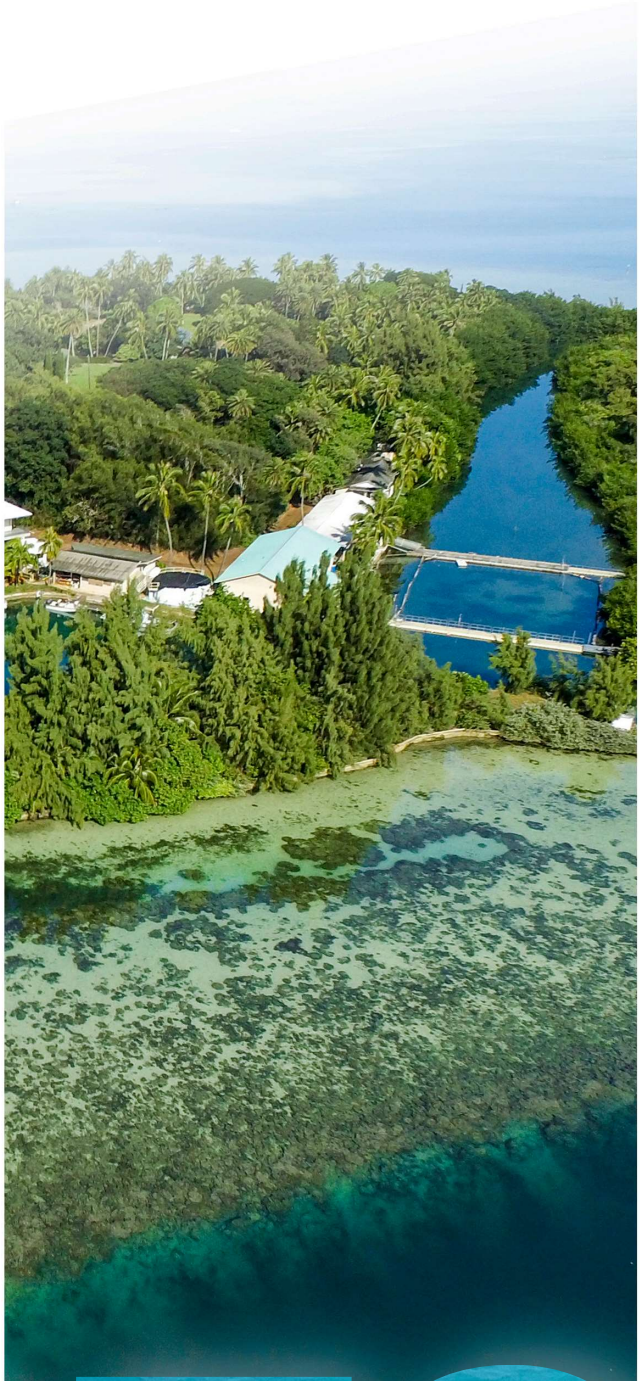
EXECUTION REPORT



# TIDES

**Technology Incubation Demonstration and Experimentation Support (TIDES)**
**March 5 & 6 2020**
**Applied Research Laboratory at the University of Hawaii**

Applied Research Laboratory
University of Hawai'i

Technology Incubation, Demonstration and Experimentation Support (TIDES) Execution Report

May 2020

This report provides a summary of activities, participating organizations, demonstrated technologies and demonstration locations during the inaugural Technology Incubation, Demonstration and Experimentation Support (TIDES) event conducted in Honolulu, Hawaii on March 5 and March 6, 2020.

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## Introduction

This report provides information on the inaugural Technology Incubation, Demonstration and Experimentation Support (TIDES) event conducted at Coconut Island, Bellows Air Force Station (BAFS), and the Applied Research Lab (ARL) at the University of Hawaii (UH) in Honolulu, Hawaii on 5-6 March 2020. TIDES is a test and evaluation (T&E) platform where innovative technologies can be incubated in Hawaii and tested and assessed with warfighter involvement in operationally relevant environments.

The TIDES design comprises three parts. The first part (incubation) is to conduct initial testing of emerging technologies in Hawaii to assess the technology's readiness in an isolated or integrated setting and identify problem areas that need to be addressed before introducing the technology to the warfighters. After follow-on development has been conducted to resolve technical issues, the second and third phases of TIDES (demonstration and experimentation) are to insert the technologies, with unit sponsorship, into exercises or training events for user-operational military utility assessment.

