



*"5G for Drone-based Vertical Applications"*

## D5.2 – Report on communication, showcasing, dissemination and exploitation achievements and plan for the second term of the project

Document ID:	D5.2
Deliverable Title:	Report on communication, showcasing, dissemination and exploitation achievements and plan for the second term of the project
Responsible Beneficiary:	ROBOTS EXPERT FINLAND OY (RXB)

Topic:	H2020-ICT-2018-2020/H2020-ICT-2018-3
Project Title:	Unmanned Aerial Vehicle Vertical Applications' Trials Leveraging Advanced 5G Facilities
Project Number:	857031
Project Acronym:	5G!Drones
Project Start Date:	June 1 <sup>st</sup> , 2019
Project Duration:	42 Months
Contractual Delivery Date:	M23
Actual Delivery Date:	30.04.2021
Dissemination Level:	PU
Contributing Beneficiaries:	RXB, UO, THA, ALE, INV, NCSRD, AU, COS, AIR, UMS, INF, NOK, EUR, CAF, FRQ, OPL, MOE



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857031.

**Document ID:** D5.2  
**Version:** V1.0  
**Version Date:** 30.04.2021  
**Authors:** G. Georgiev (RXB), G. Srinivasan (RXB), S. Delmas (AIR), V. Koumaras (INF), V. Mavrikakis (INF), I. Stergiou (INF), T. Papadopoulos (INF) Fofy Setaki (COS) and all WP5 Partners involved in T5.1, T5.2 and T5.3  
**Security:** Public (PU)

#### Approvals

	Name	Organization	Date
Coordinator	Jussi Haapola	UO	30.04.2021
Technical Committee	Farid Benbadis	THA	30.04.2021
Management Committee	Project Management Team and COS	FRQ, AU, THA, UMS, AIR, UO, COS	24.04.2021

#### Document History

Version	Contribution	Authors	Date
V0.1	Template	AIR	22.02.2021
V0.2	Contributions exploitation	COS	03.03.2021
V0.3	Contributions to communications	INF	18.03.2021
V0.4	Contributions to dissemination	RXB	19.03.2021
V0.5	Review	ALL WP5	22.03.2021
V0.6	Exploitation part frozen	AIR	25.03.2021
V0.7	Pre-final draft	RXB	31.03.2021
V0.8	Final draft	RXB	06.04.2021
V0.9	Revised final draft circulation	RXB, COS, UO, FRQ	24.04.2021
V1.0	Final version	RXB	30.04.2021

## Executive Summary

Deliverable D5.2 (D5.2) documents 5G!Drones communication, showcasing, dissemination and exploitation achievements as well as project's interaction with the other 5G-PPP research projects during the period from M1 to M21 of the 5G!Drones project runtime (June 2019 - February 2021). It also sets the plan for the communication, showcasing, dissemination and exploitation activities for the rest of the project runtime: M22 – M42.

All performed COMMUNICATION activities and interactions are described in detail, and are evaluated against the goals that were set by the 5G!Drones communication, showcasing, dissemination, exploitation plan and standardization roadmap (D5.1), delivered at M6. Statistics, results and impacts are analysed while goals and plans for the activities of the next and last period are presented.

WP5 and D5.2 in particular, contributes towards the high-level project Objective 8 (O8): “Dissemination, standardisation and exploitation of 5G!Drones”. For attainment O8, following specific objectives have been pursued within WP5, and D5.2, as well as among the entire project activities:

- Communicate project outcomes to a wide audience,
- Showcase the activities and results of the project in large events,
- Disseminate results to industrial and academic communities, as well as standardisation and regulatory bodies,
- Cross-fertilize within 5G-PPP and beyond,
- Exploit the results of the project by various means: Improve 5G facilities, provide recommendations for the 5G system, improve UAV products to take full advantage of the 5G potential, etc. and
- Produce and manage intellectual property and perform activities towards commercialisation.

In respect to the communication and dissemination objectives, the document presents in great detail the relevant achievements. Among these, it is noteworthy that during this first period of the project, in term of DISSEMINATION, 27 publications have been recorded and communicated through the project's webpage. Members of the consortium published 9 papers in journals, 11 conference papers, 6 5G-PPP white papers and 2 Master/PhD Theses. The Consortium co-organized 2 workshops, made 35 presentations in conferences and panel discussions and released 4 videos and 4 short technical reports following the 1<sup>st</sup> year feasibility trials. The project web-site is constantly updated, and more than 110 posts have been published. 5G!Drones is actively present in all popular social media networks, ,Twitter, LinkedIn, Facebook, Instagram and YouTube, as analysed in the document.

Considering the EXPLOITATION strategy, a thorough analysis of the adopted methodology is performed, and detailed classification of the project exploitable outcomes in relevance to the identified project results categories is presented. In addition, the specific individual exploitation plans of the project partners are updated during the period and detailed herein. In future work, to be reported in D5.6 deliverable, the project plans to prioritise and analyse, using the Business Value Proposition Canvas and Lean Canvas frameworks the most promising business cases.

The methodology, Key Performance Indicators (KPI's) and expected results were defined at D5.1 in M6 of the project.

This deliverable summarises the activities of the first 21 months of the project duration and describes the revised and extended plan for communication, showcasing, dissemination and exploitation of the project, fit to the dynamically developing Vertical Take-Off and Landing Unmanned Air Vehicles VTOL UAVs and 5G technology and application ecosystem in the EU and worldwide.

This deliverable aims to set the foundation for an even more efficient dissemination, communication, exploitation, and networking activities for the rest of the project runtime, as well as for the final report on the topic – D5.5 at the end of the project, which will be published at M42.

## Table of Contents

EXECUTIVE SUMMARY .....	3
TABLE OF CONTENTS .....	4
LIST OF FIGURES .....	5
LIST OF TABLES .....	7
LIST OF ABBREVIATIONS .....	8
1 INTRODUCTION .....	9
1.1. OBJECTIVES OF THE DOCUMENT .....	9
1.2. STRUCTURE OF THE DOCUMENT .....	9
1.3. TARGET AUDIENCE AND ACTIVITY PHASES .....	9
2 COMMUNICATION ACTIVITIES – FIRST PERIOD (M1-M21) .....	11
2.1 COMMUNICATION CHANNELS AND ACTIVITIES .....	11
2.1.1 5G!Drones Logo .....	11
2.1.2 Website .....	11
2.1.3 5G!Drones Social Media Channels .....	21
2.1.3.1 Facebook Account .....	21
2.1.3.2 Twitter Account .....	23
2.1.3.3 LinkedIn Account .....	25
2.1.3.4 Instagram account .....	27
2.1.3.5 YouTube account .....	29
2.1.4 Newsletter .....	30
2.1.5 Leaflet .....	32
2.1.6 Poster .....	33
2.1.7 Press releases .....	34
2.1.8 Other communication channels .....	34
2.2 CONTROL-MONITORING MECHANISMS AND STATISTICAL DASHBOARDS - FIRST PERIOD (M1-M21) 36	
2.2.1 Control and Monitoring Mechanisms for Communication material .....	36
2.2.2 Website and Social media Statistical Dashboards for M1-M21 .....	38
2.3 COMMUNICATION PLAN OVERVIEW AND UPDATE .....	47
3 5G!DRONES DISSEMINATION .....	52
3.1 PUBLICATIONS .....	52
3.1.1 Papers in Journals .....	52
3.1.2 Papers in Conferences and Workshops .....	53
3.1.3 5G-PPP White Papers and Other Publications .....	54
3.1.4 Thesis Publications .....	54
3.2 WORKSHOPS, PRESENTATIONS AND TRIALS .....	54
3.2.1 Workshops .....	54
3.2.2 Presentations, Poster sessions, Committees, Webinars, and Panel Discussions ..	55
3.2.3 Field Tests and Trials .....	59
3.3 ARTICLES .....	60
3.4 PRESS RELEASES .....	62
3.5 DELIVERABLES .....	62
3.6 EVENTS .....	64
3.7 DISSEMINATION PLAN FOR M22 – M42 .....	65
3.7.1 Targets for Dissemination and Showcasing .....	65

3.7.1.1	Publication targets .....	65
3.7.1.2	Workshop targets .....	65
3.7.1.3	Conference targets .....	66
3.7.1.4	Particular partners updates .....	67
3.7.2	Monitoring and Evaluation of the Dissemination and Showcasing activities .....	67
3.7.2.1	Online Repository .....	67
3.7.2.2	WP5 Activities and Impact Tracking .....	68
<b>4</b>	<b>5G!DRONES PROJECT RESULTS EXPLOITATION STRATEGY .....</b>	<b>69</b>
4.1	PROJECT'S RESULTS EXPLOITATION METHODOLOGY .....	69
4.1.1	Exploitation Potentials & Project Results .....	69
4.1.1.1	Exploitable Outcome .....	69
4.1.2	Project's Results .....	70
4.1.3	Relevant Exploitation Models and Plan of Action .....	70
4.1.3.1	Value Proposition Canvas Methodology .....	71
4.1.3.2	Lean Canvas Methodology .....	72
4.2	IDENTIFICATION OF 5G!DRONES EXPLOITABLE OUTCOMES .....	73
<b>5</b>	<b>CONCLUSION .....</b>	<b>83</b>
	<b>ANNEX 1 - 5G!DRONES STATISTICAL DASHBOARDS (M1-M21) .....</b>	<b>85</b>
	<b>ANNEX 2 – NEWSLETTER RELEASED ISSUES .....</b>	<b>91</b>
	<b>REFERENCES .....</b>	<b>92</b>

## List of Figures

FIGURE 1: 5G!DRONES LOGO .....	11
FIGURE 2: 5G!DRONES WEBSITE .....	12
FIGURE 3: 5G!DRONES JOURNAL PAPERS .....	13
FIGURE 4: 5G!DRONES CONFERENCE AND WORKSHOP PAPERS .....	14
FIGURE 5: 5G!DRONES 5G-PPP WHITE PAPERS AND THESIS PUBLICATIONS .....	14
FIGURE 6: 5G!DRONES WORKSHOPS .....	15
FIGURE 7: 5G!DRONES PRESENTATIONS .....	15
FIGURE 8: 5G!DRONES TRIALS .....	16
FIGURE 9: 5G!DRONES ARTICLES .....	17
FIGURE 10: 5G!DRONES PRESS RELEASES .....	18
FIGURE 11: 5G!DRONES DELIVERABLES (A) .....	19
FIGURE 12: 5G!DRONES DELIVERABLES (B) .....	19
FIGURE 13: 5G!DRONES ATTENDED EVENTS (A) .....	19
FIGURE 14: 5G!DRONES ATTENDED EVENTS (B) .....	20
FIGURE 15: 5G!DRONES NEWS .....	20
FIGURE 16: 5G!DRONES FACEBOOK ACCOUNT .....	22
FIGURE 17: FACEBOOK TOTAL FOLLOWERS & POSTS .....	23
FIGURE 18: 5G!DRONES TWITTER ACCOUNT .....	24
FIGURE 19: TWITTER TOTAL FOLLOWERS & POSTS .....	25

FIGURE 20: 5G!DRONES LINKEDIN ACCOUNT .....	26
FIGURE 21: LINKEDIN TOTAL FOLLOWERS & POSTS.....	27
FIGURE 22: 5G!DRONES INSTAGRAM ACCOUNT .....	28
FIGURE 23: INSTAGRAM TOTAL FOLLOWERS & POSTS .....	28
FIGURE 24: 5G!DRONES YOUTUBE CHANNEL .....	29
FIGURE 25: 5G!DRONES NEWSLETTER WEBPAGE.....	30
FIGURE 26: 5G!DRONES NEWSLETTER (ISSUE 7 COVER PAGE).....	31
FIGURE 27: 5G!DRONES LEAFLET (SIDE A) .....	32
FIGURE 28: 5G!DRONES LEAFLET (SIDE B) .....	33
FIGURE 29: 5G!DRONES POSTER.....	34
FIGURE 30: MS TEAMS ONLINE TOOL.....	37
FIGURE 31: MS EXCEL FILE FOR COMMUNICATION ACTIVITIES (M1-M21) .....	37
FIGURE 32: WP7 COMMUNICATION ACTIVITIES-EVENTS FOLDER .....	38
FIGURE 33: 5G!DRONES WEBSITE STATISTICAL DASHBOARD .....	39
FIGURE 34: 5G!DRONES FACEBOOK STATISTICAL DASHBOARD (PAGE 1) .....	40
FIGURE 35: 5G!DRONES FACEBOOK STATISTICAL DASHBOARD ( PAGE 2) .....	41
FIGURE 36: 5G!DRONES TWITTER STATISTICAL DASHBOARD (PAGE 1) .....	42
FIGURE 37: 5G!DRONES TWITTER STATISTICAL DASHBOARD (PAGE 2) .....	43
FIGURE 38: 5G!DRONES LINKEDIN STATISTICAL DASHBOARD (PAGE 1) .....	44
FIGURE 39: 5G!DRONES LINKEDIN STATISTICAL DASHBOARD (PAGE 2) .....	45
FIGURE 40: 5G!DRONES INSTAGRAM STATISTICAL DASHBOARD .....	46
FIGURE 41: SOCIAL MEDIA POST .....	50
FIGURE 42: USE OF HASHTAGS.....	50
FIGURE 43: PARTNER TYPE AND RELATED EXPLOITATION TYPES AND OUTCOME .....	70
FIGURE 44: VALUE PROPOSITION CANVAS .....	71

## List of Tables

TABLE 1: 5G!DRONES SOCIAL MEDIA CHANNELS.....	21
TABLE 2: FACEBOOK ACTIVITY (M1-M21) .....	23
TABLE 3: TWITTER ACTIVITY (M1-M21) .....	25
TABLE 4: LINKEDIN ACTIVITY (M1-M21).....	27
TABLE 5: INSTAGRAM ACTIVITY (M1-M21) .....	29
TABLE 6: YOUTUBE ACTIVITY (M1-M21).....	29
TABLE 7: COMMUNICATION ACTIVITIES SUMMARY (M1-M21) .....	35
TABLE 8: TARGETED AUDIENCE, ACTIVITIES AND TIMING .....	47
TABLE 9: COMMUNICATION PLAN PHASES .....	49
TABLE 10: ORGANISED WORKSHOPS .....	55
TABLE 11: PRESENTATIONS AT EVENTS.....	55
TABLE 12: LIST OF REPORTED DELIVERABLES.....	63
TABLE 13: LEAN CANVAS MODEL.....	72
TABLE 14: 5G!DRONES EXPLOITABLE OUTCOMES.....	73
TABLE 15: 5G!DRONES PARTNERS INDIVIDUAL EXPLOITATION PLAN UPDATES .....	75

## List of Abbreviations

5G	5th Generation Cellular Technology
5G-IA	5G Infrastructure Association
5G-PPP	5G Infrastructure Public Private Partnership
Dx.y	Deliverable y of WP x
ICT	Information and Communication Technologies
KPI	Key Performance Indicator
UAV	Unmanned Aerial Vehicle
WG	Working Group
WP	Work Package
VTOL	Vertical Take-Off and Landing



## 1 Introduction

### 1.1. Objectives of the document

The scope of D5.2 is to present and analyse the developments of the project's second term (M1 – M21) and subsequent plans (M22 – M42) in respect to the communication, dissemination and showcasing plan, and the standardisation roadmap. Subsequently it presents the methodology for the project's results exploitation strategy. All the described activities are a part of WP5 "Dissemination, standardisation and exploitation" and corresponding WP5 project tasks. Plans and strategies presented in this deliverable will be applied throughout the entire remaining life-cycle of the project and will be regularly updated/revised, if required, as per the needs of the project. Any further developments will be reflected in D5.6 "Report on activities related to commercial exploitation and partnership development" due at the end of the project.

5G!Drones activities have differed in intensity, based on the time evolution of the project. To better monitor the intensity and set the corresponding goals per time period, the WP5 activities are be divided and carried out in two main phases:

1. Phase 1: M1-M21 (reported here).
2. Phase 2: M22-M42 (planned here).

The corresponding future deliverables will report in detail those achievements and will revise (if required) the corresponding plans.

### 1.2. Structure of the document

The document is structured into 5 main sections as follows:

- **Section 1** introduces to the reader the purpose of this document, its structure and its target audience.
- **Section 2** presents an overview of the performed communication activities of 5G!Drones. Analysis is made on the communication channels used, with emphasis on website and social media channels, targeted audience, content used, strategy applied and control/monitoring tools used. An updated communication plan for the remaining project runtime has been elaborated and is presented here.
- **Section 3** presents a dissemination and showcasing overview for Months 1 - 21 of 5G!Drones, and the two months before the delivery deadline of the current document were used for the document elaboration, editing and finalisation. Focus is made on the means that were and will be used and the events that were and will be targeted by 5G!Drones partners for achieving the greatest impact and dissemination of project's activities.
- **Section 4** presents the exploitation activities already performed during the recent 21 months by all 5G!Drones partners, as well as the plan for the upcoming ones for the time period M22 – M42.
- **Section 5** concludes this document.

### 1.3. Target Audience and Activity Phases

5G!Drones communication, dissemination, showcasing, exploitation and standardization plans and strategies are executed by all the partners and differ in regard to the nature of the partner as well as the means, content and target audience. The industrial partners have approached industry sectors and their distributors as well as client networks, the academic and research partners - relevant research institutes and universities, and cross-sectoral collaboration was performed as well. Furthermore, an additional number of activities are targeted to organizations, communities, industry, academia and research institutions, as well as the general public.

Overall, the target audience of D5.2 is the following:

- The broadest possible technical and non-technical audience: This category covers the potential end users of 5G and drones' products and services as well as the general public who is interested in these technological fields and advancements.
- All 5G!Drones partners, collaborators and stakeholders: This document addresses the entire 5G!Drones Consortium and serves as documentation of the performed activities on communication and dissemination activities, demonstrations, partner specific exploitation and standardization activities and relevant collaborations - such as 5G-PPP, 5G-IA and Networld2020. Here 5G!Drones partners and relevant project related stakeholders are involved and/or their collaborative activities are described. Another crucial part of the document is dedicated to describing a plan for activities on communication, dissemination, showcasing and exploitation.

Additional details on the targeted audience are given at the corresponding sections of each chapter.

## 2 Communication Activities – First Period (M1-M21)

### 2.1 Communication Channels and Activities

The 5G!Drones project has already focused during its initial phase (M1-M6) on the composition and use of an effective communication action plan, targeted towards specific market targets and stakeholders, while communication assortment is used as a core communication measure for constantly promoting the project to its target audience. In this context, since June 2019, several communication channels have been set up, regularly updated, and intensively utilized up to now for maximizing the impact of the project activities, results and achievements. More details on the communication channels have been provided in the D5.1 [4], where the 5G!Drones communication channels were introduced and the communication plan to be followed throughout the project lifetime was presented.

An update is provided in this section for all 5G!Drones communication channels, highlighting how they have been utilized throughout the period (M1-M21) and what type of content and activities have been communicated and by which channel during the 21 first months of the project (period: June 2019 – February 2021).

#### 2.1.1 5G!Drones Logo

At the very beginning of the project, the visual identity of the 5G!Drones project was created for giving a consistent identity and appearance. The initial proposal logo was updated and redesigned to the one of Figure 1. The logo creatively incorporates a picture of a drone embedded with the keyword 5G within its frame. The key elements of the project and its conception are connoted by this logo. These strong and prominent metrics have intelligently expressed the idea of the project to the audience since June 2019. The 5G!Drones logo has been intensively used in any communication activity and has created distinct brand awareness and attained project recognition from the very early stages of the project.



Figure 1: 5G!Drones logo

#### 2.1.2 Website

The 5G!Drones official website (<https://5gdrones.eu/>) operates as the core digital means of communication and also as one of the principal publicity tools of the project. It was created and launched before the kick-off meeting of the project. It is public and live since May 2019. The visitors can find information about the project nature, the use cases, the objectives, the consortium, the dissemination activities and how to communicate with us.

Briefly some technical details about the website:

- Developed in WordPress (currently at ver5.6)
- Google Analytics enabled
- reCAPTCHA v3 protected
- Multiple menu options are available for covering all types of project's activities
- Contact form (addressing project coordinator) available

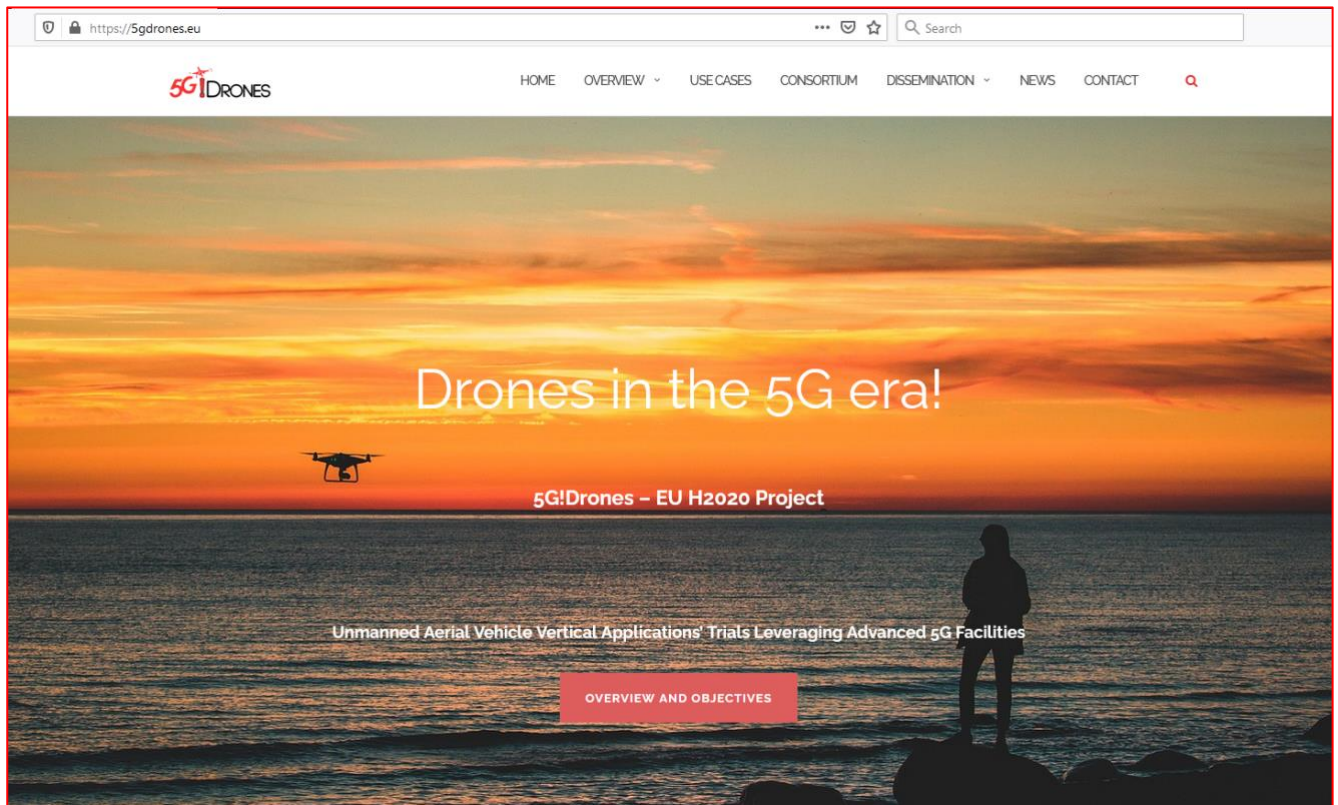


Figure 2: 5G!Drones website

Through the 21 months of its operation, the 5G!Drones website is constantly updated on a weekly basis with project news and activities providing direct access to vital information to its audience. In order to better present within D5.2 the activities that have been communicated through the website, each webpage that has been updated through the period June 2019-February 2021 is presented below (per webpage).

- **Publications webpage** (<https://5gdrones.eu/research-papers/>): The 5G!Drones publications page is constantly updated with 5G!Drones papers and publications in journals, conferences, workshops, book chapters, white papers and contributions to 5G-PPP publications. Moreover, every publication has a dedicated URL where the viewer can have access to the preferred material as well as the Digital Object Identifier (DOI) of the publication whenever applicable. During this first period of the project: 27 publications have been recorded and communicated through this webpage. Members of the consortium published 9 papers in journals, 11 conference papers, 6 5G-PPP white papers and 2 Master/PhD Theses. For each publication type, a separate section is provided on the webpage.



### Papers in Journals

- Samir Si-Mohammed, Maha Bouaziz, Hamed Hellaoui, Oussama Bekkouché, Adlen Ksentini, Tarik Taleb, Lechosław Tomaszewski, Thomas Lutz, Gokul Srinivasan, Tanel Jarvet and Paweł Montowtt, *Supporting UAV Services in 5G Networks: New High-Level Architecture integrating 5G with U-space*, IEEE Vehicular Technology Magazine (PDF) – DOI: 10.1109/MVT.2020.3036374
- H. Hellaoui, M. Bagaa, A. Chelli, and T. Taleb, *Joint Sub-carrier and Power Allocation for Efficient Communication of Cellular UAVs*, IEEE Transactions on Wireless Communications, Sept 2020 (PDF) – DOI: 10.1109/TWC.2020.3021252
- T. Taleb, A. Ksentini, H. Hellaoui, and O. Bekkouché, *On Supporting UAV based Services in 5G and Beyond Mobile Systems*, IEEE Network Magazine (PDF) – DOI: (Under Publication)
- Adlen Ksentini and Pantelis A. Frangoudis, *On extending ETSI MEC to support LoRa for efficient IoT application deployment at the edge*, IEEE Communications Standards Magazine, Volume 4, Issue 2, pages 57-63 (PDF) – DOI: 10.1109/MCOMSTD.0011900051
- B. Yang, T. Taleb, Z. Wu, and L. Ma, *Spectrum Sharing for Secrecy Performance Enhancement in D2D-Enabled UAV Networks*, IEEE Network Magazine, pages 1-8 (PDF) – DOI: 10.1109/MNET.0112000093
- Oussama Bekkouché, Konstantinos Samdanisz, Miloud Bagaa, Tarik Taleb, *A Service-Based Architecture for enabling UAV enhanced Network Services*, IEEE Network Magazine, Volume 34, Issue 4, pages 328-335 (PDF) – DOI: 10.1109/MNET.0011900556
- Bouziane Brik, Adlen Ksentini and Maha Bouaziz, *Federated Learning for UAVs-Enabled Wireless Networks: Use Cases, Challenges and Open Problems*, IEEE Access Journal, Vol.8 Issue 1 (PDF) – DOI: 10.1109/ACCESS.2020.2981430
- Adlen Ksentini and Pantelis A. Frangoudis, *Towards Slicing-Enabled Multi-Access Edge Computing in 5G*, IEEE Network Magazine, Volume 34, Issue 2, pages 99-105 (PDF) – DOI: 10.1109/MNET.0011900261
- Mariem Malouak and Tarik Taleb, *Dynamic Maps for Automated Driving and UAV Geofencing*, IEEE Wireless Communications Magazine 2019, Volume 26, Issue 4, pages 54-59 (PDF) – DOI: 10.1109/MWC.2019.1800544

Figure 3: 5G!Drones Journal papers

### Papers in Journals

- Samir Si-Mohammed, Maha Bouaziz, Hamed Hellaoui, Oussama Bekkouché, Adlen Ksentini, Tarik Taleb, Lechosław Tomaszewski, Thomas Lutz, Gokul Srinivasan, Tanel Jarvet and Paweł Montowtt, *Supporting UAV Services in 5G Networks: New High-Level Architecture integrating 5G with U-space*, IEEE Vehicular Technology Magazine (PDF) – DOI: 10.1109/MVT.2020.3036374
- H. Hellaoui, M. Bagaa, A. Chelli, and T. Taleb, *Joint Sub-carrier and Power Allocation for Efficient Communication of Cellular UAVs*, IEEE Transactions on Wireless Communications, Sept 2020 (PDF) – DOI: 10.1109/TWC.2020.3021252
- T. Taleb, A. Ksentini, H. Hellaoui, and O. Bekkouché, *On Supporting UAV based Services in 5G and Beyond Mobile Systems*, IEEE Network Magazine (PDF) – DOI: (Under Publication)
- Adlen Ksentini and Pantelis A. Frangoudis, *On extending ETSI MEC to support LoRa for efficient IoT application deployment at the edge*, IEEE Communications Standards Magazine, Volume 4, Issue 2, pages 57-63 (PDF) – DOI: 10.1109/MCOMSTD.0011900051
- B. Yang, T. Taleb, Z. Wu, and L. Ma, *Spectrum Sharing for Secrecy Performance Enhancement in D2D-Enabled UAV Networks*, IEEE Network Magazine, pages 1-8 (PDF) – DOI: 10.1109/MNET.0112000093
- Oussama Bekkouché, Konstantinos Samdanisz, Miloud Bagaa, Tarik Taleb, *A Service-Based Architecture for enabling UAV enhanced Network Services*, IEEE Network Magazine, Volume 34, Issue 4, pages 328-335 (PDF) – DOI: 10.1109/MNET.0011900556
- Bouziane Brik, Adlen Ksentini and Maha Bouaziz, *Federated Learning for UAVs-Enabled Wireless Networks: Use Cases, Challenges and Open Problems*, IEEE Access Journal, Vol.8 Issue 1 (PDF) – DOI: 10.1109/ACCESS.2020.2981430
- Adlen Ksentini and Pantelis A. Frangoudis, *Towards Slicing-Enabled Multi-Access Edge Computing in 5G*, IEEE Network Magazine, Volume 34, Issue 2, pages 99-105 (PDF) – DOI: 10.1109/MNET.0011900261
- Mariem Malouak and Tarik Taleb, *Dynamic Maps for Automated Driving and UAV Geofencing*, IEEE Wireless Communications Magazine 2019, Volume 26, Issue 4, pages 54-59 (PDF) – DOI: 10.1109/MWC.2019.1800544

Figure 3 above presents the 9 journal papers published by 5G!Drones consortium while the Figure 4 below presents the 11 conference and workshop papers.

