RELIEF

Research & Experimentation for Local & International Emergency & First-Responders

QUICK LOOK REPORT

12-1 Experimentation: 2-4 November 2011

Scheduled Experiments

Ad Hoc Experiments

Informational Briefs

NPS Field Experimentation Cooperative
Research and Experimentation for Local and International Emergency First Responders (RELIEF) 12-01

Airborne Situational Awareness Platform

KnowledgeBridge International

Principal Investigator/Lead: Denisa Scott, KnowledgeBridge International

Objective:

Provide requested overhead video collection of the event to hosts/organizers and participants, and test a new mount configuration for COTS video cameras.

Overview/Background:

KBI has been developing COTS-based configurations of situational awareness tools for Humanitarian Assistance/Disaster Relief (HA/DR) efforts. We were originally invited to the STAR-TIDES event to collect overhead by Dr. Lin Wells, but were unable to get required permissions from base-security. Subsequently, it was suggested we could do the same for the NPS-RELIEF event. This gave us the opportunity to field-test a new mount configuration for our balloon-based situational awareness platform.

Experiment Description:

Timing varies dependent on weather and other environmental factors, but flights can generally last up to 1.5 hours, at heights of 100-900 feet, tethered to a human operator on the ground. Intent is simple demonstration of capability and field-testing of new configuration for equipment. Platform can be re-deployed as many times as daylight and flight conditions/host schedule allow.

Measurements/Data Collection Plan:

Current onboard storage capacity for video cameras is about 1.5 hours. Data is retrieved post-flight and transferred to additional portable storage.

What new capability (or improvement to existing capability) does this represent?

The new mount-design provides for significantly improved image stability using a very low-tech physical design. Other improvements will be found not in the capability itself, but in the expansion of environments in which the platform will have been tested. Data gathered, and documentation of this event contributes to the establishment of guidelines for evaluation and some sort of "certification" for use in a range of conditions, based on a yet to be determined codification of field-testing protocol tailored for HA/DR requirements.

Initial Quantitative & Qualitative Results:

Initial results were positive. We retrieved several Gb of video; its utility for testing against the algorithms has yet to be determined, but initial review is favorable. We were able to simulate several conditions, including but not limited to:

- Small targets from Altitude
- Obscured dismounts
- Dismounts in high-contrast light-conditions
- Dismounts in “scrum” conditions

These data will be valuable in determining the efficacy of the automation software intended to be employed with the system.

Observations & Comments:

Great group of people, and if the folks from Army Research Lab (ARL) had not agreed to take physical ownership of the platform, and allow us to benefit from the experiment and take data, we would not have had any success. We are definitely looking forward to participating further, and expanding our repertoire of airborne platforms and sensors suites for rapid-deploy situational awareness.

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Collaborative and Platform Agnostic User Defined Operational Picture

Geocent

Principal Investigator/Lead: Zachary Rouse / Brandon Haynie, Geocent

Objective:

Demonstrate the capabilities of a fully interoperable and editable real-time GIS layer across multiple platforms and Common Operational Pictures (COP). We propose a solution that addresses the barriers to achieving actionable collaborative intelligence when multiple agencies and organizations respond to a disaster event with proprietary software and independently created operational pictures. An extension to this solution is the ability to dynamically edit this information in a platform agnostic environment and the distribution of these changes throughout the network in real-time. The result is a truly collaborative information environment where the focus is agency/organization interaction above vendor compatibility.

Overview/Background:

The proliferation of proprietary solutions and custom software within agencies/organizations that create COPs presents an impasse to collaboration when multiple entities respond to a disaster event. Differences in formatting, styling, and sharing strategies prevent the timely inclusion of critical layers when developing courses of action (COAs). This was an observation by several international agencies during the Haiti disaster where an effective solution to identify resources and condition was not available. This gap spawned multiple efforts and duplication of resources throughout the theater. A set of collaborative real-time platform agnostic mapping services that allow organizations to retain their technology investments and data ownership would prove a great benefit for improving decision making and response.

Experiment Description:

Geocent conducted an experiment to display a user defined layer to multiple GIS platforms present at the RELIEF exercise, not having operated with any of the organizations prior to this event will emulate a disaster environment. For our purposes, each entity represented an arriving agency or organization. This experiment had four primary objectives with increasing levels of difficulty (user interaction).

1. A user defined layer created in OpenCOP and displayed in several dissimilar mapping platforms (the following systems are in use at RELIEF: Ushahidi, Google Earth, GeoIQ, Nowforce).
2. Train the user to change the style or status of an icon from their platform and acknowledge this change throughout the network (viewing the status change on another platform/system).
3. Demonstrate the capability for the user to add content to the layer and observe the new information throughout the network
4. Assist in the dissemination of critical data contained within a single platform for consumption/viewing by other systems. For example, the information and analysis created by GeoIQ served as a layer so it can be included to other COPs to support course of action (COA) development.

What new capability (or improvement to existing capability) does this represent?

Current C2 platforms have the capability to display information from multiple sources. In practice much of this information remains static. Distributed real-time editing of shared data has not been an option, as any changes must be performed through the original mapping client and redistributed. The proposed capability will allow credentialed personnel to update and create the information in these real-time shared layers from within all of the deployed mapping platforms. The result is rapid access to dynamically editable interagency information regardless of platform.

Initial Quantitative & Qualitative Results:

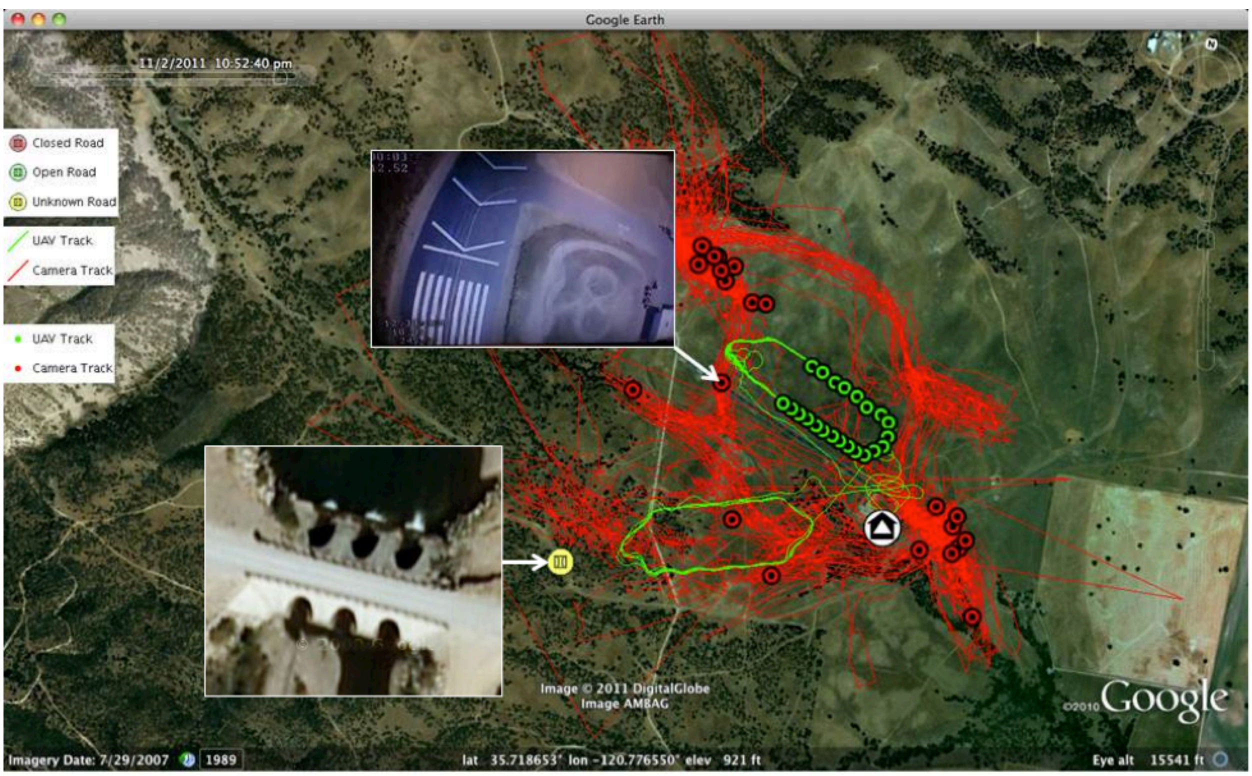
Several Ad Hoc experiments were conducted during this event to test the hypothesis that a strategy exists that can allow a real-time layer to be viewed and edited on multiple GIS platforms developed by different vendors or organizations. The Ad Hoc experiments are listed below:

1. UA Vision and Geocent Part I
2. UA Vision and Geocent Part II
3. GeoIQ and Geocent
4. Lockheed Martin and Geocent

Geocent's OpenCOP met with success on several of its initial trails. The lack of a rigid predetermined plan of action prior to arrival at Camp Roberts was in itself a test of the agility of OpenCOP to communicate with other platforms in a mock disaster. Training the operators proved successful with minimal commitment to time and without intrusion of their own experimentation objectives. The use of the software also proved an important milestone for interoperability. OpenCOP provides an opensource compliment to existing systems. OpenCOP is able to exchange GIS data and provide real-time services throughout the network eliminating the need for massive investments of middleware and storage solutions from which others draw their information. The data owner remains the custodian of the information and by default the storage facility. The services simply provide the conduit to exposing this information to all other parties involved who may have a need to know.

One of the more involved experiments was the collecting of UA Visions UAV data (Reference Ad Hoc UA Vision/Geocent Parts I & II). This experiment centered on taking UAV track and camera data and providing it as a shared layer in various GIS service formats for other platforms. The service provides a decision maker with the UAVs path and where its sensors were collecting data. Accessing the sensor data would provide the video from the UAVs flight. The analog video limited the ability to associate a specific frame could with the timestamp and location, but this would be a simple task with the inclusion of digital video. With no prior cooperation before RELIEF, creating this functionality required less than two days for two Geocent GIS developers. This relationship will continue to further push the limits of the technology and assist UA Vision with developing their capabilities. The result is a service providing UAV information to several entities. These entities can easily access the sensor data for supporting their own specific mission or task from within their own systems. For example, one organization may use this data to view the condition of a logistical route, where as another may use the UAV video to confirm reports of displaced personnel within a specific area. The same data used for two unique requirements.