ARL, with support from the United States (US) Department of Defense (DoD) Indo-Pacific Command (INDOPACOM) unified combatant command and industry partners, is uniquely positioned to conduct air, ocean surface, ground and/or underwater testing in Hawaii due to proximity and access to DoD and non-DoD test sites, access to warfighting units, and because of Hawaii's mild climate and environmental diversity. By partnering with technology partners and the warfighting community, ARL is able to focus on all aspects of technology performance and military utility. Applying the TIDES process for T&E provides a holistic look at technology performance that goes beyond the technical. It allows scrutiny of other factors, such as cultural, environmental, and interoperability aspects that go into assessing technology readiness and capability. TIDES will help enrich collective assessments of technologies, to better understand and be aware of the multiple considerations affecting operational effectiveness. Only field testing, largely unscripted, can provide this level of value – illustrating the effects of weather, wind, water, blowing sand, radio frequency interference, communications disruption that occur, and the impact these chaotic elements can have on the decision chain and human-machine interaction.

## Background

The ARL recently established the TIDES framework in Hawaii. TIDES is a T&E platform where technologists can incubate innovative technologies in diverse, realistic settings, identify and address technical issues, and then test and assess the technologies with direct warfighter involvement in operationally relevant environments. The first TIDES event was designed to introduce stakeholders to two of Hawaii's test areas – Coconut Island (owned and operated by UH) and BAFS (owned and operated by DoD). To enable a collaborative and productive inaugural event, ARL invited DoD, industry, and academic partners to provide ideas and technologies to help shape the demonstration scenario.

## Locations

### Coconut Island

The first day of the TIDES event featured technology demonstration scenarios at Coconut Island and BAFS (Figure 1). The second day featured a hot wash discussion at the ARL offices in Honolulu.

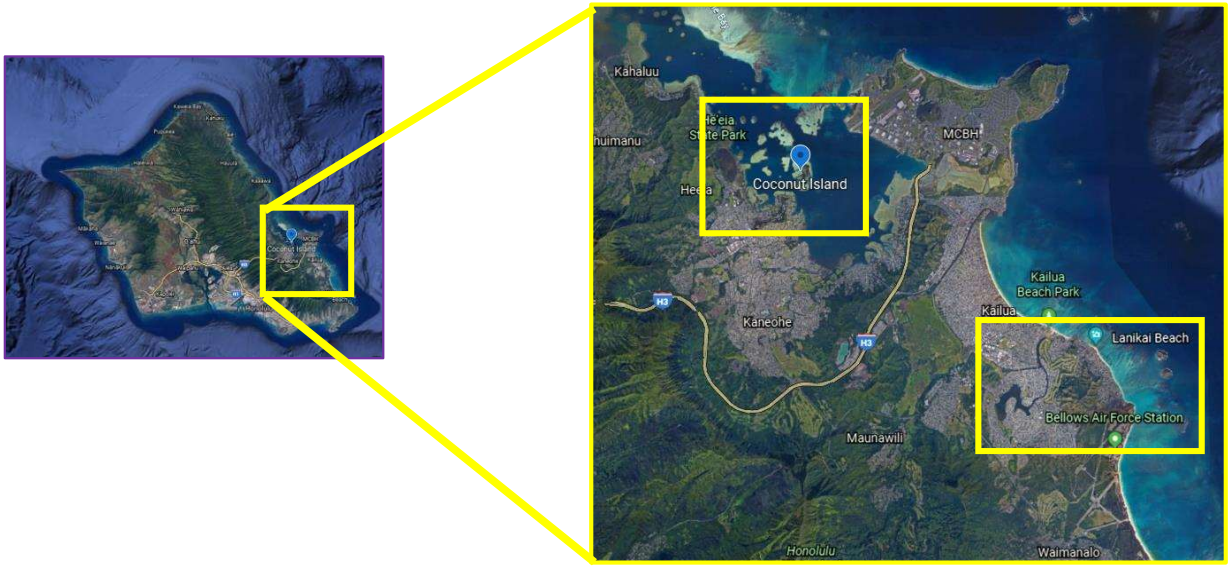


*Figure 1 - (Left) Map of Oahu, Hawaii indicating the windward side of the island. (Right) Detail of the map showing Coconut Island and BAFS on East Coast of Oahu.*

