Small Unmanned Aerial Systems at Hurricanes Harvey and Irma

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TEES Center for Robot-Assisted Search and Rescue Technical Report CRASAR-2017-01
FSU Center for Disaster Risk Policy Technical Report 20170901

Largest known deployment of SUAS for public officials

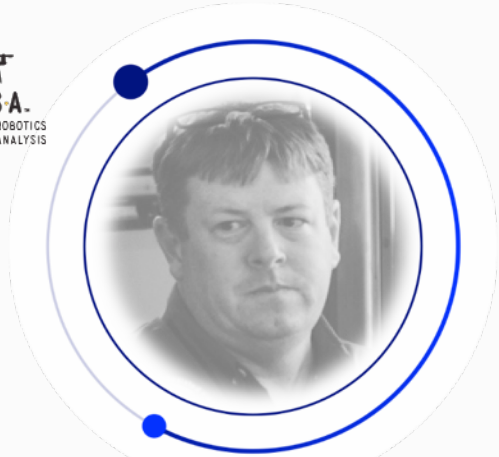
Harvey: TEES Center for Robot-Assisted Search and Rescue for Fort Bend County OEM Texas

Irma: FSU Center for Disaster Risk Policy for FL TF-8 and and Collier County OEM Florida

see video at: http://fbcoem.org/fort-bend-county-uas-operations-video/

UAS Deployment Leaders

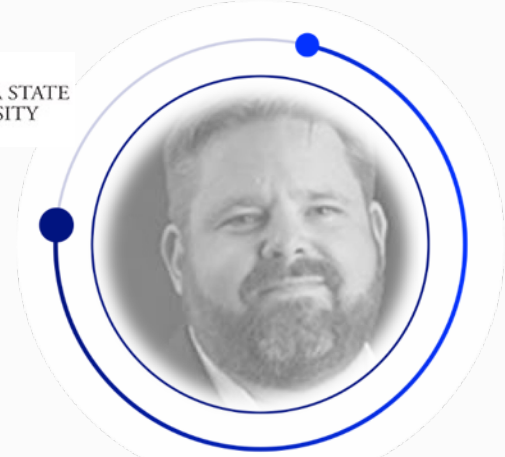
ROBOTICISTS WITHOUT BORDERS



JUSTIN ADAMS

Air Operations Branch Director
Fort Bend County Office of Emergency Management
CRASAR Director UAS Operations, Harvey
Kovar Associates LLC Unmanned Robotics Systems Analysis

Adams is a civilian and drone pilot. He served dual roles at Harvey- managing all manned and unmanned aircraft to the county and overseeing CRASAR UAS. He was deputy UAS operations manager at Irma.



DAVID MERRICK

CDRP Director UAS Operations, Irma
CRASAR UAS Operations, Harvey
Florida State University
Center for Disaster Risk Policy

Merrick is a drone pilot and served as the CRASAR RWB tactical UAS operations manager for Harvey and as the overall UAS operations manager for CDRP deployment to Irma.

ROBIN MURPHY

Dir. Center for Robot-Assisted Search and Rescue
Roboticists Without Borders
Texas A&M Engineering Experiment Station

Murphy is a drone pilot and has been on UAS teams for Hurricanes Katrina, Wilma, and 6 other disasters. CRASAR hosts the RWB program and was requested by Fort Bend County.. CRASAR was reciprocally requested by CDRP to assist with Irma.

Hurricanes Harvey and Irma

ROBOTICISTS WITHOUT BORDERS

Harvey

- Houston area Aug 26; first flight Aug. 25. Deployed 8/24-9/4
- Fort Bend County Office of Emergency Management (Texas)
- 119 flights (sorties) for 119 mission objectives or targets
- 13 pilots, 2 data managers from Florida State, Kovar Associates LLC, Lone Star UASC, Texas A&M, USAA
- 10 different models of UAS used: DJI Inspire, DJI Mavic Pro, DJI M600 Pro, DJI Phantom 3 Pro, DJI Phantom 4 Pro, Insitu Scan Eagle, Intel Falcon 8, Parrot Disco, PrecisionHawk Lancaster 5, 3DR Solo
- 14 models available, including AirRobot 200, AirRobot 180, PrecisionHawk M100, and UAUSA Tempest.

