



JIFX
 Joint Interagency Field Experimentation



JIFX 17-3 Quicklook

From the Director:

The Naval Postgraduate School Field Experimentation program is fifteen years old this year and yet every event is filled with new developments, insight, and learning. In 2002, under the leadership of Dr. Dave Netzer we began to build our model of a Multi-Institutional, Semi-Structured Learning Environment to support emerging Special Operations requirements in the War on Terror. These areas of experimentation, to develop better intelligence, communication, weapons, and targeting capabilities remain, and we continue to explore how emerging technologies can meet them. In 2012, we expanded to become the current Joint Interagency Field Experimentation (JIFX) program to include requirements and research challenges from all the Combatant Commands, services and Interagency partners. Humanitarian Assistance and Disaster Response (HADR) applications have been a recurring line of experimentation, and was a large part of the 17-3 cycle held at Camp Roberts. Over a dozen organizations, including private industry, academic and government researchers worked together to integrate data from multiple air and ground sensors, deployable power, and handheld equipment to aid Search and Rescue and improve triage operations. Many of these technologies were developed over several events, and some were brand new prototypes. What has been consistent since 2002 however, is the culture of collaborative development – thanks to all of the participants and we look forward to seeing you again in August.

This year also marks a transition point in our JIFX Team. Over the past couple of years, we’ve seen a few of our team depart for new opportunities and adventures. Nelly Turley is now a Lieutenant in the Coast Guard and we hope her next assignment brings her back to the West Coast. Tristan Allen is now running a small business disaster resiliency program for the State of Washington. Replacing them has been difficult, but our new team is now mostly in place. Ashley Hobson is our new Operations Manager. Ashley had an internship with us in 2012, and comes most recently from a local environmental consultancy company. Aurelio Monarrez and Jean Ferreira have been with NPS for a number of years in other capacities, but are now full-time on the CRUSER/JIFX team. Aurelio manages our air operations, while Jean manages our finances and logistics. Kerri Williams, who is also a Navy Reserve Lieutenant Commander, coordinates large integrated field experiments, such as the integrated unmanned systems Command and Control experiment that will be conducted later this year on San Clemente Island.

WHAT'S INSIDE

JIFX 17-3 Recap
 Page 2-4

JIFX 17-3 Experiment List
 Page 2

Integrated Scenario Experiment
 Page 3

Experiment Highlights:
 Page 3 – 4

JIFX 17-3 By the Numbers
 Page 4

JIFX Updates
 Page 5

JIFX News:
WLIF Data & Info Workshop
 Page 5

JIFX News:
First-Ever UAS Swarm Dogfight
 Page 6

<http://www.nps.edu/fx>



JIFX
Joint Interagency Field Experimentation



JIFX 17-3 Recap

The JIFX 17-3 (15-19 May 2017) event was held at the Naval Postgraduate School's Field Laboratory at McMillan Airfield and the Combined Arms Collective Training Facility (CACTF), at Camp Roberts, California. The focus of this JIFX cycle was **Autonomy and Human-Robotic Teaming in Humanitarian Assistance and Disaster Response**. The event was attended by 71 registered participants from 31 unique organizations.

Experiments at JIFX 17-3

<i>Unmanned, Semi-Autonomous, and Autonomous Systems</i>	Use of a Tethered UAS for Communication Payload (Otherlab) Phantom Ice Fully-Autonomous UAS Test Flight and Acoustic Characterization (Boeing) Drone-Based Real-Time Multi-Spectral Monitoring (Teledyne) Target Recognition and Synchronized Training Onboard sUAS (Carnegie Mellon University)
<i>Intelligence, Surveillance, and Reconnaissance</i>	Precision 3D Mapping and Visualization for Situational Awareness and Targeting (Lockheed)
<i>Communication and Networking</i>	Patient Tracking: Moving Data During HA&DR Missions (SwerveLogic) Onyx Smart Walkie Talkie (Orion Labs) Wireless Networked Communications for Persistent Sensing (ARL) Extensible Communications Platform (Joint Vulnerability Assessment Branch)
<i>Decision Support, Situation Awareness and Visualization</i>	21st Century SOS (Southwest Synergistic Solutions) UAS: Man's Best Friend (Carnegie Mellon University)
<i>Humanitarian Assistance and Disaster Response</i>	S-Cuts (Southwest Synergistic Solutions)
<i>Medical</i>	Initial Field Triage (Southwest Synergistic Solutions)
<i>Expeditionary Infrastructure, Power, and Water</i>	E/T Lights (Southwest Synergistic Solutions) Power Management for Expeditionary and Emergency Response (Protonex)

Visit <https://my.nps.edu/web/fx/jifx-live> for more event specific details

<http://www.nps.edu/fx>



JIFX
Joint Interagency Field Experimentation



JIFX 17-3 Recap

JIFX Integrated Scenario Experiment



JIFX Staff work with Teledyne Experimenters to place "patients" in the rubble pile at the CACTF