Coconut Island, located in Kaneohe Bay, Oahu and operated by the Hawaii Institute of Marine Biology (HIMB) at UH, primarily conducts marine conservation research. Coconut Island (Figure 2), is immediately surrounded by a shallow-water, littoral reef environment, and has served the ARL as an ideal T&E site for aerial, surface, and underwater vehicles with controlled public access. Convenient boat service provides transportation of people and equipment from Oahu to Coconut Island, which hosts a world-class laboratory and supporting infrastructure including docks and vessels, workshops, classrooms, and conference rooms. Internet and electric power throughout the Coconut Island facilities provide connectivity and capability equivalent to those on Oahu. Coconut Island easily supports programs with 100 participants. The Federal Aviation Administration (FAA) low altitude authorization and notification capability allows Unmanned Aerial Systems (UAS) flights in accordance with Federal Acquisition Regulation (FAR) Part 107 to be conducted under 100 feet above ground level for the majority of Kaneohe Bay except directly in the flight path for the Marine Corps Base Hawaii (MCBH) active runway (airport symbol NGF; shown upper-left Figure 2). This airspace access can support academic or contractor-sponsored UAS operations. For government-sponsored UAS programs in this airspace, authorization under the Department of the Navy Airspace Access Authorization (AAA) procedures is available.

*Figure 2 - Coconut Island, located within Kaneohe Bay, Oahu. This image shows the proximity of the MCBH active runway to Coconut Island (see upper-left corner).*

## Bellows Air Force Station

BAFS (Figure 3), located in Waimanalo, Oahu, serves the important morale, welfare and recreation mission for military families. Secondary mission sets at BAFS include resilience and training. ARL regularly conducts T&E operations involving UAS and other emerging technologies in support of INDOPACOM and component services at BAFS, helping expand BAFS's functionality as a T&E and innovation site for emerging military technologies. In its unique non-strategic status, BAFS presents a superb opportunity for T&E activities from initial concept through pre-deployment training with site access and operational requirements scaled to mitigate risk.

BAFS has multiple terrains for testing including a former active airfield, unpopulated coastline, open fields, deep forest canopy, abandoned cantonment, freshwater streams and ocean conditions that range from still water to active surf. BAFS airspace is FAA Class G, enabling ARL and contractor UAS operations under FAR 107, FAA Educational Interpretation, or Certificate of Authorization. Government-sponsored UAS operators can be authorized under AAA. Coordination of air activities with adjacent Marine Corps Training Area Bellows (MCTAB) range safety officer ensures that ARL operations are deconflicted with MCTAB operations. BAFS site leadership and their security team have welcomed appropriately designed T&E events developed by ARL, supporting these activities through base access and equipment rental for shelter and power in the field. BAFS personnel monitor and participate in ARL-planned programs on site.


*Figure 3 - Aerial view of BAFS showing (inactive) runway 03-21 and the shoreline where TIDES operations took place in March 2020. Inset: TIDES Main Operating Base (MOB) prior to the T&E exercise.*

## Additional Ranges

The inaugural TIDES event showcased only two of Hawaii's available test areas. Listed below are other DoD test ranges and non-DoD-controlled sites that can be made available to the DoD community for technology testing. For more information on these test areas, please contact ARL.

*DoD*

- Makua Valley Kahuku Training Area
- Marine Corps Training Area Bellows
- Pacific Missile Range Facility
- Pohakuloa Training Area
- Schofield Barracks Schofield East Range

*Non-DoD*

- Kilo Nalu and Aloha Underwater Cabled Observatories
- Lanai Island aerial and stratospheric flight operations
- University of Hawaii Marine Center, Honolulu Harbor
- Waimanalo Experimental Farm
- Wave Energy Test Site

**TIDES Spring 2020 Participating Organizations**

**ARL** serves as a research center of excellence for critical Navy and national defense, science, technology, and engineering with a focus on naval missions. As a designated Navy-sponsored University-Affiliated Research Center administered by the UH System, ARL conducts strategic research for DoD and other government agencies in several core competency areas including ocean environmental effects; astronomical research; advanced electro-optical systems, detectors, arrays and instrumentation; environmental sensor research and remote sensing; new renewable energy; and mission-related and public-services oriented research and development.