Irma

- Initial Landfall Sept 10; first flight Sep 12; Deployed 9/9-15
- Putnam and Collier County Office of Emergency Management (Florida)
- 247 flights (sorties) for over 500 mission objectives or targets
- 6 pilots, 1 data manager from Florida State, Kovar Associates LLC, Texas A&M
- 2 models of UAS used: DJI Mavic Pro, DJI Inspire 1
- 8 models available:, including DJI Inspire, DJI Mavic, DJI M600 Pro, DJI Phantom 3 Pro, DJI Phantom 4 Pro, Intel Falcon 8, Parrot Disco, PrecisionHawk Lancaster 5

Snapshot of The Differences

ROBOTICISTS WITHOUT BORDERS

Harvey

- Fort Bend County: densely populated Houston suburb surrounded by rural area
- Texas drone privacy statute 423
- Had a UAS policy in place
- dense, low-altitude air traffic
- flights began before, then immediately after
- missions tended to be to support response and for EOC situation awareness (response)
- Cellular network intact
- High influx of volunteer drones

Irma

- FL TF-8/Putnam and Collier County: rural with retirees
- Florida drone privacy laws 934.50
- No UAS policy in place
- light air traffic
- flights after
- FL TF-8 mission focused solely on life safety; later missions tended to be for damage assessment (reconstruction and recovery)
- Cellular network down
- no volunteer drones

Comparison of Missions

ROBOTICISTS WITHOUT BORDERS

Harvey (119 flights)

- Missions: Damage assessment, Flood inundation, Route, Public information-rumor control, Mapping levees, Bridge inspection
- Single mission objective or target per flight (sortie)
- At least 1 county official with each team
- Data products: Video as the primary data product in initial 5 days, then mapping as focus on monitoring river levee

Irma (247 flights)

- Missions: FEMA Property Damage Assessment, USAR overwatch
- Multiple targets inspected per flight (sortie)
- Initial embed in Task Force, then on own to accomplish PDA
- Data products: “5 picture” stills (elevation views of all sides plus nadir) and overview video as primary data product, some mapping for larger targets to produce orthomosiac

Air Space Observations

ROBOTICISTS WITHOUT BORDERS

- Air Operations branch needs an expert in UAS in order to coordinate
- ICS should be followed throughout county, state, federal
- Volunteerism/disaster tourism is a real problem
- FAA: well-intentioned but inconsistent and unfamiliar with the first critical phases of emergency response
  - Temporary flight restrictions are helpful but need to be enforced and not rescinded
  - E-COAs regulations should be followed
    - only for government sponsors- were granted to industry with no agency sponsor
- Flip the UTM discussion: UAS need to know where manned assets are
  - Air Operations should use tracking e.g., Harris RangeVue
  - Drone teams should have VHF radio and all air traffic on same frequencies
- During Irma in Florida, E-COAs were granted freely to private sector organizations.

Why Flying in a Disaster Requires a Different Skill Set Than Just a Part 107

ROBOTICISTS WITHOUT BORDERS

- Aviation and jurisdictional rules during an incident are different
  - Temporary flight restrictions may be in place and E-COAs may be required; these are not well-covered on part 107 test
  - Jurisdictions may deny physical access
- Must co-exist with dense, low-altitude manned aircraft flying 50-400 feet AGL
  - Requires greater diligence and coordination with manned aviation
  - BLOS is not safe without aircraft tracking
  - Safe reaction may be to rapidly ascend or "park in the trees" versus return to home
- GPS signal interference from cloud cover, Electronic Interference from power lines - "walk aways" and "fly aways" may occur
- Launch/landing zones are limited, may be highly constrained, and pose personal risk
- Can't wait for optimal conditions
  - fly in high winds
  - conduct photogrammetric mapping in low light or cloud cover
- Requires right data products for the mission
- Requires handling of data to be consistent with privacy laws and agency regulations

Volunteerism/Disaster Tourism

ROBOTICISTS WITHOUT BORDERS

- Harvey saw untrained out of state teams called in (but not under a MOA or contract) by the American Red Cross and local and out of state self-deployed teams seeking missions (and funding) from agencies
  - New apps and a business spontaneously created to encourage self-deployment
  - Courses being offered on flying for disasters- may lead to situations such as untrained canine search teams
- Flights for ARC were in violation of Texas Privacy Statute 436
- Self-deployed teams
  - often relied on “friend of a friend” relationship (e.g., a sheriff, county assessor) to get a mission or a E-COA, which violated county or state processes for assets and Air Operations
  - posted data to social media, violating Texas Privacy Act
  - duplicated effort for existing damage inspection and debris removal contracts
  - appeared to be unprepared for austere conditions, being self-sufficient, and unaware of challenges of flying in disasters

Prior CRASAR UAS Deployments

ROBOTICISTS WITHOUT BORDERS

2005
- Hurricane Katrina (State of Florida SERT)
- Hurricane Wilma (Fort Myers Marina and Harbor)

2007
L'aquilla Earthquake Italy (Italian Fire Brigade)

2009
Berkman Plaza Collapse (Jacksonville Fire Rescue Dept)

2011
Fukushima Daiichi Nuclear Accident (TEPCO).

2014
Oso Mudslides Washington State (Snohomish County OEM)

2015
Texas Memorial Day Floods: Wilderness Search and Rescue (Wemberly County OEM)

2016
- Louisiana April floods (Tangipahoa and Washington Parish OEM)
- Texas Memorial Day Floods (Fort Bend County OEM)