The figure below is a screenshot from the initial effort between UA vision and Geocent. The solid lines indicate the entire path while the circles indicate a specific location at time "t". This is blended with the infrastructure layer for bridges (defined by the user to only show bridges whose condition is in question and the TOC location for the RELIEF Exercise).



The experiment with GeoIQ centered on being able to consume real-time interactive layers for infrastructure (bridges) and UAV tracks in the GeoIQ mapping client. GeoIQ was able to view the layer on their system while retaining the original styling of the icon and successfully interacted with the information by changing the status of a structure (open, closed, unknown). This information is propagated throughout the network so all other platforms viewing this layer observed the change in near real-time. Combining the information from the GeoIQ analytics operational overlays improves the situational awareness and decision-making process.

Ushahidi's OpenLayers mapping client uses the same technology as OpenCOP's map interface and should similarly allow users to view and edit the shared real-time layers. This was not attempted during the RELIEF exercise, but should be confirmed. The GeoIQ mapping platform was able to export the Quicknets Ushahidi mapping information containing the geolocation of actionable reports as a static kml file and Geocent established this data as a service. Geocent has developed interfaces for OpenCOP with popular state and local emergency management tools including WebEOC. These interfaces allow the data in these tools to be served out in the variety of real-time mapping formats required to achieve the desired levels of interoperability across the multiple deployed COPs. Preliminary investigation into the Ushahidi data sharing API's identified a path to building the same type of interface. Enhancing Ushahidi's real-time GIS interoperability might be of interest for further demonstrations.

The Nowforce dispatching system includes a mapping interface that displays responder and dispatch information. The mapping interface could pull in static ESRI shapefiles produced by OpenCOP and include them in the operator's view. Further investigation, verification, and development are required to support ingesting and sharing real-time collaborative layers.

Geocent also tested mapping services with Lockheed Martin team. Initially the appropriate mapping format for integrating into Lockheed Martin's system was identified and selected from OpenCOP's GIS service offerings. Lockheed Martin successfully imported the collection of RELIEF mapping services that included the real-time bridge status layer. Geocent performed updates on this layer from within the OpenCOP environment and Lockheed Martin verified their operating picture visually reflected the near real-time status. The attributes associated with the bridges were also accessible from within the Lockheed Martin mapping system. With proper login credentials, the operator was able to change a bridge status to "closed". The new status was verified in the Lockheed Martin map, OpenCOP map, and OpenCOP mapping services. The operator also was able to launch the OpenCOP form created to capture the relevant information for a new bridge. When this form was filled out the new bridge appeared in all of the OpenCOP's mapping services. A minor OpenCOP user experience issue was identified in this stage and Geocent is pursuing avenues that simplify this workflow that adhere to the open standards and platform agnostic OpenCOP bidirectional map sharing model.

Observations & Comments:

There are several developments during this exercise that we should consider for continued investigation. These could form a set of more elaborate scenarios in the next RELIEF exercises as a proof of concept. The idea is not to create a detailed exercise that would distract from the openness and flexibility of the RELIEF environment but provide abbreviated blocks of time where all the participating agencies could apply their skill set to solve a specific tasking.

The first is a new process or procedure for the reporting of critical infrastructure following a disaster. An infrastructure layer viewed on a UAV console would allow the UAV operator to conduct damage assessment as an implied tasking (if not explicitly directed) updating status of a structure when it is in range of their sensors (as either a point along their corridor or area of operation). This would provide maximum usage of a high demand limited resource. (see Ad Hoc Lockheed Martin/Geocent). Of interest to the Department of Homeland Security (DHS), is taking the current static layers of the Homeland Security Information Program (HSIP) datasets and creating a dynamic editable layer for status collection. The collection process can now be a unified effort of Federal, State, local governments and non-government organizations following a disaster event. A single source of infrastructure status which is being dynamically updated by properly credentialed agencies and organizations for dissemination will prove vital in large scale operations, such as a New Madrid event.

The use of social media (GeoIQ) as a shareable mapping layer would present a new facet of course of action development and decision-making. Layering the social analysis with the resources and infrastructure creates greater insight into the "feeling" of the populace as decisions are executed during the relief effort. This would prove beneficial when the major agencies are managing the post disaster environment to ensure the use of its resources has the maximum effect. While this was demonstrated within GeoIQ's mapping client, the distribution of this information as a service could benefit all the agencies/organizations supporting the operation.

Our experience at the RELIEF Exercise was incredible, the openness to cooperate and collaborate on experimentation and provide value to others makes this one of the best environments to learn and improve. The relationships formed at this event will prove beneficial in pushing technology to its next evolutionary step and create the products and services which may better support future disaster response.

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Disaster Area Assessment Using Small UAS with Geo-Referencing Imaging

UA Vision LLC

Principal Investigator/Lead: Donald Smith, UA Vision LLC

Objective:

UA Vision objective for RELIEF was to demonstrate low cost UAS systems to support disaster responders in assessing siting for relief operations as well as damage assessments for direction of assets for best efficiency. UA Vision demonstrated two UAS systems, one a repurposed, demilitarized system and a second new platform with exceptional operating capabilities. Both systems are standalone, requiring no external support for short-term operations in the field.

Overview/Background:

UA Vision has developed a small UAS (SUAS) system using COTS hardware and an in house designed airframe that has unusual performance while providing a georeferenced image in real time. The aircraft is very light weight and yet is robust and capable of operations in winds as high as 40 kts. This aircraft was compared to an improved repurposed RQ11-A that was developed to provide training opportunities in an educational environment.

Experiment Description:

UA Vision flight demonstrated real time imaging systems on two different SUAS platforms to highlight the different opportunities available for simple COTS equipped ISR platforms that are capable of supporting the needs of disaster relief operations. These systems can provide initial site survey, local area damage assessment, asset distribution, etc. Aircraft are hand launched and auto landed. Flight altitudes are ideally under 1000 ft AGL for best fidelity, and could range as far as 4 miles if needed.

What new capability (or improvement to existing capability) does this represent?

These systems can enhance the effectiveness of first responders by providing real time information about the conditions facing the responders from the initial arrival and operations center siting to long term progress and proper relief asset utilization in the damaged area.

Initial Quantitative & Qualitative Results:

Flew 8 sorties over 4 days. Demonstrated that live video could be simply geo-referenced using COTS display overlays containing GPS data. Demonstrated flights of 50 min at altitudes up to 1500 feet using a block camera with 10x optical zoom. Demonstrated stable flight in winds up to 15 knots (all that was available). Demonstrated capability to read RFID tags at an altitude of 600 feet.

Observations & Comments:

- Frequency deconflictions are critical in a test agenda with multiple players.
- Do not assume that all participant frequencies have been vetted.
- Need for digital video or digitized video is critical to allow full integration of UAS data into the higher level command and control structure
- The synergism generated by multiple entities in a testing environment that encourages cooperative experimentation is very valuable. We developed connections that will enhance not only UA Visions product development but also the development of expanded capabilities for the RELIEF community that may not have happened in a different environment.

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Emergency Operations Center

Lockheed Martin Corporation

Principal Investigator/Lead: Russell Chan, Lockheed Martin

Objective:

Demonstrate situational awareness with EO/IR, radar and voice communications from an operations center for local, state, federal and military personnel. Demonstrate capabilities to provide seamless voice and video to all participants in a humanitarian relief scenario.

Overview/Background:

Lockheed Martin's concept provides remote situational awareness with an EO/IR, radar systems mounted on a trailer. The remote sensors relay data back to the operations center and disseminate data to smartphones. Voice communications are provided by a standalone cellular network. First responders can relay video from their smartphones back to the operations center or other first responders in the field. First responder locations derived from Direction Finding (DF) of cellular signals are demonstrated as a means to determine personnel locations. These capabilities enable all first responders to send/receive both voice and video to enhance the overall situational awareness of the disaster response.

Experiment Description:

The experiment demonstrated the enhanced situational awareness and response time associated with real-time voice and video from the field to both first responders in the field and incident commanders.

What new capability (or improvement to existing capability) does this represent?

Interoperable IP based communications with various wireless technologies (LMR, 2G/3G/4G, tactical radios), remote control of wireless technologies, low bandwidth streaming video from first responders in the field, remote situational awareness.

Initial Quantitative & Qualitative Results:

The EO/IR turret was located at the McMillan air field near the CIRPAS hangar building. The turret was mounted on a 20 ft. deployable mast. Vehicles and people were easily viewed approximately 0.5 miles away. The IR sensor will be demonstrated during our night operation during TNT. We successfully demonstrated streaming video from the turret to both 2G and 3G smartphones in the field. Both 2G and 3G cellular demonstrated ranges of approximately 1.5 miles from our Emergency Operation Center (EOC) at McMillan air field to Generals Road around the first set of hills toward the FOB. These ranges are mostly due to the terrain surrounding the air field. We demonstrated streaming video from a vehicle mounted camera and also controlling the Pan, Tilt, Zoom camera remotely from smartphones. The vehicle streaming video was demonstrated with commercial 3G cellular (AT&T) and our video encoder. The vehicle drove from our EOC at McMillan air field to San Luis Obispo. We demonstrated streaming video from a smartphone in the field back to our EOC. All video feeds were relayed to our EOC at McMillan air field and disseminated to smartphones and tablets via our non-commercial based 2G and 3G cellular systems. This demonstrated interoperability with commercial cellular (AT&T) and non-commercial 2G and 3G cellular systems. The radar system was not able to be at Camp Roberts. We would like to experiment with this ground radar at a future RELIEF event. The Land Mobile Radio (LMR) system with a 100 Watt transmitter (located at our trailer) can reach the FOB area approximately 3.8 miles to both a mobile LMR with a 50 Watt transmitter and a 5 Watt handheld radio. However, the trailer could not hear the mobile LMR or handheld LMR system. The LMR systems performance is due to a combination of antenna performance and transmit power. The Direction Finding system was not able to be at Camp Roberts. We would like to experiment with this technology at a future RELIEF event.