**HIMB** conducts, promotes and supports research and training in tropical marine biology and is a world leader in research aimed at understanding and conserving tropical marine ecosystems. HIMB is home to over 100 researchers, postdocs, students and staff who leverage the unique setting of Coconut Island to implement cutting-edge research and develop new technologies that advance informed stewardship of marine and coastal biodiversity both in Hawaii and globally.

**BAFS** is a US military reservation located in Waimanalo, Oahu, Hawaii. An essential airfield during World War II, BAFS now serves as a recreation area for active and retired DoD military and civilian employees. BAFS is operated by Detachment 2, 18th Force Support Squadron of the 18th Mission Support Group based at Kadena Air Base, Okinawa, Japan. BAFS is currently commanded by Major Stephen C Hodgson US Air Force (USAF).

**Naval Air Warfare Center, Aircraft Division (NAWCAD) Avionics Engineering** provides the engineering personnel, processes, tools and facilities required by Naval Air Systems Command (NAVAIR) and the Program Executive Officers to accomplish the technology research, systems development, acquisition, and in-service support of naval avionics, mission systems, equipment and associated architectures and operating software required for support of naval aviation Integrated Warfighting Capabilities and Electromagnetic Maneuver Warfare. This includes providing system engineering, integration, design, analysis, prototyping, tests, evaluation, and in-service, sustainment support and products related to advanced architectures, mission computers and processors, communications; navigation; controls; displays; mission sensors; instruments; antennas; armament control; information and electronic warfare; interface devices; electronic data buses; mission planning; aviation-related ship and shore-based electronics; other related systems and equipment; and associated operating software.

**IDEMIA - National Security Solutions (NSS)** is the industry's foremost video surveillance technology provider, offering predictive, preventive, and investigative analytics. Its best-in-class identity solutions are top-rated by the National Institute for Standards and Technology for speed, accuracy, and reliability. For over 60 years, NSS's extensive hardware and software product portfolio has driven consistent results for its clients.

**FLIR Systems, Inc.** designs, develops, manufactures, markets, and distributes technologies that enhance perception and awareness. FLIR brings innovative sensing solutions into daily life through thermal imaging, visible-light imaging, video analytics, measurement and diagnostic, and advanced threat detection systems. FLIR offers a diversified portfolio that serves a number of applications in government and defense, industrial, and commercial markets. FLIR products help first responders and military personnel protect and save lives, promote efficiency within the

trades, and innovate consumer-facing technologies. FLIR strives to strengthen public safety and well-being, increase energy and time efficiency, and contribute to healthy and intelligent communities.

**Hydronalix** is a DoD contractor founded in 2009 to develop advanced small unmanned surface vehicles (USVs). Hydronalix's man-portable USVs range in size from 50-80 inches. Hydronalix's commercial product line includes thirteen different off-the-shelf standard USV platforms. The company also has export sales and is internationally renowned for its Emergency Integrated Lifesaving Lanyard (EMILY) which is a robotic lifeguard. The company has shipped nearly 500 platforms, and its systems operate in over thirty countries.

**UH Hilo Aeronautical Sciences Dept at the University of Hawaii-Hilo** offers a four-year degree in aviation operations, including manned and unmanned pilot training. For its students and instructors to remain fully abreast of user-oriented operational needs and gain insight on future directions of aviation development, Aeronautical Sciences participates in field experimentation with ARL such as TIDES and supports other collaborative outreach.

## Technology Descriptions

### LiveEarth - Real-Time Visibility & Automation

LiveEarth is a data analytics and visualization platform with automation capabilities that operate at Cloud scale to enable faster decision making and reduce operational risk (Figure 4). LiveEarth was developed using advanced open-source mapping software geographic information system which allows organizations the ability to ingest millions of real-time data points from any source providing advanced data visualization with a complete operational picture of what is happening in their business or jurisdiction for better decision making and automation.

*Figure 4 - The LiveEarth data analytics and visualization platform.*

### i2 Edge - Next Generation Identity Intelligence Video Surveillance

With surveillance software and hardware all in one package, the i2: Edge Embedded appliance is a high-performance, low-power computing device optimized for next-generation video analytics and computer vision solutions. With a variety of form factors, i2: Edge Embedded supports diverse operations from multiple cameras and high person throughput to single-camera deployments to tactical, covert applications.