#### Papers in Conferences and Workshops

- Samir Si-Mohammedi, Adlen Ksentini, Maha Bouazizi, Yacine Chellal, and Amar Balla, *UAV mission optimization in 5G: On reducing MEC service relocation*, in IEEE Globecom'20, Taipei, Taiwan, Dec. 2020. (PDF) – DOI: 10.1109/GLOBECOM42002.2020.9322304
- Y. Dang, C. Benzaid, Y. Shen, and T. Taleb, *GPS Spoofing Detector with Adaptive Trustable Residence Area for Cellular based-UAVs*, in IEEE Globecom'20, Taipei, Taiwan, Dec. 2020. (PDF) – DOI: 10.1109/GLOBECOM42002.2020.9348030
- Lechosław Tomaszewski, Robert Kolakowski, Sławomir Kuklinski, *Integration of U-space and 5G for UAV services*, IFIP Networking 2020 Conference (Virtual) – Workshop on Network Slicing 2020, Paris, France, June 22-25 2020. (PDF) – Electronic ISBN: 978-3-903176-28-7
- S. Ouahouah, J. Prados, T. Taleb, and C. Benzaid, *Energy-aware Collision Avoidance stochastic Optimizer for a UAVs set*, IEEE IWCMC, Limassol, Cyprus, 15-19 June 2020. (PDF) – DOI: 10.1109/IWCMC48107.2020.9348495
- H. Hellaoui, A. Chelli, M. Bagaa, and T. Taleb, *UAV Communication Strategies in the Next Generation of Mobile Networks*, IEEE IWCMC, Limassol, Cyprus, 15-19 June 2020. (PDF) – DOI: 10.1109/IWCMC48107.2020.9348312
- Sławomir Kuklinski, Lechosław Tomaszewski, Paweł Korzecy and Robert Kolakowski, *5G-UASP: 5G-based multi-provider UAV platform architecture*, IEEE Conference on Network Softwarization, 29 June – 3 July 2020 (Virtual Conference). (PDF) – Corpus ID: 220040698
- Lechosław Tomaszewski, Robert Kolakowski and Paweł Korzec, *On 5G support of cross-border UAV operations*, Workshop on Integrating UAVs into 5G and Beyond in IEEE International Conference on Communications, 7-11 June 2020 (Virtual Conference). (PDF) – DOI: 10.1109/ICCWorkshops49005.2020.9145262
- Lechosław Tomaszewski, Sławomir Kuklinski and Robert Kolakowski, *A new approach to 5G and MEC integration*, 5th Workshop on "5G – Putting Intelligence to the Network Edge" (5G-PINE 2020) in AIAI 2020, 16th International Conference on Artificial Intelligence Applications and Innovations, 5-7 June, 2020 (Virtual Conference). (PDF). Reference link: [https://link.springer.com/chapter/10.1007/978-3-030-49190-1\\_2](https://link.springer.com/chapter/10.1007/978-3-030-49190-1_2)
- Oussama Bekkouche, Miloud Bagaa and Tarik Taleb, *Toward a UTM-based Service Orchestration for UAVs in MEC-NFV Environment*, 2019 IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9-13 December 2019. (PDF) – DOI: 10.1109/GLOBECOM38437.2019.9014200
- Hamed Hellaoui, Ali Chelli, Miloud Bagaa and Tarik Taleb, *Efficient Steering Mechanism for Mobile Network-enabled UAVs*, 2019 IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9-13 December 2019. (PDF) – DOI: 10.1109/GLOBECOM38437.2019.9014131
- Sihem Bakri, Pantelis A. Frangoudis and Adlen Ksentini, *Dynamic slicing of RAN resources for heterogeneous coexisting 5G services*, 2019 IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9-13 December 2019. (PDF) – DOI: 10.1109/GLOBECOM38437.2019.9013954

**Figure 4: 5G!Drones Conference and workshop papers**

Similarly, Figure 5 presents the 7 publications (5G-PPP white papers and other publications) in which 5G!Drones has contributed and/or referenced, as well as two Thesis publications performed on topics related to 5G!Drones project activities.

#### 5G-PPP White Papers and Other Publications

- *Interface for Data Exchange between MNOs and the UTM Ecosystem NetworkCoverage Service Definition*, ACJA, GSMA and GUTMA approved version (Feb 2021). You may access it [here](#).
- *5G PPP Progress Monitoring Report (2019 release)*, Oct 2020. 5G-PPP. You may access it [here](#).
- *Empowering Vertical Industries through 5G Networks – Current Status and Future Trends*, 5G-PPP, 21 5G-PPP Phase II and Phase III R&I projects and the 5G-IA verticals engagement task force, August 2020. You may access it [here](#).
- *The 5G-PPP Projects Heritage figure (Version 1.0)*, 5G-PPP and 5G IA, July 2020. You may access it [here](#).
- *The European 5G Annual Journal 2020*, 5th edition, Full 5G and 5G-PPP, June 2020. You may access it [here](#).
- *Business Validation in 5G PPP vertical use cases*, 5G-PPP and 5G IA, July 2020. You may access it [here](#).

#### Thesis Publications

- Jyrkkä Johannes, *Drone heading calculation indoors*, University of Oulu, Faculty of Technology, Mechanical Engineering, 15 October 2020. You may access it [here](#).
- Prashant Shah, *Enabling seamless application migration over multi-core network environments*, University of Oulu, Faculty of Information Technology and Electrical Engineering, Communications Engineering, 26 June 2020. You may access it [here](#).

**Figure 5: 5G!Drones 5G-PPP White Papers and Thesis Publications**

- **Workshops, Presentation and Trials webpage (<https://5gdrones.eu/workshops/>)**. In this webpage, any stakeholder can easily access 5G!Drones documented activities from workshops, presentation, conferences, panel discussions and trials. On these type of communication/dissemination activities, the Consortium had been highly active as they co-organised 2 workshops, made 35 presentations in conferences and panel discussions and performed 10 feasibility tests and pre-trials accompanied by the release of 4 videos and 4 short technical reports.

5G!Drones organizes/co-organizes several workshops, participates in conferences and delivers presentations in various events, performs trials and test as per the defined use cases. All these related communication and dissemination activities are summarized below.

## Workshops

5G!Drones has organized or co-organized with other projects the following workshops.

EVENT	WORKSHOP DETAILS
1 IEEE WCNC2020	Aerial Communications in 5G and Beyond Networks (AERCOMM) workshop, co-organized by 5G!Drones and EU-Korea PriMO-5G project, colocated with IEEE Wireless Communications and Networking Conference, 25-28 May 2020 (Virtual Conference), Beyond Connectivity: What Comes After 5G
2 Online workshop	"5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives" online workshop on 14 Oct 2020. This online workshop is organised by the Institute of Informatics & Telecommunications of NCSR Demokritos (Athens, Greece), EU projects 5GENESIS and 5G!Drones and with the support of the 5G-PPP partnership.

**Figure 6: 5G!Drones Workshops**

Figure 6 above presents the two workshops co-organized by 5G!Drones while Figure 7 below shows an indicative sample of the performed 5G!Drones presentations at various events.

## Presentations, Poster sessions, Committees, Webinars and Panel Discussions

5G!Drones partners have participated in various events in order to promote 5G!Drones activities and achievements through presentations. The table below summarizes all presentations made by 5G!Drones partners in conferences, workshops, special sessions and info/business days.

EVENT	EVENT DETAILS	PRESENTATION TITLE
1 EuCNC 2019	EMPOWER workshop "Empowering Transatlantic Platforms for Advance Wireless Research", 18 June 2019, Valencia, Spain	5G!Drones vertical use cases and requirements
2 EuCNC 2019	5G PPP ICT-19 session "Launching of Advanced 5G validation trials across multiple vertical industries and the next steps", 21 June 2019, Valencia, Spain	5G!Drones technical overview
3 Salon du Bourget, Paris Air Lab	Company presentation of INVOLI partner by Mélanie Guittet and its involvement into the 5G!Drones European project in Salon du Bourget, Paris Air Lab, 21 June 2019	INVOLI and 5G!Drones
4 5GEVE Meeting, Pisa	Adlen Ksentini (Eurocom) presented 5G!Drones to 5GEVE ICT-17 partners during their GA meeting in Pisa, Italy, Sept 2019	5G!Drones Overview
5 Digital Transport Days, Helsinki	Dr. Jussi Haapola (University of Oulu), 5G!DRONES project coordinator, presented 5G!DRONES project and the opportunities 5G can bring to UAV transport sector ( October 9th, 2019 )	What can 5G bring to Drones?
6 ITS World Congress 2019, Singapore	Tero Vuorenmaa (Robots Expert) presented Urban Air Mobility requirements and 5G!Drones project in ITS World Congress in Singapore on 24 October 2019	5G!Drones
7 5GTNF Results and Demo Seminar, Helsinki, Finland	Prof. Ari Pouttu ( University of Oulu ) presented the 5G!Drones at the poster session of 5GTNF Results and Demo Seminar in Helsinki, Finland, on 1st of November 2019.	5G!Drones Poster session

**Figure 7: 5G!Drones Presentations**

During the period M1-M21, 5G!Drones has conducted 10 tests and pre-trials (either remotely due to COVID-19 restrictions or as a field tests with physical presence of participants). Most trial activities are also accompanied by supplementary material either in the form of video or a short technical report overview (Figure 8).



### Field Tests and Trials

During the project lifetime, 5G!Drones partners will conduct several field tests and trials as part of the 5G!Drones use cases for meeting the set goals and objectives.

1. CAFA Tech conducted initial field trials with DJI Mavic Pro drone and 5G smartphones, testing 5G aspects that will be used in 5G!Drones use cases. In specific, CAFA Tech conducted tests with DJI Mavic Pro drone and 5G smartphones on 24th October 2019 in Aalto University, Helsinki, Finland. Measured Results: Stream upload: 21 Mbps and Ping: 11 ms.
2. CAFA Tech conducted also 5G drone test flight on 1st of November 2019, in Tallinn, Estonia, at Elisa Telecom operator's 5G NSA test network using the 5G smartphone Huawei Mate 20X. Measured results: Upstream throughput: 25-47 Mbps and Ping: 8-10 ms.
3. Orange France, 5G!Drones partner, conducted an experiment of a tethered drone embedding a cellular base station based on Open Air Interface, acting as a connectivity bubble, at French championships of Windsurf in Saint-Pierre-Guibert France, from 1st to 3rd of November, as part of 5G!Drones use case #4 (UC4) initial tests.
4. In May 2020, NCSR Demokritos team, 5G!Drones partner, performed the first feasibility flight of a drone piloting over 5G, i.e. transmitting the Cx (Communication and Control) channel over 5G. The feasibility flight was performed using the 5GENESIS Athens 5G experimentation platform located at NCSR Demokritos campus as initial trial of the 5G!Drones Athens use case. Video of the feasibility flight available [here](#).
5. On June 30, 2020 5G!Drones partners NCSR Demokritos (located in Athens, Greece), CAFA Tech (located in Tallinn, Estonia) and Unmanned Life (located in Brussels, Belgium) conducted virtual feasibility tests related to 5G!Drones Use Case 4 "Drone based 5G connectivity extension" scenario. Due to COVID-19 travel restrictions the tests conducted remotely. More details on the Athens feasibility tests and results [here](#).
6. 5G!Drones partners conducted flight trials under 5G network in Aalto and Oulu, Finland, on August 24-28 2020 for collecting preliminary inputs for 5G!Drones next developments and actions. In these tests, 5G infrastructure owners of Aalto University and Oulu yliopisto - University of Oulu, and technology companies CAFA Tech, HEPTA, NOKIA and robots expert participated, conducting physically tests of 5G!Drones use cases UC1Sc1/UC3Sc1/UC3Sc2. More details on the Finland feasibility tests and results [here](#).
7. Nokia, 5G!Drones partner, executed 5G!Drones pre-trial measurements during 27-28 August 2020, which focused on the Nokia lead Use Case 3 Scenario 3: Location of UE in non-GPS environments. These feasibility tests were successfully conducted in Nokia premises in Oulu, Finland.
8. 5G!Drones partners NCSR Demokritos, Cosmote, HEPTA, CAFA Tech, robots expert, Municipality of Egaleo and INFOLYSIS, conducted flight trials under 5G network in Municipality of Egaleo stadium (part of 5GENESIS 5G Athens platform, Greece), on October 19-20 2020, for collecting inputs and verifying the interaction between 5G and drones under 5G!Drones use case #4 (Connectivity during crowded events). Two videos available at 5G!Drones YouTube channel [here](#). An overview report on Egaleo Stadium trials is available [here](#).
9. 5G!Drones partners NCSR Demokritos, Cosmote, CAFA Tech, robots expert and INFOLYSIS, conducted flight trials under 5G network in OTE-Cosmote Academy premises (part of 5GENESIS 5G Athens platform, Greece), on October 21 2020, for testing the offering of a better level of network services with drones under 5G and avoiding dropped calls and degraded Internet connectivity during mass events (5G!Drones use case #4 - Connectivity during crowded events). Video available at 5G!Drones YouTube channel [here](#). An overview report on OTE-Cosmote Academy trials is available [here](#).
10. 5G!Drones partners EUR, CAF, AIR, DRR, FRQ, REK conducted remote Feasibility tests using Eutecom (France) and CAFA Tech (Estonia) facility on 17th and 18th December 2020 to test how 5G!Drones containers (C+U-Space), MCS- and latency measurement container) work in EUR servers and the connections with these containers' client applications in smartphones. Video available at 5G!Drones YouTube channel [here](#).

**Figure 8: 5G!Drones Trials**

- **Articles webpage (<https://5gdrones.eu/published-articles/>):** In the Articles webpage 22 online articles and interviews are listed (Figure 9).



## 5G!DRONES published articles

5G!DRONES articles are published in several media such as journals, newspapers, websites, newsletters etc. All published articles are presented in detail on the following sections:

1. 5G!Drones presented at the 5GPPP website: <https://5g-ppp.eu/5gdrones/>
2. 5G!Drones presented at the Cosmote website: [https://www.cosmote.gr/cs/otegroup/en/5g\\_drones.html](https://www.cosmote.gr/cs/otegroup/en/5g_drones.html)
3. 5G!Drones presented at NCSR Demokritos website: <https://www.iit.demokritos.gr/projects/unmanned-aerial-vehicle-vertical-applications-trials-leveraging-advanced-5g-facilities/>
4. 5G!Drones on the News webpage of 5GENESIS website: <https://5genesis.eu/5th-5genesis-ga-meeting-presentation-of-ict-19-5gdrones-project/>
5. "Les drones à l'épreuve de la 5G" article/interview: IMT – Institut Mines Telecom: <https://blogrecherche.wp.imt.fr/2020/02/19/les-drones-a-lepreuve-de-la-5g/>
6. "How Poland built and introduced an operational, integrated national UTM/ATM system" PansolUTM interview with Unmanned Airspace: <https://www.unmannedairspace.info/news-first/how-poland-built-and-introduced-an-operational-integrated-national-utm-atm-system/>
7. "Putting Drones to the 5G test": IMT, Eurecom interview: <https://blogrecherche.wp.imt.fr/en/2020/04/01/putting-drones-to-the-5g-test/>
8. "The EU Funded 5G!Drones Research Project is Testing, Validating, and Defining KPIs for the Future of the Drone Industry": Invol, Droneflader and Robots Expert partners interviewed by Danielle Gagne, Commercial UAV News Editorial Analyst: <https://www.commercialuavnews.com/infrastructure/5g-drones-is-testing-kpi-s-for-the-drone-industry>
9. "A Service-Based Architecture for enabling UAV enhanced Network Services", Connectivity Technology blog, featuring the 5G!Drones journal paper "A Service-Based Architecture for enabling UAV enhanced Network Services": <https://www.connectivitytechnology.com/2020/08/a-service-based-architecture-for.html?m=1>
10. "Feasibility Tests for Future Air Mobility", Dr. Jussi Haapola, 2nd version of 5G Waves magazine by 5G Flagship: <http://julkaisutiete.fi/files/lsbng7892627541.pdf>
11. "Technical trials of drones and 5G at Municipal stadium of Egaleo", online article at Municipality of Egaleo website (in Greek): <https://www.egaleo.gr/2020/10/22/techniques-dokimes-5g-me-drones-sto-dimotiko-giopedo-egaleo/>
12. "5G!Drones project carries out network tests at Greek stadium", online article at TheStadiumBusiness website: <https://www.thestadiumbusiness.com/2020/10/27/5gdrones-project-carries-out-network-tests-at-greek-stadium/>
13. "Drones to boost mobile and internet connection in crowded events", online article at CommercialDroneProfessional.com website: <https://www.commercialdroneprofessional.com/drones-to-boost-mobile-and-internet-connection-in-crowded-events/>
14. "5G!Drones is Putting the Pieces of the Drone Ecosystem Together to Make Sure They Fit and Can Deliver Value to Stakeholders", Unmanned Life, CAFA Tech, COSMOTE, RobotsExpert, NOKIA, INVOLI and Frequentis 5G!Drones partners, interviewed by Danielle Gagne, Commercial UAV News Editorial Analyst: <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>
15. "5G Trials in Europe: 5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives" and "5G!Drones Athens Feasibility Tests": Institute of Informatics & Telecommunications (IIT), NCSR-D, Newsletter: <https://www.iit.demokritos.gr/newsevents/iit-dedicates-october-5g-networks/>
16. "5G!Drones Athens Trials over the 5GENESIS Athens platform (Egaleo Stadium and Cosmote Academy)", Institute of Informatics & Telecommunications (IIT), NCSR-D, News: <https://www.iit.demokritos.gr/newsevents/5gdrones-feasibility-tests-athens/>
17. "Hepta Drones and 5G will solve poor network connection during crowded events", online article by www.innoenergy.com at: <https://www.innoenergy.com/news-events/hepta-drones-and-5g-will-solve-poor-network-connection-during-crowded-events/>
18. InterDrone Online 2020: "It is hard to promote the drone industry while drones are still not visible" at unmannedairspace.info: <https://www.unmannedairspace.info/uncategorized/interdrone-online-2020-it-is-hard-to-promote-the-drone-industry-while-drones-are-still-not-visible-north-central-texas-aviation-department/>
19. "Top 10 Commercial Drone Insights and Updates from 2020" by Commercial UAV News online at: [https://www.commercialuavnews.com/energy/top-10-commercial-drone-insights-from-2020?utm\\_source=Commercial%20UAV%20News&utm\\_medium=social&utm\\_campaign=5\\_minute](https://www.commercialuavnews.com/energy/top-10-commercial-drone-insights-from-2020?utm_source=Commercial%20UAV%20News&utm_medium=social&utm_campaign=5_minute)
20. "Drones over Egaleo city" by ktypes.gr (in Greek) available online here
21. "5G and Drones trials at Egaleo stadium" by kedko.gr online at: <https://kedko.gr/techniques-dokimes-5g-me-drones-sto-dimotiko-giopedo-egaleo/>
22. "The idea that 5G can enable BVLOS missions is something of a myth" by unmannedairspace.info online at: <https://www.unmannedairspace.info/news-first/the-idea-that-5g-can-enable-bvlos-missions-is-something-of-a-myth-gokul-srinivasan/>

**Figure 9: 5G!Drones Articles**

- **Press Releases webpage** (<https://5gdrones.eu/press-releases/>). On this webpage, any visitor to the 5G!Drones website may access different press releases that have been published by partners through the reporting period. So far 6 press releases have been recorded (Figure 10).

5G!Drones Press Releases are listed below:

1. 5G!Drones announced at the Cosmote website: [https://www.cosmote.gr/cs/otegroup/en/5g\\_drones.html](https://www.cosmote.gr/cs/otegroup/en/5g_drones.html)
2. 5G!Drones announced at NCSR Demokritos website: <https://www.iit.demokritos.gr/projects/unmanned-aerial-vehicle-vertical-applications-trials-leveraging-advanced-5g-facilities/>
3. 5G!Drones announced at the DroneRadar website: <https://www.unmannedairspace.info/latest-news-and-information/sgdrones-research-project-starts-polands-dronerada-joins-the-consortium/>
4. 5G!Drones at the 5GPPP website: <https://5g-ppp.eu/sgdrones/>
5. "Technical trials of drones and 5G at Municipal stadium of Egaleo", online article at Municipality of Egaleo website (in Greek): <https://www.aigaleo.gr/2020/10/22/technikes-dokimes-5g-me-drones-sto-dimotiko-gipedo-aigaleo/>
6. 5G!Drones Athens Trials over the 5GENESIS Athens platform (Egaleo Stadium and Cosmote Academy), Institute of Informatics & Telecommunications (IIT), NCSR, News: <https://www.iit.demokritos.gr/newsevents/sgdrones-feasibility-tests-athens/>

**Figure 10: 5G!Drones Press Releases**

- **Deliverables Webpage** (<https://5gdrones.eu/deliverables/>). Deliverables are a highly efficient method of evaluating and monitoring a project's objectives and results, documenting them in a report and making it public so as everyone can be informed. In this webpage, 5G!Drones website visitor may access and read all released public deliverables and be informed about the upcoming ones. Until the moment D5.2 was under editing, 13 public deliverables have been published online (Figure 11 and Figure 12). Of course, deliverables are usually subject to some delay before publishing them on the website.

5G!Drones Deliverables are listed below. All public (PU) deliverables are available for downloading.

Del.#	Name	WP#	Lead Participant	Type	Dissemination Level	Delivery Date	Download
D1.1	Use case specifications and requirements	1	UML	R	PU	M05	PDF
D1.2	Initial description of the 5G trial facilities	1	UO	R	PU	M05	PDF
D1.3	5G!Drones system architecture initial design	1	ORA	R	PU	M08	PDF
D1.4	Report on UAV business and regulatory ecosystem and the role of 5G	1	CAP	R	PU	M12	PDF
D1.5	Description of the 5G trial facilities and use case mapping	1	UO	R	PU	M12	PDF
D1.6	5G!Drones system architecture refined design	1	DEM	R	PU	M24	
D1.7	Final report on UAV business and regulatory ecosystem and the role of 5G	1	INF	R	PU	M42	
D2.1	Initial definition of the trial controller architecture, mechanisms, and APIs	2	AU	R	PU	M12	PDF
D2.2	Initial implementation of the trial controller	2	INV	O	Software, CO	M23	
D2.3	Report on algorithms, mechanisms and tools for data analysis and visualisation	2	FRQ	R	PU	M24	
D2.4	Definition of the trial controller architecture, mechanisms, and APIs	2	EUR	R	PU	M24	
D2.5	Trial controller software final release	2	DEM	O	Software, CO	M30	
D2.6	Data analysis and visualisation software implementation	2	NCK	O	Software, CO	M30	
D3.1	Report on infrastructure-level enablers for 5G!Drones	3	QPL	R	PU	M18	PDF
D3.2	Report on vertical service-level enablers for 5G!Drones	3	EUR	R	PU	M25	
D3.3	5G!Drones Enablers Software Suite	3	UO	O	Software, CO	M32	
D3.4	UAV use case service components	3	ALE	O	Software, CO	M33	
D4.1	Integration plan	4	DRR	R	PU	M7	PDF
D4.2	Integration status and updated integration plan	4	DRR	R	PU	M25	
D4.3	Trial plan	4	CAP	R	PU	M25	
D4.4	Trial evaluation report	4	CDS	R	PU	M42	
D5.1	Communication, showcasing, dissemination and exploitation plan and standardization roadmap	5	INF	R	PU	M6	PDF
D5.2	Report on communication, showcasing, dissemination and exploitation achievements and plan for the second term of the project	5	FXB	R	PU	M23	

**Figure 11: 5G!Drones Deliverables (A)**

<b>D5.3</b>	Report on contribution to standardisation and international fora- 1st Version	5	AIR	R	PU	M18	PDF
<b>D5.4</b>	Report on contribution to standardisation and international fora- 2nd Version	5	THA	R	PU	M42	
<b>D5.5</b>	Final report on communication, showcasing, dissemination and exploitation	5	CRA	R	PU	M42	
<b>D5.6</b>	Report on activities related to commercial exploitation and partnership development	5	OPL	R	PU	M42	
<b>D6.1</b>	Data Management Plan and quality and risk management plan	6	OU	CRDP	PU	M4	PDF
<b>D6.2</b>	Annual report, year 1	6	OU	R	PU	M12	PDF
<b>D6.3</b>	Mid-term review report	6	OU	R	PU	M18	PDF
<b>D6.4</b>	Annual report, year 2	6	OU	R	PU	M24	
<b>D6.5</b>	Annual report, year 3	6	OU	R	PU	M36	
<b>D6.6</b>	Final project report	6	OU	R	PU	M42	
<b>D6.7</b>	Information on cumulative expenditure incurred - M18	6	OU	R	CO	M18	
<b>D6.8</b>	Information on cumulative expenditure incurred - M30	6	OU	R	CO	M30	

**Figure 12: 5G!Drones Deliverables (B)**

- **Events Webpage** (<https://5gdrones.eu/past-events/>). In this webpage every event in which 5G!Drones participates is recorded. In the first period of the project and up to February 2021, partners have participated in at least 42 events (Figure 13 and Figure 14).

All events such as conferences, workshops, special sessions, invited talks and presentations in which 5G!DRONES participated are summarized in this page.

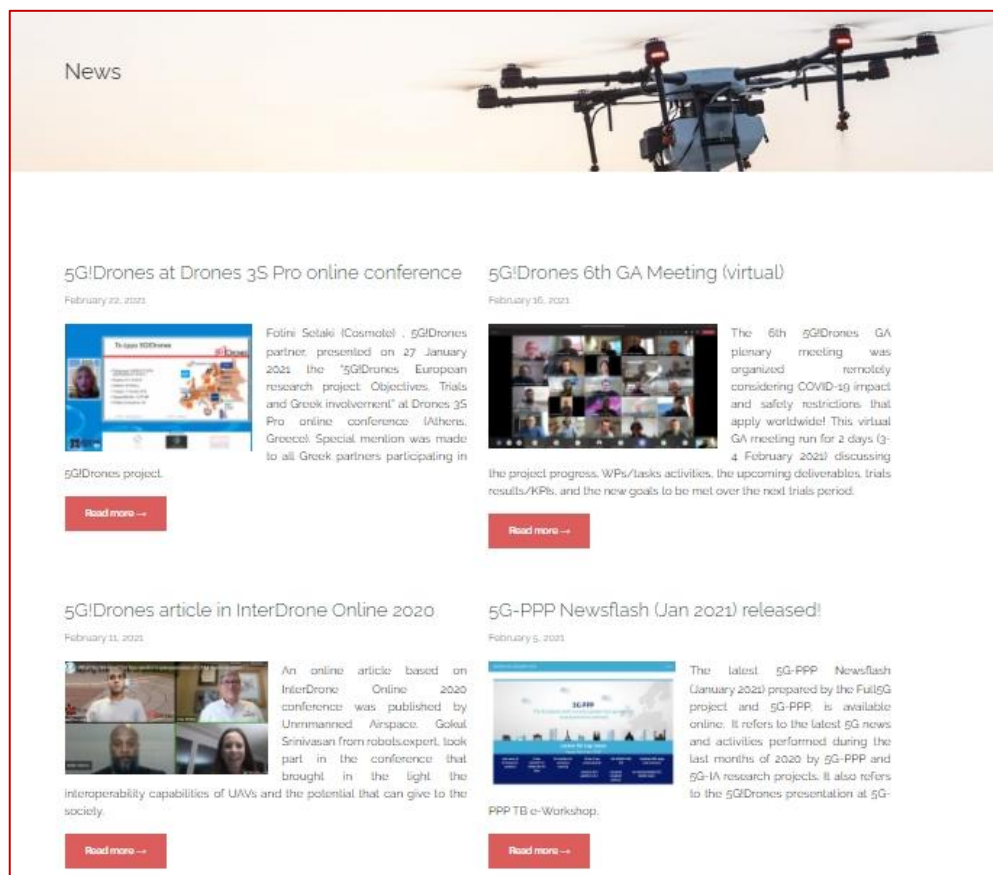
- Drones 3S Pro, 27-28 January 2021, online conference (Athens, Greece)
- InterDrone Online event, 15-17 December 2020
- 5G and Internet of Things Thessaloniki Week 2020, 14 December 2020
- 5G-PPP Technology Board e-Workshop, 10 December 2020
- Unmanned Cargo Aircraft conference 9th Edition 8 Dec. 2020
- Global 5G Evolution online event, 8 December 2020
- Amsterdam Drone Week 2020, 17 September and 1-3 December 2020
- FinDrones2020 online conference, 12 Nov 2020
- "5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives", online workshop, 14 Oct 2020, 09:00-15:00 (organised by the Institute of Informatics & Telecommunications of NCSR Demokritos (Athens, Greece), EU projects 5GENESIS and 5G!Drones and the support of the 5G-PPP partnership).
- Low Latency Conference (virtual), 6 October 2020
- U-space Concept of Operations (ConOps) webinar organized by Eurocontrol, 2 October 2020
- "International Conference on Smart Cities, Smart Infrastructures and Smart Buildings", European Digital Week (virtual), 23-24 September 2020
- 5G Momentum webinar, 3 September 2020
- ICUAS 2020 (International Conference on Unmanned Aircraft Systems), 1-4 September 2020
- ASTM International Committees, August 2020
- InterDrone Podcast, 5 August 2020
- Connectivity Technology blog, 2 August 2020
- PX4 Developer Summit 2020 (Virtual), 7 July 2020
- IFIP Networking 2020 Conference (virtual) - Workshop on Network Slicing 2020, Paris, France, June 22-25 2020
- IEEE Conference on Network Softwareization (NetSoft2020), 29 June - 3 July 2020 (Virtual Conference)
- IEEE IWCMC, Limassol, Cyprus, 15-19 June 2020
- EuCNC 2020, June 16-17, Virtual event, Dubrovnik, Croatia June 16-17
- PrintoCent Webinar Series 2020, 8 June 2020
- IEEE International Conference on Communications, Workshop on Integrating UAVs into 5G and Beyond, 7-11 June 2020 (Virtual Conference)
- AIAI 2020, 16th International Conference on Artificial Intelligence Applications and Innovations, 5th Workshop on "5G - Putting Intelligence to the Network Edge" (5G-PINE 2020), 5-7 June, 2020 (Virtual Conference)

**Figure 13: 5G!Drones Attended Events (A)**

- Aerial Communications in 5G and Beyond Networks (AERCOMM) workshop, co-organized by 5G!Drones and EU-Korea PriMO-5G project, colocated with IEEE Wireless Communications and Networking Conference, 25-28 May 2020 (Virtual Conference), Beyond Connectivity: What Comes After 5G
- Mobile World Congress 2020 (MWC2020), Barcelona, Spain, 24-27 February 2020 – CANCELLED due to coronavirus
- AIX & FCAO Event (6 February 2020, Tampere University, Finland)
- Finnish Satellite Workshop and Remote Sensing Days 2020 (20-22/01/2020, Helsinki, Finland)
- IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9-13 December 2019
- EASA High Level Conference on Drones – Amsterdam Drone week (5-6 December 2019, Amsterdam)
- INFOCOM World Conference 2019 (26 November 2019, Athens)
- FOKUS FUSECO 2019 Forum (7-8 November 2019, Berlin)
- 25th FRUCT Conference (8 November 2019, Helsinki)
- 5GTNF Results and Demo Seminar (1 November 2019, Helsinki)
- ITS World Congress (21-25 October 2019, Singapore)
- 5G-PPP Technology Board meeting and Technical Workshop on key enablers for 5G Experimentation (8-10 October 2019, Malaga)
- Digital Transport Days Conference (7 – 9 October 2019, Helsinki)
- 5G PPP 5G-Initiative Steering Board (17 September 2019, Brussels)
- Salon du Bourget, Paris Air Lab (21 June 2019, Paris)
- EuCNC 2019 (17-21/06/2019, Valencia)
- 7th Global 5G Event (17-19/06/2019, Valencia)

**Figure 14: 5G!Drones Attended Events (B)**

- **News Webpage** (<https://5gdrones.eu/news/>). The News webpage is the most regularly updated page of the website. It informs the visitor on a weekly basis about new events, project activities, partners actions, flagship events and the 5G-PPP dissemination and communication actions along with URLs to related material, videos and files. During the period M1-M21 5G!Drones has communicated more than 110 News posts through the News webpage (Figure 15).



**Figure 15: 5G!Drones News**



In conclusion, as it can be realised from the above-mentioned section descriptions and images, the 5G!Drones website is a compact, comprehensive and always updated communication channel, providing all useful information and material about project's activities. Please note that a more detailed website description about all the technical aspects and the sections of the website has been provided through D5.1 "Communication, showcasing, dissemination and exploitation plan and standardization roadmap" which can be downloaded from the 5G!Drones website on the deliverables page: <https://5gdrones.eu/deliverables/>

### **2.1.3 5G!Drones Social Media Channels**

5G!Drones is actively present in all popular social media networks. In specific, the following 5G!Drones social media accounts are available and have been actively used since the beginning of May 2019: Twitter, LinkedIn, Facebook, Instagram and YouTube and their access links are the following (Table 1).