Observations & Comments:

Lockheed Martin demonstrated that voice/data interoperability with commercial cellular carriers, Land Mobile Radios, and private (non-commercial) 2G/3G cellular systems can provide timely, enhanced situational awareness. The capability to share voice from any radio system and video feeds from both local fixed video (EO turret), vehicle and smartphone video from the field would enable first responders and Emergency Operations Center (EOC) commanders to make decisions faster and maintain situational awareness.

In addition to our planned experiment, Lockheed Martin collaborated with other industry participants and customers (OSD/Naval Surface Warfare) to explore integrated solutions with multiple technologies and capabilities.

On November 2, Lockheed Martin provided local private (not commercial carriers, AT&T, Verizon, etc.) 2G cellular coverage for NowForce's smartphone application at McMillan air field. Our local 2G cellular system was connected to the internet via SATCOM. NowForce determined that 2G cellular cannot support the bandwidth required to support their software.

On November 3, Lockheed Martin provided local private 3G cellular coverage to NowForce. After the switch to the 3G cellular system, NowForce stated that their software was completely functional. NowForce thanked us for showing what the difference between a 2G and 3G cellular system had on the execution of their smartphone application. We also worked with Geocent to display their KML layers onto our local Google Earth Enterprise server located at our remote EOC located at McMillan air field. We were able to retrieve the KML layer from our connection to the internet with our SATCOM capability. We added and changed content that was transmitted back to the internet to update the Geocent KML layers. We demonstrated a remote node location with local communications and information systems that could add/modify information and subsequently upload and update databases resident on the open internet via SATCOM connectivity.

On the final day of the RELIEF event, Lockheed Martin collaborated with the QuickNets team to simulate a disaster response area that had private (not commercial carriers, AT&T, Verizon, etc.) local 2G and 3G cellular systems in combination with a SATCOM capability back to the open internet. Our Universal Communications Platform created an interoperable communications system with all of the heterogeneous communications networks located at the McMillan air field. We obtained an android smartphone with the QuickNet application. We connected the QuickNet smartphone to our private 2G cellular network. We had two of our android smartphones also connected to the same 2G cellular network. We passed SMS text messages between our smartphones to the QuickNet smartphone. The QuickNet smartphone was collocated at our site at McMillan air field. The QuickNet smartphone was also connected to our local Wi-Fi access point to upload the SMS message to the QuickNet server via our SATCOM connectivity. The main QuickNets team was located at the Camp Roberts Fire Department Emergency Operations Center. We successfully demonstrated a realistic disaster communications environment where the local communications infrastructure is not operational. Our Lockheed Martin interoperable communications network (Universal Communications Platform, 2G/3G cellular, Wi-Fi and SATCOM) represented a deployable disaster response capability in conjunction with the QuickNets smartphone application to successfully transmit data from a remote area back to the emergency operations center. Overall, Lockheed Martin is privileged to participate in RELIEF events to collaborate and explore solutions to aid in the rapid response to humanitarian needs during all phases of disaster recovery and stabilization.

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International First Response Collaboration

NowForce

Principal Investigator/Lead: Evan Spier / Jason Goldberg, NowForce Inc.

Objective:

The primary objective was to determine how its existing cloud based platform can manage the military in civil support roles with several different types of domestic and international agencies on the same incident.

Experiment Description:

Day 1: Several types of first responders from varying agencies and organizations were deployed into a mock disaster zone resulting from a massive storm and a tornado. This zone consisted of multiple causalities and patients with various types and levels of injuries. All responder participants had the NowForce Responder application installed on their mobile device. First Responders generated new EMS incidents with their mobile device which should activate the appropriate nearby resources based on pre-defined rules created during set-up. Incident Command utilized the command and control platform to track all first responders as well as micro-incidents generated by all EMS and other ground force personnel. 2 way messaging was utilized by the IMT (incident management team) to maintain situational awareness by gathering instant field data. IMT branch officers had different levels of log-in access so they coul track their specific users. The IC was able to view the entire incident and all users.

Day 2: Worked with Quicknets and Lockheed Martin UCP. Incidents generated from Quicknets were dispatched using NowForce using several different types of devices on several networks including Lockheed Martin's UCP.

What new capability (or improvement to existing capability) does this represent?

NowForce has not yet been utilized in a multi-jurisdictional & multi-national disaster relief environment. Current NowForce environments consist of users within the same vertical who respond to the same call types. This experiment will allow NowForce R&D to identify any system issues when unrelated public safety roles are assigned to the same call types.

Additionally, NowForce is looking to test its grouping capability by only granting IMT branch-officers the rights to view and manage their responders.

Initial Quantitative & Qualitative Results:

These preliminary results are based on end-user experience. If you would like to see actual log data (i.e. location and data sync updates) with device information, please e-mail Jason@nowforce.com

- Lockheed Martin UCP GSM 2G Service: Service was not fast enough for baseline response rules. Auto-Dispatcher would pass over device.
- Lockheed Martin UCP GSM 3G Service: User's reported similar speeds and location accuracy to 3G commercial CDMA service and 3G commercial GSM service
- Android devices effectively generated new incidents in the cloud which resulted in blackberry devices being dispatched
- All devices delivered effective turn by turn directions to incident locations

Observations & Comments:

Many of Camp Robert's Roads were not labeled in Google Maps. Based on the information given in QuickNets, dispatchers were able to identify cross streets or house numbers that were adjacent to an incident location. Additonally, dispatchers, "flashed" updates on responder's cell phones giving them an exact incident location. User's used the turn by turn directions to get to the incident area and relied on the, "flash update" (i.e.- tag is located next to the green painted rock) for on-site directions.

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Lightweight Cellular Networks

Range Networks, Inc.

Principal Investigator/Lead: David Burgess

Objective:

We came to operate a light-weight, portable 2G cellular network based on OpenBTS software. Our goal was to better understand interoperability requirements of other RELIEF participants.

Overview/Background:

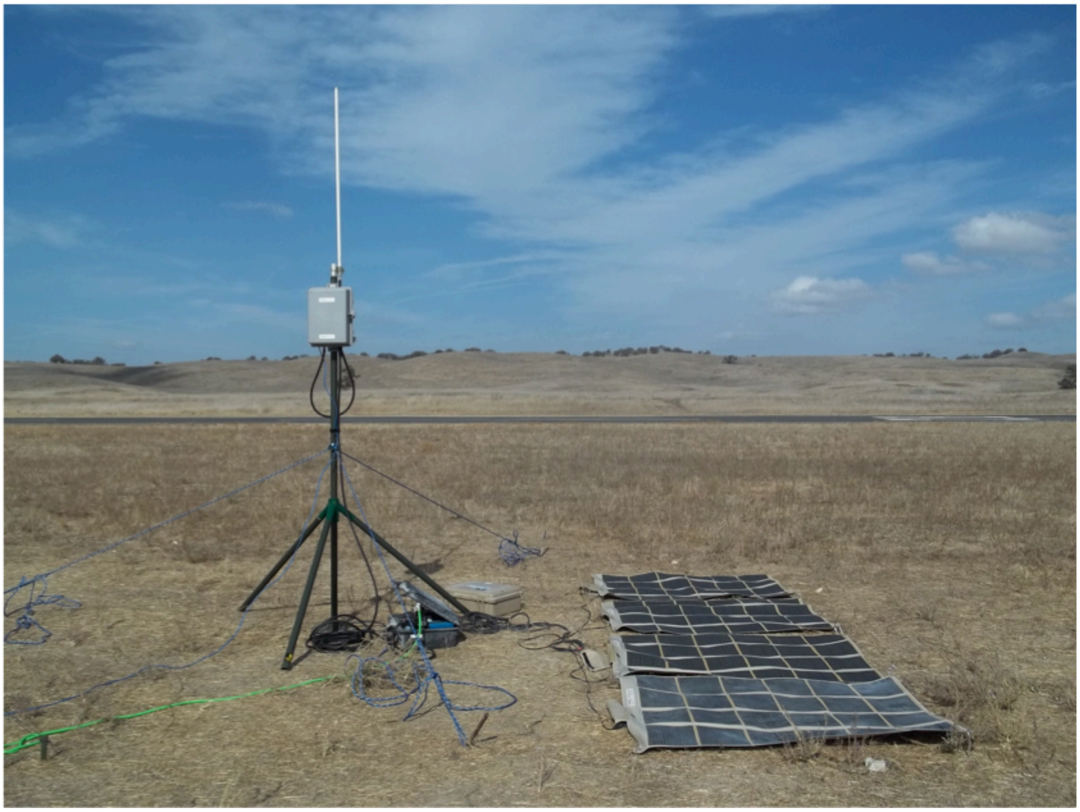
See http://openbts.org for information about OpenBTS itself. Range is designing and prototyping systems based on OpenBTS specifically for the disaster response environment.

Experiment Description:

The original experiment plan was to operate two man-portable 2G GSM cell sites with self-contained power, with the two sites unified to form a single network sharing a common satellite link. On site, the plan was modified to operate two independent single-node networks on different parts of Camp Roberts. See the associated Ad Hoc Experiment Description for mode details.

What new capability (or improvement to existing capability) does this represent?

We are providing a much simpler, more power efficient and more portable cellular network, in contrast to the COWs typically used for these applications. The systems tested here are small enough to be delivered by light aircraft, helicopter, pack animal or even by a small group of people on foot, allowing fast deployment even in areas lacking paved roads. (See photo for an example.) This network is also very flexible, allowing on-site development of ad hoc interfaces between 2G (non-smart-phone) handsets and other IP-based applications.