*Figure 5 - The i2: Edge Embedded appliance.*

**R80D SkyRaider - See Without Being Seen**

Developed for US DoD and Federal Government customers, the R80D SkyRaider delivers a range of versatile Group 2-3 payload capabilities with the agility and single-operator deployment footprint of a proven Group 1 vertical take-off and landing aircraft. With its ability to carry and deliver multiple payloads up to 4.4 pounds, an open architecture, and one of the fastest, most powerful embedded artificial intelligence computing devices available on a small UAS, the SkyRaider is redefining what's possible with a man-packable UAS.

*Figure 6 – The R80D SkyRaider.*

**Black Hornet Personal Reconnaissance System - Covertly Gain Situational Awareness**

The Black Hornet is the world's smallest operational intelligence, surveillance and reconnaissance platform. Available as a personal reconnaissance system (PRS) for dismounted warfighters or as a vehicle-based system for armored or mechanized vehicles, the platform's game-changing electro-optical (EO) and infra-red (IR) technology bridges the gap between aerial and ground-based sensors.

The Black Hornet PRS equips the non-specialist dismounted soldier with immediate covert situational awareness (SA). Game-changing EO and IR technology bridge the gap between aerial and ground-based sensors, with the same SA as a larger UAS and threat location capabilities of unmanned ground vehicles (UGVs). Extremely light, nearly silent, and with a flight time up to 25 minutes, the combat-proven, pocket-sized Black Hornet PRS transmits live video, and high-definition still images back to the operator.

*Figure 7 - The Black Hornet PRS.*

**FirstLook - Throwable, Rugged Robot**

FirstLook is a throwable, rugged, and expandable robot that provides immediate situational awareness, performs persistent observation, and investigates dangerous and hazardous material while keeping its operator out of harm's way. FirstLook allows operations where other robots can't fit or maneuver. This rugged, lightweight robot can be inserted into structures and provide operators with visual, audio, and sensor feedback before entry. The robot climbs small obstacles, overcomes curbs, turns in place, and self-rights when flipped over.

*Figure 8 - The FirstLook robot.*

**TruWITNESS - Changing the Way Security Operations Centers Function**

By utilizing smart sensors on the ground, in the air, and everywhere in between, TruWITNESS augments video management system fixed and integrated assets, providing enhanced SA and centralized intelligence. TruWITNESS combines mobile technology, Cloud networking, and traditional video surveillance infrastructure to create a network of smart Internet-of-things devices that can stream video, audio, and location data directly to the control room. Providing eyes and ears at the center of the occurrence, TruWITNESS brings dramatic improvements to real-time interactions between the control room operators and early responders during the critical moments of security and public safety scenarios.

*Figure 9 - TruWITNESS technology.*

**EMILY - Emergency Integrated Lifesaving Lanyard**

EMILY represents a family of unmanned surface vessels used for search and rescue and reconnaissance. During TIDES, the new, advanced Man Over Board EMILY (MOBE) system was used for swimmer intruder interception and small watercraft interception. MOBE is equipped with a high-definition day-and-night camera for real-time viewing along with a new long-range *ad hoc* digital radio system. The MOBE platform is capable of providing rescue assistance for 6-8 people and can travel up five miles speeds above 30 mph. Also used in the demonstrations were a SONAR EMILY, a POLICE EMILY, and a Water Sampling SPEEDoo EMILY. The SONAR EMILY demonstrated the ability to find objects underwater, including people or intruding unmanned

underwater vehicles, as well as the ability to provide high-definition sonar maps of the ocean floor. The POLICE EMILY demonstrated a powerful onboard speaker system and emergency lighting for communicating with individuals or watercraft away from the shore. The Water Sampling SPEEDoo EMILY demonstrated the ability to collect water samples in hazardous or remote locations at various depths. The Water Sampling SPEEDoo EMILY also demonstrated real-time 5G control and data management through a standard smart phone or tablet.