**Table 1: 5G!Drones social media channels**

<b>Facebook</b>	<a href="http://www.facebook.com/5gdrones">www.facebook.com/5gdrones</a>
<b>Twitter</b>	<a href="https://twitter.com/5gdrones">https://twitter.com/5gdrones</a>
<b>LinkedIn</b>	<a href="https://www.linkedin.com/in/5gdrones/">https://www.linkedin.com/in/5gdrones/</a>
<b>Instagram</b>	<a href="https://www.instagram.com/5gdrones_project/">https://www.instagram.com/5gdrones_project/</a>
<b>YouTube</b>	<a href="https://www.youtube.com/channel/UChPj4gQ5P5go7Fer6NJxGOQ">https://www.youtube.com/channel/UChPj4gQ5P5go7Fer6NJxGOQ</a>

5G!Drones social media posts are focused on spreading the news of the initiative as well as the dissemination activities in which the members of the Consortium are involved. Briefly the following news and type of activities are communicated through the 5G!Drones social media channels:

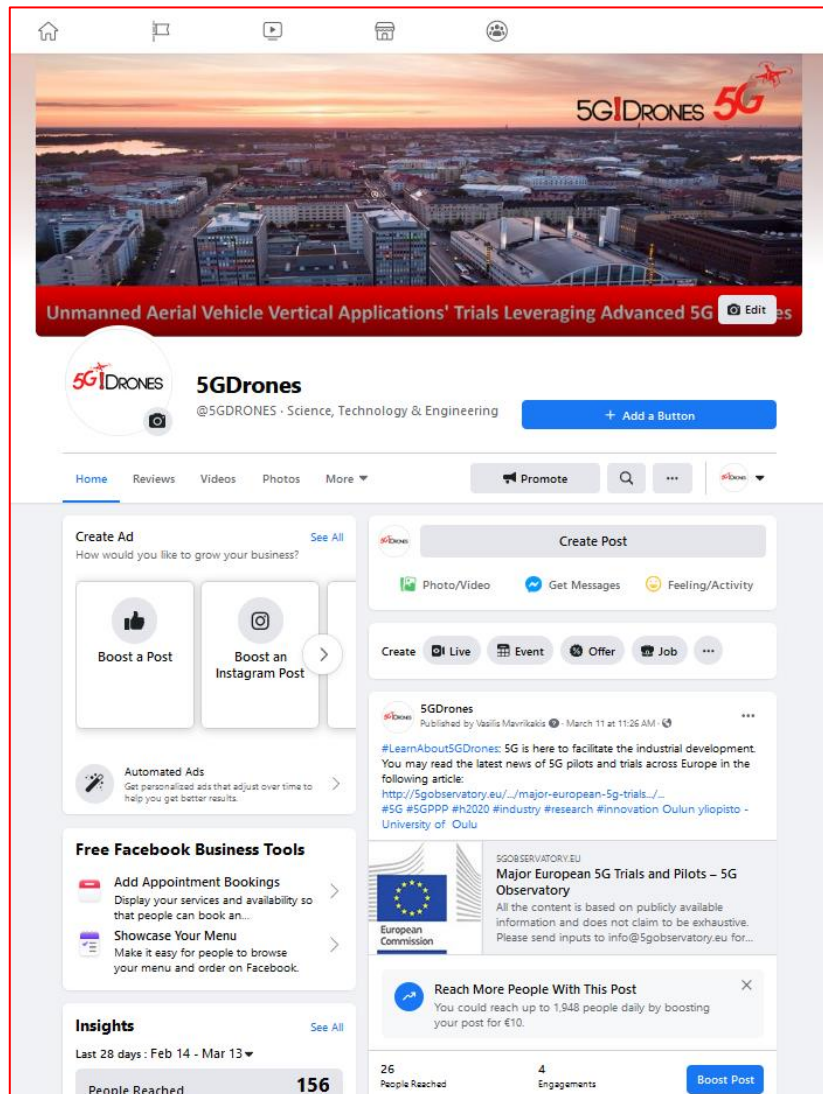
- News and updates on the 5G!Drones activities and progression of project's tasks and deliverables
- Papers and presentations originating from workshops, conferences, journals etc.
- White papers and technical reports
- Project showcases/demonstrations
- Publications in articles, online sources, newspapers/newsletter
- Upcoming events prompting stakeholders for papers (CfP) and events participation (registration)
- Videos and photos from activities (conferences, presentations, trials) related to the project
- 5G!Drones Partners related activities and achievements
- Newsletter issues
- General articles about 5G and Drones topics (addressing a wide non-technical audience)
- 5G-PPP activities (events, newsletters, newflashes, publications, white papers and articles)
- 5G-PPP, NetWorld2020 and 5G-IA Working Groups activities
- Related activities of other 5G-PPP and 5G related research projects

In parallel to the main social media channels, 5G!Drones also runs a dedicated 5G!Drones YouTube channel as a communication tool focused exclusively on videos from 5G!Drones events, presentations, workshops, conferences and trials. More details are provided on the next sections where the activity of all 5G!Drones social media channels are reported for the period June 2019-February 2021.

#### **2.1.3.1 Facebook Account**

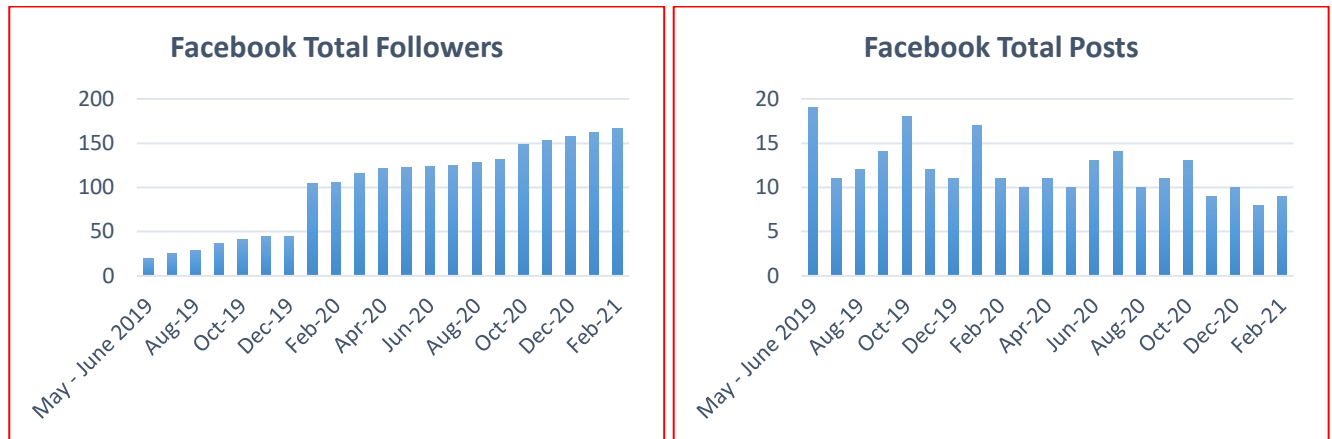
The 5G!Drones Facebook account is used to intensively communicate project activities to a wide non-technical audience (Figure 16). In the Facebook page any interested visitor may access the latest posts

of the project activities (technical and non-technical), 5G!Drones project information/identity, as well as, several article posts based on the two fundamental pillars of the project: the 5G and the UAVs topics. Also, there are frequent references through posts to 5G-PPP association that supports all 5G-related ICT projects with several activities.



**Figure 16: 5G!Drones Facebook account**

Facebook statistics and impact are monitored on a monthly basis. In Figure 17 the total followers and the total posts accumulated during the first 21 months of the project are depicted. As it can be easily seen the number of Facebook followers is gradually rising during the reporting period while we can spot the periods/months of more intensive posting activity by checking the Facebook Total posts chart.



**Figure 17: Facebook total followers & posts**

In Table 2, quantitative figures of specific Facebook metrics are provided. During the period M1-M21, 5G!Drones Facebook account attracted 158 page likes, attracted 167 followers, made 253 posts which reached (was viewed by) 18,029 Facebook users.

**Table 2: Facebook Activity (M1-M21)**

Facebook Activity	
June 2019 – February 2021	
Facebook Page Likes	158
Facebook Followers	167
Total Posts	253
Total Reach	18,029

### 2.1.3.2 Twitter Account

The 5G!Drones Twitter channel is used as the news overview portal of the project, communicating all 5G!Drones activities (technical and non-technical) to its followers in a brief and concise structure (Figure 18).

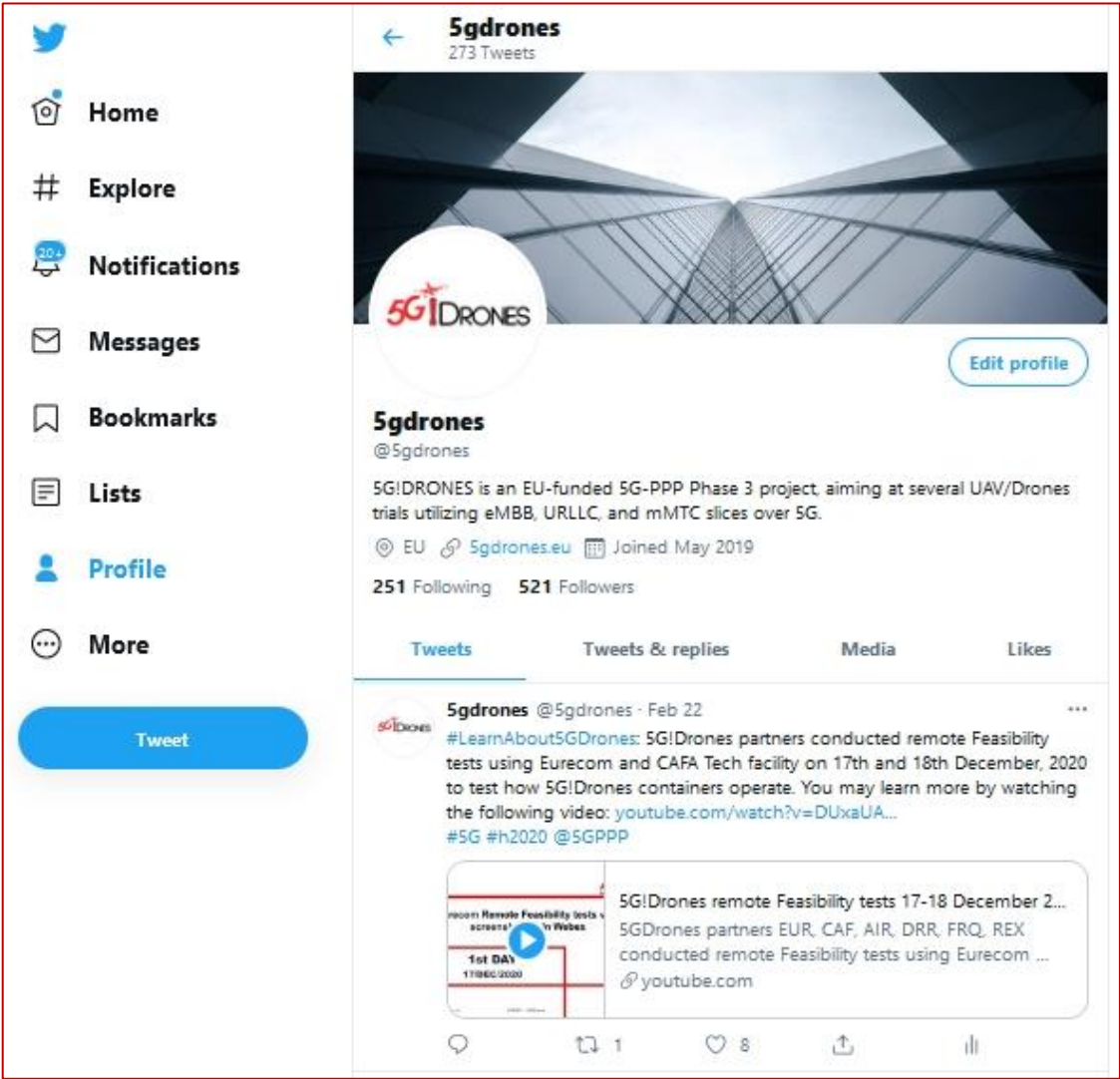
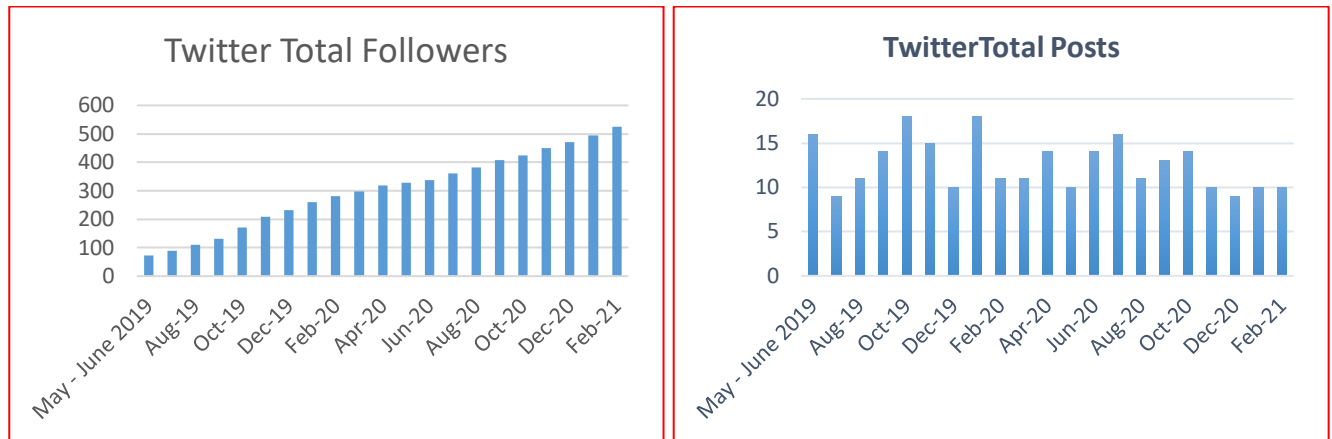


Figure 18: 5G!Drones Twitter account

The following figure and table (Figure 19 & Table 3) outline the Twitter activity for this first period of the project. As it can be clearly noticed, the number of Twitter followers is growing constantly as the time progresses. In addition, the posts intensity fluctuates per month, but always remain high (above the set weekly average of at least two posts). This intense fluctuation in the number of monthly posts is part of the communication strategy where we post and communicate more intensively during periods with high project and dissemination activities (e.g. meetings, trials).





**Figure 19: Twitter total followers & posts**

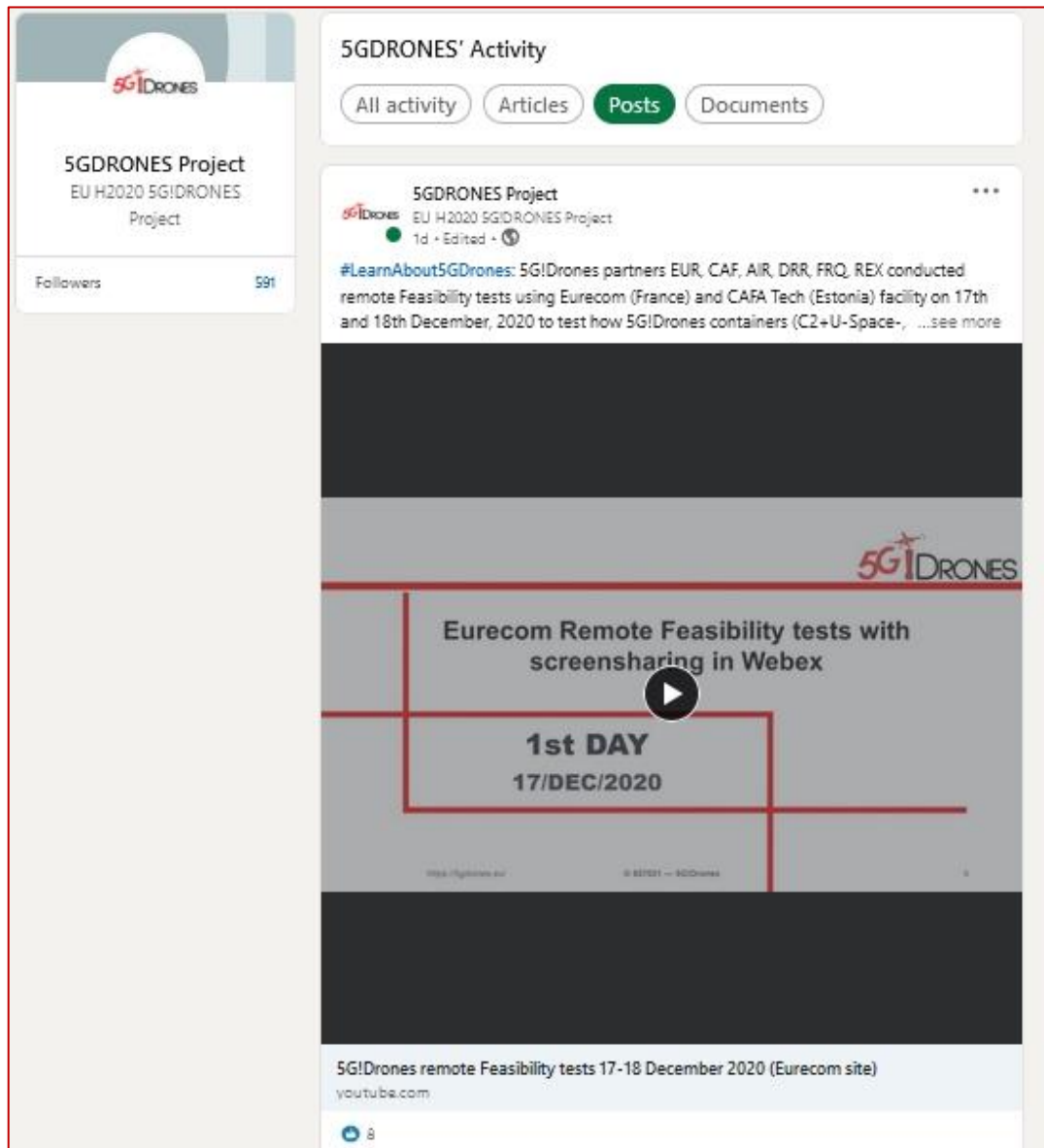
Furthermore, the following table shows some overall details about the Twitter activities such as the number of the total followers (526), total likes (1,976) and the total tweets (273) for these 21 months during the period M1-M21.

**Table 3: Twitter Activity (M1-M21)**

Twitter Activity	
June 2019 – February 2021	
Twitter Followers	526
Total Tweets	273
Total Likes	1,956

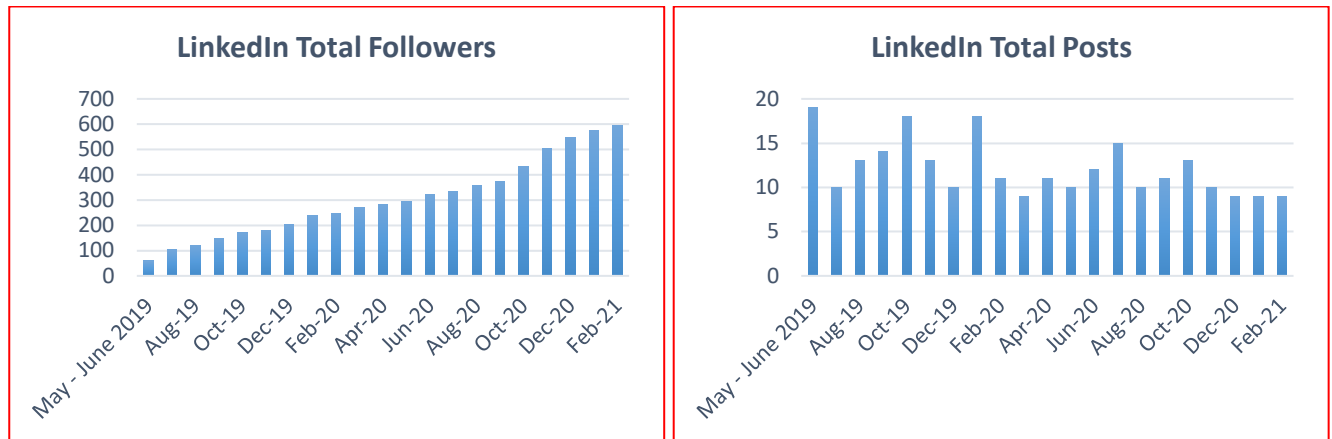
### 2.1.3.3 LinkedIn Account

The LinkedIn account allows the user to present material in a more academic and business manner for addressing a more technical audience. 5G!Drones LinkedIn channel showcases all the activities of the project and information about its results. LinkedIn occasionally is used for more technical and academic posting content since a more technical and academic audience is addressed (Figure 20).



**Figure 20: 5G!Drones LinkedIn account**

In Figure 21 we evaluate the gradually increasing number of LinkedIn followers for the reporting period. Also, it can be easily noticed our differentiated plan for more active posting under specific periods which is also depicted in the corresponding Posts graph.



**Figure 21: LinkedIn total followers & posts**

Table 4 summarizes the LinkedIn activities such as the total number of followers (596), LinkedIn connections (526) and the total number of posts (253) and likes (2,370).

**Table 4: LinkedIn Activity (M1-M21)**

LinkedIn Activity	
June 2019 – February 2021	
LinkedIn Followers	596
Connections	526
Total Posts	253
Total Likes	2,370

#### 2.1.3.4 Instagram account

The 5G!Drones Instagram account is also used to communicate material from events and activities related to the project but using a more visual approach. Considering the nature and the audience of the Instagram platform, 5G!Drones team communicates mainly visual content and especially images through the 5G!Drones Instagram channel. Images from events, presentation and trials along with a short text outline any posted activity (Figure 22). Furthermore, in the bio of the profile, any interested visitor can find the 5G!Drones website address where he can be redirected for more details (this URL is temporarily updated with links that need to address specific post activities such URL of an event or a video that was posted on that period).

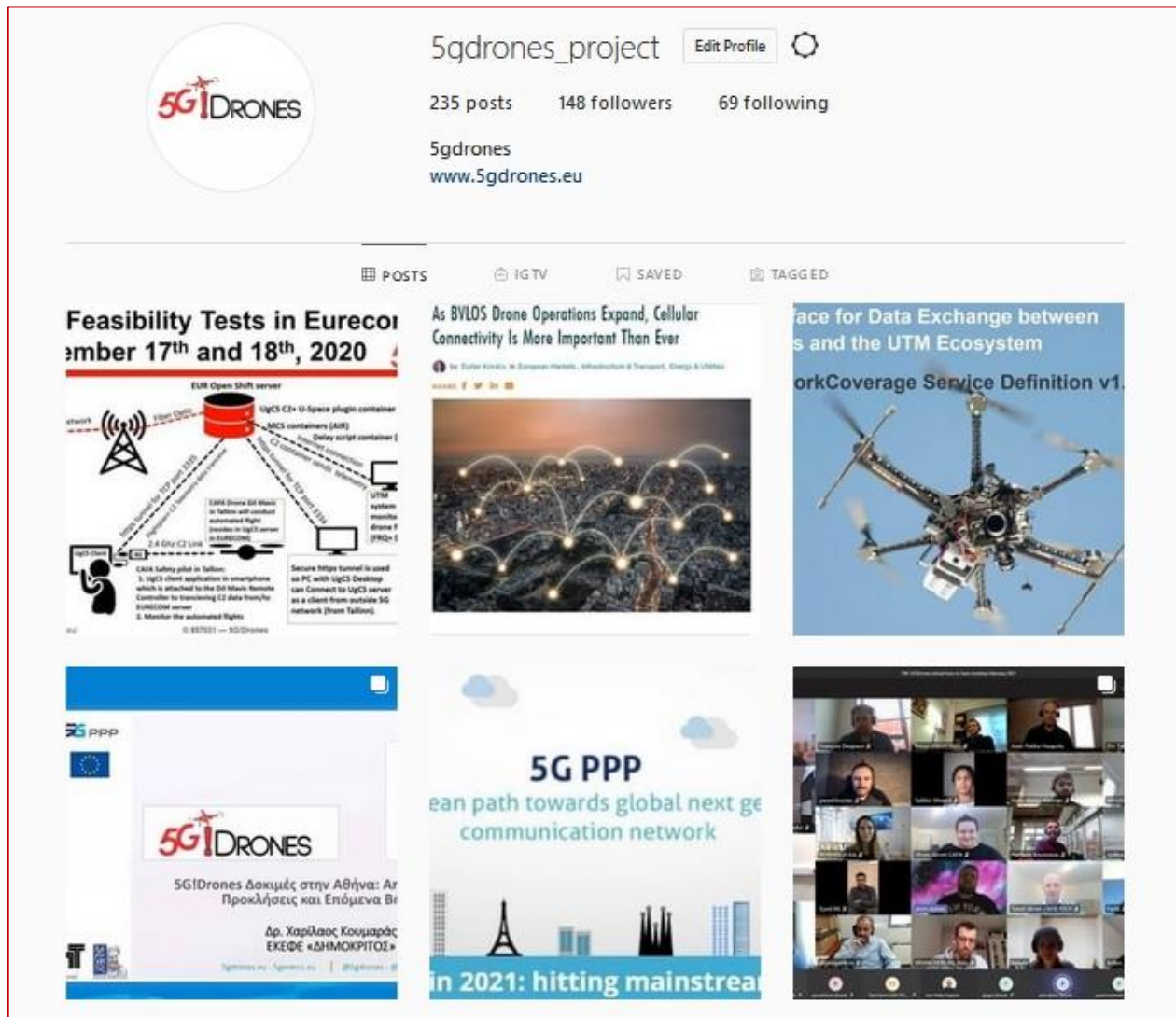


Figure 22: 5G!Drones Instagram account

In Figure 23, the followers accumulation is depicted over time along with the number of posts made per month.

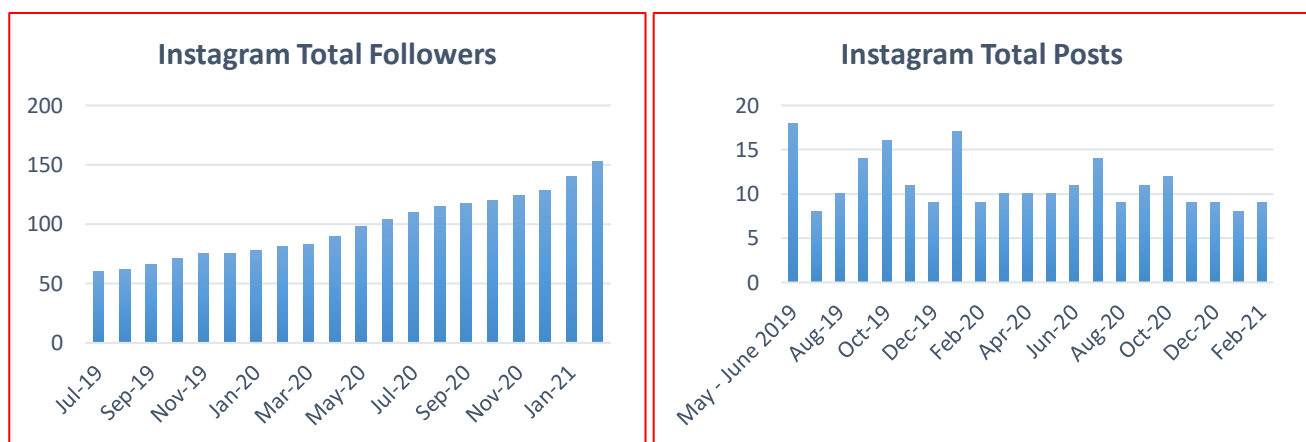


Figure 23: Instagram total followers & posts

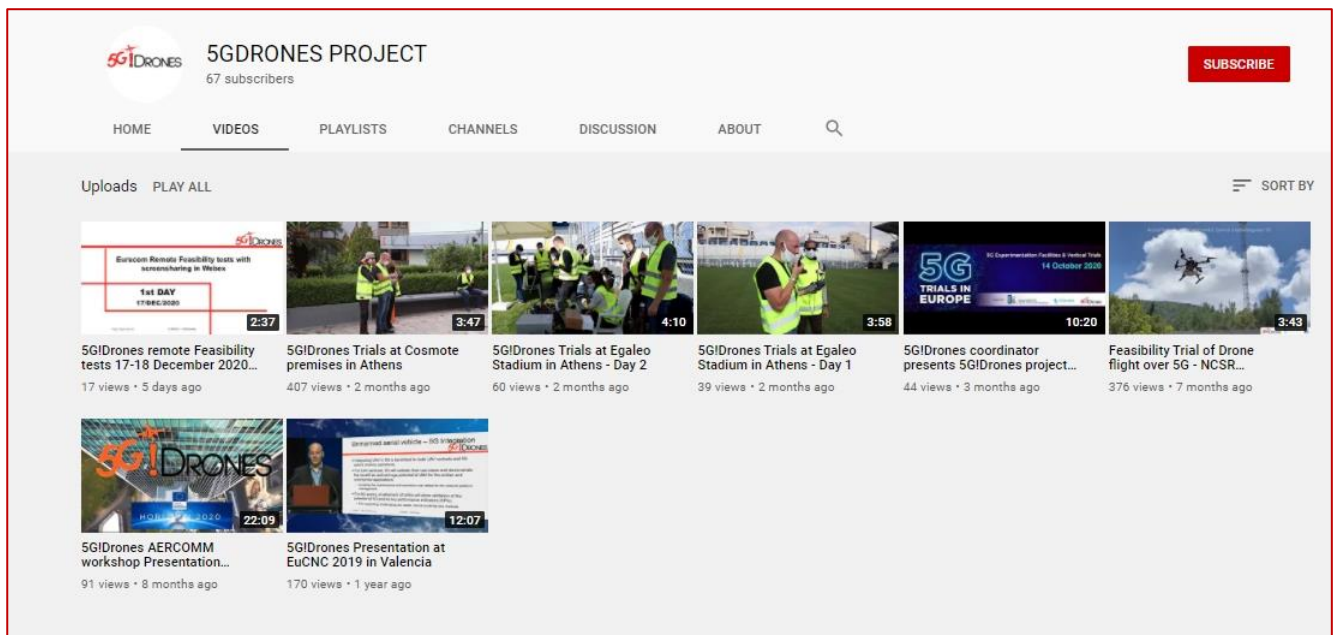
In Table 5, the period insights are provided such as the total followers (153), the overall posting activity (233) and the total number of likes gained (2,140).

**Table 5: Instagram Activity (M1-M21)**

Instagram Activity	
June 2019 – February 2021	
Instagram Followers	153
Total Posts	233
Total Likes	2,140

### 2.1.3.5 YouTube account

The YouTube is a video-based communication channel. Thus, the 5G!Drones YouTube channel is being used for communicating the project activities, trials and results through videos (Figure 24). In the 5G!Drones YouTube channel there are available videos from project's presentations, trials and conferences.



**Figure 24: 5G!Drones YouTube Channel**

As per Table 6, during the period June 2019-February 2021, the 5G!Drones YouTube channel has reached 67 subscribers, has posted 8 video and has gained 37 likes and 1204 views.