Initial Quantitative & Qualitative Results:

Our main useful results were:

- verification that BGAN can provide a suitable backhaul for a small GSM cellular installation (described the associated Ad Hoc Experiment report)
- detailed discussions with Ushahidi developers on efficient, robust and secure methods to connect our cellular systems to Ushahidi servers, including those of Quick-Nets, without relying on SMSCs in the public network,
- a better understanding of the operational requirements of a disaster relief environment,
- a better understanding of the operational requirements of FOBs in rural Afghanistan.

Our experience and learning at RELIEF 12-01 will inform design improvements in our systems over the next 3-4 months that will allow us to better integrate with systems used by other RELIEF experiments in the future.

Observations & Comments:

This was our first participation in RELIEF. We were pleased and impressed with the quality and diversity of participants and look forward to participation in future exercises.

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Mobile Device Real-Time Annotation and Collaboration During Response

GeoIQ

Principal Investigator/Lead: Matt Madigan

Objective:

Assess the use the GeoIQ Platform, in conjunction with the Ushahidi SMS and Microtasking facilitated by Humanity Road and the QuickNets team, to assign responders to the various events in the field and to provide dynamic visualization and analytics for situational awareness during disaster response.

During the response portion of the exercise we wanted to test a GeoIQ mobile application (Android) built on the GeoIQ Platform using GeoIQs streaming analysis and how that data would interact with the QuickNets program.

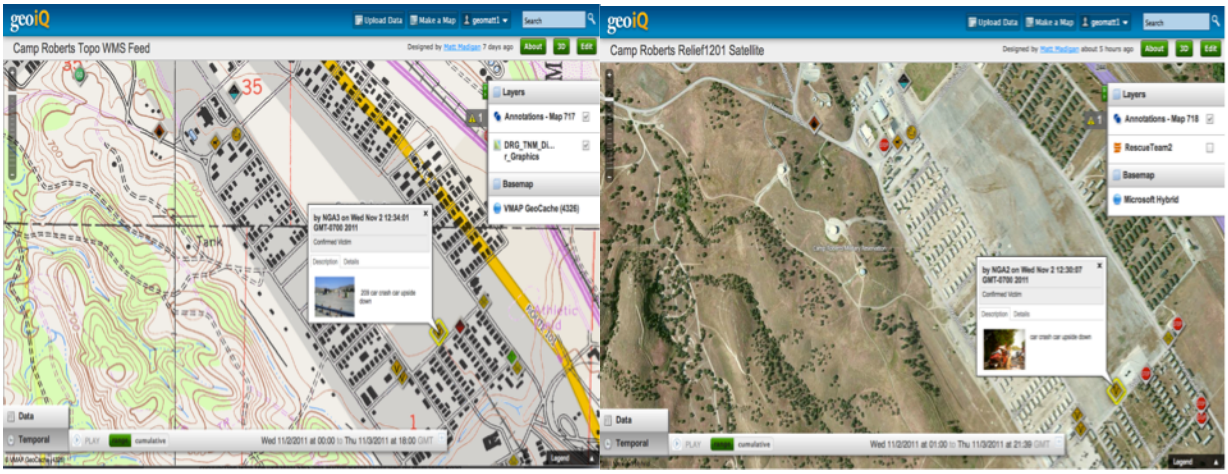
Overview/Background:

GeoIQ has developed a geospatial visualization and analysis platform that enables data to be collected in the field real-time via database connectors and mobile devices. Working with the QuickNets team, the objective is to continue to identify integration points for the collaboration between the QuickNets team partners and data providers for easy visualization and analytics at an Emergency Operations Center.

Experiment Description:

Victims were played by ribbons attached in the field to act as a proxy of their location. To implement the test response system the QuickNets team used Ushahidi based microtasking, led by Cat Graham of HumanityRoad, to direct a volunteer core of responders. Microtasking is a brokerage function that facilitates voluntary selection of needs by responders, monitoring status of those responses, and tracking them to closure.

At each location the victims were documented in a notebook for condition and location. This information was then texted with the identified victims description and location to the operations center. Additionally at each victim location we used the GeoIQ mobile application to mark the precise GPS coordinates, category and a picture of the victim. We also experimented on whether Topographic WMS or a Satellite Image would be the best basemap and pre-loaded both.



During the response day, teams would be assigned by dispatchers to collect the ribbons and update the operations center.

What new capability (or improvement to existing capability) does this represent?

This is the first exercise in the field for the GeoIQ mobile application. Field testing it with QuickNets personnel, and others, will help with the integration decision points as QuickNets, GeoIQ, and Ushahidi look at next steps.

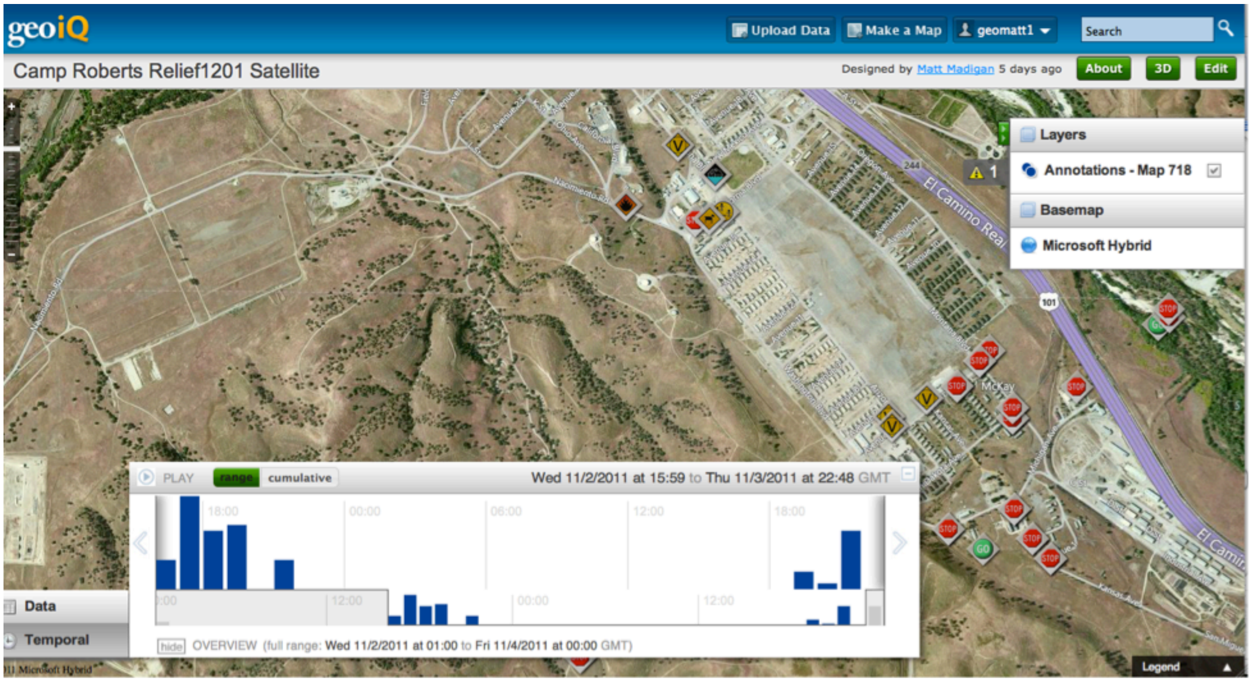
Initial Quantitative & Qualitative Results:

Overall very happy with results. John Livengood of the Pacific Disaster Center and Matt Madigan of GeoIQ, identified victims in the field by placing 18 ribbons in the Rescue Team 2 response area and were able to get everything documented

Two teams of Israeli Hatzalah responders were dispatched by QuickNets, working with NowForce and Camp Roberts base fire response personnel to retrieve the ribbons as described by the dispatcher. At each location the responder collected the ribbon, but also closed the ticket by changing the category on the GeoIQ mobile application. The operation center was a flurry of activity. Dispatchers actively processed the incoming texts and the GeoIQ mobile app was updated in real-time as victims were discovered and collected.

As the afternoon wound down, there were several identified victims that had not been responded that we could see on the map. The Israeli team needed to head to the airport so John Crowley, Galit Sorokin and Matt Madigan headed out with the GeoIQ mobile application and only using the map were quickly able to clear the field of the final eight ribbons and updated the status for operators back at base.

From the Operations Center, we were able to see the progress responders made in real-time and view victims that had not been attended to. By having responders use a Stop Search Category, icons on the map made the progress and resolution easy to see.



Ease of Use: In identifying the victims, things went well. Some of the workflow could be worked around but overall happy with the app.

The Hatzalah response team went through training in about 5 minutes and went out in the field. As they were directed by dispatch they marked a new icon on the map and comment. They reported the Disaster Response App as fast once it cached, and slower when it was first brought up, "No Problem," and easy to use, and very easy to find location especially using the zoom.

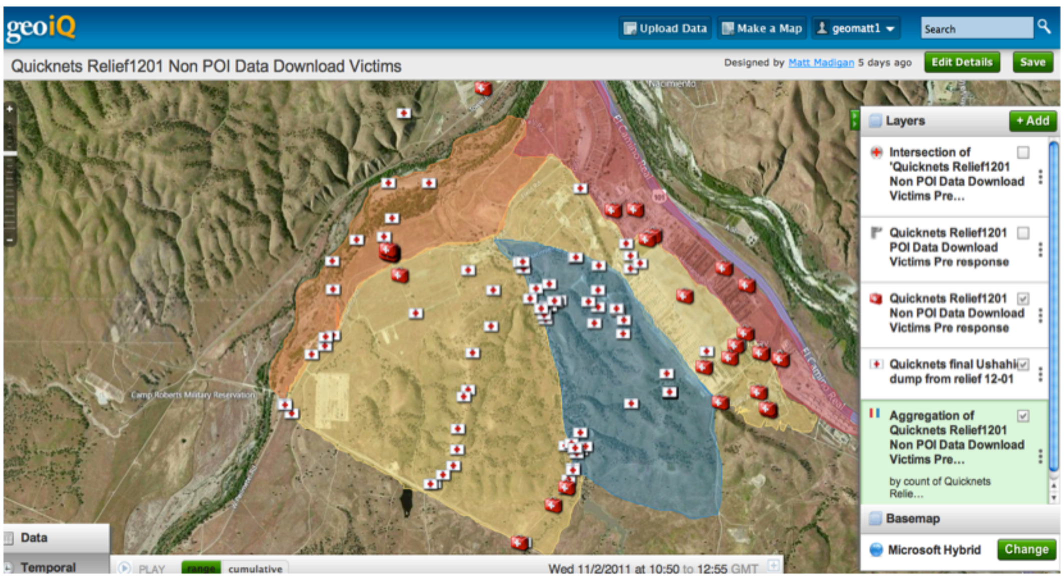
Accuracy: Icons added to the mobile device on both the USPLS Topo and the satellite image were reported as very accurate for responders. However, during Day 1 phase of identifying the victims there was an issue with one of the phones and the accuracy of the location for the "Use my Location" button. Hardware may have been to blame, but an investigation is needed. The other devices location worked reliably as did manual marking the maps with the categorized icons and annotations.