*Figure 10 – Family of EMILY vessels deployed during TIDES.*

**Quantix – Agricultural UAS**

Quantix is a hybrid rotorcraft-wing-borne semi-autonomous UAS optimized for high-resolution, rapid earth-surface characterization and biologic analytics. The sensor set and flight planning logic are integrated to produce maps and vegetation assessment with high resolution. These maps are useful for many activities, including special operations that take place in previously unsurveyed or recently-mapped terrain. At BAFS, a UH Hilo unit was onsite performing a site survey when the TIDES demonstration began. The UH Hilo team was commandeered by ARL to assist with conducting the scenario by collecting mapping data showing access and escape routes in the surrounding forested and open areas.

*Figure 11 – Quantix UAS.*

## Scenarios

ARL developed two scenarios showcasing the broad capabilities of the participating technologies to provide context for the TIDES events on Coconut Island and at BAFS. Emphasis was placed on the ability of the technologies to operate in realistic environments with limited advance planning.

### Coconut Island Scenario

Special Operations (Spec Ops) have landed at a site and established a security perimeter that includes an overwatch UAS with a live video feed, plus a land-based video feed focused on a strategic pathway to the site. Video analytics are used to detect people, vehicles, and boats in the video feed. An unknown boat has drifted into the secure perimeter and is detected by the R80D overwatch UAS. Operators can see that two individuals are in the boat, but they are unable to immediately determine whether the boat poses a threat; it appears to be disabled, but the security team cannot rule out malicious intent. Spec Ops decide to deploy the Black Hornet PRS to investigate further. Using facial recognition, the Black Hornet operator identifies the individuals on the boat as friendly, but the presence of the Black Hornet intimidates one of the boaters causing him to jump into the water. The boater in the water is now in need of rescue. The team dispatches the MOBE rescue vehicle to assist the distressed boater, concluding the scenario.

### Bellows Air Force Station Scenario

Spec Ops have been tasked with protecting a group visiting a friendly air station for scientific research. The team sets up a security perimeter using an overwatch drone feeding data to a forward operating base (FOB) to identify threats with command at a rear-area MOB. The overwatch drone observes two suspicious individuals discretely land on the beach via a small boat. One of the two individuals re-enters the water and shows signs of distress, apparently in need of rescue. Spec Ops launches the MOBE surface vehicle to rescue the individual; however, the swimmer becomes uncooperative and resists rescue, as documented by video streamed from MOBE. Spec Ops realizes that the swimmer is a decoy, allowing the other individual to slip inland. The R80D continues to provide visual overwatch for the FOB, searching for unusual behavior or actions and reporting such to MOB. The R80D witnesses the ashore individual place a suspicious package in close proximity to the group under protection. Spec Ops launches the FirstLook UGV to investigate the package. Concurrently, Spec Ops commandeers UAS data from nearby scientists who are collecting high-resolution topographic maps of the air station using a Quantix UAS for agricultural research to enhance situational awareness of the event perimeter and egress routes. The UGV inspects the suspicious package and determines that it is another decoy. Spec Ops then dispatches an interdiction agent wearing a TruWITNESS body camera and the Black Hornet PRS to surveil and apprehend the ashore individual. The objective of this scenario is to gather sufficient information and awareness using the combination of the tactical observational technologies employed – R80D overwatch, MOBE, FirstLook UGV, the TruWITNESS recognition system, the Black Hornet PRS, and the Quantix perimeter mapping data – to detain and secure the two individuals, successfully concluding the scenario.

**Execution**

The TIDES event was executed six weeks after inception by a team including ARL, US government personnel and industry partners. The major activities included forming the TIDES execution team, conducting the initial site survey and planning meetings, gaining site access authorization, developing the scenarios, organizing the logistics, and executing the event. The two-day execution comprised demonstrations on March 5, 2020 to introduce two of Hawaii's unique test locations, Coconut Island (Non-DoD) and BAFS (DoD) (Figure 12), and the hot wash conducted at ARL main offices on March 6, 2020.

*Figure 12 - (Left) Margo Edwards, ARL director, welcomes TIDES attendees to Coconut Island. (Right) Major Steve Hodgson, BAFS Commander, welcomes TIDES attendees to BAFS.*

During the Coconut Island demonstration, the TIDES team conducted a situational awareness and water rescue scenario involving aerial and surface vehicles in the littoral waters around Coconut Island. For this scenario, the operational teams were dispersed as they would be in a typical Special Operations mission. However, observers were able to view the activities from a common operational picture platform set up at an operational command center (Figure 12, left side). The individual technologies, as well as the communication systems linking all of the technologies, were demonstrated. This scenario underscored the dependence of operations and field experimentation on the all-important backbone of communications. The scenario was executed almost exactly as planned.