As with all JIFX events, the Naval Postgraduate School staff brought together many of the experiments in around a common integrating scenario on Thursday morning. Approached as a contextual framework, the scenario was not designed to address a specific mission need, rather to provide an informal way for different technologies to explore their capability within a common setting. The integrated scenario consisted of a major event in which patients needed to be identified and tracked in a significantly damaged area. UAV technology from Carnegie Mellon University, Lockheed Martin, and Teledyne was used to discover individuals in the field, and the UAV's worked in conjunction with a response team from I Marine Expeditionary Force to track and triage the patients. Once individuals were located in the field, the Army Research Lab, Southwest Synergistic Solutions, Swerve Logic, and Orion Labs, compiled the data and sent it to a situational awareness command center. Lasting almost two hours, the integrated scenario allowed experimenters and military operators hands-on interaction and produced a variety of suggestions for improvement and suggestions for further exploration.

Experiment Highlights

Target Recognition and Synchronized Training Onboard sUAS UAS: Man's Best Friend

Carnegie Mellon University Silicon Valley

Carnegie Mellon University Silicon Valley (CMU) continued their experimentation into machine learning on board small UAVs. Using a single-board computer on a light quad rotor, they were able to train the UAV to recognize a wide variety of different targets, from color-coded cell phone screens to individuals in a crowd. All of the learning and feature detection algorithms run completely on the UAV learning while in flight. An additional CMU experiment paired this learning on-board AI with a wearable EKG device, allowing the UAV to respond to increases in the stress level of a warfighter on patrol, autonomously fly to and then follow the warfighter. CMU also tested the prototype of their Virtual Image Processing for Research (VIPR) project, creating a hardware-in-the-loop, faster-than-real-time learning environment for autonomous systems.



Carnegie Mellon University staff and students next to their "CrossMobile" - an ambulance converted into an innovative mobile lab

Visit <https://my.nps.edu/web/fx/jifx-live> for more event specific details

<http://www.nps.edu/fx>



JIFX
Joint Interagency Field Experimentation



JIFX 17-3 Recap

JIFX 17-3 BY THE NUMBERS

71

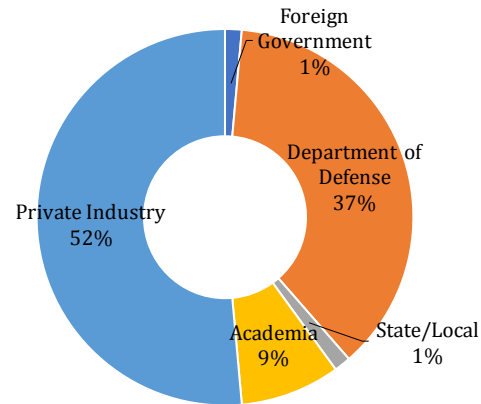
Experimenters

15

Experiments

31

Unique Organizations Represented



Experiment Highlights - Continued

Onyx Smart Walkie Talkie

Orion Labs

Orion Labs experimented with the latest version of their IP-based intercom system, using a back-end processing to create near-real-time transcriptions of command and control radio net traffic and geolocation tracking of operators in the field. Orion deployed approximately 100 Orion Onyx Smart Walkie Talkies to participants of the event to provide real-time heads-up voice communications in the austere and RF-denied environments of Camp Roberts.

Precision 3D Mapping and Visualization for Situational Awareness

Lockheed Martin

Lockheed Martin flew and recorded full motion video from 13 Indago flights and 6 DesertHawk flights. During the integrated scenario, the Indago UAS was able to remain in over-watch and searching for victims for over 40 minutes per flight with minimal recycle time between flights. The Indago real-time high resolution video feed facilitated the identification and rescue of multiple victims during the exercise.

E/T Lights & Initial Field Triage

Southwest Synergistic Solutions

The E/T Light combines four colors into one compact, durable, and long lasting signaling device. Throughout the week, the experimenters measured the output of the E/T Lights compared to various other methods of lights. During the Initial Field Triage experiment, Marines from the 1st Reconnaissance Battalion used the E/T Lights in a triage scenario to test the time differences of triage using chemical lights and the E/T Lights.

Drone-Based Real-Time Multi-Spectral Monitoring and Analysis for Rapid Assistance and Response

Teledyne Scientific and Imaging

Teledyne flew an octocopter drone equipped with a 4-band multi-spectral camera with on-board real-time processing capabilities. Teledyne demonstrated that the camera can collect full-frame images at very high rates, and then through real-time fusion and segmentation, display a multi-spectral image.

Visit <https://my.nps.edu/web/fx/jifx-live> for more event specific details

<http://www.nps.edu/fx>



JIFX
Joint Interagency Field Experimentation



JIFX Updates

JIFX 17-4

The next JIFX event will take place at Camp Roberts from 31 July – 4 August with a focus on Counter UAS. We are now accepting experiment proposals for this event – visit www.nps.edu/fx for more information!