Bandwidth: Time for the map to render and the annotation to save was an issue (10 seconds to 2 min.) based on bandwidth, but all of the data was included when a minimum of 2G were available. 2G and Edge were slower than hoped and 3G, 4G and Wi-Fi all worked very well.

Data Analysis, Discoverability, and Portability: The app worked as it was designed. As the dispatch team worked with the responders, the Operations Center was able to track the progress the team was making. Each team's icons and updates came through in real-time as designed.

The bonus of pushing the field data back to the GeoIQ server - it was instantly discoverable by the Camp Roberts team and portable in over a half dozen formats. It is critical that during disasters data is accessible and portable, and does not get trapped in any single system. This will be all the more true when data is coming from mobile applications. To this end we continue to work with a variety of third party mobile apps so their data can easily be published for quick discovery and format translation.

For the QuickNets team this meant they could start running analysis on the data right away. In this case we took the mobile data from the field and aggregated to the five rescue regions to quantify the activity by area. We also were able to use intersection, filtering, merging and temporal visualization to analyze the entire exercise.



Observations & Comments:

Continued next steps to automate the data integration from the various players and others to create a unified platform are required. Working manually with data during a disaster takes time and will become outdated as more information is collected automatically and on mobile devices. Fortunately, the technologies in the platforms used above are close to doing this and we would like to come back to Camp Roberts with an even better solution.

GeoIQ would like to combine the new streaming analysis into a Camp Roberts exercise. This would allow a responder to kick off a search of people using Twitter to request help, and stream that data live to the mobile application. The responder can then verify the social media on the ground through annotations from the mobile application. These annotations stream back in real time to command center allowing dynamic collaboration between the two. The potential to leverage the human sensor network of mobile devices during a disaster is something we believe will be transformative. Camp Roberts was an awesome experiences and we look forward to hooking up with more cool technologies and people the next time around.
We created a blogpost with much of the above information:
http://blog.geoiq.com/2011/11/11/more-fun-at-camp-roberts-mobile-interoperability/

NPS Field Experimentation Cooperative
Research and Experimentation for Local and International Emergency First Responders (RELIEF) 12-01

QuickNets

Naval Surface Warfare Center – Dahlgren Division

Principal Investigator/Lead: Mark Bradshaw, NSWC-DD

Objective:

Field experimentation and evaluation of crowd sourcing system called QuickNets.

Overview/Background:

QuickNets is a prototype capability for collection, processing, prioritization and coordination of response to urgent needs in HADR missions. It uses state of the art crowd sourcing techniques and technologies to collect urgent needs from the general population of the affected area. It also incorporates new tools to streamline the processing of that data, and coordinate a unity of effort in response to those needs across the civ-mil boundary.

Experiment Description:

The experiment encompassed 3 days onsite.

Day 1:

A. The team victim deployed across the Camp Roberts territory as permitted by regs/policy. Each victim was given a variety of potential location zones to go to, once there they select from a list of needs/injuries for game purposes. Then they sent an SMS into QuickNets, and affixed a card or ribbon to a nearby tree or fixed marker. They then proceeded to the next location of their choosing and repeated. We needed at least 20 people doing this for a total of 6 hours to generate the volume of messages and variety of location and content needed. Each participant brought and used their own personal cell phone at own expense.

B. The message processing (microtasking) team engaged about noon and started processing the messages from the victims. We used local and virtual teams to support this. Each processing team member used their own computer equipment.

Day 2: We dedicated all day to Microtasking and message processing. No victims or responders on this day.

Day 3:

A. The responders deployed. Responders selected the needs they were going to respond to using the QN brokerage function. They then deployed to the site for each victim report. Once there, they collected the card or ribbon as proof of completion, and communicated closure to the QN op center. The report was then marked as closed. This was repeated for every victim report.

B. The microtasking / message process continues as required to complete. We needed the same number of responders as victims.

What new capability (or improvement to existing capability) does this represent?

This is intended to fill a critical gap in coordinating a unity of response across the civ-mil boundary for HADR missions. QuickNets enables coordination of volunteers as well as government responders without command and control over any of them, enabling a unity of effort in the most difficult of situations. Nothing like this exists today.

Initial Quantitative & Qualitative Results:

We received highly positive feedback from the first responders as well as the online processing team with respect to operational relevance and utility. We also got valuable inputs for future enhancements.

NPS Field Experimentation Cooperative
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Social Media Emergency Management: Microtasking Transition to Local Teams

Humanity Road Inc

Principal Investigator/Lead: Cat Graham, Humanity Road

Objective:

Document the Microtasking life cycle of Social Media Emergency Management and return the event management to local support as soon as it is feasible. Its important to tap the local population to assist in the chain of information both for situational awareness as well as recovery. We're exploring a method for activating, training and transferring the micro task from the launch team to the local team.

Overview/Background:

In the past two years, crisis-maps that emerge at the onset of disaster have been used successfully to gain situational awareness in large scale events. However, as this is emerging technology there are few guidelines for best practices and an absence of documentation on how to effectively execute the lifecycle of the map against the lifecycle of the event. The map initiator has varied from newspaper organizations to student organizations, as well as crisis camp volunteers. Service centers begin to appear on the map (such as distribution centers, service centers, ice, mobile hospitals). As needs are fulfilled inbound incidents decline and the map morphs from situational awareness for responders to situational awareness for the public. Maintaining this effectively will help improve crisis communications. Transitioning the map to a local team as soon as the local community can support it is important for monitoring public needs and effective crisis management. This can potentially help reduce or prevent the "disaster after the disaster," namely caused by ineffective resource management. Local Community Emergency Response Teams (C.E.R.T) were trained first responders. While those inside the impact area may be tied up with initial response, trained individuals near the impact zone can provide invaluable support as the local transition team. C.E.R.T. are trained on coordinating with the local emergency management teams so they become instrumental as the first responders online for situational awareness and coordination.

Experiment Description:

We attended RELIEF 12-1 in collaborative support of Quick-Nets, microtasking and incident processing. For this experiment, we focused on identifying only one portion of the overall map management: the process flow for returning Microtasking management to local support as soon as it is feasible. These steps included: Activating Volunteers; Training Volunteers; and Transition to local.

Activating Volunteers: Microtasking with skilled volunteers at the onset of disaster is critical to gaining accurate situational awareness early in the disaster phase. Humanity Road has been collaborating with Quick-Nets in the development of the system beginning in February 2011 and in providing volunteer support to fill the Microtasking role. Tasks involved in micro-tasking include filtering, categorizing, geo-mapping, and processing incidents.

Training Volunteers**:** Volunteers in or near the impact zone have key information to local impacts, culture, language, local geography as well as local populations and points of interest that are critical for effective Microtasking. For this experiment, volunteers will be trained using established standard training processes used by Humanity Road in previous actual disasters and disaster exercises. This training includes written documentation and hands on experience.

Transfer to local community: We selected C.E.R.T, the Community Emergency Response Team which is under the umbrella of FEMA Citizen Corps. Using this approach enhances the traditional and approved national response framework. Trained individuals near the impact zone or in fringe territories can provide invaluable support as the local transition team. C.E.R.T. volunteers are trained on coordinating with the local emergency management teams. They become instrumental as the first responders for situational awareness and coordination. Three teams were selected and expressed interest in participating in the event. Monterey County, California Broward County, Florida and Chesterfield County, Missouri

What new capability (or improvement to existing capability) does this represent?

Currently there is no local trained resource within the national response framework to support this effort. Seventeen areas of disaster preparedness were identified in need of improvement in the *"Federal Response To Hurricane Katrina Lessons Learned"* report. Placing this crisismapping role in the hands of trained volunteers inside the National Response framework enhances their capability and improves situational awareness at the local level for responders as well as the public. This helps to improve all seventeen areas including public Communications.

Crisis-mapping provides incremental intelligence to a broader audience allowing neighbors to assist neighbors in need. In a catastrophic event, this form of monitoring and data collection can reduce the demand on traditional response organizations and even alleviate non-emergency calls in local channels that can already be overwhelmed. However, this very public bird's eye view into local incidental needs can also trigger a flood of humanitarian aid if not handled properly. This can further tax already strained resources. Often the map initiators lack sufficient resources and training to effectively manage the large task of processing incidents presented at the onset of disaster. Therefore, training teams in advance who are from the local area and transitioning these maps to the local community as soon as possible is key to effective crisis management.

Initial Quantitative & Qualitative Results:

Three CERT teams elected to participate in the experiment. Two participated during the event. One was unable to contribute actively due to sudden onset local flooding. Post event surveys will be distributed to participants as well as other CERT teams to determine feasibility, willingness and availability. All three C.E.R.T. teams invited to take part in the exerciseexpressed interest in further pursuing opportunities to discuss ways they can train, and develop their teams in support of Microtasking for catastrophic events.

Initial feedback from victims and responders on the accuracy of data that was processed by the CERT and Humanity Road volunteers indicates their accuracy was remarkable. Working in woodlands with few publicly available points of interest and working with data that was intentionally vague or misspelled, volunteers processed, adjusted and geolocated quickly. Initial results from the Microtasking volunteers indicated that CERT Team leads could be selected, trained and transitioned to leadership capacity within a three hour period. At the end of the 3 hour training they were able to handle all four levels of Microtasking as well as credentialing. The system is designed to be user friendly and it appears to meet that level of expectation.

