



## Unmanned Aerial Vehicle Vertical Applications' Trials Leveraging Advanced 5G Facilities

### ISSUE HIGHLIGHTS

The sixth issue of the 5G!Drones newsletter presents the project activities during the period September-November 2020. This issue focuses on the latest 5G!Drones dissemination and communication activities, the trials performed, the deliverables that have been published as well as the general assembly meeting's details.

#### 5G!Drones activities in numbers:

- Three Journal Papers
- Two Conference Papers
- One White Paper
- One Thesis
- Eight Articles
- Three Webinars - Presentations
- Three Online Conferences - Presentations
- One Co-organized Workshop
- Five Feasibility Tests
- Four Deliverables
- Two Upcoming Deliverables
- One General Assembly Meeting (virtual)

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## DISSEMINATION AND COMMUNICATION ACTIVITIES

### JOURNAL PAPERS

#### IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS

The 5G!Drones paper entitled “Joint Sub-carrier and Power Allocation for Efficient Communication of Cellular UAVs” was published in the IEEE Transactions on Wireless Communications on 10 September 2020. You may read the paper online at 5G!Drones website:

<https://5gdrones.eu/wp-content/uploads/2020/09/IEEE-Journal-Joint-Sub-carrier-and-Power-Allocation-for-Efficient.pdf>



#### IEEE NETWORK MAGAZINE

The 5G!Drones paper entitled “On Supporting UAV based Services in 5G and Beyond Mobile Systems” was accepted and it is under publication in the IEEE Network Magazine. You may read the paper on the 5G!Drones website:

<https://5gdrones.eu/wp-content/uploads/2020/09/IEEE-Network-On-Supporting-UAV-based-Services-in-5G-and.pdf>



#### IEEE VEHICULAR TECHNOLOGY MAGAZINE

A 5G!Drones journal paper entitled “Supporting UAV Services in 5G Networks: New High-Level Architecture integrating 5G with U-space” has been accepted and is under publication in IEEE Vehicular Technology Magazine. You can read the whole paper on the 5G!Drones website:

<https://5gdrones.eu/wp-content/uploads/2020/11/Supporting-UAV-Services-in-5G-Networks.pdf>



### CONFERENCE PAPERS

#### IEEE GLOBECOM

The 5G!Drones conference paper with the title “GPS Spoofing Detector with Adaptive Trustable Residence Area for Cellular based-UAVs” was accepted and it is under publication on the context of IEEE Globecom conference that will take place in December. You can read the paper online on the 5G!Drones website:

<https://5gdrones.eu/wp-content/uploads/2020/09/Globecom-GPS-Spoofing-Detector-with-Adaptive-Trustable.pdf>



The 5G!Drones conference paper entitled “UAV mission optimization in 5G: On reducing MEC service relocation” has been accepted in the context of IEEE Globecom 2020 is affiliated with the 5G!Drones project. You can read the paper here:

<https://5gdrones.eu/wp-content/uploads/2020/10/UAV-mission-optimization-in-5G-On-reducing-MEC-service-relocation.pdf>



## **WHITE PAPER**

A 5G-PPP White Paper entitled “Empowering Vertical Industries through 5G Networks - Current Status and Future Trends”, which refers to the 5G!Drones project, is available online at:

<https://5g-ppp.eu/wp-content/uploads/2020/09/5GPPP-VerticalsWhitePaper-2020-Final.pdf>

## **THESIS**

Master thesis with the title “Enabling seamless application migration over multi-core network environments” was published at the University of Oulu, Faculty of Information Technology and Electrical Engineering, Communications Engineering by Shah Prashant and reviewed by Jussi - Pekka Haapola, 5G!Drones project coordinator. You may access the thesis at the following online link: <http://jultika.oulu.fi/Record/nbnfioulu-202006212616>