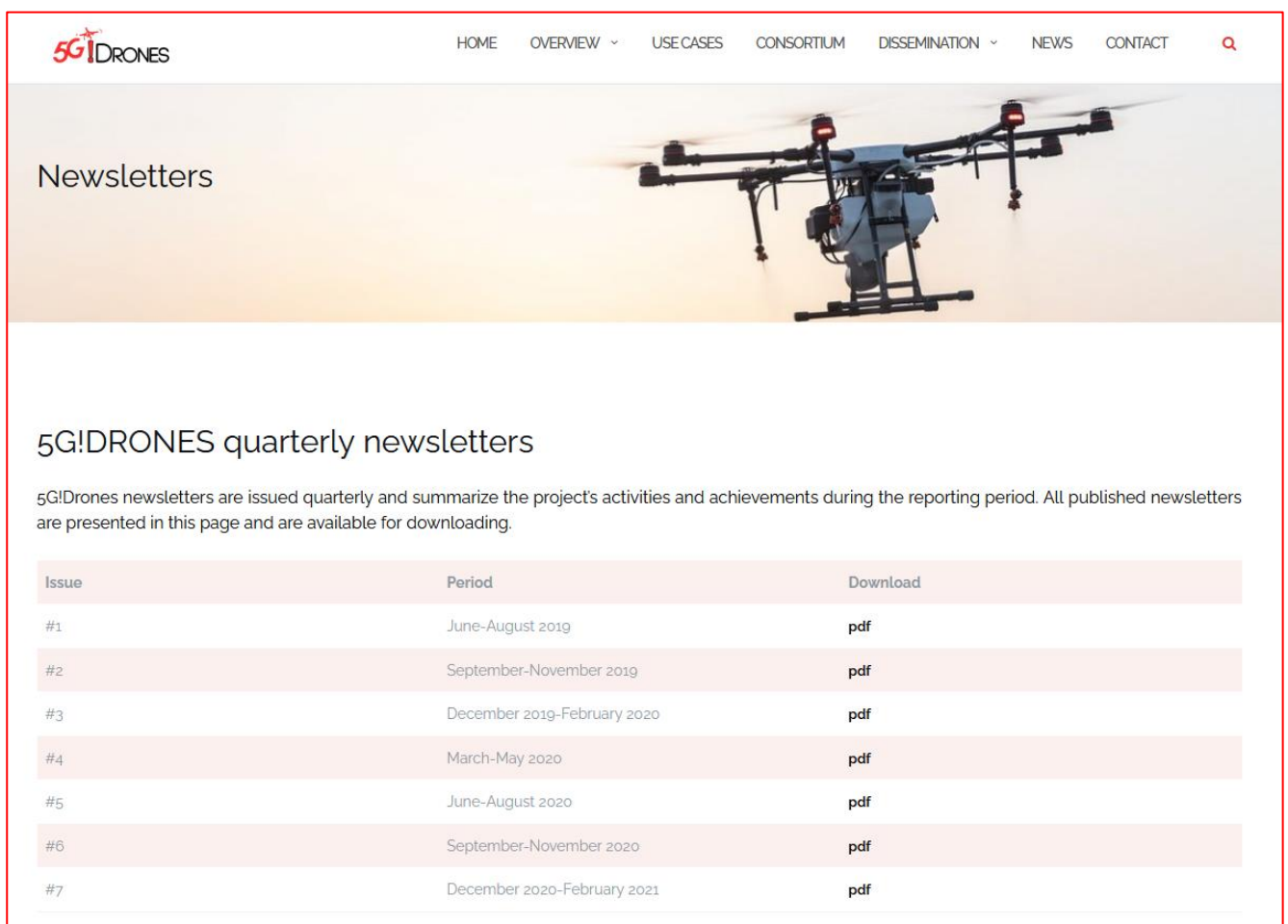
**Table 6: YouTube Activity (M1-M21)**

YouTube Activity	
June 2019 – February 2021	
Subscribers	67
Total Videos	8

Total Video Views	1204
Total Video Likes	37

#### 2.1.4 Newsletter

The 5G!Drones newsletter is being issued on a quarterly basis (every three months). The newsletter presents to the public each quarter's events and activities in a compact and comprehensive way. A specific template is used making the 5G!Drones newsletter easily recognisable and each text paragraph is followed by a URL and a small picture in order to show off better the equivalent activity. Each newsletter issue, upon release in public, is communicated through 5G!Drones social media channels and it is also available for downloading (pdf format) through the 5G!Drones website, on the Newsletters webpage in the following link: <https://5gdrones.eu/newsletter/> (Figure 25).



**Figure 25: 5G!Drones Newsletter Webpage**

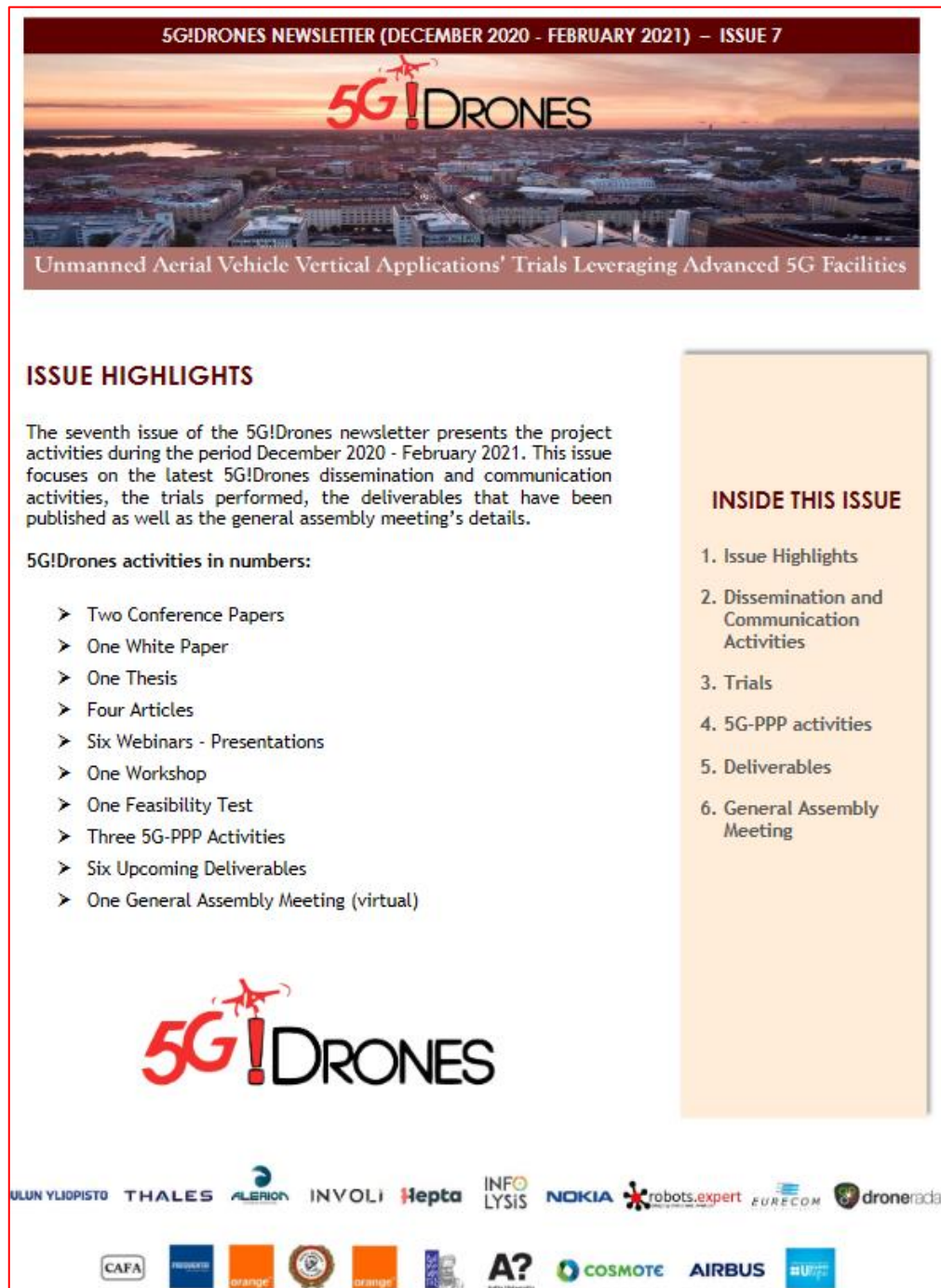
During the reporting period, 7 newsletter issues have been published. The latest one is the issue 7 referring to the quarter December 2021 – February 2021 (Figure 26). At the time that this deliverable was under editing, the initial draft version of newsletter issue 8 has been created and its editing process also initiated.

A specific internal editing process is followed before every issue is made public. Every new issue is first released as draft internally and is circulated through the dedicated WP5 mailing list to the consortium



partners for internal review (comments, additions, editing). When the review process is completed, the issue is finalized by INF team and released through the website Newsletter page (available for downloading through dedicated link) and also communicated over the 5G!Drones social media channels.

Please refer to the Newsletters webpage ( <https://5gdrones.eu/newsletter/>) or to Annex 2 of this deliverable for accessing all the 5G!Drones Newsletter quarterly issues of the period June 2019-February 2021.



**Figure 26: 5G!Drones Newsletter (Issue 7 cover page)**

## 2.1.5 Leaflet

5G!Drones has created a three folded leaflet version in order to enrich its communication impact. Leaflet versions are constantly updated and used both in printed and digital format for communicating the project in several events and activities where audience is present. The 5G!Drones leaflet briefly describes details of the project such as objectives, architecture, use cases and the consortium members (Figure 27 and Figure 28). The latest leaflet version is also available for downloading through 5G!Drones Communication and Dissemination webpage here: <https://5gdrone.eu/wp-content/uploads/2020/06/5GDrone-Leaflet-DL6.pdf>



Figure 27: 5G!Drones Leaflet (side A)



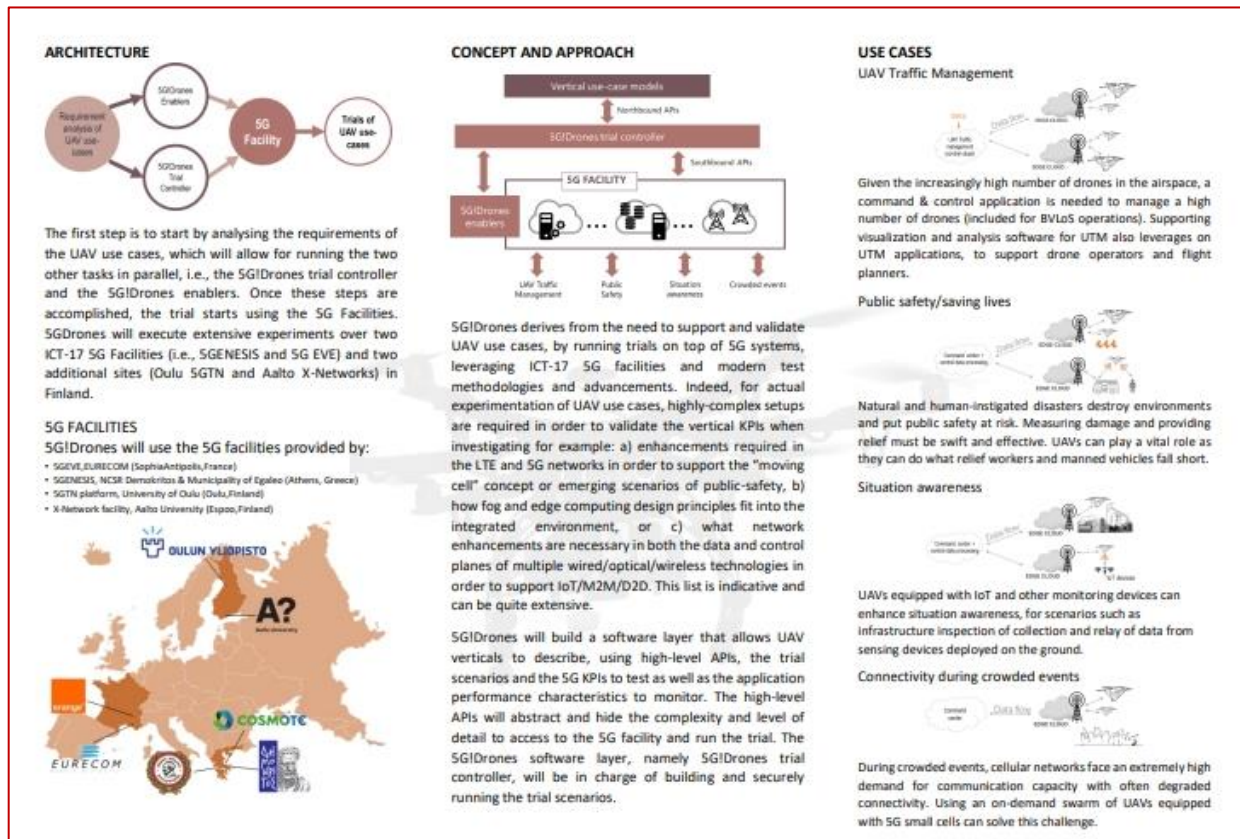


Figure 28: 5G!Drones Leaflet (side B)

### 2.1.6 Poster

A respective 5G!Drones poster has been created in order to be used for applying the communication strategy of the project (Figure 29). The poster serves similar scope with the leaflet. In other words, the main use of the poster is for communicating the project in face-to-face meetings, conferences, presentations and booths in various events. It can also be used for online purposes and digital events. The latest poster (A1 size) is also accessible through the Communication and Dissemination webpage here: <https://5gdrones.eu/wp-content/uploads/2021/02/Poster-5GDrones-v3.pdf>

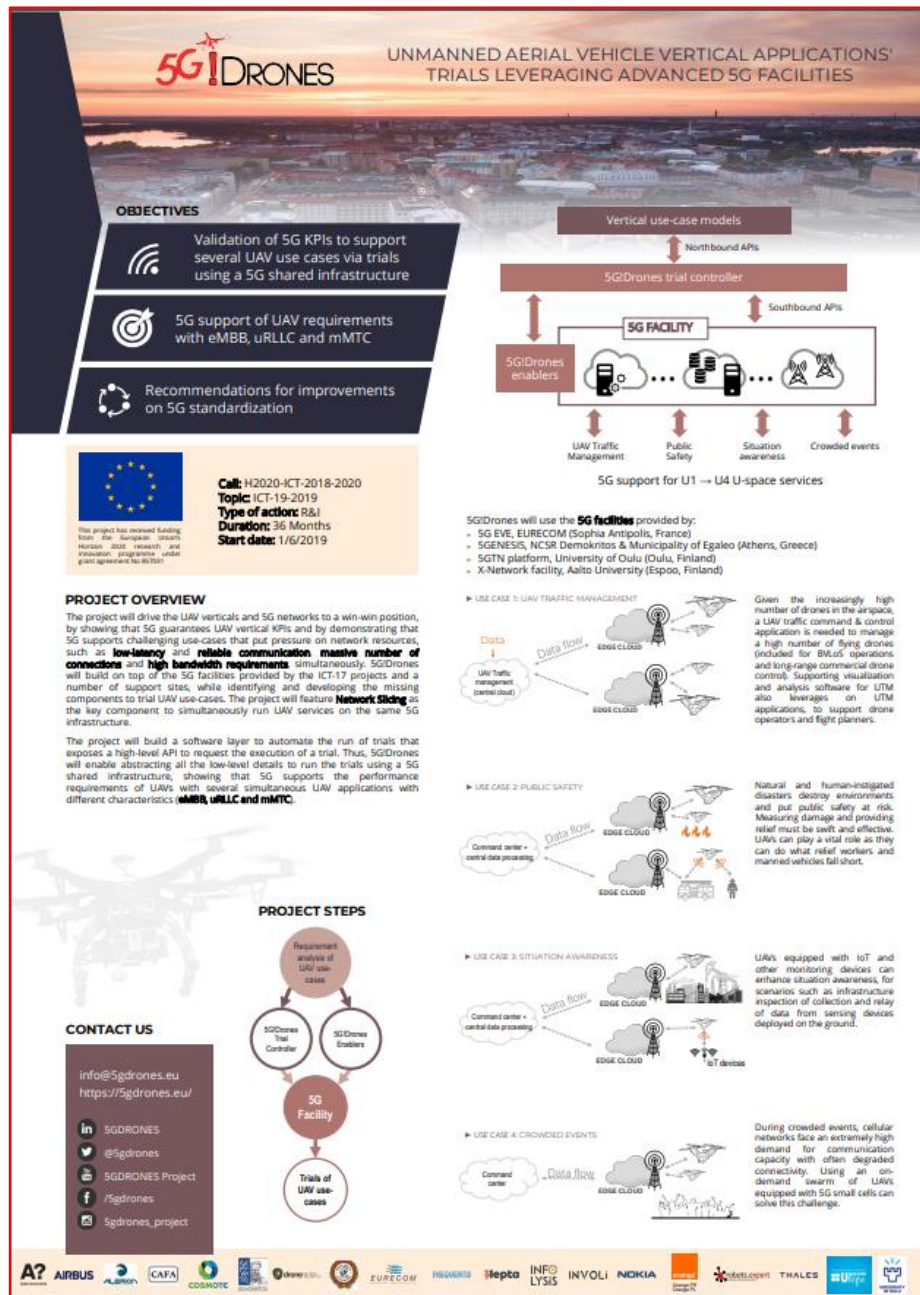


Figure 29: 5G!Drones Poster

### 2.1.7 Press releases

Press releases are primarily aimed at gaining publicity and raising public awareness. Press releases are created and shared via our partners to various media and press contacts (European and international). Press releases are also issued by partners (mainly online) and hosted on a dedicated page of the 5G!Drones website here: <https://5gdrones.eu/press-releases/>. During the reporting period, 6 press releases have been communicated.

### 2.1.8 Other communication channels

The 5G!Drones project has enabled some additional means in order to effectively promote and disseminate the project such as:

- Online articles
- Published articles in magazines/newspapers
- Interviews, as well as videos, which may be conducted by the partners, events that the partners participated or demonstrations
- Use of EU and 5G-PPP channels (e.g. websites, newsletters, newsflashes) for communicating 5G!Drones and stepping on findings
- Printed material (Leaflets)
- Stickers

During the first period (M1-M21), partners have conducted a large number of activities for effectively promoting and communicating the project. The next table summarizes the total communication activities of the period June 2019-February 2021.

**Table 7: Communication Activities Summary (M1-M21)**

Mean	Channel - Section	URL	Activity
Website	News	<a href="https://5gdrones.eu/news/">https://5gdrones.eu/news/</a>	>110 posts
	Publications	<a href="https://5gdrones.eu/research-papers/">https://5gdrones.eu/research-papers/</a>	23 papers
	Workshops/ Presentations	<a href="https://5gdrones.eu/workshops/">https://5gdrones.eu/workshops/</a>	37 presentations 2 workshops
	Trials	<a href="https://5gdrones.eu/workshops/">https://5gdrones.eu/workshops/</a>	10 trials 4 trial reports 4 trial videos
	White Papers	<a href="https://5gdrones.eu/research-papers/">https://5gdrones.eu/research-papers/</a>	6 publications
	Press Releases	<a href="https://5gdrones.eu/press-releases/">https://5gdrones.eu/press-releases/</a>	6 press releases
	Events	<a href="https://5gdrones.eu/past-events/">https://5gdrones.eu/past-events/</a>	42 events attended
	Website Visitors	<a href="#">Communication and Dissemination Activities – 5G!Drones H2020 ICT-19-2019 5G-PPP 5GDrones Project</a>	8,357 visitors
	Website page views		30,384 views
Social Media	Facebook	<a href="https://www.facebook.com/5gdrones">www.facebook.com/5gdrones</a>	253 posts
	LinkedIn	<a href="https://www.linkedin.com/in/5gdrones/">https://www.linkedin.com/in/5gdrones/</a>	253 posts
	Twitter	<a href="https://twitter.com/5gdrones">https://twitter.com/5gdrones</a>	273 tweets
	Instagram	<a href="https://www.instagram.com/5gdrones_project/">https://www.instagram.com/5gdrones_project/</a>	233 posts
	YouTube	<a href="https://www.youtube.com/channel/UCbPj4gQ5P5qo7Fer6NJxGOQ">https://www.youtube.com/channel/UCbPj4gQ5P5qo7Fer6NJxGOQ</a>	8 videos
	Total Followers		1509 followers
	Total Posts		1020 posts

Leaflets		<a href="https://5gdrones.eu/publications-and-dissemination/">https://5gdrones.eu/publications-and-dissemination/</a>	2 leaflet versions
Posters		<a href="https://5gdrones.eu/wp-content/uploads/2021/02/Poster-5GDrones-v3.pdf">https://5gdrones.eu/wp-content/uploads/2021/02/Poster-5GDrones-v3.pdf</a>	1 poster version
Newsletters		<a href="https://5gdrones.eu/newsletter/">https://5gdrones.eu/newsletter/</a>	7 issues published and 1 issue under editing
Printed Material	Printed Leaflets	<a href="https://5gdrones.eu/wp-content/uploads/2020/06/5GDrones-Leaftlet-DL6.pdf">https://5gdrones.eu/wp-content/uploads/2020/06/5GDrones-Leaftlet-DL6.pdf</a>	1000 pieces
Others	Stickers	in progress	500 pieces

## **2.2 Control-Monitoring Mechanisms and Statistical Dashboards - First period (M1-M21)**

### **2.2.1 Control and Monitoring Mechanisms for Communication material**

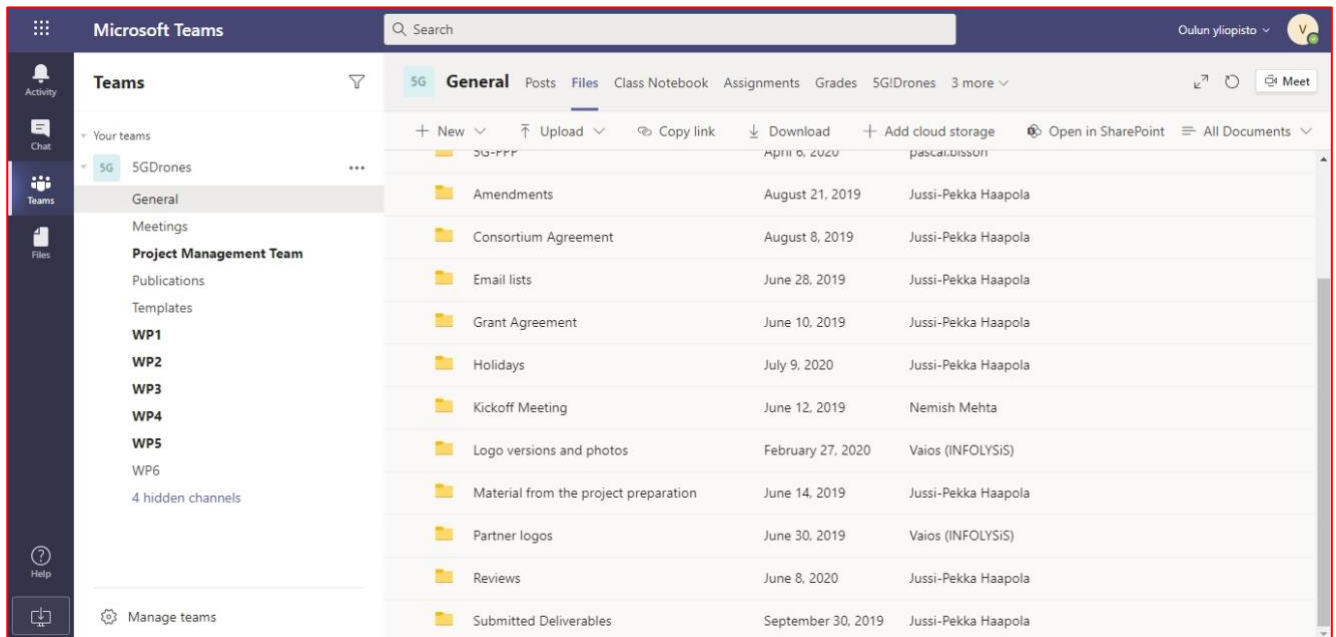
Since the project start, 5G!Drones partners have established control and monitoring mechanisms in order to constantly evaluate and assess the communication/dissemination activities. Such mechanisms have the ability to track and validate the communication processes. These control and monitor processes are extremely valuable for the project since on the one hand they provide us with useful feedback about the digital existence of the project and on the other hand they work as collaboration tool among the members of the consortium.

- **Microsoft Teams Online Repository and Collaboration Tool**

The members of the consortium use Microsoft Teams as the online repository and collaboration tool. MS Teams is divided into sections – folders and sub-folders - for the smooth distribution and better organization/filing of the project's material. As a result, each WP has its dedicated section which is divided into other folders and subfolder about tasks and activities. MS Teams also provide the feature of online editing. Online editing is very important for the smooth collaboration between partners as it helps the documentation of activities and events. Furthermore, MS teams gives the chance to user to organize online meetings and teleconferences. So, through this online platform the consortium facilitates its meetings at WP level or at GA plenary level.

Over the first 21 months, several folders and files have been created in MS Teams facilitating the effective collaboration and data sharing among partners (Figure 30).





**Figure 30: MS Teams Online Tool**

- **Activities' documentation in dedicated Excel file for communication purposes**

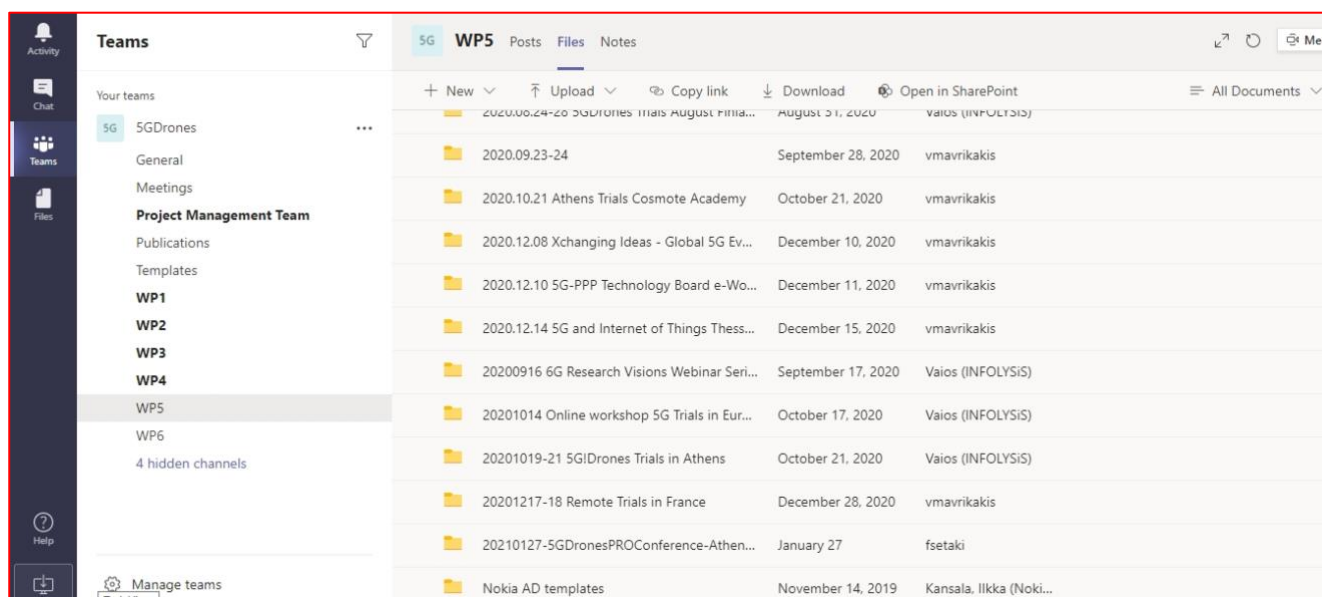
As part of task 5.1, an additional mechanism has been setup for allowing all partners to document communication and dissemination activities they have performed and must be communicated over the project's communication channels. This mechanism relies on the existence of an online Excel file on MS Teams entitled "WP5 activities". This file is located in the T5.1 folder inside WP5 section and only registered users (i.e. partners) may access it (Figure 31).

Item #	Authors/Partners	Activity Title	Target (Event, Location, Date)	Description
59	EUR, CAF, AIR, ORR, FRQ, REX	Trials Video	Video: Trials 17 & 18 December	5G!Drones partners EUR, CAF, AIR, ORR, FRQ, REX conducted remote Feasibility tests using Eurecom (France) and CAFE Tech (Estonia) facility on 17th and 18th December, 2020 to test how 5G!Drones containers (C2+U-space, MCS- and latency measurement container) work in EUR servers and the connections with these containers' client applications in smartphones. Video available here: <a href="https://youtu.be/DUxUAABuVik">https://youtu.be/DUxUAABuVik</a>
60	Gokul Srinivasan/ robots.experts	Online Article	Online Article unmannedairspace.info "The idea that 5G can enable BVLOS missions is something of a myth"	Gokul Srinivasan from robots.experts, 5G!Drones partner, shared some details about the interoperability between BVLOS and UTM services with 5G network, in the online article "The idea that 5G can enable BVLOS missions is something of a myth" by unmannedairspace.info. You may access the article here: <a href="https://www.unmannedairspace.info/news-first/the-idea-that-5g-can-enable-bvlos-missions-is-something-of-a-myth-gokul-srinivasan/">https://www.unmannedairspace.info/news-first/the-idea-that-5g-can-enable-bvlos-missions-is-something-of-a-myth-gokul-srinivasan/</a>

**Figure 31: MS Excel File for communication activities (M1-M21)**

In addition to the excel file, every partner should upload any related material such as photos, presentations, webinars, camera ready papers, etc. from the event he participated in, into the

corresponding WP5 corresponding event folders. Every partner must create a new subfolder for each new event. All these event sub-folders are created inside the “Activities Material” folder (Figure 32).



**Figure 32: WP7 Communication Activities-Events folder**

During the reporting period (M1-M21), all relevant activities have been reported in the mentioned folders and excel file. Indicatively, the documented communication and dissemination activities in the excel file sum up to: 66 activities (Year 1 M1-M12), 45 activities (Y2 - 9 months: M13-M21) and a total of over 28 event folders with related uploaded material.

### **2.2.2 Website and Social media Statistical Dashboards for M1-M21**

In order to evaluate and assess the digital impact of the project, two evaluation and monitoring tools are being utilised: Google Analytics and Google Data Studio Statistical Dashboards.

Google Analytics is used primarily for recording and evaluating the performance of 5G!Drones website. It helps to extract in-depth and complicated data reflecting different metrics and activities of the website performance and impact. The website administrator (INF team) is responsible for monitoring these data variations and depicting/evaluating different aspects of the website's functionality. Users' activity such as, in which specific pages users were more interested in, number of sessions, average duration of website visits, the visitors' path and information about user acquisition, are just an indicative sample of the metrics that are internally monitored and analysed through Google Analytics on a monthly basis.

In parallel, Google Data Studio is used for the most comprehensive visualisation of the accumulated data, not only of the 5G!Drones website but also of 5G!Drones social media channels. Google Data Studio statistical Dashboards (one per channel) have been designed and developed exclusively for 5G!Drones project and depict an overview of each communication channel along with several useful details and metrics.

The dashboards are released internally to all consortium members on a monthly basis. INFOLYSiS also prepares special quarterly, annual, or for requested time periods of the project, dashboard releases for including them in specific occasions and events such as deliverables, WP meetings and dedicated presentations. All monthly website and social media dashboards (one per channel) are made available online and dedicated URLs are provided for accessing them.

All monthly dashboards (URLs) released during the period June 2019-February 2021 are available in ANNEX 1 - 5G!DRONES Statistical Dashboards (M1-M21).

In the following sections, there is a dashboard analysis/presentation per channel for the period June 2019 – February 2021. The aggregated period results are presented through the dashboards along with a brief text, explaining the data depicted in them.

### • Website Statistical Dashboards (M1-M21)

In the website dashboard (Figure 33), data related to the website activity and performance are presented such as the number of new users (8,316), the total page views (30,384), the average session duration (00:02:11), and the pages per session (2.17). Furthermore, the website dashboard reveals insights concerning the path that a visitor followed for visiting projects' website. For instance, the majority (43.9%) of the 5G!Drones visitors reached the website through the Google search engine while the 35% came directly to the website. We can also spot at this dashboard the different means that the visitors used for viewing the website. The vast majority (86.4%) of the visitors used their desktop devices, the second most popular device is the mobile phones (12.3%), while a minor number (0.3%) of visitors used their tablet devices.