Observations & Comments:

Generally speaking the C.E.R.T. community seems interested and potentially well positioned to train in support of crisi communications not only in crisismapping but in support of Emergency Management in monitoring social media. Implementing a volunteer training program available to all Citizen Corps teams, instead of just C.E.R.T. may be the most effective way of fast tracking and the rapid development of skilled volunteers. This approach can quickly train a large corps of volunteers who can support their local community. We will need to reach out to FEMA Citizen Corps to determine further interest in discussing next steps. Tapping existing volunteers within the current NRF can provide a method for rapid development and training of already established volunteer resources.

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[EXPERIMENT CANCELLED]

Tethr Box

Principal Investigator/Lead: Aaron Huslage, Tethr

Objective:

Validate prototype of new crisis communication solution.

Overview/Background:

Tethr is creating a new crisis communication solution for NGOs, Journalists and Commercial users. The box combines Internet access (VSAT, BGAN, GSM/LTE, Dial-up, Ethernet) with a server, WiFi, GSM basestation and batteries. It allows people to operate while infrastructure is damaged/offline/compromised during a crisis.

The server allows for people to operate while offline and sync content automatically with Tethr's cloud services. It also allows for local hosting of applications.

Experiment Description:

We have created a prototype that contains a BGAN modem and server running Ushahidi and OpenStreetMaps. We want to validate the operation of the device and work with the community to improve it.

What new capability (or improvement to existing capability) does this represent?

There isn't currently a system that contains the sync, offline use and connectivity options that we provide.

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Ad Hoc Experiment

BGAN-Backed Cell Site

Date: 3 November 2011

Partners: Range Networks, MedWeb, Quick-Nets team

Description:

On the first day of operation we configured two portable cell sites operating as a unified network at McMillan airfield, using the MedWeb VSAT van for a VoIP connection to the public telephone network. Near the end of the first day of operation we were informed that relocation of the VSAT van to the cantonment area would provide a critical service to the Quick-Nets experiment, which was otherwise languishing for lack of internet connectivity. We agreed to yield the VSAT van to support Quick-Nets on the condition that we could use an available BGAN terminal (also borrowed from MedWeb) to support Site #2 as a completely independent, self-contained site. There were provisioning problems with the BGAN terminal, but on morning of the second day, the Quick-Nets team brought us a second BGAN terminal that allowed us to run a complete self-contained Site #2 at McMillan field. The MedWeb VSAT van and Site #1 were relocated to the cantonment area where MedWeb personnel successfully deployed the cellular equipment with no assistance from Range. At this point, we had two completely independent cell sites: Site #2 at McMillan field and Site #1 in the cantonment area. On each of these sites we tested inbound and outbound call routing with the PSTN and on Site #2 we tested outbound routing of text messages.

This experiment was significant because it was the first time that we used BGAN as a backhaul for a GSM cell site, a configuration that greatly enhances the portability of the system.

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Ad Hoc Experiment

Geocent/UA Vision I

Date: 3 November 2011

Partners: Geocent/UA Vision

Description:

Geocent collected UA Vision UAV course path and distributed to all participating Common Operational Pictures (COPs) as an interactive UAV layer. Using this layer allows one to view flight paths and access (link) the video from the flight to view areas or points of interest (AOI/POI). Platforms which were able to view this information and interact with the layer: OpenCOP, Google Earth (SAGE), GeoIQ.

Next steps

1. As UA Vision develops its capabilities, Geocent can deploy OpenCOP to provide a real-time aerial track of the asset (UAV) by providing UA VIsion. Coupling this capability with a time series stamp of video imagery, "stills" of the AOI/POI are readily available along the route. The benefit of this capability provides an EOC or TOC with dynamic tasking of the asset to support the collection plan (e.g. an event occurs at location "X", where is the closest asset to confirm).
2. The RFID interrogation capability by UA Visions UAV can provide the capability for logistics mapping. As the UAV interrogates the resource, this information is available through a WMS providing location and contents to the responding agencies/organizations. The benefit is an accurate logistical picture as resources move throughout the effected disaster area.

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Ad Hoc Experiment

Interactive Data Layer with GeoIQ

Date: 3 November 2011

Partners: Geocent/GeoIQ

Description:

The experiment centered on GeoIQ being able to consume a real-time interactive layer for infrastructure (bridges). GeoIQ was able to view the layer on their system while retaining the original styling of the icon and interact with the information by changing the status of a structure (open, closed, unknown). This information is propagated throughout the network so all other platforms viewing this layer will observe the change improving situational awareness.

Combining the information of the analytics from GeoIQ and operational overlays improves the situational awareness and decision-making process.

Next steps:

1. Assist GeoIQ with their capability to provide web-mapping services for others to consume with their organic platforms (same information on multiple unique systems). The concept it to use GeoIQ as the analytical base but provides its results as services to combine with additional operational or intel layers/products (user defined views) to support individual tasking or mission sets.

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Ad Hoc Experiment

Cellular Connectivity for NowForce

Date: 2-3 November 2011

Partners: Lockheed Martin Corporation and NowForce

Description:

On November 2, Lockheed Martin provided local standalone (not commercial carriers, AT&T, Verizon, etc.) 2G cellular coverage for NowForce's smartphones at McMillan airfield. Our local 2G cellular system was connected to the internet via SATCOM. NowForce determined that 2G cellular cannot support the bandwidth required to support their software. On November 3, Lockheed Martin provided local standalone 3G cellular coverage to NowForce. After the switch to the 3G cellular systems, NowForce stated that their software was completely functional. NowForce thanked us for showing what the difference between a 2G and 3G cellular system had on the execution of their smartphone application.

Next steps:

Lockheed Martin and NowForce could explore future collaboration to experiment with 3G and potentially 4G cellular technologies to support the deployment of their smartphone application in a simulated disaster response environment or provide actual communications capabilities in a real environment with some of their existing customers.

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Ad Hoc Experiment

Google Earth Server and Geocent Layers

Date: 3 November 2011

Partners: Lockheed Martin Corporation and Geocent

Description:

Lockheed Martin collaborated with Geocent to display their KML layers onto our local Google Earth Enterprise server located at the McMillan air field. We were able to retrieve the KML layer from our connection to the internet with our SATCOM capability. We added and changed some content that was transmitted back to the internet to update the Geocent KML layers. We demonstrated a remote node location with standalone local communications and information systems that could add/modify information and subsequently upload and update databases resident on the open internet via SATCOM connectivity.

Next steps:

Lockheed Martin and Geocent could explore future collaboration with their rapid data layer visualization and annotation capabilities to update both Google Earth and 2D maps. We could explore these capabilities to/from remote mobile devices to simulate environments with no connection to normal commercial local networks but have local standalone cellular networks with reachback capability with SATCOM.

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Ad Hoc Experiment

Remote Disaster Node for QuickNets

Date: 3 November 2011

Partners: Lockheed Martin and QuickNets

Description

Lockheed Martin collaborated with the QuickNets team to simulate a disaster response area that had standalone (not commercial carriers, AT&T, Verizon, etc.) local 2G and 3G cellular systems in combination with a SATCOM capability back to the open internet. These interoperable communications systems were located at the McMillan airfield. We obtained an android smartphone with the QuickNet application. We connected the QuickNet smartphone to our 2G cellular network. We had two of our android smartphones also connected to the same 2G cellular network. We passed SMS text messages between our smartphones to the QuickNet smartphone. The QuickNet smartphone was collocated at our site at McMillan airfield. The QuickNet smartphone was also connected to our local (not CIRPAS) Wi-Fi access point, which then connected to the open internet via SATCOM to upload the SMS message to the QuickNet server. The main QuickNets team was located at the Camp Roberts Fire Department Emergency Operations Center. We successfully demonstrated a realistic disaster communications environment. Our Lockheed Martin interoperable communications network (Universal Communications Platform, 2G/3G cellular, Wi-Fi and SATCOM) represented a deployable disaster response capability in conjunction with the QuickNets smartphone application to successfully transmit data from a remote area back to the main emergency operations center.

Next steps:

Lockheed Martin would like to explore a collaborative effort with QuickNets to develop a small deployable system comprised of Universal Communications Platform, cellular and SATCOM communication systems with the QuickNet smartphone applications. This integrated system would be able to support any rapid disaster response to leverage the QuickNet mobile crowd-sourcing capability.

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Ad Hoc Experiment

Micro tasking – Dispatch/Rescue Broker at the EOC

Date: 3 November 2011

Partners: QuickNets, Humanity Road, Camp Roberts Fire and Rescue, Monterey County CERT, United Hatzalah, GeoIQ , Now Force, Naval Post Graduate School

Description:

Field testing the Quick-Nets system required the need for co-locating resources at Fire & Rescue EOC to monitor, track dispatch and record incidents as closed. Camp Roberts Fire and Rescue as well as other spontaneous Camp Roberts participant volunteers took part in placing victim tags as well as texting additional information into the map.

Prior to the search and rescue phase, 'Now Force' requested to join the experiment to test their system by accessing data from the Quick-nets situation map. They moved their operation down to the EOC and co-located their dispatch with Fire and Rescue Dispatch. They were partnering with Hatzalah (Israel Rescue) for their search and rescue team. This allowed the micro tasking team to monitor track and update incidents for two SAR teams and two dispatchers using two unrelated non-synchronous communications systems and best represented real-world situation.

The crisis mapping system is designed to allow brokers to pull, take ownership and close incidents. This was an experiment in determining methods of tracking urgent medical as well as search and rescue requests using incident reports from the Quick-Nets map. The scheduled exercise included testing the ability to dispatch from the map. We wanted to determine the feasibility of utilizing the brokering micro tasking role to help monitor activity, responses and recovery operations and update this information on the map in close to real time.