## **ARTICLES**

### **6G WAVES MAGAZINE BY 6G FLAGSHIP**

5G!Drones project was featured in the 2nd version of 6G waves magazine by the 6G Flagship. Dr. Jussi Haapola, 5G!Drones coordinator, from University of Oulu, shared some insights about the features and the distinctiveness of the project. In addition, he gave information about the long-term evaluation of drones. The magazine was published in October 2020 and you can access it at the following link: <http://jultika.oulu.fi/files/isbn9789526227641.pdf>

### **WEBSITE ARTICLE: COMMERCIALDRONEPROFESSIONAL.COM**

An article was published on the Commercial Drone Professional website giving information about the 5G!Drones feasibility tests that were executed at 5GENESIS Athens 5G platform (Municipal stadium of Egaleo) in October 2020. The trials were conducted in the context of 5G!Drones Use Case 4 (connectivity during crowded events). To access the article, click on the following link: <https://www.commercialdroneprofessional.com/drones-to-boost-mobile-and-internet-connection-in-crowded-events/>

### **WEBSITE ARTICLE: AIGALEO.GR (IN GREEK)**

An article (in Greek) was published on the official website of Municipal of Egaleo exploring the nature of 5G!Drones feasibility tests executed at 5GENESIS, Athens 5G platform (Municipal stadium of Egaleo). The trials conducted in the context of Use Case 4 (connectivity during crowded events). To access the article, click on the following link: <https://www.aigaleo.gr/2020/10/22/technikes-dokimes-5g-me-drones-sto-dimotiko-gipedo-aigaleo/>



5G PPP

5G IA

5G PPP Technology Board &  
5G IA Verticals Task Force

**Empowering Vertical Industries through  
5G Networks - Current Status and  
Future Trends**





### WEBSITE ARTICLE: COMMERCIALUAVNEWS.COM

An interview put into an interesting article by Danielle Cagne from Commercial UAV News with the title "5G!Drones Is Putting the Pieces of the Drone Ecosystem Together to Make Sure They Fit and Can Deliver Value to Stakeholders " explores the nature, the dimensions and the extensions of the 5G!Drones project with a view on the creation and validation of a safe and reliable drones ecosystem in the next few years. Many thanks to all partners (Unmanned Life, CAFA Tech, COSMOTE, Robots.Expert, NOKIA, INVOLI, Frequentis) that contributed to this article. You may access the article online here :

[https://www.commercialuavnews.com/europe/5g-drones-is-putting-the-pieces-of-the-drone-ecosystem-together-to-make-sure-they-fit-and-can-deliver-value-to-stakeholders?fbclid=IwAR1\\_FZiG1PnCs50ZmA5Clmei\\_KcIfPtPxOPeHY3tRbEW-obqketTKY150E](https://www.commercialuavnews.com/europe/5g-drones-is-putting-the-pieces-of-the-drone-ecosystem-together-to-make-sure-they-fit-and-can-deliver-value-to-stakeholders?fbclid=IwAR1_FZiG1PnCs50ZmA5Clmei_KcIfPtPxOPeHY3tRbEW-obqketTKY150E)



### WEBSITE ARTICLE: URBANAIRMOBILITYNEWS.COM

The website of Urban Air Mobility News provides information about the 5G!Drones feasibility tests that were executed at 5GENESIS Athens 5G platform (Municipal stadium of Egaleo) through an interesting article. The trials were conducted in the context of Use Case 4 (connectivity during crowded events). You may access it by clicking on the following link:

<https://www.urbanairmobilitynews.com/uncategorized/drones-alongside-5g-to-solve-poor-network-connection-during-crowded-events/>



### WEBSITE ARTICLES: IIT.DEMOKRITOS.GR

A website article and a video presentation about the 5G!Drones feasibility trials in 5GENESIS Athens platform were published online by NCSR Demokritos. Dr. Harilaos Koumaras along with representatives from 5G!Drones partners collected inputs and verified the interaction between 5G and drones.

