Drones as mobile communication platforms during natural disasters

Dr. Panayiotis Kolios, KIOS COE – UCY email:pkolios@ucy.ac.cy



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KIOS CoE





ΚῶἶΟϚ ^Δ University</sup> of Cyprus

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KIOS CoE Premises





1km



First things first...

- Terminology
 - Drones
 - Remotely Piloted Aircraft System (RPAS)
 - Unmanned Aerial System (UAS)

Unlock enormous potentials due to the following advantages:

- Cost (much cheaper to operate)
- Size
- Timeliness
- Provide greater probability of mission success without the risk of loss of aircrew resource
- Can be exposed to dangerous environments
- Manned aircrew can lose concentration after many hours spent on watch; therefore loss of mission effectiveness





DG ECHO PREDICATE – GA 713851



- PREDICATE: PREventing DIsasters by CApitalizing on unmanned aerial systems Technology (Jan 2015 – Dec 2017)
 - Monitoring disaster-prone regions for the purpose of prevention and risk reduction
 - Using Unmanned Aerial Systems (UASs)
 - Affordable and highly capable platforms
 - Easily adaptable (to different situations), flexible and reconfigurable
 - Guide the selection and use of UAS in watch-keeping and patrolling of different regions of interest
 - Needs assessment and technology review procedures
 - Intelligent path planning toolkit for efficient UAS operation
 - Implement prototypes and facilitate cooperation and coordination of enduser partners

http://www.kios.ucy.ac.cy/predicate/





Humanitarian Aid and Civil Protection



SWIFTERS: Safe and Rapid Evacuation Facilitated by UAV Swarms

(Jan 2018 – Dec 2019)

- SWIFTERS will study, design, develop, and test, cooperation strategies to better coordinate UAV swarms conduct tasks that will improve response efficiency and reduce evacuation times
- The following three operations will be integrated:
 - 1. Monitoring of the hazard (and available evacuation routes),
 - 2. Informing/alarming about the decision to evacuate (through audiovisual means),
 - **3.** Monitoring locations of interest (e.g., movements of people during evacuation, assembly area, and transportation routes).
 - 4. At all times a joint operation picture will be maintained through updated data streams provided by the participating UAVs.
- It will also train personnel in using swarms of UAVs (each with a specific role in the mission)
- Tests will be conducted at international exercises, including "Eggelados", "Lellapa" and "Argonaftis", with the participation of first responders from across Europe

http://www.kios.ucy.ac.cy/swifters



Humanitarian Aid and Civil Protection



DG ECHO LEAPFROG – GA 782233

- Develop Standard Operating Procedures
- Develop appropriate training program that will consist of a theoretical as well as a practical part
- Integrate autonomous functionalities
- Manage data and develop process of extracting and communicating information to support decision-making
- Conduct extensive training and exercises to build capacity and assert the competencies
- Introduce the RPAS module to the voluntary pool

http://www.kios.ucy.ac.cy/leapfrog





REPUBLIC OF BULGARIA MINISTRY OF INTERIOR





RPAS Unit

EXERCISES & DEPLOYMENT









Humanitarian Aid and Civil Protection

PREDICATE PROJECT (ECHO/SUB/2015/713851/PREV29)

- Cyprus Expo, 9 April 2016
 - More than 150 Civil Defence personnel, volunteers and conscripts







"Lelapa 2016" Fire Fighting Exercise



Collaboration Exercise 2016

Strovolos Nicosia, 18 April 2016



and Civil Protection

Collaboration Exercise 2016 II

Latsia, Nicosia, 23 April 2016









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Argonavtis 2016

Larnaca Port, 24, 26 and 30 April 2016













Eggelados 2017

Lageia, Saturday 11 March 2017







Eggelados 2017

Zygi, Monday 13 March 2017(Aerial Information Team)









PACES Exercise

 Joint earthquake exercise conducted 22-23 June in Limassol, Cyprus





Ora Village Fire

Use of drones at midnight of 19 July
 2017 to assess danger to houses



Eggelados 2018







Lellapa 2018



Argonavtis 2018







TRAINING AND DEMOS





UAV in Emergency Response: Research and Innovation Challenges



3 October 2017, University of Cyprus, Cyprus
40 engineering students and practitioners have attended the event







UAVs and their use in servicing the Community



NEXT GENERATION COMMUNITY POLICING

25 – 27 October 2017, Heraklion, Crete, Greece
150 attendees from public organizations, the European Union and internationally