Earlier in the day, the local CERT Team Lead was trained to be local Lead for microtasking (Monterey County CERT). He credentialed and on-boarded the spontaneous NPS volunteer. Quick-Nets and Humanity Road worked with the NPS volunteer and the dispatcher for Fire and Rescue on developing the micro tasking role. The experience gained from all who took part in the live dispatch situation allowed for great feedback on ways to determine feasibility, and help improve the process. GeoIQ was onsite for testing a bandwidth experiment. GeoIQ engaged ad-hoc into the dispatch and recovery process by compiling a time-lapse display of the inbound incidents and recovery for the event.

Next steps:

Collecting the feedback from dispatchers and victims and responders on the accuracy of the data as well as assessing tips and feedback on dispatch brokering options as well as other was where SAR can utilize the intelligence provided by the map.

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Ad Hoc Experiment

NPS Remote Sensing Center Integration

Date: 3 November 2011

Partners: Naval Surface Warfare Center, Pacific Disaster Center, GeoIQ, RELIEF, NOWFORCE and its USAR team

Description:

Many of the goals of the post-earthquake-event emergency response research underway at the NPS Remote Sensing Center (RSC) pair well with the experiments during RELIEF. In particular, the common operating picture provided by QUICK-NETS (NSWC), used to verify crowd sourced reports, might benefit in the dispatch stage from many imagery derived products. The ability to discuss the needs of first responders (Camp Roberts fire dept.), CERT team members, and international search and rescue teams was a beneficial exercise in understanding their current needs and their comfort level with complex derived data products.

Next steps:

Derive imagery products from multiple datasets that can be integrated into the emergency response framework and useful to first responders. These may include fire hazard, tsunami, geological risk, annotated critical infrastructure, and change detection raster and/or vector layers. The partners also discussed the feasibility of using better tools for dissemination as it was apparent that both USAR and CERT teams would benefit from better field maps and imagery products. We hope to test some of these prototype products at future RELIEF events.

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Ad Hoc Experiment

UA Vision Collaborations

Date: 2 November 2011

Partners: KnowledgeBridge International

Description:

Provided video data for Knowledgebridge to use for further development of a video stabilization algorithm, along with telemetry data.

Next steps:

Knowledgebridge will provide a beta software trial to evaluate the effectiveness of their algorithm.

Date: 3 November 2011

Partners: QuickNets

Description:

Performed planning and direction to generate a flight request for overview/verification of a reported bridge outage. Flight itself was scrubbed due to frequency conflicts.

Next steps:

Plan and execute a flight earlier in the disaster scenario timing to gauge the effectiveness of introducing UAS data into the response mapping.

Date: 4 November 2011

Partners: Lockheed Martin, UA Vision

Description:

Provided target UAS flights to evaluate 9mm camera tracking

Next steps:

Provide IR emitter on aircraft to evaluate IR tracking of 9mm camera.

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Ad Hoc Experiment

UAV Track and Camera Angle presented as a layer with the ability to access the video information for specific points.

Date: 4 November 2011

Partners: Geocent/UA Vision PART II

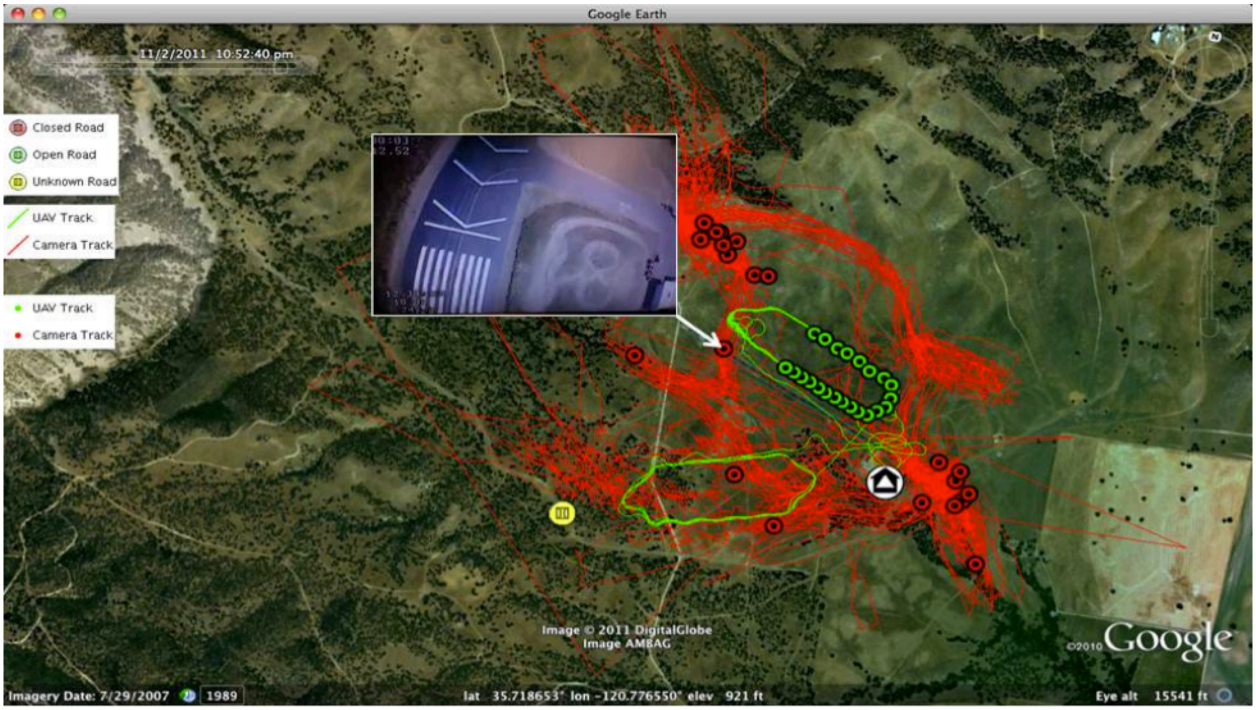
Description:

In disaster relief, UAV information is valuable when the agencies or organizations requiring this information can access in a form that supports their decision cycle or requirement. Combing the raw video with the temporal-geolocation point of interest can prove a tedious task consuming precious time and delaying the response. Many of the current solutions require accessing a separate console from the operational picture and mentally overlaying the information.

Geocent and UA Vision collaborated to produce a UAV track and camera overlay with a time series capability (based on the GIS position and time field). This capability allows a decision maker to see when and where the UAV was positioned and viewing. The analyst can use this information to support their decision cycle; either verifying other reports or supporting a particular course of action (COA).

As a result of this experiment, platforms which were able to view this information and interact with the layer included: OpenCOP, Google Earth (SAGE, Lockheed Martin), and GeoIQ.

The following screen shot visualizes this experimentation and demonstrate its application during a disaster response effort. Green indicates the UAV track and Red is the camera tack at simultaneous time “t”. (Solid lines display the overall tracks for the entire interval).



Next steps:

1. UA Vision is applying digital video to their platform. This will enable the splicing of the video into time stamped still shots allowing Geocent to associate the individual frame or set of flames at time "t". The user will then have access to the actual fame still by simply clicking the map point (which indicates the camera viewing center). This will allow the user to quickly access the information which may be of value for analysis to support their decision.
2. Another experiment with the digital video should be exercised to test this capability in a real environment/scenario (reference Goecent/Lockheed Martin Ad Hoc experiment). This experiment could be in conjunction with another follow on experiment with UA Vision (reference Geocent/UA Vision Ad Hoc experiment Part I).

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Crowdsourcing Security Standards & Best Practices

National Defense University & Rogue Genius LLC

Principal Investigator/Lead: George Chamales, Rogue Genius / Sam Bendett, NDU

Objective:

Discuss the need for standards and best practices for crowdsourced crisis response operations.

Overview/Background:

Three people have been murdered in the town of Nuevo Laredo for taking part in crowdsourced monitoring of drug-related violence. Their deaths highlight the need for security standards for those deploying, reporting to, and using information from crowdsourced technologies. There are numerous indicators from around the world including Egypt, Pakistan, and Sudan that hostile groups are coming to understand and act against crowdsourced systems. Until standards exist for operating them in a secure manner, crowdsourced crisis response deployments will continue to be insecure by default. We do not know if the deaths in Nuevo Laredo are the first, but they will not be the last.

Experiment Description:

In this workshop we provided a short presentation on some of the known vulnerabilities and previous incidents related to crowdsourcing deployments. That presentation served as the foundation for further discussion amongst the attendees about additional threats, vulnerabilities, and consequences as well as solid next steps that can be taken to develop and implement standards and best practices.

What new capability (or improvement to existing capability) does this represent?

Improvements in the security and safety of large-scale crowdsourced crisis response deployments.

Initial Quantitative & Qualitative Results:

Sam Bendett (STAR-TIDES / NDU) and George Chamales (Rogue Genius LLC) presented a lunch-time seminar on Operational Security Concerns of Crowdsourcing Technology on Thursday, November 3rd. The presentation drew attendees from numerous organizations represented at the Camp Roberts RELIEF exercise including members from the US government, NGO community, and the Volunteer Technical Community.

The presentation focused on a series of ten attacks against crowdsourced crisis response deployments with real-world examples of where each of those attacks has been seen in the wild. Following the discussion on attacks, the presentation shifted to the ad hoc defensive strategies that have been promoted in the crowdsourced crisis response community to deal with these vulnerabilities. These approaches provide limited coverage of the range of potential attacks and the case was made for the development of standards and best practices capable of robust coverage. Once developed, those standards should be field-tested at exercises such as Camp Roberts, where an active exercise would include adversaries attempting to disrupt or manipulate the response operation.

Attendees asked numerous questions throughout the presentation and made additional comments from their own experiences with this and similar technology. Numerous points were raised that highlighted the need for thorough standards in the field. These ranged from the concern that discussing potential attacks could provide adversaries with ideas for new attack types (not a primary concern given the relatively low-sophistication needed to exploit the current set of known vulnerabilities) to basic best practices for personal computer security that could be taken by members taking part in the deployments remotely.

