting teams in creating a funding strategy around commercial, defense, or dual-use tracks, locating appropriate funding pathways, and helping them prepare their pitch or application for those government and/or commercial opportunities. Teams will start near the end of Task 2. It is expected that teams will not be of sufficient IRL level to move out of Pre-Incubation and some interim funding pathways will be part of the process.</p> <p><b>Task 4: Team Stipends</b></p> <p>H4XLabs will provide direct stipends between \$10,000 (ten thousand) to \$20,000 (twenty thousand) to support teams as they continue to develop their technologies. The amount of stipend will depend on each team's investment readiness level based on their technology's IRL, TRL, and ARL.</p>

2020	<p>The Stanford H4D Project partnered H4X Labs, an accelerator capability that provides select student teams graduating from the H4D course at Stanford support beyond the course.</p> <p>The purpose of Stanford H4D activities are to:</p> <ul style="list-style-type: none"> <li>• Instill lean innovation methods and thinking in faculty, students, and government and military personnel;</li> <li>• Engage talented faculty, students, professionals, and entrepreneurs in classes and events to help them develop new concepts, technologies, and startup companies aimed at solving defense-related challenges.</li> </ul> <p><b>Introduction</b></p> <p>H4DI through collaboration with H4X Labs provided dual-use startup support and educational support to two and a collection of partial teams from the 2019 Stanford Hacking for Defense course. The complete teams were Learn2Win and Deep Fakes. In addition, H4DI provided counseling to a number of H4D students as they determined their future career choices.</p> <ul style="list-style-type: none"> <li>• Learn2Win (L2W) built a software platform to increase Air Force fighter pilot training readiness.</li> <li>• Deepfakes prototyped a system to detect AI-generated fakes to combat misinformation.</li> <li>• L2W completed the entire program, while DeepFakes chose to postpone their engagement until they gained more team alignment.</li> <li>• Panacea - Prototyped a concept for innovation management tools within organizations.</li> <li>• 5 individual students participated in the class looking for guidance.</li> </ul> <p>With the support of H4X Labs, Learn2win was able to:</p> <ul style="list-style-type: none"> <li>- Receive \$750K in Air Force SBIR Funding and successfully grow their customer traction from the pilot to the maintainer communities.</li> <li>- Build a strategy to refine their product and customer approach to receive an additional \$1.75M in Naval SBIR funding (closing soon).</li> <li>- Leverage DoD traction to raise venture funding, usually a barrier with traditional VCs.</li> <li>- Navigate the complex DoD security accreditation process to deploy their product.</li> <li>- Help raise their Technology Readiness Level by helping them put in place a product strategy, increased their Adoption Readiness Level by helping them get initial government contracts, and raised their Investment Readiness level to actually receive Venture Funds.</li> </ul> <p>A few quotes from the Andrew Powell, CEO of L2W</p> <ul style="list-style-type: none"> <li>• "Our experience with H4X Labs was phenomenal to demystify the DoD environment and make strategic connections. I learned more in each 30 min phone call than I would have learned in months. If we didn't have those connections we'd be spinning in circles."</li> <li>• "H4X Labs helped us understand long term opportunities within the DoD and position ourselves to speak to a broader vision with investors. From the early days of H4X Labs, Steve has been asking the right questions to build strategy, so I felt prepared going into the VC fundraising process."</li> </ul> <p>Other Teams received training, initial education, and basic strategic counseling and mentoring, but over the course of the period decided to stay in school and take the learnings but delayed the company formation.</p> <p><b>Goals and Key Results</b></p> <p>The goals of our program are to support these teams with:</p> <p><b>Team Formation Sourcing and Company Creation Advisory Services</b></p> <p>The goal is to transition teams into businesses by assisting them:</p> <ul style="list-style-type: none"> <li>• Developing strong ties with the sponsor</li> <li>• Identifying pathways to bringing their solution to fruition as a startup</li> <li>• Navigating how to create a dual use startup</li> </ul> <p><b>Key Result (A): Developing strong ties with the sponsor</b></p> <ol style="list-style-type: none"> <li>1. Built weekly sponsor development strategies to grow key sponsor relationships allowing Learn2Win (L2W) to close their Phase II SBIR funding for \$750k. Built strategies to explore adjacent commercial markets to bolster their SBIR funds.</li> <li>2. Increased L2W's product reach by helping the team grow from the initial AF pilot sponsor to maintainer communities and other training institutions. Advised the team on sponsor best practices as they undertook their "road show" to demo the product at Naval bases.</li> </ol>