UAS in emergency management

Ministry of Security of the Republic of Argentina, 12-13 Dec 2017







Situational and needs assessment using UAS



UCPM AMC, 7 May / 10 Sept / 26 Nov 2017
20 trainees of various backgrounds and nationalities







EU Exchange of Experts, 6th – 9th March 2018

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Training Activity: Drones in Emergency Management

Tuesday, 6 March 2018	
09:00 - 10:00 Arrival and registration of part	icipants
10:00 - 11:00 Presentation of KIOS CoE Activi	ties
11:00 - 12:00 Tour of KIOS CoE Laboratory Fa	cilities
12:00 – 13:30 Lunch	
13:30 - 15:00 Introduction to drone technolo	ogies (presentations)
 Drones in emergency management 	
 Drone-based mission classification 	
 Real-life experiences with the use of drag 	ones in emergency situations
15:00 – 15:30 Coffee break and live demos	
15:30 – 18:00 Fundamental principles of dron	ne operations
 History, category and types of drones 	
 Air Law 	
 Safety and risk management 	
 Situational Awareness 	Thursday, 8 March 2018
Charts	09:00 - 12:00 Hands-on session: Manual flights in GPS and ATT mo
 Aviation Weather – Principles 	12:00 – 13:30 Lunch
 Communications 	13:30 - 16:30 Hands-on session: Manual flights in GPS and ATT mo
 Route planning and navigation 	Friday 0 March 2019
 Flight Dynamics 	Friday, 9 Warch 2018
 Equipment and system operations 	12:00 – 12:00 Hands-on session: Flying using mission planning too
19:30 – 21:30 Dinner	12:00 - 15:50 Lunch 12:20 - 16:20 Hands on sossion: Elving using mission planning tool
Wednesday, 7 March 2018	15.30 – 10.30 Hands-on session. Fight using mission planning tool
09:00 – 10:00 Multiple choice quiz	10.50 – 17.50 Lessons learned and concluding remarks
10:00 – 11:00 O&A on guiz questions	
11:00 – 12:00 Matching drone technologies t	o mission types
12:00 - 13:30 Lunch	
13:30 – 14:30 Review of software tools for m	ission planning and execution
14:30 – 15:00 Coffee break and live demos	
15:00 – 16:00 GIS technologies for managing	and processing collected data
16:00 – 17:00 Computer vision and machine	learning for object detection
17:00 - 18:00 Introduction to DG ECHO PRAS	module

19:30 – 21:30 Dinner



Agenda



EU Exchange of Experts, Magor

Hungary Budapest, 1-3 May 2018

- Consider work flow from simply taking images to support decision makers and responders, including:
 - Incident
 - Regulations
 - Capacity of the asset
 - SOP
 - Sharing methods
- Participants from:
 - Manchester Air Unit
 - Magor Dronesquad
 - THW
 - DEMA
 - KIOS CoE







Humanitarian Aid and Civil Protection

EMERGENCY MANAGEMENT APPLICATIONS







Mapping & Reconnaissance

- Manually
- DroneDeploy
- Pix4D









Automated watch-keeping and patrolling



Automated watch-keeping and patrolling



Automated watch-keeping and patrolling



Automated watch-keeping and patrolling II



Demo







Data management





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Data management II







3D reconstruction from stitched images







Monitoring & Tracking



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Monitoring & Tracking II





ΚοΐΟς ^Δ University</sup> of Cyprus

Temporary Utility Infrastructure









Delivery of Help-Aid









Safety & security

- Anti-drone Birds
 - Disabled by physical capture (e.g. Dutch police)
- Net casting (physically tangle the UAV)
 - Ground launcher (e.g. SkyWall)
 - Drone-based entangling (e.g. Rapere drone)
- RF jammers (disrupting communication and image capture – using lasers)
 - Ground solution (e.g. DroneDefender, Blacksage)
- GPS spoofing (malicious data injection to divert an autonomous drone)
- High-energy laser (physical damage)
 - 60-150KW steady power







Software defined radio (SDR)

- SDR hardware
 - HackRF
 - BladeRF
 - USRP B210
- Open access software for Cellular
 - OpenAirInterface
 - OpenBTS
 - OpenLTE
- Open access software for Radio
 - ADS-B
 - AIS











Software defined radio (SDR)

Spectroscopy







GPS jamming







GPS spoofing