This dashboard (M1-M21) can be accessed online at:

<https://datastudio.google.com/reporting/9151f0ec-8bc6-441d-8d2a-d70b583aa016>

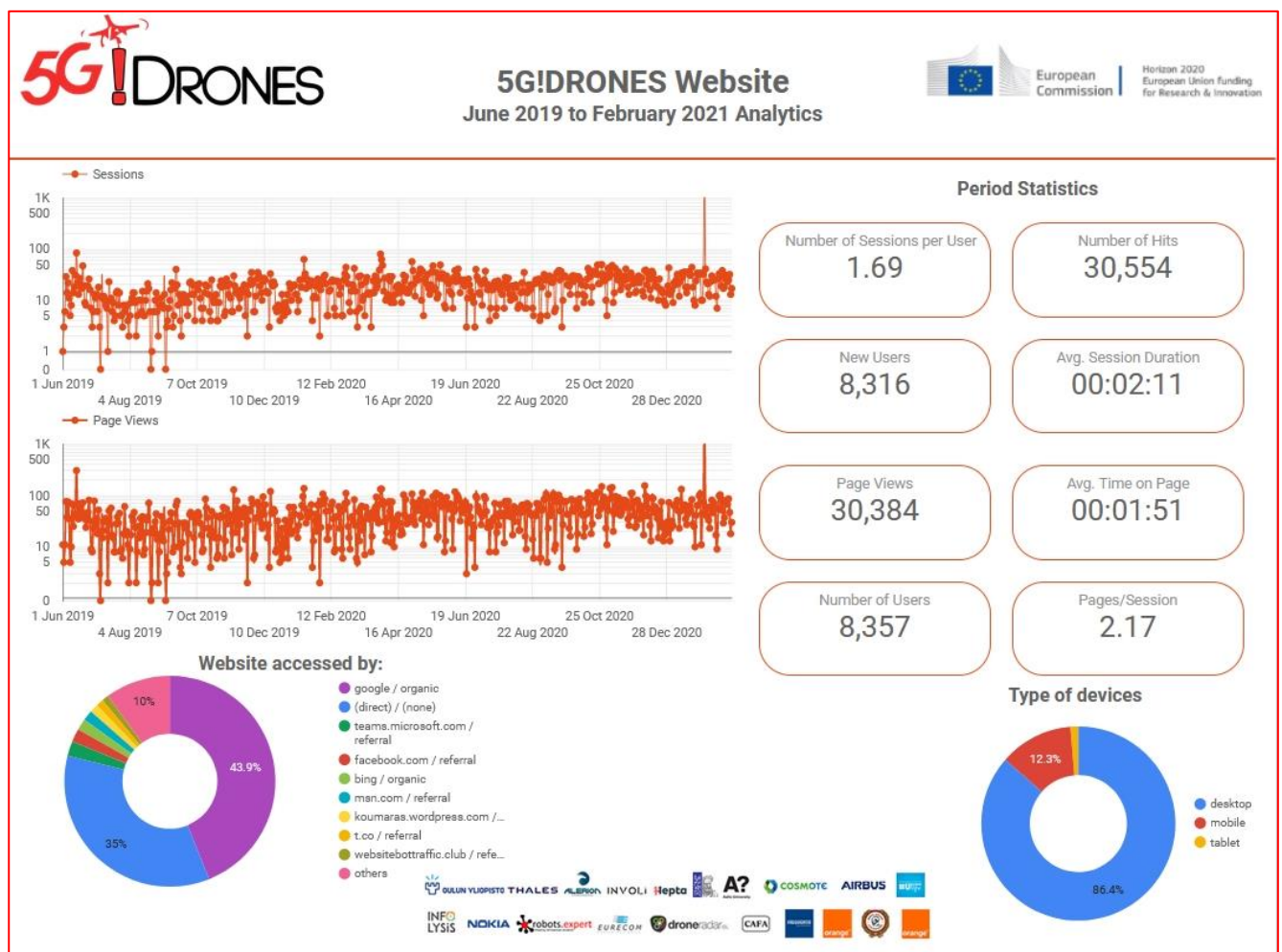


Figure 33: 5G!Drones Website Statistical Dashboard

- Facebook Statistical Dashboards (M1-M21)

The 5G!Drones Facebook channel dashboard is compiled in two different pages for providing more insights about Facebook activities. In the Figure 34, the statistical analysis/findings of the first page are presented. This page of the dashboard aggregates between period and total statistics (in this case both periods coincide to June 2019-February 2021, but this distinction is extremely vital when monthly periods are under analysis), the top-rated posting activity and a graph outlining the total page views and unique users. Briefly, during the reporting period, the 5G!Drones Facebook page has accumulated 158 total page likes, 905 page views, 167 page followers, and has hosted 253 5G!Drones posts.

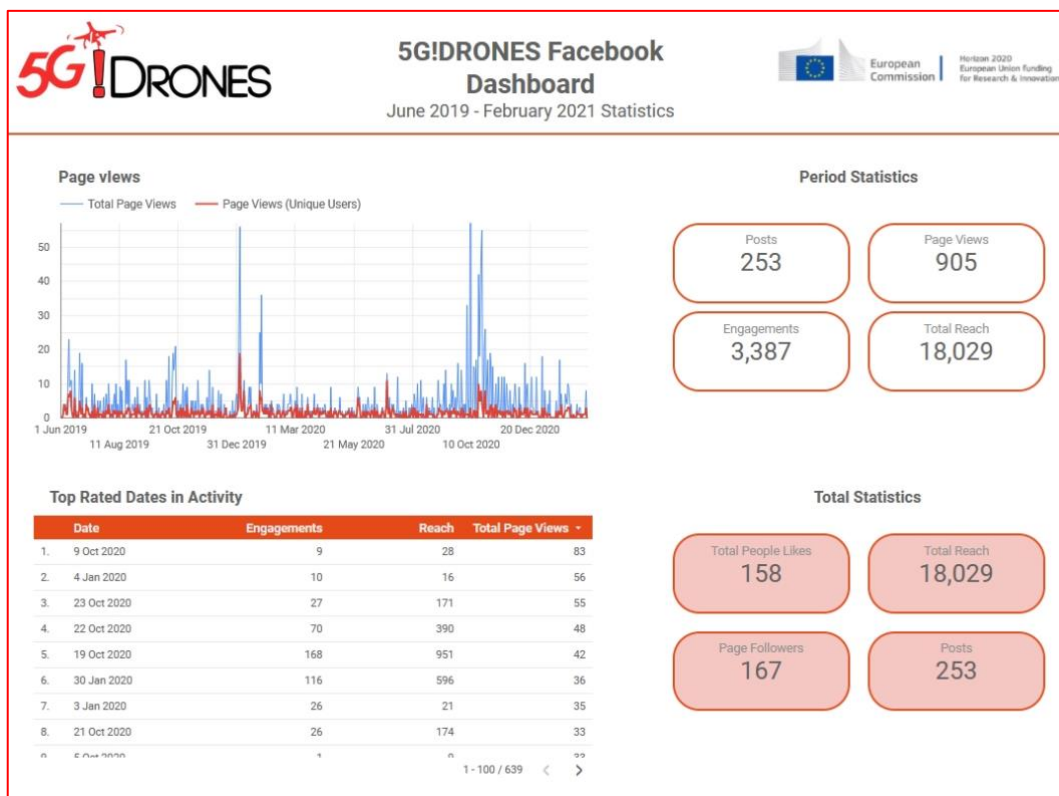


Figure 34: 5G!Drones Facebook Statistical Dashboard (page 1)

Figure 35 shows the second page of the dashboard and through the use of graphs, the fluctuations between different periods and variables such as reach per date, post engagement per date and page likes and unlikes on a daily basis, are presented.



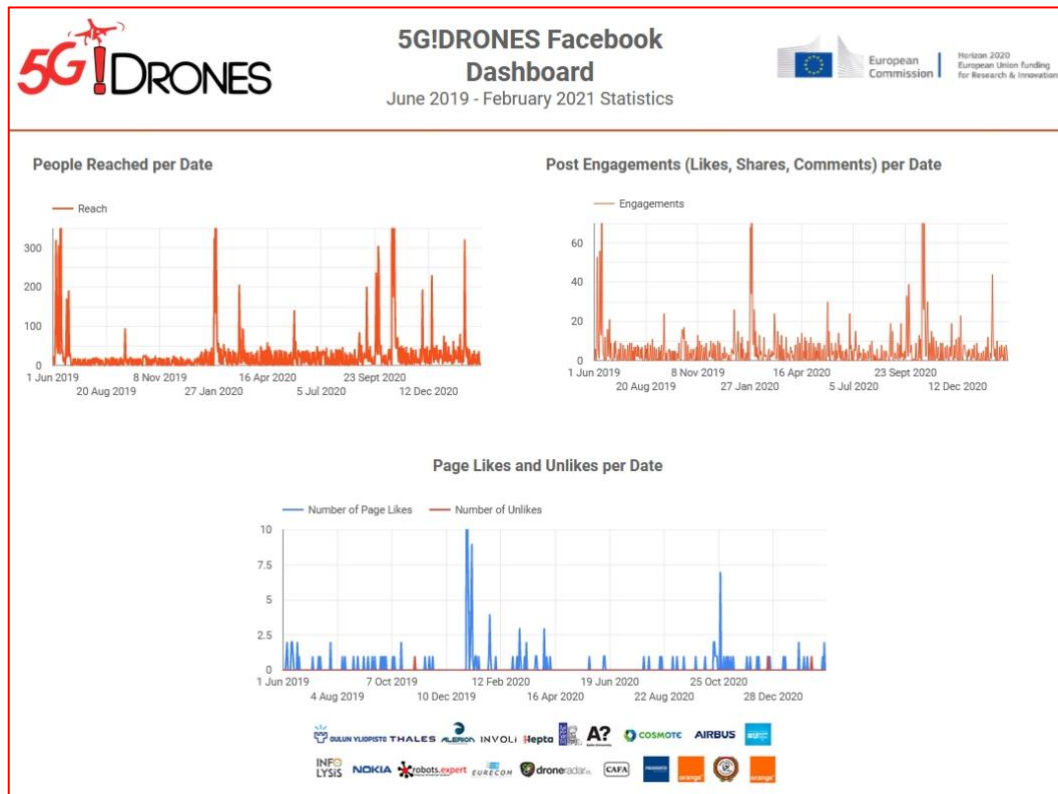


Figure 35: 5G!Drones Facebook Statistical Dashboard ( page 2)

The Facebook statistical dashboard (M1-M21) for the reporting period can be accessed online at:

<https://datastudio.google.com/reporting/c920629a-a0da-4d00-b76f-b0738e8b5077>

- **Twitter Statistical Dashboards (M1-M21)**

The Twitter 2-pages dashboard similarly summarises and visualises the activity for the first 21 months of the project. In Figure 36, the first page of the dashboard categorizes the top-rated tweets and presents through a histogram the number of likes per total Tweets per date. Brief results' analysis shows that there have made 273 tweets for this period, attracting 1956 likes and 465 retweets. The 5G!Drones Twitter account has accumulated 526 followers so far.

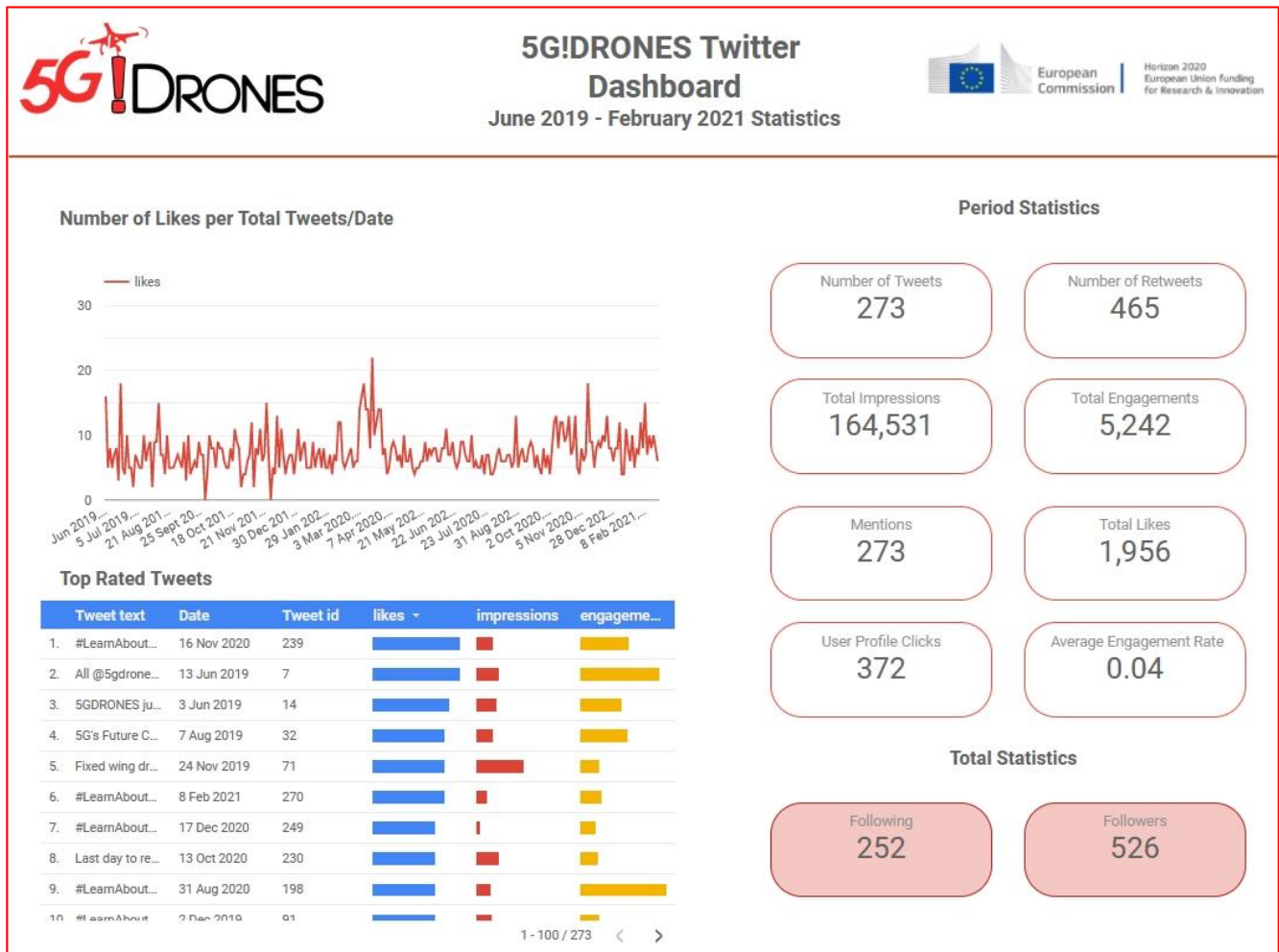


Figure 36: 5G!Drones Twitter Statistical Dashboard (page 1)

The second page of the Twitter dashboard (Figure 37) gives insights through graphs about the total number of engagements, the impressions, and the number of tweets and retweets over time.

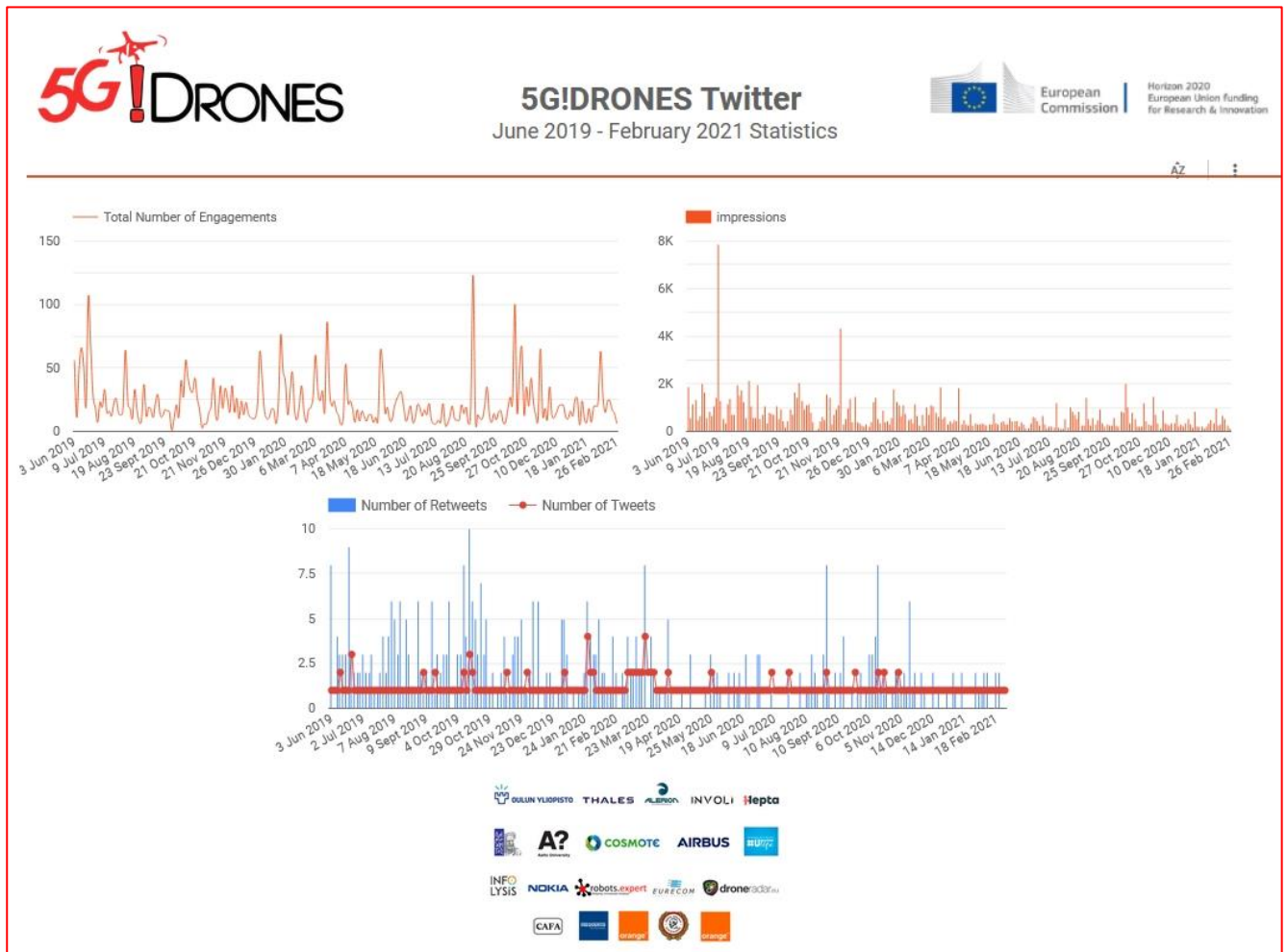


Figure 37: 5G!Drones Twitter Statistical Dashboard (page 2)

The Twitter dashboard (M1-M21) can be accessed online at:

<https://datastudio.google.com/reporting/7605e7dd-a2f8-4ff6-a372-5c53e539b3f6>

- **LinkedIn Statistical Dashboards (M1-M21)**

5G!Drones LinkedIn dashboard is also follows a two-pages structure. On the first page, which is depicted in Figure 38, it is shown that the 5G!Drones LinkedIn profile has accumulated 526 connections, 596 followers and 3299 profile views. On this first page the top-rated posts in views and a graph depicting the number of views per post and day are also listed.

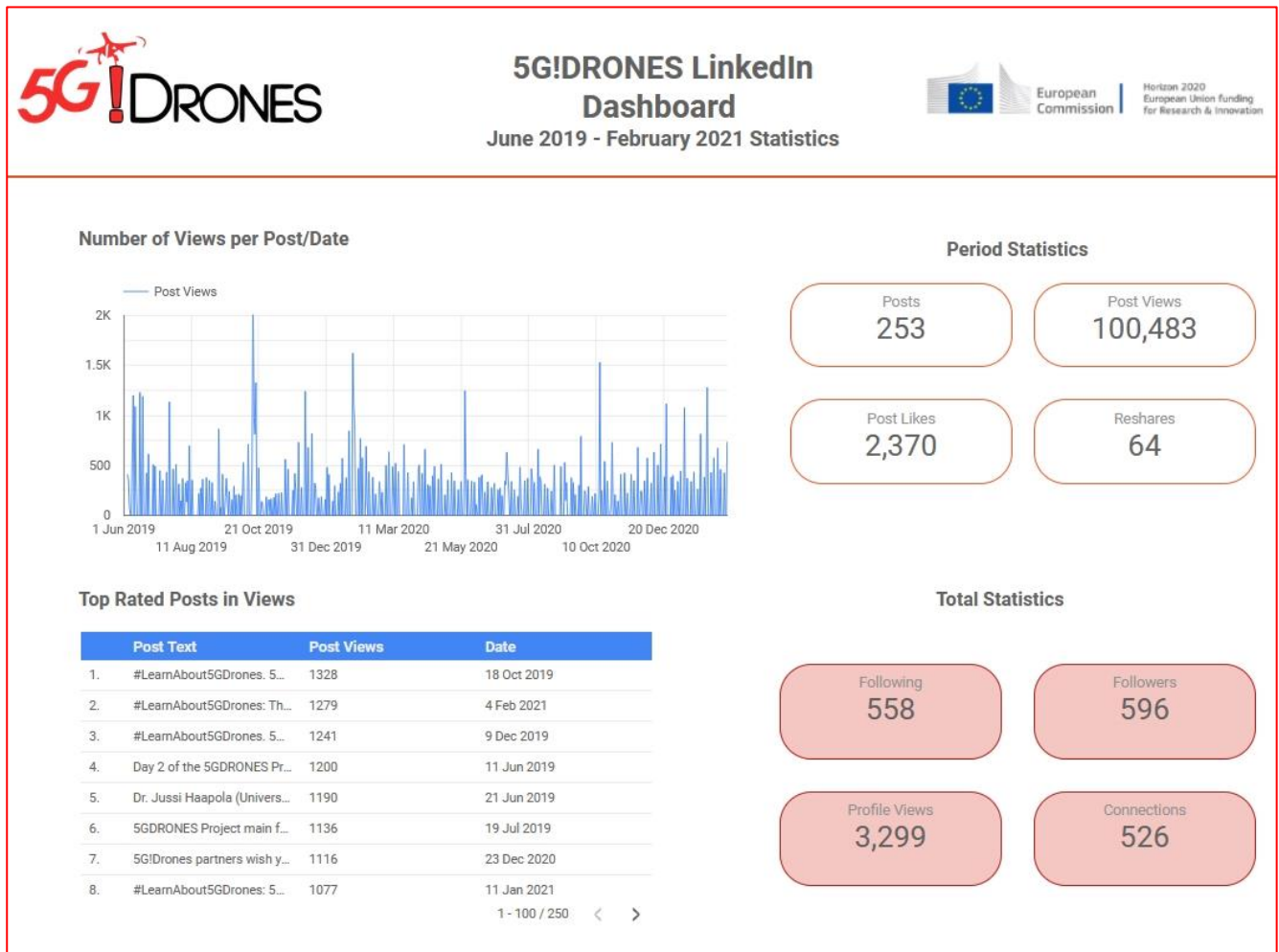


Figure 38: 5G!Drones LinkedIn Statistical Dashboard (page 1)

The second page of the dashboard (Figure 39) outlines through infographics the number of likes and reshares. It also lists the top-rated posts in terms of likes.

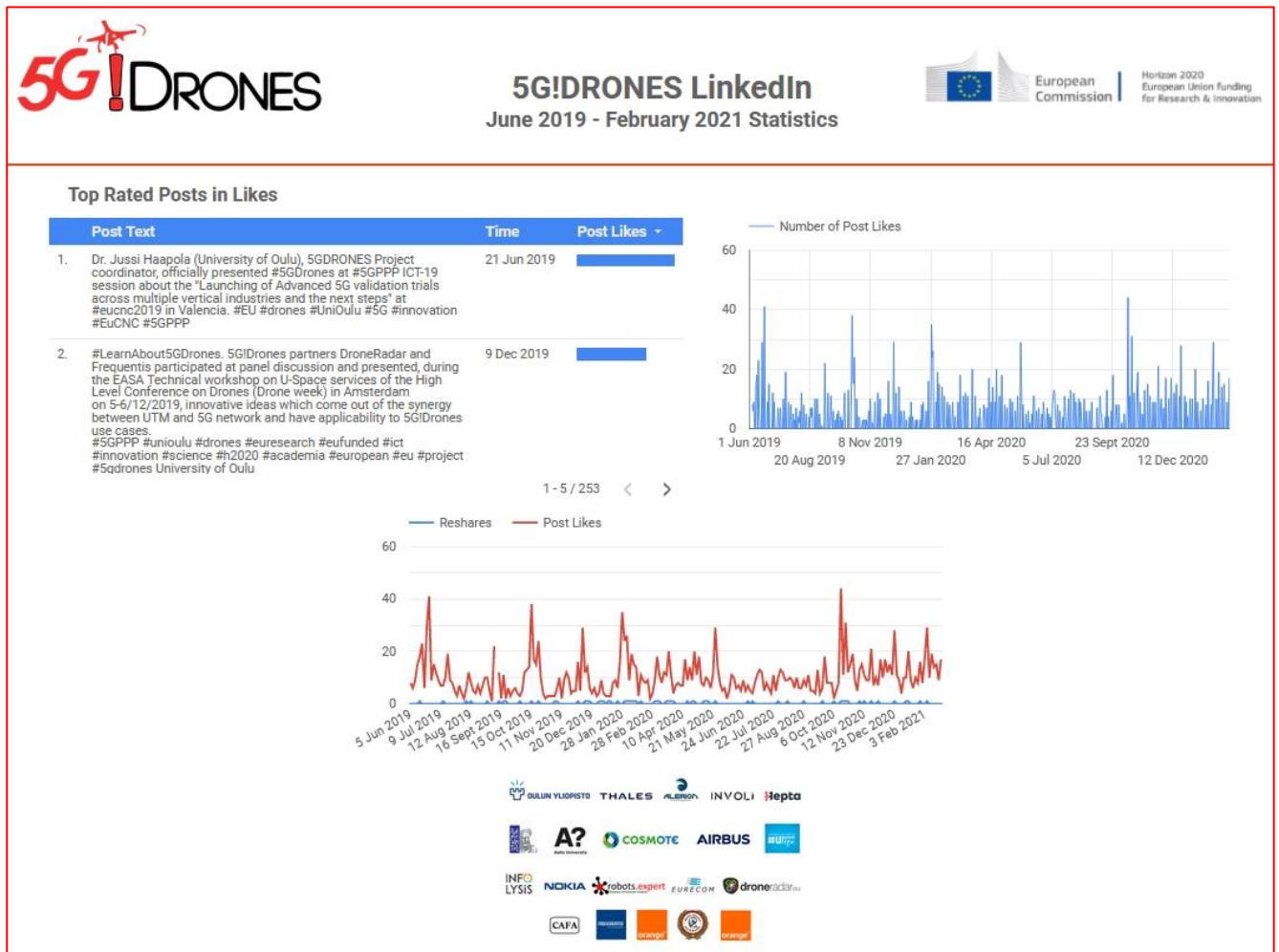


Figure 39: 5G!Drones LinkedIn Statistical Dashboard (page 2)

The LinkedIn dashboard (M1-M21) can be accessed online at:

<https://datastudio.google.com/reporting/127ba158-87f9-40cb-b067-9019c6a9a7fd>

#### • Instagram Statistical Dashboards (M1-M21)

The 5G!Drones Instagram dashboard (Figure 40) outlines the most important and useful information about the Instagram account of the project as recorded during the reporting period. So, like the previous mentioned social media dashboards, the Instagram dashboard shows several types of data, such as 153 accumulated followers, 233 posts, 2140 post likes, and 98 profile visits. Moreover, the dedicated Instagram dashboard, shows thorough a graph the number of likes per total posts/ date and also the post details in a table with the top-rated posts in terms of likes.

The Instagram dashboard (M1-M21) can be accessed online at:

<https://datastudio.google.com/reporting/6c7a83a3-f270-4801-8b5f-1fe989be6045>



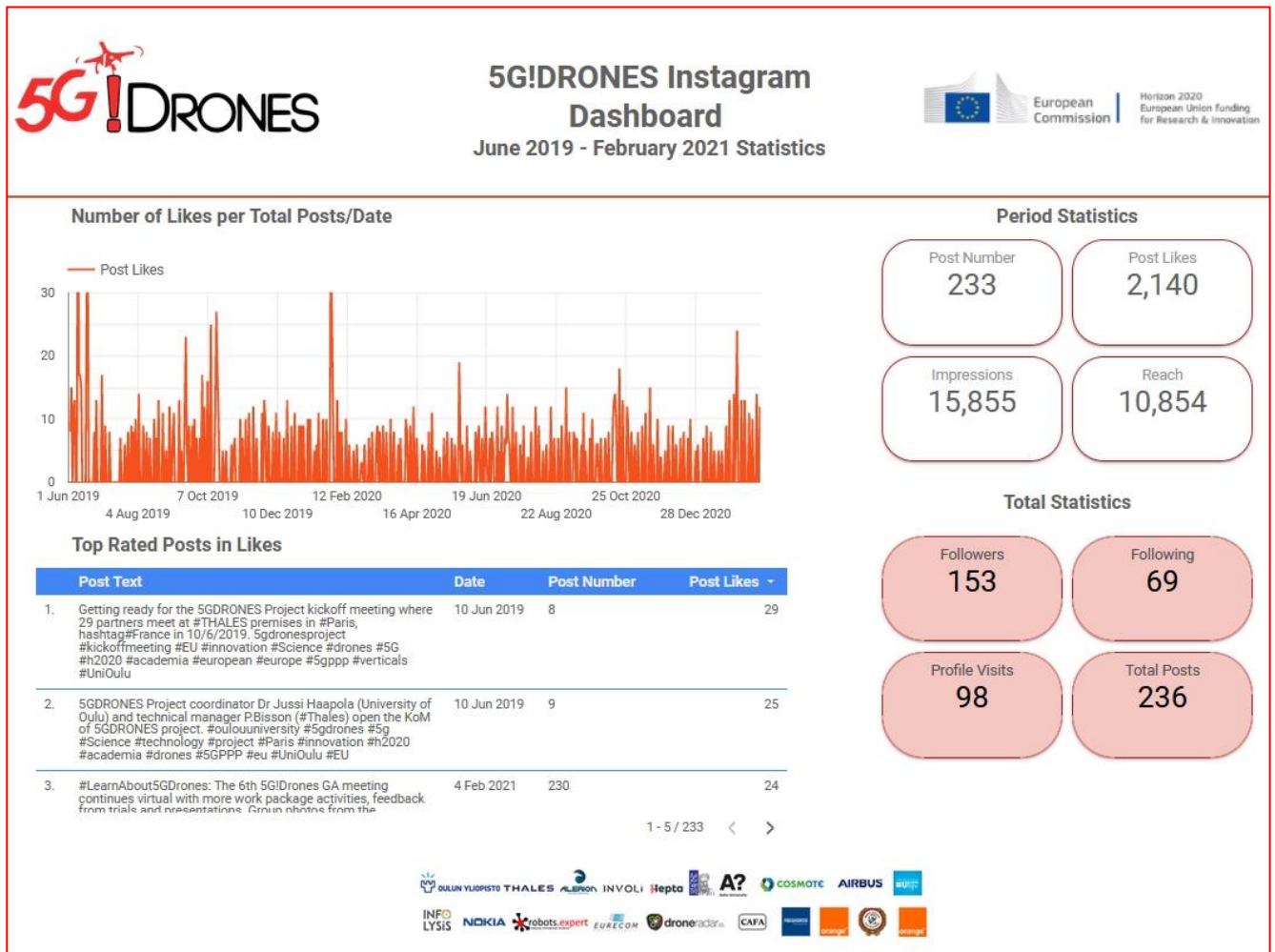


Figure 40: 5G!Drones Instagram Statistical Dashboard

## 2.3 Communication Plan Overview and Update

The communication action plan, as described in D5.1 (M6), is being executed since the first months of the project and will continue to be applied as the project progresses. Monitoring and evaluation results so far have proven the efficiency and the effectiveness of 5G!Drones communication plan, which will continue to be applied by all partners as per the initial action plan. Communication performance has not shown deviations or delays from the initial targets (despite the COVID-19 pandemic that has limited the physical communication opportunities) and for that reason no major updates/adjustments are scheduled for the upcoming period (M25-M42).