The afternoon demonstration at BAFS was set up differently, with a MOB, a FOB, and technologies distributed as before on Coconut Island, but the scenario unfolded within direct view of observers to illustrate the FOB/MOB interaction and interdependence (Figure 12, right side). This deployment represented a hypothetical force protection scenario involving aerial, surface, and ground systems performing in the ocean, along the coastline, and in forested areas. Wearable technologies were also included in the BAFS scenario.

In both scenarios, the TIDES team demonstrated the integration of cutting-edge UAS overwatch, low-altitude surveillance, facial identification, personnel tracking systems and analytic algorithms applied to multiple individuals, open-ocean robotic rescue devices, and visualization tools. Situational awareness, decision support, and direct interception were all demonstrated.

As is always the case during field demonstrations, the weather – blustery winds and occasional driving rain – created the reality that is almost impossible to replicate in the laboratory or in table-top exercises. Furthermore, the adverse effects of sunlight on screens, the need for remote power, the effects of exposure to rain and salt air, and non-working or accidentally misplaced equipment and supplies all contributed to remind participants that durable physical packaging that can be nimbly and quickly deployed must be designed into operational solutions, whatever the core technology.

The TIDES 2020 hot wash took place at the ARL main office on March 6, 2020. The assembled TIDES team and participants discussed the technology demonstrations conducted the previous day, other T&E sites available in Hawaii, and future opportunities for larger T&E collaborations. Through the hot wash interaction, various organizations presenting and/or participating in TIDES expressed requirements, challenges and capabilities in greater depth than was possible in the field during the dynamic action that took place on the previous day. There was strong agreement to move forward with interactions between individuals from the various organizations to explore further the lessons learned at TIDES 2020 and begin to lay the groundwork for collaborative design of the next TIDES.

**Timeline**

The TIDES event planning process began roughly six weeks prior to execution. The following provides a timeline of planning and execution for this inaugural event.

**17 January 2020, Coconut Island site access request.** Following internal ARL procedures, a request was made to the Hawaii Institute of Marine Biology for site access at Coconut Island. After confirming that there were no prior conflicting events on the island during the planned TIDES event dates, access was granted within 24 hours. Over the following weeks, detailed accommodations for facility use, boat and captain rental, overnight storage, guest tours, and guest waiver policy were finalized.

**21 January 2020, BAFS site access request.** Following the procedure ARL has developed, a request was made to BAFS leadership and security for site access, and BAFS staff were invited to participate in TIDES. This request was processed through higher headquarters USAF 18$^{th}$ Wing for approval, and permission to conduct the BAFS scenario was granted on February 25.

**25 January 2020, Initial Site Survey**: Christopher Centamore (NSS), Mike Tran (NSS), Shujie Chang (ARL), Chad Dennis (ARL), Josh Levy (ARL), Brennan Yamamoto (ARL), and Ted Ralston (ARL) visit the Coconut Island and BAFS to survey site logistics and discuss technologies operationally relevant to those test sites.

**20 February 2020, Scenarios Drafted:** T&E scenarios based on technologies operationally relevant to Coconut Island and BAFS were drafted and distributed between the ARL and technology partners.

**25 February 2020, TIDES Briefing (Teleconference):** A teleconference between the ARL and technology partners (FLIR, Hydronalix, IDEMIA NSS, NAVAIR) was conducted to discuss T&E scenarios and logistics. The two technology scenarios were finalized.

**03 March 2020, Final Site Survey:** Site survey with the entire TIDES execution team. For most technology demonstrators, this was their first time surveying the test site in person. This final site survey allowed demonstrators to finalize their technology demonstration in the context of the test site and raise any potential concerns regarding logistics. Upon the site survey, the location for the BAFS scenario was changed, and approval of the revised location was received from the Base Commander.

**04 March 2020, Full Technology Demonstration Practice Run:** Using lessons learned from the final site survey the day before, technology demonstrators transported, set-up, executed, and broke down their technology demonstrations for both testing sites. The Coconut Island practice run took place in the morning (0600 to 1200), and the BAFS practice run took place in the afternoon (1300 to 1800), which was reflective of the execution order of the actual event.