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	<ol style="list-style-type: none"> <li>3. Connected L2W to 10+ potential sponsors in the government (AFWERX; ONR; NAVAIR- Pax River; AMC- C17 Training Directorate; AETC - AF University SOC Training Directorate) and with Prime Contractors (BAE- Fast Labs, FLIR- Training Directorate, Lockheed Martin Ventures) for additional customer opportunities.</li> <li>4. Helped DeepFakes to understand the potential sponsor landscape for validating their problem approach with customers in the DoD and IC.</li> </ol> <p>Key Result (B): Identifying pathways to bring their solution to fruition as a startup</p> <ol style="list-style-type: none"> <li>1. Helped Learn2Win connect with relevant stakeholders through understanding feature requirements for DoD and commercial customers. Provided customer segmentation training to identify distinct customer segments within gov enterprise. Outcome was L2W developed their product roadmap strategy in line with their SBIR solicitation.</li> <li>2. Charted out different product value propositions, helping to prioritize initial customers. Provided interview coaching and best practices for deeper customer discovery, helping L2W to set customer outreach strategy.</li> <li>3. Guided L2W through foundational startup requirements such as: hiring team members, distributing equity, fundraising strategy, company structure setup, etc.</li> <li>4. Provided guidance to DeepFakes to undertake a competitive analysis, and conduct an internal company diagnostic to determine capacity gaps to fill. This review caused the company to evaluate their current position and realize they needed increased team buy-in to move forward.</li> </ol> <p>Key Result (C): Navigating how to create a dual use startup</p> <ol style="list-style-type: none"> <li>1. Guided L2W on how to distribute their effort between their commercial athletic market and their DoD effort. Helped leverage their athletic brand and traction as a way to boost their reach within DoD.</li> <li>2. Highlighted dual-use specific best practices for building DoD focused startups. Gave insight on customer pipeline timelines, government engagement opportunities (tech demos, RFIs, RFPs, etc.) and connections into relevant customers within DoD. Provided an overview on a DoD focused startup's journey, giving L2W an initial "map" of what it takes to build a dual-use company. Help them strategize and understand the next steps.</li> <li>3. Ensured L2W could work with government clients by assisting to set up nuanced back-office (accounting, legal, etc.) functions necessary to engage in DoD work (DUNS Number, CAGE Code, DoD Program Office recs, gov-specific accounting systems, etc.). Helped navigate bringing on a new C-level leader to build out the DoD vertical of L2W.</li> </ol> <p><b>Pre-Incubation Services - Creating Investment Ready Companies</b></p> <p>The goal is to help companies become investment-ready. Outcome will be producing teams that are well positioned to gain government (e.g. SBIR) and commercial (e.g. VC, angel investor, and/or incubator/accelerator) support and/or funding. H4XLabs helped by:</p> <ul style="list-style-type: none"> <li>• Validating Product- Mission Fit to see if the product will solve a large problem</li> <li>• Validating the technology path to reach investment readiness level</li> <li>• Validating government and commercial paths to adoption of the technology</li> </ul> <p>Key Result (A): Validating Product-Mission Fit</p> <ol style="list-style-type: none"> <li>1. Built strategy for Learn2Win to approach highest value customers. Performed customer stakeholder mapping advice to understand the scope of training problems within different training program offices in the AF and Naval communities. Identified potential early adopters and connected L2W for customer interviews. Delineated different value propositions across the acquisitions chain (i.e. how to approach end users vs. economic buyers vs. security officers).</li> <li>2. Helped refine L2Ws approach to aircraft training communities, leading to more inbound interest in product demos. Reviewed weekly customer discovery updates and built strategies for L2W to grow their understanding of the product-mission fit of their software. Provided materials to L2W Helped the team to prepare for interviews and site visits, boosting their customer outreach.</li> <li>3. Guided L2W through constraints for their product-mission fit. Provided insights on product specifics (UI, engineering approach, hardware requirements) to ensure L2W was able to work within government systems. Guided L2W through future projections on technological and customer trends in the training space.</li> </ol>