**Error! Reference source not found.** summarises the communication action highlighting the communication activities, the targeted audience and an updated timing of their application mainly due to the fact that the project was extended by 6 months):

**Table 8: Targeted Audience, Activities and Timing**

<b>Audience</b>	<b>Activity</b>	<b>Timing</b>
All - Technical & Non-technical audience (General public)	<b>Project website</b> 5G!Drones has shared its concepts, results and achievements through its dedicated project website. The website has been a major tool of communication and promotion of the project.	M1 and continuous update up to M42 (plus 2 years after the project ends)
All - Technical & Non-technical audience (General public)	<b>Communication via social media</b> 5G!Drones project has continuously communicated via its social media channels its activities and achievements. In addition, 5G!Drones has taken the opportunity to reshare its activities through 5G-PPP communication channels/tools, like 5G-PPP website, social media, newsletters and newsflashes.	M1 and continuous update up to M42
Industry, Academia and Research Institutions, Technical & Non-technical audience (General public), Public and Private Service Providers, Standards Developing Organizations (SDOs)	<b>Newsletters, Posters, Leaflets and Press releases</b> 5G!Drones prepared project leaflets, press releases and poster to raise public awareness on 5G!Drones technologies, i.e. 5G and UAV in various communication and dissemination events that 5G!Drones participates.	M3 and event-driven (up to M42)
Industry, Academia and Research Institutions, Technical & Non-technical audience (General public), Public and Private Service Providers, Standards Developing Organizations (SDOs)	<b>Videos</b> 5G!Drones has created public videos to explain the use cases and achievements of the project trials as well as its impact on the society. Videos might be also focused on interviews, presentations and pretrials.	M3 and event-driven (up to M42)

Industry, Academia and Research Institutions, Technical audience, Public and Private Service Providers, Standards Developing Organizations (SDO)	<b>5G!Drones partners and Communities</b> 5G!Drones partners involved in various communities at national and international level (e.g. EC, 5Global initiatives, 5G-PPP & 5G-IA, UAVS association) has promoted the project concept, use cases, trials and results through these communities and through their institutions/companies.	Event-driven M6-M42 (more intense during the second phase of the project)
Academia and Research Institutions, Industry, Public and Private sector	Academic and research partners have used the concepts developed in the project to create new contents regarding UAV business and market areas and their applicability in a 5G environment. Communication and dissemination communities will be combined for achieving the maximum project impact in various events.	Event-driven M6-M42 (more intense during the second phase of the project)

The core objective of all 5G!Drones communication activities, as described in D5.1, is maintained and continue to target to attain high project visibility and increased awareness to the broadest audience by addressing related content to the equivalent audience (especially during the second period of the project where more outcomes will be available).

As per 5G!Drones communication strategy, a specific course of actions has already been defined and will be followed throughout the rest project lifetime (as already successfully applied during the period M1-M21):

- All communication channels are continuously used and updated on a regular basis
- The project's web site will be constantly updated with news and fresh content.
- Social media posts are made on a regular basis. (at least twice a week)
- Higher frequency of posting activity for promoting special events, meetings, conferences etc. (e.g., GA meetings)
- Different strategy on posts/content used per communication channel for addressing the appropriate audience.
  - Website: Technical and non-technical content targeting the broadest possible audience.
  - LinkedIn/Twitter: More technical and project focused posts aiming at technical and academic audience with relevant background.
  - Facebook/Instagram: Non-technical audience - Posts on 5G/Drones topics of general interest and communication of all 5G!Drones dissemination and showcasing activities.
  - YouTube: Addressing the widest possible audience (technical and non-technical) with videos focused on presentations, conferences, trials, events, interviews etc. These posts are event-driven and have a dynamic frequency of occurrence.
- Continuously promoting 5G!Drones through 5G-PPP and 5G-IA associations.
- Communication of 5G-PPP activities related to 5G and UAVs.

**Error! Reference source not found.** summarises and updates the 3 communication phases as per the communication plan presented and analysed in D5.1:

**Table 9: Communication Plan Phases**

Time Period	Main Scope	Content
M01-M06	Establishing the 5G!Drones identity	General content and 5G!Drones initial activities
M06-M24	Accumulating more followers and familiarizing the audience with 5G!Drones objectives, use cases, architecture, pretrials, initial results and impact activities	Content based on 5G!Drones activities and achievements
M25-M42	Focusing on communicating 5G!Drones research and trial outcomes while also highlighting the technical, business and market related impact to the society	Content based on outcomes, trials and related to business and market prospects

5G!Drones will continue to apply the defined communication plan and strategy for the second period (M26-M42) too. The project consortium will make necessary adjustments by adding new action points in order to boost the whole communication of the project ensuring higher visibility and open the road for business and market existence as the project will reach to its end. As it can be seen in Table 9, the project is entering soon the third phase of the communication plan (M25-M42), in which the communication actions and content will rely on addressing two main pillars. The first pillar is the communication of the research outcomes of the project and the second one is communicated content related to the business and market applicability/exploitation of these outcomes.

As the project reaches its final phase, the partners attention and actions will be focused on activities such as use case demonstrations and trials and in participation to various events, conferences, publications and presentations for promoting/disseminating the project outcomes. In parallel, the main focus of the second pillar is to provide the connection between the outcomes of the project and the community. For this reason, all performed activities and obtained results will be communicated through 5G!Drones communication channels in order to raise audience awareness about the project achievements and findings. These findings and results will be communicated in several formats, either as scientific publications, technical reports, conference proceedings etc., addressing mainly the scientific and research community, or in a simpler way, in the form of demo videos, articles, presentations, providing useful insights about the use cases but also about the drone and 5G industry and community in general, matched to business, economic and market related aspects/prospects.

Figure 41 is an indicative preliminary example of the previously mentioned activity. As it can be seen, a public online article about how crowded events (sports events on this occasion) will be boosted and facilitated by the extensive use of 5G is posted in the 5G!Drones Facebook social media channel (addressing mainly a non -technical audience). This article links in a way the use of 5G in sports events with the research and trials performed in project under Use Case 4 “Connectivity during crowded events”, providing (and also ensuring) an easier and better understanding to the non-technical audience of the advances brought by 5G in the specific field and how under Use Case 4 these advances are combined with UAVs and further evolved by 5G!Drones project.

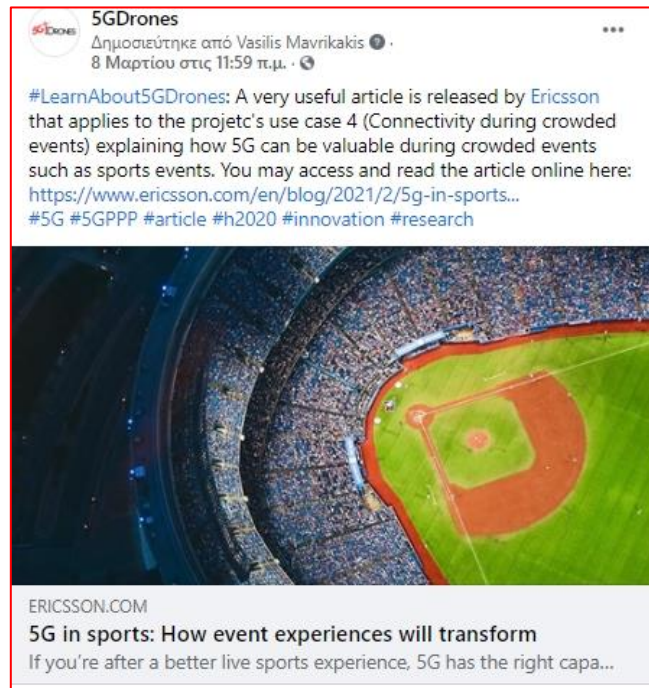


Figure 41: Social Media Post

In addition to this approach, the website and social media communicated content and activities will not only be in line with the whole communication plan and policy of the project but will also boost parallel communication activities performed through other channels of communication and dissemination (e.g. 5G!Drones newsletter issues, leaflets, presentations etc.). It is also worth noting that relevant content will be intensively shared in a coherent way among all social media accounts of the project (no need of differentiation in content of general interest that intends to address the wider possible public audience). This plan will be used for informational purposes to attract a larger audience and synchronously increase awareness of the project, its nature, achievements, and general goals to the widest potential public audience.

The upcoming second period (M25-M42) of the project will be more active concerning trials and demonstration events. To boost this activity and reach higher level of visibility keyword hashtags are utilized like #research, #trials, #results, #demos, #showcasing and #innovation (Figure 42: Use of hashtags). It is worth mentioning at this point that the hashtag use might be further differentiated based on the activity type and content communicated as the project progresses and different type of activities and results will be accumulated.

#LearnAbout5GDrones: A very useful article is released by Ericsson that applies to the project's use case 4 (Connectivity during crowded events) explaining how 5G can be valuable during crowded events such as sports events. You may access and read the article online here: <https://www.ericsson.com/en/blog/2021/2/5g-in-sports...>  
#5G #5GPPP #article #h2020 #innovation #research

Figure 42: Use of hashtags

One of the main decision factors that determine the communication approach is the knowledge and information that needs to be communicated and the audience that is targeted. 5G!Drones project adapts its strategy and disseminates its findings/results through its communication/dissemination actions over various channels but also through the channels of collaborative projects and related



communities/associations. A typical example of this framework is the collaboration between 5G!Drones and 5GENESIS projects during the 5G!Drones Athens trials performed in October 2020. 5G!Drones in order to conduct its trials (for UC4) utilized 5GENESIS 5G experimental Athens platform, gaining several insights, by performing trials in two different 5GENESIS platform locations (Municipal Egaleo stadium and Cosmote academy premises). These events were jointly communicated by both projects (and the 5G-PPP association) over different channels and in multiple content types, addressing a joint audience of different background and interests.

Following the already well established collaboration among different 5G-PPP projects (e.g . 5GENESIS and 5G-EVE), a more intensive reference strategy on 5G-PPP partnership will be also applied during the second period of the project. For 5G!Drones communication team, it is of vital importance to follow, mention and integrate 5G-PPP in 5G!Drones communication activities over social media channels and not only. In the first period of the project, 5G!Drones used to communicate 5G-PPP activities, newsletters, newsflashes and articles through 5G!Drones website News section and social media accounts. From now on, 5G!Drones will monitor more closely 5G-PPP actions and will establish a more effective two-way communication, through which 5G-PPP will become aware of 5G!Drones activities in order most of them to be shared and communicated more intensively through 5G-PPP communication channels too. In parallel to 5G-PPP mutual communication plans are made to mention more often related EU communities (that have presence in social media) through the 5G!Drones social media posting activities. Indicatively such organizations/communities might be the Community Research and Development Information Service (CORDIS) (<https://cordis.europa.eu/>), the Horizon 2020 program (<https://ec.europa.eu/programmes/horizon2020/en>), the Horizon Europe program, the NetWorld 2020 association (renamed recently to Networld Europe <https://www.networld europe.eu/>), the NGIoT community (<https://www.ngiot.eu/>) etc. This initiative will not only facilitate the diffusion of project results but may also attract more stakeholders from other projects, research and academic communities.

To sum up, the communication actions communicated over the website and social media accounts will indicatively continue to cover the following subjects, events and areas:

- News and updates on the 5G!Drones activities (coverage of activities coordinated by 5G!Drones or activities that partners participate representing the project)
- Publications and presentations originating from workshops, conferences, journals, etc.
- White papers and Technical references
- Project showcases/demonstrations and trials
- Publications in articles, online sources, newspapers
- Upcoming events calling stakeholders for papers (CfP) and events participation
- Videos and photos
- 5G!Drones partners related activities and achievements
- 5G!Drones public deliverables
- 5G!Drones Newsletter issues
- Articles on popular drones and technology related magazines addressing mainly the general public
- Exclusive content explaining the nature of 5G!Drones project (technical and non-technical), addressing various stakeholders and sectors (scientific, academic ad industrial)
- EU associations, partnerships, communities, other research projects and initiatives (e.g. 5G PPP, 5G IA, NetWorld 2020-Networld Europe, H2020, Horizon Europe, NGIoT etc.)
- Consortium plenary meetings (announcement, dates, texts, pictures, etc.).

### 3 5G!DRONES dissemination

Dissemination and showcasing activities have been of crucial importance for the project's successful diffusion of knowledge, for raising awareness and for attracting potential supporters, industries and verticals, as well as scientific interest. The main objectives that have continuously been fulfilled by the 5G!Drones dissemination and showcasing actions are:

- Disseminating project outcomes to the scientific community.
- Dissemination and awareness raising of the project developments to relevant industrial stakeholders.
- Awareness raising of the project among the most relevant stakeholder target groups.
- Fostering interdisciplinary communication with other research projects and communities.
- Dissemination and Communication of project innovations to the broader public and society.

There has been a wide range of channels and events utilized for making the project advancements, innovations, results and trials accessible and known for a broad catalogue of relevant stakeholder target groups among the entire EU.

The following chapter delivers an overview of the already performed dissemination activities, as well as of the planned ones for the rest 1,5 years of the project runtime.

#### 3.1 Publications

A variety of relevant publications was elaborated by the project team during the recent almost 2 years of the project runtime. These have found place at high-level journals, conferences and workshops, the 5G-PPP network, as well as academic thesis works, and are as follows:

##### 3.1.1 Papers in Journals

There were 9 papers published in broadly acknowledged leading journals, as follows:

- Harilaos Koumaras, George Makropoulos, Michael Batistatos, Stavros Kolometsos, Anastasios Gogos, George Xilouris, Athanasios Sarlas and Michail-Alexandros Kourtis, **5G-Enabled UAVs with Command and Control Software Component at the Edge for Supporting Energy Efficient Opportunistic Networks**, MDPI, Special Issue 5G Enabled Energy Innovation, Energies 2021, 14, 1480 (<https://www.mdpi.com/1996-1073/14/5/1480/pdf>) – DOI: <https://doi.org/10.3390/en14051480>
- Samir Si-Mohammed, Maha Bouaziz, Hamed Hellaoui, Oussama Bekkouche, Adlen Ksentini, Tarik Taleb, Lechosław Tomaszewski, Thomas Lutz, Gokul Srinivasan, Tanel Jarvet and Pawel Montowtt, **Supporting UAV Services in 5G Networks: New High-Level Architecture integrating 5G with U-space**, IEEE Vehicular Technology Magazine ([PDF](#)) – DOI: 10.1109/MVT.2020.3036374
- H. Hellaoui, M. Bagaa, A. Chelli, and T. Taleb, **Joint Sub-carrier and Power Allocation for Efficient Communication of Cellular UAVs**, IEEE Transactions on Wireless Communications, Sept 2020 ([PDF](#)) – DOI: 10.1109/TWC.2020.3021252
- Adlen Ksentini and Pantelis A. Frangoudis, **On extending ETSI MEC to support LoRa for efficient IoT application deployment at the edge**, IEEE Communications Standards Magazine, Volume 4, Issue 2, pages 57-63 ([PDF](#)) – DOI: 10.1109/MCOMSTD.001.1900051
- B. Yang, T. Taleb, Z. Wu, and L. Ma, **Spectrum Sharing for Secrecy Performance Enhancement in D2D-Enabled UAV Networks**, IEEE Network Magazine, pages 1-8 ([PDF](#)) – DOI: 10.1109/MNET.011.2000093

- Oussama Bekkouche, Konstantinos Samdanisz, Miloud Bagaa, Tarik Taleb, **A Service-Based Architecture for enabling UAV enhanced Network Services**, IEEE Network Magazine, Volume 34, Issue 4, pages 328-335 ([PDF](#)) – DOI: 10.1109/MNET.001.1900556
- Bouziane Brik, Adlen Ksentini and Maha Bouaziz, **Federated Learning for UAVs-Enabled Wireless Networks: Use Cases, Challenges and Open Problems**, IEEE Access Journal, Vol.8 Issue 1 ([PDF](#)) – DOI: 10.1109/ACCESS.2020.2981430
- Adlen Ksentini and Pantelis A. Frangoudis, **Towards Slicing-Enabled Multi-Access Edge Computing in 5G**, IEEE Network Magazine, Volume 34, Issue 2, pages 99-105 ([PDF](#)) – DOI: 10.1109/MNET.001.1900261
- Mariem Maiouak and Tarik Taleb, **Dynamic Maps for Automated Driving and UAV Geofencing**, IEEE Wireless Communications Magazine 2019, Volume 26, Issue 4, pages 54-59 ([PDF](#)) – DOI: 10.1109/MWC.2019.1800544

### 3.1.2 Papers in Conferences and Workshops

A total of 12 papers has been published and/or presented at workshops and conferences until now, as follows:

- A. Abada, B. Yang and T. Taleb, **Traffic Flow Modeling for UAV-Enabled Wireless Networks**, 2020 International Conference on Networking and Network Applications (NaNA), Haikou City, China, 2020, pp. 59-64. ([PDF](#)) – DOI: 10.1109/NaNA51271.2020.00018
- Samir Si-Mohammed<sup>1</sup>, Adlen Ksentini<sup>1</sup>, Maha Bouaziz<sup>1</sup>, Yacine Challal, and Amar Balla, **UAV mission optimization in 5G: On reducing MEC service relocation**, in IEEE Globecom'20, Taipei, Taiwan, Dec. 2020. ([PDF](#)) – DOI: 10.1109/GLOBECOM42002.2020.9322304
- Y. Dang, C. Benzaid, Y. Shen, and T. Taleb, **GPS Spoofing Detector with Adaptive Trustable Residence Area for Cellular based-UAVs**, in IEEE Globecom'20, Taipei, Taiwan, Dec. 2020. ([PDF](#)) – DOI: 10.1109/GLOBECOM42002.2020.9348030
- Lechosław Tomaszewski, Robert Kołakowski, Sławomir Kuklinski, **Integration of U-space and 5GS for UAV services**, IFIP Networking 2020 Conference (virtual) – Workshop on Network Slicing 2020, Paris, France, June 22-25 2020 ([PDF](#)) – Electronic ISBN: 978-3-903176-28-7
- S. Ouahouah, J. Prados, T. Taleb, and C. Benzaid, **Energy-aware Collision Avoidance stochastic Optimizer for a UAVs set**, IEEE IWCMC, Limassol, Cyprus, 15-19 June 2020 ([PDF](#)) – DOI: 10.1109/IWCMC48107.2020.9148495
- H. Hellaoui, A. Chelli, M. Bagaa, and T. Taleb, **UAV Communication Strategies in the Next Generation of Mobile Networks**, IEEE IWCMC, Limassol, Cyprus, 15-19 June 2020 ([PDF](#)) – DOI: 10.1109/IWCMC48107.2020.9148312
- Sławomir Kuklinski, Lechosław Tomaszewski, Paweł Korzecy and Robert Kołakowski, **5G-UASP: 5G-based multi-provider UAV platform architecture**, IEEE Conference on Network Softwarization, 29 June – 3 July 2020 (Virtual Conference) ([PDF](#)) – Corpus ID: 220040698
- Lechosław Tomaszewski, Robert Kołakowski and Paweł Korzec, **On 5G support of cross-border UAV operations**, Workshop on Integrating UAVs into 5G and Beyond in IEEE International Conference on Communications, 7-11 June 2020 (Virtual Conference) ([PDF](#)) – DOI: 10.1109/ICCWorkshops49005.2020.9145262
- Lechosław Tomaszewski, Sławomir Kuklinski and Robert Kołakowski, **A new approach to 5G and MEC integration**, 5th Workshop on “5G – Putting Intelligence to the Network Edge” (5G-PINE 2020) in AIAI 2020, 16th International Conference on Artificial Intelligence Applications and Innovations, 5–7 June, 2020 (Virtual Conference) ([PDF](#)). Reference link: [https://link.springer.com/chapter/10.1007%2F978-3-030-49190-1\\_2](https://link.springer.com/chapter/10.1007%2F978-3-030-49190-1_2)
- Oussama Bekkouche, Miloud Bagaa and Tarik Taleb, **Toward a UTM-based Service Orchestration for UAVs in MEC-NFV Environment**, 2019 IEEE Global Communications

Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9 -13 December 2019 ([PDF](#)) – DOI: 10.1109/GLOBECOM38437.2019.9014200

- Hamed Hellaoui, Ali Chelli, Miloud Bagaa and Tarik Taleb, **Efficient Steering Mechanism for Mobile Network-enabled UAVs**, 2019 IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9 -13 December 2019 ([PDF](#)) – DOI: 10.1109/GLOBECOM38437.2019.9014131
- Sihem Bakri, Pantelis A. Frangoudis and Adlen Ksentini, **Dynamic slicing of RAN resources for heterogeneous coexisting 5G services**, 2019 IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9 -13 December 2019 ([PDF](#)) – DOI: 10.1109/GLOBECOM38437.2019.9013954

### **3.1.3 5G-PPP White Papers and Other Publications**

A high number of high-impact white papers and other publications was published in the time given until now – 7, as follows:

- **Interface for Data Exchange between MNOs and the UTM Ecosystem Network Coverage Service Definition**, ACJA, GSMA and GUTMA approved version (Feb 2021). You may access it [here](#).
- **5G PPP Progress Monitoring Report (2019 release)**, Oct 2020, 5G-PPP. You may access it [here](#).
- **Empowering Vertical Industries through 5G Networks – Current Status and Future Trends**, 5G-PPP, 21 5G-PPP Phase II and Phase III R&I projects and the 5G-IA verticals engagement task force, August 2020. You may access it [here](#).
- **The 5G-PPP Projects Heritage figure (Version 1.0)**, 5G-PPP and 5G IA, July 2020. You may access it [here](#).
- **The European 5G Annual Journal 2020**, 5th edition, Full 5G and 5G-PPP, June 2020. You may access it [here](#).
- **Business Validation in 5G PPP vertical use cases**, 5G-PPP and 5G IA, July 2020. You may access it [here](#).
- **Submitted material for the 5G-PPP Annual Report 2021**, submitted by February 2021 by RXB.

### **3.1.4 Thesis Publications**

Already 2 academic thesis works on topics closely relevant for the project contents and success were performed and finalized:

- Jyrkkä Johannes, **Drone heading calculation indoors**, University of Oulu, Faculty of Technology, Mechanical Engineering, 15 October 2020. You may access it [here](#).
- Prashant Shah, **Enabling seamless application migration over multi-core network environments**, University of Oulu, Faculty of Information Technology and Electrical Engineering, Communications Engineering, 26 June 2020. You may access it [here](#).

## **3.2 Workshops, Presentations and Trials**

Another part of the dissemination activities has taken place in the framework of thematic workshops, presentations and demonstration activities, as described in the following. Despite the COVID19 pandemic situation most of the planned activities in this field were performed.

### **3.2.1 Workshops**

Two key workshops were co-organized by the project team:

**Table 10: Organised Workshops**

Event	Workshop details
1. IEEE WCNC2020	Aerial Communications in 5G and Beyond Networks (AERCOMM) workshop, co-organized by 5G!Drones and EU-Korea PriMO-5G project, colocated with IEEE Wireless Communications and Networking Conference, 25-28 May 2020 (Virtual Conference), Beyond Connectivity: What Comes After 5G
2. Online workshop	“5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives” online workshop on 14 Oct 2020. This online workshop is organised by the Institute of Informatics & Telecommunications of NCSR Demokritos (Athens, Greece), EU projects 5GENESIS and 5G!Drones and with the support of the 5G-PPP partnership.

### 3.2.2 Presentations, Poster sessions, Committees, Webinars, and Panel Discussions

36 presentations in different relevant forms were performed at online meetings, poster sessions and conventions.

**Table 11: Presentations at events**

Event	Event details	Presentation title
1. EuCNC 2019	EMPOWER workshop “Empowering Transatlantic Platforms for Advance Wireless Research”, 18 June 2019, Valencia, Spain	5G!Drones vertical use cases and requirements
2. EuCNC 2019	5G PPP ICT-19 session “Launching of Advanced 5G validation trials across multiple vertical industries and the next steps”, 21 June 2019, Valencia, Spain	5G!Drones technical overview
3. Salon du Bourget, Paris Air Lab	Company presentation of INVOLI partner by Mélanie Guittet and its involvement into the 5G!Drones European project in Salon du Bourget, Paris Air Lab, 21 June 2019	INVOLI and 5G!Drones
4. 5GEVE Meeting, Pisa	Adlen Ksentini (Eurocom) presented 5G!Drones to 5GEVE ICT-17 partners during their GA meeting in Pisa, Italy, Sept 2019	5G!Drones Overview
5. Digital Transport Days, Helsinki	Dr. Jussi Haapola (University of Oulu), 5G!DRONES project coordinator, presented 5G!DRONES project and the opportunities 5G can bring to UAV transport sector ( October 9th, 2019 ).	What can 5G bring to Drones?
6. ITS World Congress 2019, Singapore	Tero Vuorenmaa (Robots Expert) presented Urban Air Mobility requirements and 5G!Drones project in ITS World Congress in Singapore on 24 October 2019	5G!Drones
7. 5GTNF Results and Demo Seminar, Helsinki, Finland	Prof. Ari Pouttu ( University of Oulu ) presented the 5G!Drones at the poster session of 5GTNF Results and Demo Seminar in Helsinki, Finland, on 1st of November 2019.	5G!Drones Poster session
8. FRUCT2019	Tero Vuorenmaa (Robots Expert) presented “Is UAM ready for business?” focused on challenges of the Urban	5G!Drones as a use case of



Event	Event details	Presentation title
conference Helsinki, Finland 9.	Air Mobility and 5G!Drones as a use case of activity towards 5G connected drones, on 8 November 2019 in the FRUCT2019 conference Helsinki, Finland	activity towards 5G connected drones
10. 10th FOKUS FUSECO 2019 Forum – Berlin, Germany	Dr. Lechosław Tomaszewski (Orange Poland) and Tanel Järvet (CAFA Tech) presented “5G!Drones trials – how to match UAV business cases, drone capabilities and 5G test facilities” on 8 November 2019 in the 10th FOKUS FUSECO 2019 Forum – Berlin, Germany	5G!Drones trials – how to match UAV business cases, drone capabilities and 5G test facilities
11. INFOCOM WORLD CONFERENCE 2019 “Economy 4.0: Connected Future”, Athens, Greece	Cosmote partner presented 5G!Drones on 26 November 2019 in the INFOCOM WORLD Conference 2019 – Athens, Greece	5G!Drones: Unmanned Aerial Vehicle Vertical Applications’ Trials Leveraging Advanced 5G Facilities
12. 5GENESIS 6th GA Meeting, Berlin, Germany	5G!Drones project was presented by Dr. Harilaos Koumaras (NCSR Demokritos) on 29th of November 2019 during the 6th 5GENESIS GA meeting at Fraunhofer FOKUS in Berlin, explaining how 5G!Drones will use the 5GENESIS Athens platform for the connectivity during crowded events drones use case	5G!Drones and connectivity during crowded events use case
13. High Level Conference on Drones (Drone week), Amsterdam	5G!Drones partners DroneRadar and Frequentis participated at panel discussion and presented, during the EASA Technical workshop on U-Space services of the High Level Conference on Drones (Drone week) in Amsterdam on 5-6/12/2019, innovative ideas which come out of the synergy between UTM and 5G network and have applicability to 5G!Drones use cases.	Panel Discussions: 5G!Drones use cases
14. Remote Sensing Days 2020	Nokia partner participated at Remote Sensing Days 2020 (20-22/01/20, Helsinki, Finland) with a 5G!Drones project poster session.	Poster session: 5G!Drones project
15. Finnish Satellite Workshop at Remote Sensing Days 2020	Nokia partner participated at the Finnish Satellite Workshop of Remote Sensing Days 2020 (20-22/01/20, Helsinki, Finland) in a panel discussion where among others aspects of 5G!Drones were discussed.	Panel discussion
16. AIX & FCAO Event, Tampere University, Finland	5G!Drones partner Robots.Expert had the opportunity to present the use case of detection of wildfire using 5G network and drones at the AIX&FCAO Event (06/02/2020) at Tampere University, Finland, where the 5G!Drones project was also presented in the slide deck.	5G!Drones presentation

Event	Event details	Presentation title
17. AERCOMM workshop, IEEE WCNC 2020 (virtual)	Gokul Srinivasan from Robots Expert, 5GDrones project partner, presented “Challenges and Benefits of 5G in Urban Air Mobility” at the AERCOMM workshop, co-organized by 5G!Drones and EU-Korea PriMO-5G projects, at IEEE WCNC 2020 (virtual), 25 May 2020.	Challenges and Benefits of 5G in Urban Air Mobility
18. PrintoCent Webinar Series 2020	5G!Drones partner Juha Hannula (Nokia), presented “5G Benefits for Unmanned Moving Objects” at PrintoCent Webinar Series 2020 (online), 8 June 2020.	5G Benefits for Unmanned Moving Objects
19. PX4 Developer Summit 2020	Gokul Srinivasan from robots.expert had the opportunity to present “What does it take to fly the PX4 stack on a certified aircraft?” at the PX4 Developer Summit 2020 where the 5G!Drones project was also introduced to the PX4 community and industry professionals.	What does it take to fly the PX4 stack on a certified aircraft?
20. ASTM International Committees, August 2020	5G!Drones partner robots.expert participates in the ASTM International F-38 (Unmanned Aircraft Systems) and F-39 (Aircraft Systems) committees, contributing to Standards and policies, while representing also the 5G!Drones project and adding value to the project’s standardization activities.	Committees participation: 5G!Drones – standards and policies
21. InterDrone podcast	Gokul Srinivasan, from robots.expert, participated in the InterDrone podcast on 05/08/2020, representing 5G!Drones Project, where he had the chance to discuss and analyze topics about the UAS and UAM industry, robots.expert and the 5G!Drones project. Podcast video available <a href="#">here</a>	5G!Drones – UAS and UAM
22. 6G Research Visions Webinar Series	Dr. Harilaos Koumaras from NCSRDP participated and presented in the second webinar of the 6G Research Visions Webinar Series (16 Sept 2020) which addressed the essential choices for developing preferred business of 6G in the age of platforms, ecosystems, and empowerment. The video of the event is available <a href="#">here</a>	MNO Openness: The Next Business Opportunity
23. 5G Momentum webinar	robots.expert, 5G!Drones partner, participated in the 5G Momentum webinar organized by Liikenne- ja viestintävirasto Traficom / Transport- och kommunikationsverket Traficom on Thursday 3 Sept 2020. Our team member Gokul Krishna Srinivasan talked about the challenges and benefits of 5G technology in the context of Urban Air Mobility. We also had the opportunity to briefly talk about the recent feasibility tests conducted by 5G!Drones project.	Challenges and benefits of 5G technology in the context of Urban Air Mobility
24. ICUAS 2020 (International Conference on Unmanned Aircraft Systems)	Alerion, 5G!Drones partner, was a keynote speaker during the ICUAS 2020 (International Conference on Unmanned Aircraft Systems) which took place 1-4 September 2020. The 5G!Drones project was also presented.	5G!Drones project

Event	Event details	Presentation title
25. International Conference on Smart Cities, Smart Infrastructures and Smart Buildings, European Digital Week	robots.expert, 5G!Drones partner, participates in the International Conference on Smart Cities, Smart Infrastructures and Smart Buildings, European Digital Week 23-24 Sept 2020, and presents how 5G technology can leverage smart cities applications, including Urban Air Mobility, V2X and other relevant use cases and also share important insights from 5G!Drones project.	How 5G technology can leverage smart cities applications, including Urban Air Mobility, V2X and other relevant use cases
26. U-space Concept of Operations (ConOps) webinar organized by Eurocontrol	5G!Drones partner robots.expert participated in the U-space Concept of Operations (ConOps) webinar organized by Eurocontrol (2 Oct 2020). Presentations were interesting and insightful, and led to interesting explorations and discussions about how U-space architecture can be used in the 5G!Drones project.	Open discussion about how U-space architecture can be used in the 5G!Drones project
27. Low Latency Conference, Photonics Applications Week	5G!Drones with robots.expert partner, participated in the Low Latency Photonics Applications Week, as a part of the Low Latency Conference, and presented verticals for 5G technology and UAVs, while insights from 5G!Drones project (6 October 2020). The video of the presentation is available <a href="#">here</a>	5G Technology and Drones
28. 5G Experimentation Facilities and Vertical Trials online workshop	Jussi Haapola (Oulu University), 5G!Drones coordinator, presented 5G!Drones project at the “5G Vertical Experimentation (5G-PPP ICT-19 Projects)” session of the “5G Experimentation Facilities and Vertical Trials” online workshop, co-organized by the Institute of Informatics & Telecommunications of NCSR Demokritos, 5GENESIS, 5G!Drones and 5G-PPP on Wednesday 14 October 2020. The video of the presentation is available at the official 5G!Drones YouTube channel <a href="#">here</a> .	5G!Drones
29. FinDrones2020 online conference	Jonas Stjernberg (robots.expert) presented at the FinDrones2020 online conference (12 November 2020). The presentation focused on “Scaling up advanced drone operations” and presented 5G!Drones project as well!	5G!Drones
30. Xchanging Ideas – Global 5G Evolution online event	Dr. Harilaos Koumaras (NCSR), 5G!Drones partner, participates in the online event “Xchanging Ideas – Global 5G Evolution” on 8th of December 2020, presenting the trial field results of 5G-enabled UAVs that performed in the framework of 5GDRONES project on top of 5GENESIS Project experimental 5G infrastructure. The event will be broadcasted through Xchanging Ideas – Global 5G Evolution YouTube channel <a href="#">here</a> .	5G-enabled UAVs

Event	Event details	Presentation title
31. 5G-PPP Technology Board e-Workshop, 10 December 2020	Dr. Harilaos Koumaras (NCSRD), 5G!Drones partner, presented online the presentation “Field Trials of UAVs on top of 5GENESIS platform: Advances and Lessons Learned” at the 5G-PPP Technology Board e-Workshop, session “Working on Verticals”, 10 December 2021	Field Trials of UAVs on top of 5GENESIS platform: Advances and Lessons Learned
32. 5G and Internet of Things Thessaloniki Week 2020	Dr. Harilaos Koumaras (NCSRD), 5G!Drones partner, presented today at the “5G and Internet of Things Thessaloniki Week 2020” how 5G-enabled UAVs can support the IoT vertical industry, based on the work that is performed in 5G!Drones and 5GENESIS 5G-PPP projects.	How 5G-enabled UAVs can support the IoT vertical industry
33. Unmanned Cargo Aircraft conference 9th Edition 8 Dec. 2020	Gokul Srinivasan from robots.expert, 5G!Drones partner participated in Unmanned Cargo Aircraft conference presenting “Drone Deliveries: Who pays the bills”. In this session he also shared some useful insights of 5G!Drones project. You may watch the session online <a href="#">here</a>	Drone Deliveries: Who pays the bills
34. InterDrone Online event, 15-17 December 2020	Gokul Srinivasan from robots.expert, 5G!Drones partner participated in the InterDrone online event, 16 December 2020. The panel discussed about “What do we need for successful Implementation of UTM Technologies” where insights about the 5G!Drones were also shared. More information here: <a href="https://interdrone.com/">https://interdrone.com/</a>	What do we need for successful Implementation of UTM Technologies
35. Drones 3S Pro, 27-28 January 2021, online conference (Athens, Greece)	Fotini Setaki (Cosmote) , 5G!Drones partner, presents on 27 January 2021 the “5G!Drones European research project: Objectives, Trials and Greek involvement”. More information at (in Greek): <a href="https://dronespro.gr/drones-3s-project-2021/programma/">https://dronespro.gr/drones-3s-project-2021/programma/</a>	5G!Drones European research project: Objectives, Trials and Greek involvement
36. Drones 3S Pro, 27-28 January 2021, online conference (Athens, Greece)	Dr. Harilaos Koumaras (NCSRD), 5G!Drones partner, presents on 27 January 2021 the “5G!Drones Trials in Athens: Results, Challenges and the Next Steps”. More information at (in Greek): <a href="https://dronespro.gr/drones-3s-project-2021/programma/">https://dronespro.gr/drones-3s-project-2021/programma/</a>	5G!Drones Trials in Athens: Results, Challenges and the Next Steps

### 3.2.3 Field Tests and Trials

The field tests and trials are crucial for the project success, since these serve as validation of the proposed highly innovative communication technology approaches enabling a successfully operated advanced air mobility, and 10 were performed during the project runtime until now:

- CAFA Tech conducted initial field trials with 5G smartphones, testing 5G aspects that will be used in 5G!Drones use cases. In specific, CAFA Tech conducted tests with 5G smartphones on 24th October 2019 in Aalto University, Helsinki, Finland. Measured Results: Stream upload: 21 Mbps and Ping: 11 ms.