Observations & Comments:

Overall, the audience was very positive on the material presented - acknowledging that the concerns raised were legitimate and that there was a definite need to move towards the development of standards, best practices, and evaluation exercises.

We are continuing the discussion with the contacts we made during the presentation and at Camp Roberts and look forward to the next exercise in February.

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Informational Brief

Fielded Integrated Quick-Response UAS-Based Aerial Delivery System "Blizzard"

Naval Postgraduate School / University of Alabama

Principal Investigator/Lead: Prof. Oleg Yakimenko

Objective:

Demonstration of growing capabilities of a small parafoil-based system "Snowflake" for precise coordinated delivery of the mission critical items (munitions, medications, sensors) and ground robots to exact locations at the battlefield from the large standoff distances. Its fielded version, "Blizzard", relies on a catapult-launched / belly-landing unmanned aerial system Arcturus T-20 and is somewhat autonomous. The operator can pick any point on the ground and the payload will be delivered there with a 10m accuracy. Alternatively, an onboard image-processing system can pick up a landing site autonomously if it sees a man waiving hands or a certain color cloth on the ground. Another option is that troops leave a marker (ground weather station) and then the payload / sensor will be delivered right to it right away or later (including covertly night delivery). Finally, the Blizzard system allows to deliver payloads to a moving target (track or ship).

Overview/Background:

During the last decade, several GN&C concepts for gliding parachute applications have been developed and published. The best autonomously guided systems (Strong Enterprises Screamer; MMIST Sherpa, Airborne Systems Megafly, Firefly, Dragonfly, and Microfly; Aerobotics Dragon Train; Stara Mosquito; Attair ONYX; Pioneer Aerospace/Aerazur Panther; and Dutch Space Spades) were demonstrated during Precision Airdrop Technology Conference and Demonstration PATCAD-2001, PATCAD-2003, PATCAD-2005, PATCAD-2007, PATCAD-2009 (at the U.S. Army Yuma Proving Ground, Yuma, AZ); PCAD-2006 and PCAD-2008 (near Bordeaux, France). The ultimate goal for the perspective delivery system is to have payloads delivered from the large standoff distances with a less than 100m CEP accuracy. During the 2009 PATCAD the Blizzard system developed by NPS-UAH team within the framework of TNT/CBE experimentation outperformed all other systems. With the very strong winds affecting all systems (lightest systems the most), Snowflake aerial delivery system (ADS) exhibited 39m CEP accuracy in 6 drops. The closest, heavily funded competitors, Stara and ONYX were able to

achieve 50m and 45m CEP, respectively with more than 40% failure rate (if accounted for all drops their accuracy degrades down to as low as 477m CEP, which absolutely unacceptable).
The keys to the NPS-UAH team success is in systematic approach putting forward a novel, optimal guidance and control paradigm and devoting a lot of efforts to system modeling, parameter identification, computer and hardware-in-the-loop simulations. On top of that, the Snowflake ADS is the only one in the world allowing exploiting global and tactical network. As opposed to other approaches, NPS-UAH team explores the ideas of tracking the near-optimal trajectory established in the inertial coordinate frame using the model-predictive controller. During the final phase of their descent, the trajectory is being constantly updated (in real time) to accommodate the latest data on the ground winds collected and unlinked by the target weather station. The previous drops performed at Camp Roberts and at Yuma Proving Ground in 2008-2009 demonstrated a continuous improvement of performance in terms of the CEP accuracy from 55m for the very first series of drops back at TNT 08-3, down to ~25m during TNT 09-3 and unbeatable 10m demonstrated at TNT 10-3 and ever since.

Experiment Description:

At TNT 11-3, experiments included:

- testing a new CCT camera capable to accurately locate targets from the air
- repeat testing novel glide-slope control techniques
- continue testing/tuning wind estimation algorithms (in case no data from the ground is available)
- test a novel 3D optimization guidance during the final approach
- test a Monkey autopilot
- continue testing/tuning algorithms allowing to land onto a moving platform
- continue testing/tuning algorithms for UAV autoland into a net (for the NAVY operations at sea)

We used our usual setup. The launch site was located midfield or even closer to the West end of the McMillan airfield to deconflict with other teams (if any). One or two stationary targets were established somewhere further west of the launching site. These targets included portable weather stations (measuring ground winds and barometric pressure). These ground stations constantly broadcasted weather data to the NPS TNT SA-server. Two Snowflake ADSs were loaded onto Arcturus T20 UAS and released upwind from the target from an altitude of about 3,000ft AGL. After the drops, the Snowflake ADSs were repacked and loaded onto Arcturus T20 UAS again.

Two or three drops were carried out from a higher altitude of ~14,000' MSL (the specific dates will be negotiated with CIRPAS). Another two or three drops involved a portable weather station installed on a car moving westward along the runway and an autonomous Segway-based ground vehicle (four-wheeled personal transport).
To accommodate all aforementioned tests anticipated having 3-4 series of drops every day for the course of five days.

Quantitative/Qualitative Results:

During the text week about 30 drops were performed from the altitudes of 2,500-11,000 ft AGL. On the average, touchdown accuracy was on the order of 11m CEP with several Snowflakes landing within 2-3 m from the target (Fig.1).

Figure 1. Snowflake landing 2m away from the target (left), Snowflake hitting the target with another one (relying on a “logarithmic winds profile” wind estimate scheme) 20m away (right)

During almost every flight a new capability allowing assigning Snowflake target by picking some point of the screen of a display at the mission control center was tested.

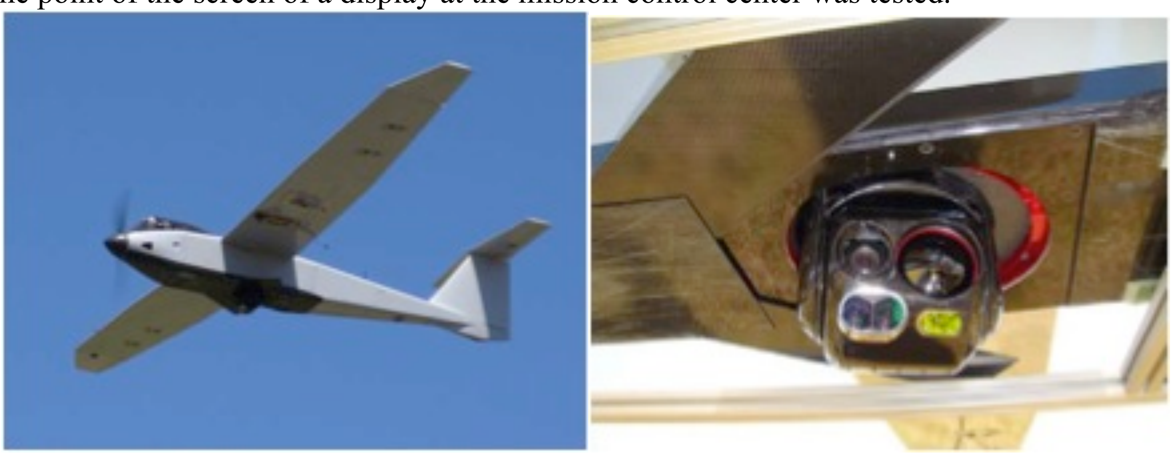

Figure 2. Arcturus T-20 UAV (left) equipped with TASE300 camera gimbal (right)

The Blizzard system utilizes a retracting TASE300 (or TASE200) high performance gimbal (seen in Fig.1a and shown in more detail in Fig.2b) featuring a full 360° un-obstructed field of view, direct drive brushless motors for increased stabilization performance, integrated global positioning system (GPS) receiver plus three-axis inertial measurement unit for standalone operation that eliminates the need for vehicle mounting calibration, and integrated image processing board. It includes the 640 pixels by 480 pixels long-wavelength infrared camera and an FCB-EX980 Sony block camera with optional laser pointer, range finder and illuminator (as shown in Fig.2b). Operation modes include pilot mode, stabilized mode, Lat/Lon/Altitude mode, object tracking, and geo-location estimation. Blizzard’s camera gimbal provides a continuous pan and tilt of +40° / -220° with a 200°/sec slew rate and 0.023° pointing resolution (0.05° for TASE200), i.e. 1m per each 2.5km of slant distance (2m for TASE 200), and is capable to operate day and night.

The Cobham Tactical Communications and Surveillance miniature microwave standard definition video transmitter coupled with a 2Watt variable efficiency power multiplier (Fig.3a) 2allows transmitting the encrypted mpeg4 video stream taken by the camera down to MCCC for up to 50 miles with 5Db margin. The T-20 UAV utilizes a simple 4Db blade antenna under the tail and MCCC includes a two-patch antenna with a total coverage of 90 degrees. As is well-known for UAV applications, signal bounce off the earth or buildings may induce fading, causing signal breakup. The Cobham receiver uses spatial diversity to overcome fades and multipath and enhance video quality. To be more specific, it uses a robust digital modulation system known as coded orthogonal frequency division multiplexing, relying on a voting logic board which votes for the best signal during the horizontal antenna beam electronic scan 15,000 times per second. The system works with the smallest angle of line-of-sight clearance above the ground, and for short-range operations (less than 15 miles) allows non-line-of-sign operations inside canyons, around the hills and tall buildings (urban operations). Therefore, there are almost no restrictions on accurate and persistent target tracking. Figure 3b show an example of the data, where the coordinates of the located wounded soldier who is in need of medical supply are computed by the TASE300 sensor and then passed wirelessly to the Snowflake ADS, which in turn computes the release point and passes it back to UAV's autopilot to execute.

Figure 3. Microwave radio transmitter (left) and desired impact point chosed using TASE300 sensor (right)

As far as collecting some video data all Snowflakes (and T20 UAV) were equipped with the high definition GoPro cameras like shown in Fig.4.

Figure 4. Snowflake GNC with the lanyard activated trigger in its lid (left) and release mechanism (right)

These cameras allowed collecting valuable data for further processing. These include Snowflake deployment (Fig.5), prove the reason for tangled lines occurred once in a while (Fig.6) and video stream on the final approach (see still images in Fig.7)