You can access the article and watch the video presentation on the Demokritos website:

<https://www.iit.demokritos.gr/newsevents/5gdrones-feasibility-tests-athens/>



In addition, the Institute of Informatics & Telecommunications (IIT), NCSR, dedicated its October newsletter to 5G Networks. The workshop "5G Trials in Europe: 5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives" was successfully organised by the Media Networks Laboratory (MNL) on Wednesday 14 October 2020, between 9:00-15:00 CEST, in the frame of H2020 projects 5GENESIS and 5G!Drones with the support of the 5G-PPP partnership. It was attended online by almost 100 participants.

More information is available at:

<https://www.iit.demokritos.gr/newsevents/iit-dedicates-october-5g-networks/>







## WEBSITE ARTICLE: INNOENERGY.COM

5G!Drones partner Hepta Airborne represented the project in an article published on the InnoEnergy website. This article explains the automation capabilities that 5G can provide in the UAV industry and was written in the context of the Athens Trials which took place in October 2020 concerning the poor network connection during crowded events. You can read the article at: <https://www.innoenergy.com/news-events/hepta-drones-and-5g-will-solve-poor-network-connection-during-crowded-events/>



## WEBINARS-PRESENTATIONS

### 5G MOMENTUM WEBINAR ORGANIZED BY LIIKENNE- JA VIESTINTÄVIRASTO TRAFICOM

5G!Drones partner Gokul Krishna Srinivasan from robots.expert participated in the 5G Momentum webinar organized by Liikenne - ja viestintävirasto Traficom / Transport- och kommunikationsverket Traficom on Thursday 3 September 2020. The discussion was about the challenges and benefits of 5G technology in the context of Urban Air Mobility. He also had the opportunity, to briefly talk about the recent feasibility tests conducted by the 5GDrones project.



### WEBINAR PRESENTATION - "MNO OPENNESS: THE NEXT BUSINESS OPPORTUNITY"

The second webinar of the 6G Research Visions Webinar Series, organised by 6G-Flagship of the University of Oulu, took place on 16 September 2020. Dr. Harilaos Koumaras from NCSR-D, 5G!Drones partner, participated and presented in this webinar which addressed the essential choices for developing preferred business opportunities of 6G in the age of platforms, ecosystems, and empowerment. You can find information about the webinar here:

<https://www.6gchannel.com/items/6g-research-visions-webinar-series-essential-choices-for-developing-preferred-business-of-6g-in-the-age-of-platforms-ecosystems-and-empowerment/?fbclid=IwAR0Mnr5bJnhHPLXYS6CPXJguICXEhE6AyjhtUlvia3y8KqOKtLiSiwWIA>. You may also access the webinar video: <https://www.youtube.com/watch?v=4ebFm1qdgC0&feature=youtu.be>





## U-SPACE CONOPS WEBINAR HOSTED BY EUROCONTROL

5G!Drones partner, robots.expert, participated in the U-space ConOps webinar hosted by EUROCONTROL and presented by Andrew Hatelly. The presentation, led to interesting explorations and discussions about how U-space architecture can be used in the 5G!DRONES project. More information about this webinar is available online on the following link:

<https://www.unmannedairspace.info/emerging-regulations/delegates-to-discuss-u-space-conops-at-eurocontrol-webinar-registration-now-open/>



## ONLINE CONFERENCES-PRESENTATIONS

### "5G TECHNOLOGY AND DRONES" PRESENTATION AT LOW LATENCY CONFERENCE

Gokul Srinivasan from robots.expert, 5G!Drones partner, participated in the online Low Latency Conference on 6 of October 2020, where he talked about 5G technology and drones. The conference took place during the Photonics Applications Week. You may watch the presentation online:

[https://www.youtube.com/watch?v=VVOW\\_vckdnM&app=desktop](https://www.youtube.com/watch?v=VVOW_vckdnM&app=desktop)



### INTERNATIONAL CONFERENCE ON SMART CITIES, SMART INFRASTRUCTURES & SMART BUILDINGS (EUROPEAN DIGITAL WEEK)

5G!Drones partner, robots.expert, participated in the International Conference on Smart Cities, Smart Infrastructures & Smart Buildings, European Digital Week which took place from 23-24 September 2020, and presented how 5G technology can leverage smart cities applications, including Urban Air Mobility, V2X and other relevant use cases. He also shared important insights from the 5G!Drones project. Read all the information about the event at:

<https://ditech.media/eudw/icscib/gokul-srinivasan/>

VIDEO: <https://www.youtube.com/watch?v=toRMVOjt6lo>



### FINDRONES2020 ONLINE CONFERENCE

Jonas Stjernberg (robots.expert) presented at the FinDrones2020 online conference. The FinDrones2020 conference was held on 12 November 2020 (virtually). The presentation focused on "Scaling up advanced drone operations" and include the 5G!Drones project as well! The link to the conference for more details is:

<https://events.tuni.fi/findrones2020-en/programme/>



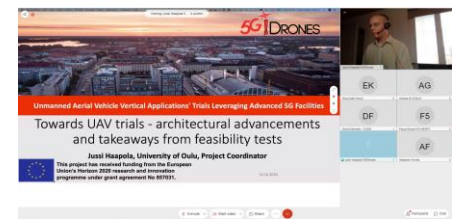


## **CO-ORGANISED WORKSHOP AND PRESENTATION**

### **"5G EXPERIMENTATION FACILITIES AND VERTICAL TRIALS: CURRENT STATUS AND FUTURE PERSPECTIVES"**

The online workshop "5G Trials in Europe: 5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives" was successfully co-organised by the Media Networks Laboratory (MNL)-NCSR D together with the H2020 projects 5GENESIS and 5G!Drones and with the support of the 5G-PPP partnership on Wednesday, 14 October 2020.

Jussi Haapola from University of Oulu and 5G!Drones Project Coordinator participated and presented. You can access the video on 5G!Drones YouTube channel: <https://www.youtube.com/watch?v=ya7P6uZ5DSk>



## **FEASIBILITY TESTS-TRIALS**

### **AALTO UNIVERSITY TRIALS**

On 24 August 2020, 5G!Drones partners CAFA Tech, HEPTA, NOKIA and robots.expert conducted tests in the campus of Aalto University in Finland, showcasing how 5G and UAVs can provide logistic solutions. The scenario was about the delivery of a medicine to a person by subscribing to a Drone Logistics Network. For the execution a drone took some medicine (up to 50g) from a virtual pharmacy and flies towards the customer personal delivery box. You can read more about the trials here:

<https://5gdrones.eu/wp-content/uploads/2020/09/5GDrones-Finland-feasibility-tests-24-28-August-2020.pdf>



### **OULU UNIVERSITY TRIALS**

On 27 and 28 August 2020, 5G!Drones partners CAFA Tech, HEPTA, NOKIA and robots.expert conducted feasibility tests at the Oulu University in Finland. In this set of trials, the main target was to test 5G Quality-of-Service (QoS) mapping and infrastructure inspection flights. Also, feasibility tests for infrastructure reasons were conducted. More information about the trials at the following link:

<https://5gdrones.eu/wp-content/uploads/2020/09/5GDrones-Finland-feasibility-tests-24-28-August-2020.pdf>



### **NOKIA TRIALS**

5G!Drones partner Nokia conducted pre-trial measurements at the Nokia premises in Oulu on the 27 and 28 of August. The trials were conducted in the context of Use Case 3 Scenario 3: "Location of UE in non-GPS environments".