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	<p>4. Conducted a deep dive on the Value Proposition and Mission Model Canvases to understand DeepFake's product-mission fit. This guidance caused DeepFakes to revisit if their product met a need outside of their initial sponsor's requirement.</p> <p><b>Key Result (B): Validating the technology path to reach investment readiness level</b></p> <ol style="list-style-type: none"> <li>1. H4XLabs helped identify L2W's competitive advantages and worked to build communication strategies for potential customers. H4XLabs undertook competitor analysis with training platforms both in the commercial and DoD sector to help L2W prioritize their competitive moat in order to boost investment.</li> <li>2. Increased the defensibility of L2W's IP position by reviewing current IP strategy and identifying potentially critical gaps. Built strategies for being awarded IP protection (copyright, trademark, etc.). Provided guidance on DoD specific IP questions (ownership, data sharing etc.) to ensure L2W maintained control of their product and became more attractive to investors.</li> <li>3. Helped L2W develop more efficient ways to develop their product to meet government needs. Provided technological guidance on L2W's tech stack and product roadmap approach. This included migration to Amazon Web Services servers, planning for future product shifts (VR training, etc.), as well as nuanced questions about the software development plan.</li> </ol> <p><b>Key Result (C): Validate government and commercial paths to adoption of the Technology</b></p> <ol style="list-style-type: none"> <li>1. Provided continuous support on L2W's AF SBIR award application to meet award milestones. Also helped build Naval SBIR specific strategy that has enabled L2W to reach the final stage of closing a Navy \$1.75M SBIR award (in current process). H4XLabs provided support by connecting L2W with leadership of maintainer communities across the AF and Navy as to validate the needs of their product.</li> <li>2. Guided L2W through a complex security accreditation process in order to obtain an Authority To Operate (ATO) to deploy their technology with AF clients. Covered best practices on the overall ATO process, provided insight on typical failure points, and built strategies with the team on approaching gov security officials with their ATO requests. Our process sped up L2W's ATO journey and helped them avoid critical pitfalls that derail security accreditation and block adoption.</li> <li>3. Helped L2W chart out the key metrics to understand if their platform was driving value for customer adoption. Consulted the team on how to demonstrate their results to boost the value of their training approach with stakeholders.</li> </ol> <p><b>Next-Step Funding Services:</b></p> <p>The goal is to coach the teams to prepare them for government and commercial funding. H4XLabs helped by:</p> <ul style="list-style-type: none"> <li>• Assisting teams in creating funding strategy around commercial, defense or dual-use tracks</li> <li>• Locating appropriate funding pathways</li> <li>• Helping teams prepare their pitch or application for those government and/or commercial opportunities</li> </ul> <p><b>Key Result (A): Assisting teams in creating funding strategy around commercial, defense or dual-use tracks</b></p> <ol style="list-style-type: none"> <li>1. Built funding strategies in response to AFWERX Strategic Funding application for a potential \$6M investment across defense and commercial funding. Provided feedback on L2W's application and gathered insight from different BMNT program teams to help L2W navigate their approach to the award. Reviewed how the new influx of funding could affect founder control of the company.</li> <li>2. Provided guidance on strategies needed to bridge from SBIR funding to Program Office funding (sometimes known as SBIR III funding). Covered the differences between SBIR and Federal Acquisitions Regulations (FAR) processes as it relates to L2W. This guidance helped build L2W's long-term DoD strategy.</li> <li>3. L2W received pushback from VCs against working with the DoD due to complexity of government work. H4XLabs has found this pushback to be ubiquitous across the venture community. As such, we provided strategies on reframing L2W's DoD work as a competitive advantage instead of a barrier to funding. Helping to communicate the value of their DoD traction served a critical part in raising L2W's VC round, which they plan to close this month.</li> </ol> <p>From L2W Co-Founder: "Working with DoD shows L2W's ability to build a product to scale from 50 users, to 3000, then to 50,000 users. This path allowed us to build our product to enterprise specs quickly, de-risking the tech and making our offering more appealing to commercial customers."</p>