New Hires

The NPS Consortium for Robotics and Unmanned Systems Education and Research (CRUSER) and JIFX team has recently welcomed three new members onboard: Mrs. Kerri Williams, Ms. Ashley Hobson, and Dr. Mollie McGuire. Mrs. Kerri Williams is serving as the action officer for the Multi-Thread Field Experimentation taking place on San Clemente Island Summer 2017, Ms. Ashley Hobson is the new Operations Manager / Event Director for JIFX Events, and Dr. Mollie McGuire will be continuing her research in Cognitive Psychology and prospective memory in high stress environments.

Weekly Experimenter Teleconferences

We are excited to announce that we will now host weekly teleconferences. The conference calls will take place between 1030 and 1130 Pacific Time, and will give experimenters and interested parties the opportunity to ask questions and discuss collaboration ideas for future JIFX events.

JIFX News

WLIF Data & Information Workshop, 22-23 March 2017

Ms. Lyla Englehorn, CRUSER Associate Director

Representatives from the Naval Postgraduate School (NPS) and the Defense Technical Information Center (DTIC) participated in a two day workshop held on 22-23 March 2017 on the NPS campus in Monterey CA to explore a question involving data and information. Using the design process, the teams were first given a broad design challenge: “How might we serve the data and information needs of future combatant commanders?”

Two teams made up of diverse perspectives were facilitated through a design sprint starting with a discovery phase where they were tasked with interviewing users and subject matter experts to better understand the problem space. Based on the data gathered from user interviews, teams then sorted their observations to surface insights and opportunities which led both teams to scope down their problem statement. The ideation phase of the design process began with time devoted to divergent brainstorming – all ideas were posted, and team members were encouraged to add to other ideas.

Facilitators then guided the two respective teams to focus in on a solution area to develop a prototype. This initial prototype was shared between teams for feedback as the first “test” with proxy users, and the teams were given a short amount of time to revise their prototypes to incorporate this initial feedback. Finally, both teams presented their prototypes to a panel of subject matter experts.

Recognizing that humans and machines have knowledge and information needs to make decisions, the first team presented a concept they titled “The Living Plan.” The second team proposed a concept they called “Speed-Dataing” to address their scoped down query: “How might NPS and DTIC create better processes to transform research data into information that improves future military decision making?” This process and the concepts presented were intended to inform a proposal to the Warfighting Lab Incentive Fund (WLIF) to further explore how the data and information needs of future warfighters might be better met.

<http://www.nps.edu/fx>



JIFX
Joint Interagency Field Experimentation



JIFX News

NPS, Academic Partners Take to the Skies in First-Ever UAS Swarm Dogfight

A swarm of unmanned aerial vehicles get into a self-determined formation during swarm vs. swarm field experimentation at Camp Roberts, Calif., Feb. 16. The match between researchers at NPS and Georgia Tech Research Institute (GTRI) is considered the first-ever swarm on swarm autonomous drone dogfight.

For NPS Associate Professor Ray Buettner, it feels like a historic occasion. "It is always difficult to know the impact of an event on the future. When the Wright brothers flew for the first time at Kitty Hawk it is unlikely that they or the folks watching could imagine that manned flight would take humanity to the moon only 66 years later," Buettner said. "As we watch the first 'dogfight' between swarms animated by different forms of artificial intelligence, I am compelled to wonder where swarming technology will lead us six decades from now."

The match is between two university teams that are well aware of the each other's reputation in the field, NPS and GTRI, but this contest isn't about bragging rights. Rather, this experimentation is to test the capability of autonomy and to learn how behaviors between each of their team's aircraft react as they penetrate the opponent's air space.

In short, the goal of this research, according to researchers and institutional leadership alike, is in the science, to answer questions in optimization and controls, and to envision how these capabilities advance the warfighter's effectiveness.

"One of the only ways to find out if the ideas we have built in labs and in experimental test beds actually work, is to bring them outside into something that closely approximates how they might perform in an actual warfighting setting," explained NPS Provost and Academic Dean Dr. Steven Lerman, on hand to witness the experimentation first-hand. "This is an outstanding example of the translation of great research into experimental practice."

Dr. Kevin Jones, who coordinated the launch and recovery for the NPS team in addition to being lead aeronautical engineer, said one of most significant lessons learned from the event was in the ability to plug and play behaviors in a live environment.

"NPS, and our research partners, demonstrated the ability to allow any third party to develop swarm behaviors and to implement them in a (compatible) software stack, permitting them to be loaded into a swarm that can engage in combat behaviors," Jones explained. "Going back to the original Swarm vs. Swarm Aerial Combat Challenge objective, all of the pieces exist to support the execution of a national grand challenge event that would eventually enable us to rapidly identify and transition swarm tactics and maneuvers from the NPS environment to more operational environments."

For more information about this landmark achievement, check out this video on the Naval Postgraduate School YouTube site.



By Javier Chagoya

<http://www.nps.edu/fx>