**05 March 2020, TIDES 2020:** On the morning of TIDES 2020, guests were transported to Coconut Island, witnessed the first demonstration/scenario, and then toured the Coconut Island facilities (0900 to 1130). Guests and demonstrators were transported from Coconut Island to Oahu via HIMB charter boats, and then they drove in personal vehicles to BAFS (1130 to 1300). At BAFS guests were provided with lunch and then witnessed the second demonstration/scenario (1300 to 1500). Guests were dismissed at 1500 while the demonstrators broke down and removed equipment.

**06 March 2020, TIDES 2020 Hot wash:** The TIDES 2020 hot wash took place at the ARL main offices at the Manoa Innovation Center with TIDES briefings in the morning and collaboration discussions in the early afternoon.

**Summary and Conclusions**

With the help of DoD and industry partners, ARL successfully executed the first TIDES event in Hawaii. This is just the beginning. TIDES can provide value to every community that touches technology. T&E assessment and feedback are important to all organizations that have technology in their portfolio. The science and technology (S&T) community uses experimentation feedback to help shape future investment strategy on product research and development. The operational community uses feedback to help maintain and enhance existing equipment assets and advance and improve the Concept of Operations and Tactics, Techniques, and Procedures. The acquisition community uses feedback to help make better and more informed procurement decisions.

There is no replacement for field experimentation as a critical gateway for technology transfer on the path of development to support the warfighter. This was shown in the inaugural TIDES event as high winds and rain affected operations during the afternoon session at BAFS after a sunny and clear morning session at Coconut Island. Nature-driven chaos and the challenges derived from the dynamics of human-human and human-machine performance are achievable only in the field. Technology, regardless of how functional in a controlled environment, must perform in an unpredictable environment to be honestly evaluated.

Discovery-based field experimentation, where program sponsors, technologists, and the user community can work together in the operating environment, are accelerator steps critically

necessary in today's evolving warfighter support. The dependence we have collectively built upon complex system integration and interaction requires collective field testing. TIDES was designed to provide a realistic, uncontrolled setting for technology development and enhancement from incubation to operations. Through facilitating access to relevant and realistic environments, ARL and our partners can create a crucible for innovation and the environment for field experimentation.

Working together with our network of partners from laboratories to operators (Figure 13), we intend for TIDES to act as a catalyst to strengthen relationships between technology and operational user communities, leverage DoD S&T resources (people and funding), promote collaboration among the operational forces, strengthen partnerships and relationships with allies and partner nations and promote an environment in which different organizations complement each other's efforts. ARL welcomes the opportunity to perform and expand this role and serve the user community through leading the progressive development of TIDES.

*Figure 13 – Group photo of TIDES attendees on Coconut Island.*

**Acronyms**

| | |
|---|---|
| AAA | Airspace Access Authorization |
| ARL | Applied Research Laboratory |
| BAFS | Bellows Air Force Station |
| DoD | Department of Defense |
| EMILY | Emergency Integrated Lifesaving Lanyard |
| EO | Electro-Optical |
| FAA | Federal Aviation Administration |
| FAR | Federal Acquisition Regulation |
| FOB | Forward Operating Base |
| HIMB | Hawaii Institute of Marine Biology |
| INDOPACOM | Indo-Pacific Command |
| IR | Infra-Red |
| MOB | Main Operating Base |
| MOBE | Man OverBoard Emily |
| MCBH | Marine Corps Base Hawaii |
| MCTAB | Marine Corps Training Area Bellows |
| NAVAIR | Naval Air Systems Command |
| NAWCAD | Naval Air Warfare Center, Aircraft Division |
| NSS | National Security Solutions |
| PRS | Personal Reconnaissance System |
| S&T | Science and Technology |
| SA | Situational Awareness |
| Spec Ops | Special Operations |
| T&E | Testing and Evaluation |
| TIDES | Technology Incubation, Demonstration and Experimentation Support |
| UAS | Unmanned Aerial System |
| UGV | Unmanned Ground Vehicle |
| UH | University of Hawaii |
| US | United States |
| USAF | United States Air Force |
| USV | Unmanned Surface Vehicle |