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	<p><b>Key Result (B): Locating appropriate funding pathways</b></p> <ol style="list-style-type: none"> <li>1. Provided insight into different avenues of funding within the DoD to ensure the most effective approach to program offices. Covered nuances within gov budgeting and timelines to ensure L2W pursued the correct “color of money”. Built strategies on alternative approaches to gov program offices to make L2W’s discovery efforts more effective.</li> <li>2. Reviewed contracting vehicles of relevance to L2W. Covered Other Transaction Authorities (OTA), Commercial Service Offerings (CSO) as well as Broad Area Announcements (BAAs) and consortium approaches. Guidance included a strategy for the various contract vehicle types, what to push for in contract language, and effective protection of IP</li> <li>3. Helped L2W create a scalable pricing strategy for customers. Covered the differences between gov and commercial approaches to SaaS pricing. Built customer discovery strategies to understand a government customer’s pricing limit.</li> </ol> <p><b>Key Result (C.): Helping teams prepare their pitch or application for those government and/or commercial opportunities</b></p> <ol style="list-style-type: none"> <li>1. Helped L2W reframe their approach to close both commercial and defense funding. Provided pitch coaching for both commercial and government customers to develop tailored fundraising approaches. Gave feedback to L2W on presentation decks and outreach collateral.</li> <li>2. Hosted an emergency session to respond to how the COVID-19 crisis would affect L2W’s fundraising timeline. Provided guidance on the importance of closing funds quickly and offered immediate insight on adjusting company burn rate.</li> <li>3. Attended the Pear Ventures Demo Day in support of L2W and gave feedback on their presentation.</li> </ol> <p><b>Team Stipends</b></p> <p>Stipends were provided to L2W. The other two teams did not proceed to the point of achieving the requirements to receive funds. The requirements were put in place to ensure that the teams were dedicated to build a company.</p> <p><b>Summary</b></p> <p>H4X Labs was able to provide pivotal guidance to L2W that helped launch the company from a team of students to a VC funded company with the DoD as a customer. The other teams and individuals received who participated were educated in the ways of creating dual use companies and realized that as students they were not ready. A few are looking toward careers when they graduate in dual-use National Security Sector and learned the basics of taking a problem and a small company and making a business.</p>
<b>2021</b>	<p>The Stanford H4D Project partnered H4X Labs, an accelerator capability that provides select student teams graduating from the H4D course at Stanford support beyond the course.</p>

### **C. Training Opportunities**

#### ***A description of opportunities for training during the reporting period***

See the "Educate NEPTUNE colleges on Hacking for Defense" subheading under the "Accomplished under goals" entry.

### **D. Results Dissemination**

A description of dissemination during the reporting period

1. H4D University Course Development and Execution
2. Educate NEPTUNE colleges on Hacking for Defense
3. Military-affiliated engagement
4. Develop an H4D-NEPTUNE accelerator capability

### **E. Plans for the next reporting period**

This grant ended on August 31, 2021. Stanford has been awarded another grant to focus deliver on similar objectives.

### **F. Honors and Awards received during the reporting period**

Jeff Decker and Mrinal Menon, "Bringing the Army to Innovation," (December 24, 2020) *War on the Rocks*: <https://warontherocks.com/2020/12/bringing-the-army-to-innovation/>

Mrinal Menon and Jeff Decker, "Why the defense industry could be the most transformative market for startups," (May 10, 2021) *Fast Company*: <https://www.fastcompany.com/90634168/why-the-defense-industry-could-be-the-most-transformative-market-for-startups>

### **G. Technology Transfer (patent applications, inventions, licenses, interaction with DoD laboratories)**

N/A