- CAFA Tech conducted also 5G drone test flight on 1st of November 2019, in Tallinn, Estonia, at Elisa (telecom operator) 5G NSA test network using the 5G smartphone Huawei Mate 20X. Measured results: Upstream throughput: 25-47 Mbps and Ping: 8-10 ms
- Orange France, 5G!Drones partner, conducted an experiment of a tethered drone embedding a cellular base station based on Open Air Interface, acting as a connectivity bubble, at French championships of Windsurf in Saint-Pierre-Quiberon France, from 1st to 3rd of November, as part of 5G!Drones use case #4 (UC4) initial tests.
- In May 2020, NCSR team, 5G!Drones partner, performed the first feasibility flight of a drone piloting over 5G, i.e. transmitting the C2 (Communication and Control) channel over 5G. The feasibility flight was performed using the 5GENESIS Athens 5G experimentation platform located at NCSR Demokritos campus as initial trial of the 5G!Drones Athens use case. Video of the feasibility flight available [here](#).
- On June 30, 2020 5G!Drones partners NCSR (located in Athens, Greece), CAFA Tech (located in Tallinn, Estonia) and Unmanned Life (located in Brussels, Belgium) conducted virtual feasibility tests related to 5G!Drones Use Case 4 “Drone based 5G connectivity extension” scenario. Due to COVID-19 travel restrictions the tests conducted remotely. More details on the Athens feasibility tests and results [here](#).
- 5G!Drones partners conducted flight trials under 5G network in Aalto and Oulu, Finland, on August 24-28 2020 for collecting preliminary inputs for 5G!Drones next developments and actions. In these tests, 5G infrastructure owners of Aalto University and Oulun yliopisto – University of Oulu, and technology companies CAFA Tech, HEPTA, NOKIA and robots.expert participated, conducting physically tests of 5G!Drones use cases UC1Sc1/UC3Sc1/UC3Sc2. More details on the Finland feasibility tests and results [here](#).
- Nokia, 5G!Drones partner, executed 5G!Drones pre-trial measurements during 27-28 August 2020, which focused on the Nokia lead Use Case 3 Scenario 3: Location of UE in non-GPS environments. These feasibility tests were successfully conducted in Nokia premises in Oulu, Finland.
- 5G!Drones partners NCSR Demokritos, Cosmote, HEPTA, CAFA Tech, robots.expert, Municipality of Egaleo and INFOLYSiS, conducted flight trials under 5G network in Municipality of Egaleo stadium (part of 5GENESIS 5G Athens platform, Greece), on October 19-20 2020, for collecting inputs and verifying the interaction between 5G and drones under 5G!Drones use case #4 (Connectivity during crowded events). Two videos available at 5G!Drones YouTube channel [here](#). An overview report on Egaleo Stadium trials is available [here](#).
- 5G!Drones partners NCSR Demokritos, Cosmote, CAFA Tech, robots.expert and INFOLYSiS, conducted flight trials under 5G network in OTE-Cosmote Academy premises (part of 5GENESIS 5G Athens platform, Greece), on October 21 2020, for testing the offering of a better level of network services with drones under 5G and avoiding dropped calls and degraded Internet connectivity during mass events (5G!Drones use case #4 – Connectivity during crowded events). Video available at 5G!Drones YouTube channel [here](#). An overview report on OTE-Cosmote Academy trials is available [here](#).
- 5G!Drones partners EUR, CAF, AIR, DRR, FRQ, REX conducted remote Feasibility tests using Eurecom (France) and CAFA Tech (Estonia) facility on 17th and 18th December, 2020 to test how 5G!Drones containers (C2+U-Space-, MCS- and latency measurement container) work in EUR servers and the connections with these containers’ client applications in smartphones. Video available at 5G!Drones YouTube channel [here](#).

### 3.3 Articles

By publishing articles in relevant media, the project activities and achievements, incl. demonstrators, were able to reach a wide relevant audience EU- and worldwide.



- 5G!Drones presented at the 5GPPP website: <https://5g-ppp.eu/5gdrones/>
- 5G!Drones presented at the Cosmote website: [https://www.cosmote.gr/cs/otegroup/en/5g\\_drones.html](https://www.cosmote.gr/cs/otegroup/en/5g_drones.html)
- 5G!Drones presented at NCSR Demokritos website: <https://www.iit.demokritos.gr/projects/unmanned-aerial-vehicle-vertical-applications-trials-leveraging-advanced-5g-facilities/>
- 5G!Drones on the News webpage of 5GENESIS website: <https://5genesis.eu/6th-5genesis-ga-meeting-presentation-of-ict-19-5gdrones-project/>
- “Les drones à l’épreuve de la 5G” article/interview, IMT – Institut Mines Telecom: <https://blogrecherche.wp.imt.fr/2020/02/19/les-drones-a-lepreuve-de-la-5g/>
- “How Poland built and introduced an operational, integrated national UTM/ATM system” PansaUTM interview with Unmanned Airspace: <https://www.unmannedairspace.info/news-first/how-poland-built-and-introduced-an-operational-integrated-national-utm-atm-system/>
- “Putting Drones to the 5G test”, IMT, Eurecom interview: <https://blogrecherche.wp.imt.fr/en/2020/04/01/putting-drones-to-the-5g-test/>
- “The EU Funded 5G!Drones Research Project Is Testing, Validating, and Defining KPIs for the Future of the Drone Industry”, Involi, DroneRadar and Robots.Expert partners interviewed by Danielle Gagne, Commercial UAV News Editorial Analyst: <https://www.commercialuavnews.com/infrastructure/5g-drones-is-testing-kpi-s-for-the-drone-industry>
- “A Service-Based Architecture for enabling UAV enhanced Network Services”, Connectivity Technology blog, featuring the 5G!Drones journal paper “A Service-Based Architecture for enabling UAV enhanced Network Services”: <https://www.connectivity.technology/2020/08/a-service-based-architecture-for.html?m=1>
- “Feasibility Tests for Future Air Mobility”, Dr. Jussi Haapola, 2nd version of 6G Waves magazine by 6G Flagship: <http://jultika.oulu.fi/files/isbn9789526227641.pdf>
- “Technical trials of drones and 5G at Municipal stadium of Egaleo”, online article at Municipality of Egaleo website (in Greek): <https://www.aigaleo.gr/2020/10/22/technikes-dokimes-5g-me-drones-sto-dimotiko-gipedo-aigaleo/>
- “5G!Drones project carries out network tests at Greek stadium”, online article at TheStadiumBusiness website: <https://www.thestadiumbusiness.com/2020/10/27/5gdrones-project-carries-out-network-tests-at-greek-stadium/>
- “Drones to boost mobile and internet connection in crowded events”, online article at CommercialDroneProfessional.com website: <https://www.commercialdroneprofessional.com/drones-to-boost-mobile-and-internet-connection-in-crowded-events/>
- “5G!Drones Is Putting the Pieces of the Drone Ecosystem Together to Make Sure They Fit and Can Deliver Value to Stakeholders”, Unmanned Life, CAFA Tech, COSMOTE, Robots.Expert, NOKIA, INVOLI and Frequentis 5G!Drones partners, interviewed by Danielle Gagne, Commercial UAV News Editorial Analyst: <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>
- “5G Trials in Europe: 5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives” and “5G!Drones Athens Feasibility Tests”, Institute of Informatics & Telecommunications (IIT), NCSR, Newsletter: <https://www.iit.demokritos.gr/newsevents/iit-dedicates-october-5g-networks/>
- 5G!Drones Athens Trials over the 5GENESIS Athens platform (Egaleo Stadium and Cosmote Academy), Institute of Informatics & Telecommunications (IIT), NCSR, News: <https://www.iit.demokritos.gr/newsevents/5gdrones-feasibility-tests-athens/>

- “Hepta Drones and 5G will solve poor network connection during crowded events”, online article by www.innoenergy.com at <https://www.innoenergy.com/news-events/hepta-drones-and-5g-will-solve-poor-network-connection-during-crowded-events/>
- InterDrone Online 2020: “It is hard to promote the drone industry while drones are still not visible” at unmannedairspace.info: <https://www.unmannedairspace.info/uncategorized/interdrone-online-2020-it-is-hard-to-promote-the-drone-industry-while-drones-are-still-not-visible-north-central-texas-aviation-department/>
- “Top 10 Commercial Drone Insights and Updates from 2020” by Commercial UAV News online at [https://www.commercialuavnews.com/energy/top-10-commercial-drone-insights-from-2020?utm\\_source=Commercial%20UAV%20News&utm\\_medium=social&utm\\_campaign=5\\_minute](https://www.commercialuavnews.com/energy/top-10-commercial-drone-insights-from-2020?utm_source=Commercial%20UAV%20News&utm_medium=social&utm_campaign=5_minute)
- “Drones over Egaleo city” by xtypos.gr (in Greek) available online [here](#)
- “5G and Drones trials at Egaleo stadium” by kedke.gr online at <https://kedke.gr/technikes-dokimes-5g-me-drones-sto-dimotiko-gipedo-aigaleo/>
- “The idea that 5G can enable BVLOS missions is something of a myth” by unmannedairspace. More information is to be found online at <https://www.unmannedairspace.info/news-first/the-idea-that-5g-can-enable-bvlos-missions-is-something-of-a-myth-gokul-srinivasan/>
- “NCSR Demokritos pioneering activities in 5G research and 5G-PPP projects”, interview by Dr. Harilaos Koumaras in Startupper magazine (in Greek) – ([pdf](#))

### 3.4 Press releases

A well performed press reflection of the project start and advancements was recorded as follows.

- 5G!Drones announced at the Cosmote website: [https://www.cosmote.gr/cs/otegroup/en/5g\\_drones.html](https://www.cosmote.gr/cs/otegroup/en/5g_drones.html)
- 5G!Drones announced at NCSR Demokritos website: <https://www.iit.demokritos.gr/projects/unmanned-aerial-vehicle-vertical-applications-trials-leveraging-advanced-5g-facilities/>
- 5G!Drones announced at the DroneRadar website: <https://www.unmannedairspace.info/latest-news-and-information/5gdrones-research-project-starts-polands-dronerada-joins-the-consortium/>
- 5G!Drones at the 5G-PPP website: <https://5g-ppp.eu/5gdrones/>
- “Technical trials of drones and 5G at Municipal stadium of Egaleo”, online article at Municipality of Egaleo website (in Greek): <https://www.aigaleo.gr/2020/10/22/technikes-dokimes-5g-me-drones-sto-dimotiko-gipedo-aigaleo/>
- 5G!Drones Athens Trials over the 5GENESIS Athens platform (Egaleo Stadium and Cosmote Academy), Institute of Informatics & Telecommunications (IIT), NCSR D, News: <https://www.iit.demokritos.gr/newsevents/5gdrones-feasibility-tests-athens/>

### 3.5 Deliverables

The planned deliverables provision has been performed according to the updated project plan and in accordance with the high-quality management and assessment criteria, set by the project consortium member organisations and external advisors. The following table provides an overview of the publicly accessible deliverables, already submitted and uploaded to the website, available for downloading by the website visitors.

**Table 12: List of Reported Deliverables**

<b>Del#</b>	<b>Name</b>	<b>WP#</b>	<b>Lead</b>	<b>Type</b>	<b>Diss. Level</b>	<b>Delivery date</b>	<b>Link</b>
D1.1	Use case specifications and requirements	1	UML	R	PU	M6	<a href="#">PDF</a>
D1.2	Initial description of the 5G trial facilities	1	UO	R	PU	M6	<a href="#">PDF</a>
D1.3	5G!Drones system architecture initial design	1	ORA	R	PU	M8	<a href="#">PDF</a>
D1.4	Report on UAV business and regulatory ecosystem and the role of 5G	1	CAF	R	PU	M12	<a href="#">PDF</a>
D1.5	Description of the 5G trial facilities and use case mapping	1	UO	R	PU	M12	<a href="#">PDF</a>
D2.1	Initial definition of the trial controller architecture, mechanisms, and APIs	2	AU	R	PU	M12	<a href="#">PDF</a>
D3.1	Report on infrastructure-level enablers for 5G!Drones	3	OPL	R	PU	M18	<a href="#">PDF</a>
D4.1	Integration plan	4	DRR	R	PU	M7	<a href="#">PDF</a>
D5.1	Communication, showcasing, dissemination and exploitation plan and standardization roadmap	5	INF	R	PU	M6	<a href="#">PDF</a>
D5.3	Report on contribution to standardisation and international fora– 1st Version	5	AIR	R	PU	M18	<a href="#">PDF</a>
D6.1	Data Management Plan and quality and risk management plan	6	OU	ORDP	PU	M4	<a href="#">PDF</a>
D6.2	Annual report, year 1	6	OU	R	PU	M12	<a href="#">PDF</a>
D6.3	Mid-term review report	6	OU	R	PU	M18	<a href="#">PDF</a>

All strategy setting deliverables have been already provided and published, since these are crucial for A. the deep understanding of the project aims and B. the precise further project work, based on the foundation set at these.

To a high extent the listed deliverables cover strategic market and ecosystem studies on both UAV verticals and advanced communication & navigation technologies, as well as action planning on both know-how generation, transfer, and dissemination.

In the core of each activity, resp. deliverable, in 5G!Drones there is the aim to optimally prepare the integration of VTOL UAV and enabling communication technologies into the system of systems, which the overall project team is collaboratively designing, testing, describing and preparing for unfolding in the market environment during the next 5 – 10 years. Therefore relevant stakeholders in the partner

countries, regions and showcasing spots have been heavily involved in the project process, so a maximal coverage on the technological validation and public acceptance can be reached – a crucial requirement for the successful 5G!Drones systemic approach application in both the market and policy context EU-wide, aiming to strengthen the local, regional and EU economy growth and sustainable development incl. implementing cutting edge communication technologies enabled transportation and mobility in the third dimension of our settlements, resp. in the aimed U-Space environment..

### **3.6 Events**

Indeed, a higher amount of events than planned and expected was covered by the project team and vice versa - 43, as it can be seen from the list of past events below.

- Drones 3S Pro, 27-28 January 2021, online conference (Athens, Greece)
- InterDrone Online event, 15-17 December 2020
- 5G and Internet of Things Thessaloniki Week 2020, 14 December 2020
- 2020 International Conference on Networking and Network Applications (NaNA), 11-14 December 2020, Haikou City, China
- 5G-PPP Technology Board e-Workshop, 10 December 2020
- Unmanned Cargo Aircraft conference 9th Edition 8 Dec. 2020
- Global 5G Evolution online event, 8 December 2020
- Amsterdam Drone Week 2020, 17 September and 1-3 December 2020
- FinDrones2020 online conference, 12 Nov 2020
- “5G Experimentation Facilities and Vertical Trials: Current Status and Future Perspectives”, online workshop, 14 Oct 2020, 09:00-15:00 (organised by the Institute of Informatics & Telecommunications of NCSR Demokritos (Athens, Greece), EU projects 5GENESIS and 5G!Drones and the support of the 5G-PPP partnership).
- Low Latency Conference (virtual), 6 October 2020
- U-space Concept of Operations (ConOps) webinar organized by Eurocontrol, 2 October 2020
- “International Conference on Smart Cities, Smart Infrastructures and Smart Buildings”, European Digital Week (virtual), 23-24 September 2020
- 5G Momentum webinar, 3 September 2020
- ICUAS 2020 (International Conference on Unmanned Aircraft Systems), 1-4 September 2020
- ASTM International Committees, August 2020
- InterDrone Podcast, 5 August 2020
- Connectivity Technology blog, 2 August 2020
- PX4 Developer Summit 2020 (Virtual), 7 July 2020
- IFIP Networking 2020 Conference (virtual) – Workshop on Network Slicing 2020, Paris, France, June 22-25 2020
- IEEE Conference on Network Softwarization (NetSoft2020), 29 June – 3 July 2020 (Virtual Conference)
- IEEE IWCNC, Limassol, Cyprus, 15-19 June 2020
- EuCNC 2020, June 16-17, Virtual event, Dubrovnik, Croatia June 16-17
- PrintoCent Webinar Series 2020, 8 June 2020
- IEEE International Conference on Communications, Workshop on Integrating UAVs into 5G and Beyond, 7-11 June 2020 (Virtual Conference)
- AIAI 2020, 16th International Conference on Artificial Intelligence Applications and Innovations, 5th Workshop on “5G – Putting Intelligence to the Network Edge” (5G-PINE 2020), 5–7 June, 2020 (Virtual Conference)
- Aerial Communications in 5G and Beyond Networks (AERCOMM) workshop, co-organized by 5G!Drones and EU-Korea PriMO-5G project, colocated with IEEE Wireless Communications and

Networking Conference, 25-28 May 2020 (Virtual Conference), Beyond Connectivity: What Comes After 5G

- Mobile World Congress 2020 (MWC2020), Barcelona, Spain, 24-27 February 2020 – CANCELLED due to coronavirus
- AIX & FCAO Event (6 February 2020, Tampere University, Finland)
- Finnish Satellite Workshop and Remote Sensing Days 2020 (20-22/01/2020, Helsinki, Finland)
- IEEE Global Communications Conference (IEEE GLOBECOM 2019), Hawaii, USA, 9-13 December 2019
- EASA High Level Conference on Drones – Amsterdam Drone week (5-6 December 2019, Amsterdam)
- INFOCOM World Conference 2019 (26 November 2019, Athens)
- FOKUS FUSECO 2019 Forum (7-8 November 2019, Berlin)
- 25th FRUCT Conference (8 November 2019, Helsinki)
- 5GTNF Results and Demo Seminar (1 November 2019, Helsinki)
- ITS World Congress (21-25 October 2019, Singapore)
- 5G-PPP Technology Board meeting and Technical Workshop on key enablers for 5G Experimentation (8-10 October 2019, Malaga)
- Digital Transport Days Conference (7 – 9 October 2019, Helsinki)
- 5G PPP 5G-Initiative Steering Board (17 September 2019, Brussels)
- Salon du Bourget, Paris Air Lab (21 June 2019, Paris)
- EuCNC 2019 (17-21/06/2019, Valencia)
- 7th Global 5G Event (17-19/06/2019, Valencia)

### **3.7 Dissemination plan for M22 – M42**

The project period covered by this dissemination plan will cover the most intensive demonstrator operations phase for advanced communication technologies driven VTOL UAVs. Therefore, serious considerations have been performed by the project partners due to the need of an optimally designed scheme and workflow on the public activities towards optimal project contents and achievements including demonstration activities dissemination. The plan is as follows:

#### **3.7.1 Targets for Dissemination and Showcasing**

The project team is having a highly ambitious dissemination and showcasing agenda. This is due to the fact that the already performed and planned project achievements and showcasing activities are based on cutting-edge technologies and systemic solutions, enabling completely new approaches to be implemented in the real world and by this improve the daily life of EU citizens. Therefore, the dissemination shall perfectly reflect these results among the public audience, as it has been the case until now and it should be intensified in future.

##### **3.7.1.1 Publication targets**

The main publication target is 5G!Drones publications (defined in chapter 3.3.1 of D5.1) to be accepted in Journals and magazines on communications/networking (e.g. IEEE Communication Magazine, IEEE JSAC, IEEE Network, IEEE Internet of Things etc.), and in vertical-oriented publications (e.g. Journal of Unmanned Aerial Systems, International Journal of Intelligent Unmanned Systems etc.).

The newly launched Open Research Europe ORE platform will be actively utilized by all consortial members for publishing, sharing and exchanging research results with relevant stakeholders.

##### **3.7.1.2 Workshop targets**



The core workshop target is to arrange 5G!Drones related workshops in each four countries and/or online (Finland, Estonia, Poland, and Greece) as reported in Section **Error! Reference source not found.** of D5.1. Workshops will be ½ to 1-day seminar to disseminate final results of Use Cases and recommendations of the use 5G for drone connectivity. Dissemination target is to gain understanding for the vertical audience, what are the opportunities, limitations and recommendation of using 5G for the drone connectivity. Dissemination target for communications audience is to communicate the market opportunity of the drone sector in telecommunications, especially in 5G. An additional target that will be fulfilled through the workshops is to gain knowledge of the drone related needs of 5G configuration and optimisation to ensure great service level for the drone connectivity.

### **3.7.1.3 Conference targets**

Conference target is partners to get accepted as speakers in at least three of the vertical-related conferences and one communications-related conference listed in Section **Error! Reference source not found.** Objectives for the conferences are the same as the ones of the workshops: to disseminate the value/knowledge of the 5G connected drones and the existing limitations, as well as to highlight the 5G recommendations for attaining drone connectivity of good service quality.

The envisaged and/or planned conference participation covers following events:

- ITS World Congress 2021 Hamburg (physical)
- Commercial UAV CUAV Expo 2021 (physical)
- Amsterdam Drone Week ADW 2021 (simultaneously with CUAV)
- ICUAS
- 5G Summit 2021
- GSMA MWC
- EuCNC2021/6GSummit (virtual, application positively evaluated)
- As well as advanced aerial mobility and sustainable urban development focused events

The EUCNC/6GSummit 2021 represents an especially crucial target for the project consortium. Therefore, RXB has registered the project consortium for a premium virtual booth at the event, in order to maximally utilize the venue opportunities for dissemination and transdisciplinary collaboration with relevant stakeholders and organisations. There, after a positive application evaluation, 5G!Drones will have a premium virtual booth, as agreed within the consortium and with the organising committee.

At CUAV and ADW in 2021, which will take place simultaneously in Berlin and are the most crucial and highest-level VTOL UAV operations conventions EU- and worldwide. A reduced price could be organised in terms of included free panel discussions for the team representatives and the Virtual News feature will be activated.

The motivation and background for this decision are as follows:

5G!Drones aim is to test several UAV use-cases covering eMBB, URLLC, and mMTC 5G services, and to validate 5G KPIs for supporting challenging use-cases. The project drives the VTOL UAV and 5G networks to a win-win position, on one hand by showing that 5G is able to guarantee UAV vertical KPIs, and on the other hand by demonstrating that 5G can support challenging use-cases that put pressure on network resources, such as low-latency and reliable communication, massive number of connections and high bandwidth requirements, simultaneously. 5G!Drones builds on top of the 5G facilities provided by the ICT-17 projects and a number of support sites, while identifying and developing the missing components to trial UAV use-cases.

The overall and ultimate objective of 5G!Drones is to design, implement and run trials of UAV use cases on top of a 5G infrastructure provided by ICT-17 and other complementary facilities, addressing contemporary 5G challenges.

The objectives related to the 5G!Drones concept and validation are:

- Analysis of the performance requirements of UAV verticals' applications and business models in 5G
- Design and implementation of the 5G!Drones software layer (or system) to execute UAV trials
- Design a high-level scenario descriptor language to run and analyse the results of the UAV trials
- Design and implementation of 5G!Drones enablers for UAV trials and operations
- Validate 5G KPIs that demonstrate execution of UAV use cases
- Validate UAV KPIs using 5G
- Advanced data analytics tools to visualise and deeply analyse the trial results, and provide feedback to the 5G and UAV ecosystem
- Dissemination, standardisation and exploitation of 5G!Drones

The main aim to actively be involved in the EUCNC/6G Summit is to present our activities and have fruitful discussions with the other exhibitors and participants in the relevant fields, enabling sustainable collaborative development of the topic 5G & Drones in future. The relevant market is emerging and quite large, so joint forces are needed in action.

The objective for participation at the event is:

5G!Drones derives from the need to support and validate UAV use cases, by running trials on top of 5G systems, leveraging ICT-17 5G facilities and modern test methodologies and advancements. Indeed, for actual experimentation of UAV use cases, highly-complex setups are required in order to validate the vertical KPIs when investigating for example: a) enhancements required in the LTE and 5G networks in order to support the "moving cell" concept or emerging scenarios of public-safety, b) how fog and edge computing design principles fit into the integrated environment, or c) what network enhancements are necessary in both the data and control planes of multiple wired/optical/wireless technologies in order to support IoT/M2M/D2D. This list is indicative and can be quite extensive.

The description of the intended demo at the premium virtual booth is as follows:

The project team will visualise some of the project trial activities and by this the capabilities of advanced communications to enable the autonomous mobility in the third dimension - air, also in the context of the overall autonomous and manned mobility modes in our settlements and regions.

#### **3.7.1.4 Particular partners updates**

5G!Drones participates in annual exhibition events and similar ones, but its dissemination activities are focused more on preparing conference and journal papers when any publishable outcome is available. This is not possible to be planned in advance, even if one usually submits to some annual conferences/symposia.

The future exploitation-related activities aim at building a broad awareness within the relevant wide stakeholder circle of the future multilateral unmanned aviation ecosystem, especially the UTM/U-space as a foundation, as well as all needs and requirements that go beyond the simple role of a transparent bits transporter, especially the deep integration of the UAV vertical environment with the control mechanisms of the 5G network. This is also something, which can't be planned in advance, and the partner organisations have been and will be taking every good opportunity for it.

### **3.7.2 Monitoring and Evaluation of the Dissemination and Showcasing activities**

#### **3.7.2.1 Online Repository**

The 5G!Drones partners use the Microsoft Teams platform as a collaborative tool in order to share information relating to the project's tasks, prioritize work packages and remain intact and well organized to efficiently reproduce high quality outputs and activities. A special section is dedicated to dissemination and showcasing activities where partners upload material (papers, presentations, photos, videos) from events in which they participated.

### **3.7.2.2 WP5 Activities and Impact Tracking**

All of the project related dissemination activities are performed in the framework of high-level local, national and international media, venues and a strongly interdisciplinary environment. The demonstration activities are regularly reflected in media and always the best possible constellation society/academia/experts/industries/policy making is searched and organised for these in the framework of the demonstration, dissemination and communication activities within the project.

The impact tracking has been performed both on the qualitative and quantitative level. On the quantitative level feedback from listeners and viewers of conferences, as well as conventions, is being collected by debriefing discussion formats. On the quantitative level, the impact is being quantitatively measured – website visits, event attendees' numbers etc.

The collected qualitative and quantitative data on the interest shows a strong interest of representatives of relevant stakeholders' target groups, incl. from the entire knowledge triangle: A. Education, B. R&D and C. Business, Industries and Regulators. Considering the high amount of interested Students, teachers and researchers, and the lower one from industries, business and regulators, it shall be set as a strategic goal for the entire project consortium to pursue a stronger attraction of exactly these stakeholders, since they are crucial for the successful market introduction of such cutting edge technological systemic approaches, as the 5G!Drones collectively elaborates.

## 4 5G!DRONES Project Results Exploitation Strategy

5G!Drones project's mission is to demonstrate the astonishing potentials that 5G technology can bring to the UAV transformed vertical industries and sets to validate capabilities that revolutionize the existing state-of-art. It is evident that the exploitable opportunities that arise from the project's results are manifold and span in various categories –including drones, remote control and traffic management systems, full-fledged integrated trial 5G environments, and packaged use case solutions. As these results are generated by many partners of versatile interests and strategic (profitable or non-profitable) goals, it is important to devise an all-encompassing exploitation strategy that shall capture and classify all possible prospects and partners' interests.

This document sets out to define the appropriate exploitation strategy methodology in Section 4.1, capture the related input per partner and conclude with the overall project's value proposition in Section 4.2. As a next step in a later phase, this value proposition shall be selectively market analysed and maturity assessed. It also reports explicitly on the specific, partner level exploitation plans of the members of the 5G!Drones consortium in Section 4.2.