## ATHENS TRIALS - MUNICIPAL OF EGALEO

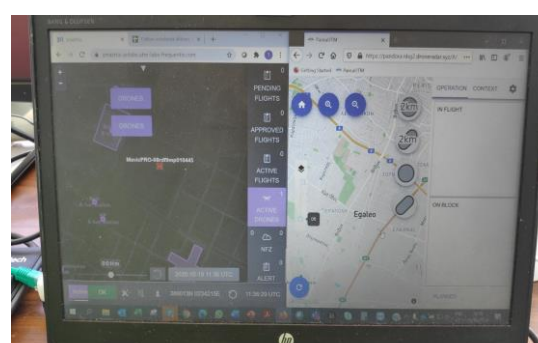
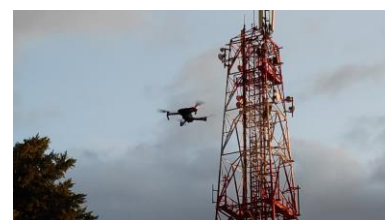
5G!Drones partners NCSR Demokritos, COSMOTE, HEPTA, CAFA Tech, robots.expert, Municipality of Egaleo and INFOLYSiS conducted feasibility tests at the 5GENESIS 5G Athens platform at the Municipal stadium of Egaleo (Stavros Mavrothalasitis) on 19 and 20 October. The main goal of the trials was to collect data of the interaction between 5G and UAVs in the context of 5G!Drones Use Case 4 (connectivity during crowded events).

## ATHENS TRIALS – COSMOTE PREMISES

5G!Drones partners NCSR Demokritos, COSMOTE, CAFA Tech, robots.expert and INFOLYSiS conducted flight trials at the 5GENESIS 5G Athens platform at COSMOTE premises (OTE Academy) on 21 October 2020. The main goal was to offer a better level of network services with drones under 5G and avoiding dropped calls and degraded Internet connectivity during mass events. These tests were also performed in the framework of 5G!Drones Use Case 4 (connectivity during crowded events).

Videos from the Athens trials available also at the 5G!Drones YouTube channel at:

<https://www.youtube.com/channel/UChPj4gQ5P5go7Fer6NJxGOQ>







## **5GPPP**

### **5GPPP ANNUAL PROGRESS MONITORING REPORT**

The 5G PPP Annual Progress Monitoring Report was published. The report gives insights and information about progress and development of ICT projects under the supervision of 5GPPP. It also provides information about the format of the consortia within these projects. You can read more by clicking on the following link: <https://5g-ppp.eu/annual-progress-monitoring-reports/>

## **DELIVERABLES**

Four deliverables are to be delivered within period, during the second year of the project:

**D3.1 Report on infrastructure-level enablers for 5G!Drones:** A deliverable that contains a detailed report of the design and implementation on enabling mechanisms for 5G!Drones at the (5G) infrastructure level (slicing, MEC, resource abstraction, facility federation).

**D5.3 Report on contribution to standardisation and international fora - 1st Version:** This deliverable gives a clear view on the standardisation activities achieved during the first 18 months of the project.

**D6.3 Mid-term review report:** A deliverable acting as an annual report describing the state of the project and administrative details. It refers to the period June 2020-November 2020.

**D6.7 Information on cumulative expenditure incurred - M18:** A deliverable giving information about the expenditure and the economics of the project and the partners.

## **UPCOMING DELIVERABLES**

**D2.2 Initial implementation of the trial controller - M23:** A deliverable describing the initial version of the trial controller engine, and execution and management APIs.

**D5.2 Report on communication, showcasing, dissemination and exploitation achievements and plan for the second term of the project - M23:** This deliverable gives information about the activities of the first half of the project's duration and describes the revised plan for communication, showcasing, dissemination and exploitation.

If you wish to learn more on the 5G!Drones deliverables, you may visit the official website on the corresponding deliverables page: <https://5gdrones.eu/deliverables/>





## 5<sup>th</sup> 5G!Drones GENERAL ASSEMBLY MEETING

Due to the current COVID-19 situation and for safety reasons the 5th 5G!Drones GA meeting was organized virtually. This virtual version of the GA ran for two days from 26-27 October 2020. The keynote of the meeting was the monitoring of the work packages/tasks activities and the overall project progress. Special reference was made about the trials that took place in Finland and Athens as well as the upcoming ones.



### Communication Channels



<https://5gdrones.eu/>

e-mail: [info@5gdrones.eu](mailto:info@5gdrones.eu)



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**Call:** H2020-ICT-2018-2  
**Topic:** ICT-19-2019  
**Type of action:** R&I  
**Duration:** 42 Months  
**Start date:** 1/6/2019