### 4.1 Project's Results Exploitation Methodology

This Section explains the methodology that is followed in order to define the project's exploitation strategy. It starts by clarifying the definition of an exploitable outcome and presents a generic classification approach of the project's results in 4.1.1. Building on these constructs, it then introduces in 4.1.3 the plan to identify exploitation opportunities and challenges by utilising the appropriate value position models.

#### 4.1.1 Exploitation Potentials & Project Results

This section clarifies the types of an exploitable outcome and proposes a categorization of the project results. These are the basic constructs upon which the exploitation methodology presented subsequently is based.

##### 4.1.1.1 Exploitable Outcome

Various types of partners may participate in a R&D EU funded project -universities, research centres, commercial companies and SMEs, and depending on their expertise and areas of interest, the exploitation strategy and activities vary accordingly. Universities and Research Centres as a general trend focus on exploitation activities regarding research items that can also lead to spin-offs, while commercial companies and SMEs are mainly involved with the exploitation opportunities of commercially oriented products. Also transdisciplinary cross type approaches are likely to be involved in here. and in the light of the diversity, and we can identify five major categories of exploitable outcome:

- **Product development** which includes the introduction of new products/features (together with a roadmap definition) and the product validation that increases the technology readiness level (TRL) towards a successful deployment. This outcome category is related mostly to commercial companies and SMEs.
- **Business development** which includes enhancement of existing processes/services and/or the creation of new services/activities. This outcome category is also related mostly to commercial companies and SMEs.
- **Standardisation** is a process tool through which the commercialization and sustainability of a project's results can be supported. Partners that are actively involved in standardization and regulatory activities may promote the results of the project to provide technical contributions to relevant standards bodies.
- **Research achievements**, including publications, IPRs and prototypes and can be produced by all partners.

- **Start-Up companies.** These can be established mainly by Universities and Research Centres in order to exploit one or more of the project's exploitable outcomes and indirectly pursue Product development outcome.

The exploitable outcome categorisation is graphically depicted in figure below.

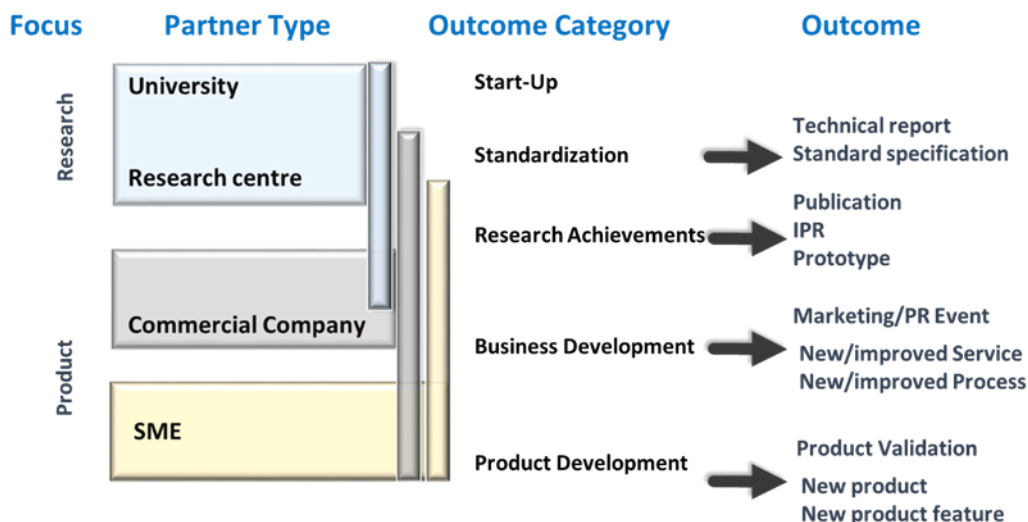


Figure 43: Partner Type and Related Exploitation Types and Outcome

#### 4.1.2 Project's Results

As a European funded project, the contributions from partners are of varying focus and type, and can be broadly categorised as follows:

- **Demonstrators** – Demonstrations of one or more 5G!Drones results/products in the field or in lab environment; either as Proof of Concept (PoC) or as Solutions addressing specific end-user needs. Demonstrators are usually joint results of more than one partners and partner types.
- **Prototypes** - Stand-alone, modular products which have been either developed or enhanced in the context of the project. Prototypes may be developed by commercial companies and SMEs or by academic or research initiatives with no direct commercialisation capability.
- **Validation Activities** – Activities aiming at validating the functionalities of specific products; these can be considered as exploitation activities aiming at increasing the technology readiness level of the associated products.
- **Contributions** to standardisation and publications – Indirectly exploitable results delivered to the industry through standardisation and dissemination paths.
- **Other Achievements** – Activities/Tools aiming at enhancing processes/services related to the introduction/deployment of the project results (ex. studies, algorithms, techno-economical tools, knowledge transfer etc.).

#### 4.1.3 Relevant Exploitation Models and Plan of Action

There are two prevailing models in the market for customer centric identification of the exploitable potentials for a given product/result. The Value Proposition Canvas that is presented in Section 4.1.3.1 and for more mature propositions the Lean Canvas in Section 4.1.3.2.

The process to be followed encompasses the following steps:



1. As a first step each project member provides input towards the potential exploitable outcomes that s/he contributes to. This is a structured information associating the Outcome with the Result Category, an Exploitation Type and the target Customer Segment. This is assessed and aligned across the project to offer a concrete final list.
2. For each Exploitable Outcome and Customer Segment, the Value Proposition Canvas is filled. Through the identification of gains, pains and opportunities a clear and structured value proposition statement for the outcome is provided.
3. For the Outcomes with promising Value Propositions, the Lean Canvas methodology is used to further analyse the exploitation potential and identify the key parameters to build the business case.

#### 4.1.3.1 Value Proposition Canvas Methodology

The Value Proposition Canvas [1] has two sides, the Customer Profile (on the right) and the Value Proposition (on the left) and is graphically depicted in Figure 2.

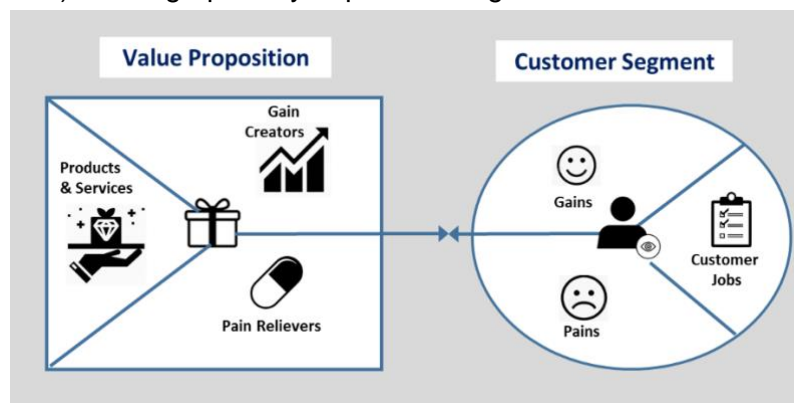


Figure 44: Value Proposition Canvas

The Value Proposition part is used to depict and identify information regarding the features of a product or service targeting a specific Customer. The Value Proposition is broken down into:

- **Products and services:** the list of 5G!Drones products and services targeting the value proposition to a specific customer segment.
- **Pain relievers:** the ways in which these product and services will alleviate specific Customer Pains.
- **Gain creators:** the ways in which these products and services can create gains for the Customer.

The Customer Segment describes the target customer profile and relevant key information to understand the expected value to be provided by 5G!Drones results:

- **Customer Jobs:** the existing customer jobs and business processes executed by the prospect (corporate) users that are relevant to each 5G!Drones product.
- **Pains:** the risks, obstacles, problems related with the existing way (without the 5G!Drones product) of performing the Customer Jobs.
- **Gains:** the outcome customers want to achieve or concrete benefits they are seeking from their Jobs.

#### 4.1.3.2 Lean Canvas Methodology

The Lean Canvas Model is a business case development method that is based on the graphic representation of a number of variables that show the values of a business and/or organisation. Lean Canvas is adapted from The Business Model Canvas [2][3] and can be applied at for direct exploitable assets of a commercial initiative. The Canvas is presented in the table below:

Table 13: Lean Canvas Model

PROBLEM	SOLUTION	UNIQUE VALUE PROPOSITION	UNFAIR ADVANTAGE	CUSTOMER SEGMENTS
EXISTING ALTERNATIVE S				EARLY ADOPTERS
	KEY METRICS		CHANNELS	
COST STRUCTURE		REVENUE STREAMS		

The key parameters foreseen in the Lean Canvas Model are explained in detail as follows:

- **Problem:** The top problems that can be addressed from the product/service, addressing the jobs that are affected, why, how and who is concerned.
- **Existing Alternatives:** Other solutions solving the same or similar problem currently.
- **Solution:** A brief description of what the solution does and how, with special focus on the main features that differentiate it from the alternatives.
- **Key Metrics:** Key activities that will be measured to track the success (e.g., units sold, users registered).
- **Unique Value Proposition:** The critical success factors of the project's product proposition towards satisfying customers' needs especially in comparison to the alternatives. The statement should underline the product's uniqueness and provide numbers to explain performance gains.
- **Unfair Advantage:** Identify advantages compared to the competition, such as acquisition, switching and maintenance costs.
- **Channels:** Detail the channels to be used to contact customers, promote and deliver the value promised.
- **Customer Segment:** The customer segment in focus, who has the problem and would be interested in buying the solution. The customer segment can be split in vertical segments to identify the strongest vertical to target for.

- **Early Adopters:** A small niche that is having the biggest problem, the ones who suffer the most and could become early adopters. In the process of identifying early adopters, geographic location, industry and connection to the problem are important aspects.
- **Cost Structure:** The main costs as soon as the solution is ready for the market (e.g., customer acquisition costs, distribution costs, hosting, human resources costs, etc.). To build a subtle business case the costs should be estimated in the short term (six months) and longer-term (three years).
- **Revenue Streams:** The main revenue streams when the solution is ready for the market in the short-term (six months) and longer-term (three years).

#### 4.2 Identification of 5G!Drones Exploitable Outcomes

The table below presents the exploitable outcomes from 5G!Drones identified so far, project result category, end customer and involved collaborating partner for each of them. This monitoring will be regularly updated and selected outcomes will follow above methodology to ensure they can be leveraged.

**Table 14: 5G!Drones Exploitable Outcomes**

#	Outcome	Project Category	Result	Exploitable Type	End Customer	Involved Partners
1	5G!Drones USPACE Adaptor	Prototype		Product Development	Integrator	FRQ, DRR, CAF
2	DronesPlatform for Experiments	Prototype		Product Development	Vertical Industry	ALL WP2 and WP3 partners
3	Mission Critical Services platform integrating Drone As A Service on 5G network	Prototype		Product Development	Public Safety Authorities - Firefighters, Emergency services, Police	AIR, CAF
4	Computer Vision cloud native application for 5G MEC	Prototype		Product Development	Construction companies	CAF
5	C2 container-based cloud native application for 5G MEC	Prototype		Product Development	Drone companies	CAF
9	Transportable 5GTN system	Demonstrator		Research Achievements	Academia	UO
10	Transportable 5GTN system	Validation Activities		Research Achievements	Vertical Industry	UO
11	Academic results, data sets	Publications		Research Achievements	Academia	UO, NOK, OPL, AU, THA, EUR
12	Contributions to ETSI SmartBAN	Publications		Standardisation	Technology Vendor	UO
13	Networked Remote ID Tracker	Demonstrator		Start-ups	Vertical Industry	INV

#	Outcome	Project Category	Result	Exploitable Type	End Customer	Involved Partners
14	Trial Validator	Demonstrator		Product Development	Software Developer	RXB, FRQ
15	KPI Component	Demonstrator		Product Development	Technology Vendor	FRQ
16	A general data collector	Other		Product Development	Software Developer	NOK
17	Drones extending 5G Connectivity	Demonstrator		Product Development	Telecom Operator	NCSRD, COS, MOE
18	Business KPIs and metrics	Other		Business Development	Vertical Industry	INF, T2.4 and T4.2 partners
19	New Business models	Other		Business Development	Vertical Industry	INF and T1.1 partners
20	Post-storm analysis of power lines	Prototype		Product development	Vertical Industry	HEP
21	Academic results	publications		research Achievements	academia	AU
22	X-network ecosystem	demonstrator		product Development	telecom Operator	AU
23	UAV-based IoT data collection	prototype		product Development	vertical Industry	AU
24	5G Hydradrone platform for inspection operations	Demonstrator		Product Development	Vertical Industry	ALE
25	UMS' software platform's capabilities in: - a. Autonomous drone swarm management - b. Object detection through video analysis - c. Enabling use cases like on-demand connectivity by providing network connectivity through drones	Demonstrator		Business Development	Vertical Industry	UMS
29	UMS simulation testbed	Prototype		Research Achievements	Vertical Industry	UMS
30	Academic results, data sets	publications		research Achievements	academia	THA
31	New network anomaly detection mechanisms	Demonstrator		Product Development	Integrator	THA

#	Outcome	Project Category	Result	Exploitable Type	End Customer	Involved Partners
32	Mission Critical Services	Prototype		Product Development	Public Safety Authorities - Firefighters, Emergency services, Police	THA
33	Analysis of 5G architecture and mechanisms compliance with requirements and needs of the entire UAV ecosystem recognized during the 5G!Drones project	Publications		Standardisation	Telecom Operator, Verical Industry, SDO	OPL
34	C2 over 5G on-board component	Prototype		Research Achievements	Research Center	NCSRD
35	Academic results	Publications		Research Achievements	academia	EUR
36	5GEVE Sophia Antipolis ecosystem	demonstrator		Open source	Telcom Operator	EUR
37	Localization of a drone	4 patents		Product Development	Drone companies /Telecom Operator	ORA

Below the exploitation plan for each 5G!Drones project partner updated at month M21 is presented:

**Table 15: 5G!Drones Partners Individual Exploitation Plan Updates**

Partner	Exploitation plan
<b>UO</b>	<p>The UO exploitation plans for 5G!Drones include:</p> <ul style="list-style-type: none"> <li>• Showcasing 5G!Drones verticals and results at key events. As the Coordinator of the project UO gives presentations in several events promoted by the European Commission.</li> <li>• Promotion of the project by target workshops at key conferences.</li> <li>• Promotion of 5G!Drones use of ICT-17 test facilities and the UO open 5G Test Network Partner facility ecosystem and beyond, aimed at rapid business development, <a href="http://www.5gtn.fi">www.5gtn.fi</a>.</li> <li>• Promotion of the project results via the Finnish 6G Flagship Programme, <a href="http://www.6genesis.org">www.6genesis.org</a>.</li> <li>• Participation as a key member in urban air mobility Oulu strategic initiative, <a href="https://uam-oulu.com/">https://uam-oulu.com/</a></li> </ul> <p>Exploitation after the project includes:</p> <ul style="list-style-type: none"> <li>• The 5G!Drones project results will actively be shared within the industrial consortium partners beyond H2020 realm.</li> <li>• The UO support facility will remain available as a significant part of the 5GTN (5G Test Network) for increasing visibility and market uptake of the project</li> </ul>



Partner	Exploitation plan
	<p>outcomes. The 5GTN will also evolve towards 6th Generation facility via the National Flagship program 6Genesis related activities.</p> <ul style="list-style-type: none"> <li>As a result of the 5G!Drones activity, UO plans to have a transportable 5GTN system encompassing 5G core, MEC, and gNB for testing and showcasing beyond the current coverage area of the network.</li> </ul> <p>UO plans to introduce its assets to operational network at the university and also for educational purposes especially in ICT related but also in multi-disciplinary fashion between all faculties in UO.</p>
<b>COS</b>	<p>COSMOTE, as the leading mobile network operator in Greece, seeks to exploit the know-how, the technologies and products developed in this project in order to:</p> <p>(i) Bring technologically advanced solutions to its customers and increase revenues from the actual adoption of 5G. Towards this, special interest is put on Use Case 4, “Connectivity Extension during Crowded Events”: UAVs equipped with 5G base stations can provide additional capacity in cases of crowded events (including festivals, large stadiums, demonstrations, traffic jams, etc.). This use case is expected to advance the end-user premium experience (ex. 8K video quality streaming), and result in high data usage and increased consumption of the network services offerings.</p> <p>(ii) Expand its products portfolio with services targeting vertical industry needs, exploring new business model potentials. All the project use cases are considered relevant to this, through their application in Logistics and Agriculture business, that are very important to the Greek market.</p> <p>(iii) Reduce OPEX by the utilization of UAVs in its mobile network and internal operational procedures. In this respect special focus is put in the application of Use Case 3 scenarios, on “Situation Awareness”: Conventional tower inspection, that involves tower climbing by the mobile operator employees or a 3rd company, apart from the effort and cost required, has been recognised as one of the most hazardous jobs. Alternatively, UAVs can be used to conduct tower inspections, capturing and transmitting in real-time pictures &amp; video to COSMOTE’s operation and maintenance facilities. In addition to not risking lives, UAVs can carry out routine audits and inspections faster and more effectively producing more reliable data, allowing instant analysis. On top of inspection, UAVs could also be actuators, e.g. utilized for melting ice from MW antennas by throwing water that the UAV could carry in buckets, or for bringing spares from the earth up to the antenna via an elastic tube. Furthermore, UAVs can be exploited for radio planning, since they can be very effectively used to determine the ideal location and height for new antenna locations. In this case, expensive on-site visits by COSMOTE employees may be substituted by UAV swarms.</p> <p>(iv) Maintain its status as an innovation pioneer in the Greek market, and its strong social responsibility profile by responding with fast and reliable communication solutions in cases of emergency situations contributing to public safety and protection. The application of Use Case 2, “Disaster recovery and emergency communications” is of great value. The project proves that UAVs can support first responders and telecommunications services in case of a disaster including earthquakes, wildfires, floods, etc. Recent utilisation of UAVs for COVID-related activities (transportation of health packages, thermometry etc.), as well as in various situations that immediate human interaction is impossible (fire and sea) comes to point out that involving UAV technology is a mandatory target for companies seeking effective and innovative solutions.</p>

Partner	Exploitation plan
<b>THA</b>	The initial work and results of the project made it possible to set up demonstrators showing the capacities of 5G networks in the fields of civil security, disaster assistance and, of course, the piloting and management of drone fleets. Thus, since the start of the project, we have been able to show the value of slicing for the separation of resources and to set up solutions that can be deployed at the edge of the network. The results of the project are also being studied for use in ECO, the drone fleet management solution made by Thales.
<b>AIR</b>	Exploitation plan for AIR has already evolved and will probably evolve the whole duration of the project as new skills are acquired and better further technical and financial studies are achieved within the project. 5G!Drones outcomes will allow Airbus DS SLC to demonstrate that 5G techniques based on native cloud technologies and network slicing technology will further enable Public Safety users with rich and reliable multimedia services and applications, as part of the PMR industry evolution to 5G Broadband. Airbus DS SLC has developed concrete innovative 5G use cases focused on firefighters' needs but that could apply to other mission critical and business critical end users. Main derived products will consist in a critical collaboration platform integrating Drones As A Service and powered by 5G capacities. This will also confirm the readiness of Airbus secured communications products to support this technology ensuring performances in accordance with public safety requirements. The project outputs will nurture Airbus DS SLC products and solutions roadmap to build a competitive portfolio and to maintain its leadership in the PMR/PPDR industries.
<b>INV</b>	<p>INVOLI's exploitation plan includes showcasing the use of 5G as the next generation framework for drone applications and especially understanding its impact on drone flight awareness, on live air traffic data transmission in crowded sky and on UTM services. INVOLI works hard to permit unparalleled flight awareness for our clients with a never-seen-before safety regarding potential collisions in the sky.</p> <p>After 18 months of the project, INVOLI's exploitation plan is to profit from advantages of the 5G technology in our products, under the condition that the coverage and services are widely accessible in the area where we use our products and there are suitable 5G devices at affordable cost. Our participation to the 5G!Drones project helps us to closely follow up the advancements of the 5G technology and its advantages from the vertical's perspective. We are also better informed about the role of standardization organizations like 3GPP, how they work and how to use their documentation. The new 5G capabilities are crucial in our business model for manned and unmanned traffic tracking, allowing fusion of both traffic types together to avoid in the future the inflexible segregation of the airspace for advantage of the coexistence of both traffic types in the same airspace volume. Projects tests also allow to understand the links between INVOLI infrastructure and ICT-17 test facilities, to understand how the current telecom infrastructure which INVOLI uses could be extended towards 5G (many partners with whom INVOLI works in the telecom industry have already pledged to extend their network to 5G). The project outputs could support clear and profitable business model in the 5G &amp; drone field, and how they can be enhanced with the new technological advances offered by 5G, and tested within this 5G!Drones project. 5G will finally permit sending live streams of data to the drone regarding the whole air traffic around, thus requiring a large amount of data sent with the lowest latency possible.</p>

Partner	Exploitation plan
	<p>Project outputs also nurture INVOLI products, credibility and viability on the long-term. Our transponder's receiver equipment tracking the aerial traffic and sending the data back to the central place for processing should be soon 5G compatible. Also, in the last year we have built and commercialized the Remote ID tracker, which can be attached to the drone. Such equipment is required by the European legislation entering soon into the force. At the moment it's 4G only, but now based on our experience and knowledge we are going to work on the 5G version.</p>
<b>HEP</b>	<p>Hepta Airborne will use the 5G!Drones project to help develop its Hepta FX-20 drone and data analysing services in regard to using the possibilities 5G network has to offer. Our trial will help understand how 5G can change power line inspection as a service and lay the foundation for more efficient solutions.</p>
<b>ORA</b>	<p>Orange exploitation plan for 5G!Drones is twofold.</p> <p>On one hand, it aims to break the locks for enabling UAV to use cellular network deployed at national scale and to assess outputs of 5G!Drones in order to evaluate how far they can contribute to release these locks. Typically, it is about to assess the quality of service in the context of long-distance missions, considering that cellular networks are currently deployed for providing connectivity for user terminals on ground and not in the air. For instance, Orange is eager to share results of tests about the impact of interferences, caused by cellular UAV on normal smartphones on ground located in adjacent cells in order to demonstrate that the introduction of cellular UAV won't jeopardize existing MNO traffic. Orange aims also at publishing results of measures on continuity of service over several cells for long missions. In such a way, Orange will have a special interest on use cases about Use Case 2, "Disaster recovery and emergency communications" and Use Case 4 "Connectivity Extension during Crowded Events", as well as Use Case 3 on "Situation Awareness".</p> <p>On the other hand, Orange will participate in standardization activities, notably 3GPP (e.g.remote ID, FS_ID_UAS study item at 3GPP SA2 WG), CEPT (e.g., a follow up of report 309), and ACJA WT2 and WT4 activities (e.g. MOPS and KPI definition).</p>
<b>OPL</b>	<p>Orange Polska plans to exploit the project experiences and outcomes in various ways. The value of the 5G!Drones project's innovation comes from pioneering implementation of the entire UAV vertical ecosystem's model with multilateral business and operational interactions, in which the network operator will be involved. Building within the Orange Polska organization the awareness of the forthcoming complex ecosystem, including the needs of particular actors, is very important for future business development.</p> <p>From the technology point of view, the involvement in the project, the own research on specific topics within the project and shared achievements of other partners, especially in the domain of UAV enablers, will allow for conscious decisions on 5G technology development and roll-out strategy in the Orange Polska network. Special focus will be devoted to the aspect of network capabilities exposure to the vertical ecosystem through the North-Bound Interface, as well as the integration of the 5G network framework with MEC framework. Trial findings related to behavior and performance of communication channels used by drones (non-payload, as UTM and C2, and payload – use case-specific) will have an important impact on User Plane Functions design and engineering. Last but not least, the Use Case 4 trial results, in which the mobile network is a customer/end-user of UAV technology will be carefully investigated as a hovering base</p>

Partner	Exploitation plan
	station is a potential temporary supplementary solution for crowded events and quickly applicable remedy in case of network infrastructure destruction during disasters.
<b>CAF</b>	CAFA Tech will use the technologies (C2 for cellular drones, Computer Vision cloud native application, Drone Logistics Network) developed during the project for its own automated drones system CAFA Dock360 and related services. It is also planned to offer 5G MEC-based solutions to other drone companies.
<b>ALE</b>	Alerion develops smart custom drones for specific applications. Alerion is involved in different projects in which it creates solutions for infrastructure inspection, environmental surveillance, and broadcasting events. With the upcoming era of 5G, Alerion is willing to use the results of this project to upgrade its offer and explore new possibilities and markets. Using 5G capabilities to enhance Alerion drones – Especially, we would like to equip our Hydradrones to explore a new usage of our technology. Our trial will explore the advantages of 5G, especially for inspection and search & recovery operations in large body of water tasks and will help us to understand how this technology will improve the performance of our Hydradrones for inspection's tasks. Thus, the possibilities offered by 5G are a great opportunity for Alerion to develop its business.
<b>NOK</b>	<p>The NOK exploitation plans for 5G!Drones include:</p> <ul style="list-style-type: none"> <li>• Promote vertical business opportunities like UAV on top of 5G to public and private sector customers. For example, help communications service providers (CSP) to utilize 5G possibilities and reduce their OPEX by using UAV in 5G Base Station (BTS) RF performance planning validation or telecommunication equipment inspection.</li> <li>• Promotion of the project by target workshops at key conferences.</li> <li>• Promotion of 5G!Drones project partner's AU and UO open 5G Test Network Partner facility ecosystem for the rapid business development, <a href="http://www.5gtn.fi">www.5gtn.fi</a>.</li> </ul> <p>Exploitation after the project includes:</p> <ul style="list-style-type: none"> <li>• The 5G!Drones project results will actively be used for creating internal 5G features and contributing those to different standards and patents.</li> <li>• Further development of Nokia Drones like enabling VR usage for managing Nokia Drone.</li> </ul>
<b>RXB</b>	<p>Robots Expert exploitation plan is mainly to lead activities related Dissemination &amp; communication as part of T5.3. This includes series of presentations, podcasts, and other public facing events to promote the activities and results of the project trials and activities.</p> <p>Robots Expert will also lead the activities related to the development and demonstration of Trial Validator, and coordinate with FRQ to ensure that the development, deployment, integration and testing of the said component adheres to the proposed release plan.</p> <p>Furthermore, Robots Expert will also participate in a variety of standardisation activities, notably, leading the efforts towards ACJA MOPS &amp; KPI definitions to contribute to the first release of ACJA's WT3 activities. Besides ACJA, RXB will also participate and contribute majorly towards 5G-PPP activities in terms of white paper, research articles, and standardisation activities. Also, RXB's standardisation activities extends to ASTM, Eurocae, EASA U-space expert group, and other notable international standardization bodies.</p>

Partner	Exploitation plan
<b>UMS</b>	<p>UMS' exploitation plans for 5G!Drones include:</p> <ol style="list-style-type: none"> <li>1. Demonstrate the capability of autonomous drones swarms controlled by our software platform in conjunction with 5G to aid first response agencies during emergency scenarios and to telcos in providing last-mile connectivity required in specific areas.</li> <li>2. Use trial results to validate our technology and its need to enable drone-based Smart Cities use cases.</li> <li>3. Establish the company as a key member within the U-Space community through its collaboration with other UAV partners within the consortium.</li> <li>4. To utilize and further develop the UMS simulation testbed to conduct testing and integration activities which do not require physical drone flights.</li> </ol>
<b>DRR</b>	<p>Droneradar exploitation plan for 5G!Drones is focused on finding ways of 5G network usage in U-space, performing a comprehensive technical analysis with the intention of spotting the MNO towards active member of U-space ecosystem.</p> <p>The integration of Droneradar products in 5G!Drones trials will help to standardize methods of communication between UTM/CIS systems and Supplementary USSP. Droneradar will also focus on freedom which gives NFV concept for U-space stakeholders. Droneradar is eager to share manned and unmanned experiences focused on connection to the ANSP/CIS between the Consortium members.</p> <p>Other objectives include generating awareness for the current Droneradar UAS product portfolio among the stakeholders, creating an efficient business model, and establishing a product roadmap based on the trials output. Additionally, Droneradar attempts to showcase to utilize outcomes of 5G!Drones project to another SESARJU projects, like ICARUS in which usage of EDGE computing become absolutely critical in the development and implementation of CARS (Common Altitude Reference Systems). The thoughts and ideas of 5G!Drones project will be validated prior commercialisation with customers and organisation we cooperate with (ANSP, CAA, Commercial and GA pilots) with the high-level purpose of reducing and predicting risks associated with UAS missions.</p> <p>Droneradar will expand its products portfolio with services targeting vertical industry needs, exploring new business model potentials. All the project use cases are considered relevant to this, through their application in C3 links, that are very important to the European U-space market.</p>
<b>INF</b>	<p>INFOLYSIS exploitation plan for 5G!Drones is focused on performing a comprehensive business model/market analysis with the intention of spotting the markets towards which 5G!Drones is targeted, their segmentation, existing competitor positioning, and all relevant emerging trends and key players. Parallel to this, the theoretical description and assessment of the market and financial feasibility of possible business models and alternative solutions (originating for the examined 5G!Drones use cases) that could be used to provide the project solution and services to the established stakeholders will be evaluated and potentially utilized from a business perspective. According to INFOLYSIS' marketing plan/strategy, the shipping industry is especially interested in the 5G expansion, with a focus on area surveillance by drones, IoT on vessels, and vast IoT opportunities over 5G with the help of various applications such as chatbots (which is the core commercial activity of INFOLYSIS). As a result of its involvement in 5G!Drones and the industry and market analysis conducted, INFOLYSIS will gain valuable 5G know-how and a major competitive advantage in the upcoming 5G market.</p>



Partner	Exploitation plan
	The project's results will profit and grow INF products and services (such as the INFOLYSIS chatbot platform), resulting in a competitive and innovative portfolio of 5G, IoT and chatbot apps.
<b>EUR</b>	EUR will exploit the work within 5G!Drones via its academic activities, strengthening its scientific and technical expertise in cutting edge research areas in which it is already very active, such as software- defined communication systems, cloud computing and NFV, mobile communication systems, network slicing and softwarisation, and edge computing, but also extending its know-how with respect to the UAV vertical industry. EURECOM's participation in 5G!Drones will allow it to channel this knowledge to its M.Sc. and Ph.D. programs, preparing its students and interns for work in advanced science and technology sectors and giving them the opportunity to carry out timely research. Moreover, 5G!Drones will contribute to OpenAirInterface and other related software projects EURECOM is leading, such as its Network Slicing and Multi-Access Edge Computing platforms, and will give the opportunity to test them in large-scale trials, increasing both their quality and visibility. EURECOM will also exploit the selection of the Sophia Antipolis site of the ICT-17 5G-EVE facility for 5G!Drones trials, enhancing the functionality of the facility to meet the needs of the UAV industry, and ensuring the utility of the platform well-beyond the end of the 5G-EVE project.
<b>NCSRD</b>	Participation in 5G!Drones is seen by DEMOKRITOS as a direct step toward establishing a strong research and scientific position in the field of future network architectures and management systems. 5G!Drones will be the platform for building on DEMOKRITOS' experience and expertise in novel 5G network infrastructures and related technologies (software networks, monitoring, and management) gained through involvement in various EU-funded ventures, as well as the Centre's strategic research interests. DEMOKRITOS will use the findings of the 5GDrones project in its study and in developing new subjects for PhD theses and dissertations for new graduate students interested in learning more about the project's key issues. Furthermore, DEMOKRITOS is home to the "Lefkipos" Technical Park, which houses many private companies in the fields of IT and telecommunications, where the results of the various vertical industry tests will be promoted and exploited with possible synergies and joint ventures. Toward that direction the prototype C2 over 5G components that is developed within the project is appropriately communicated to highly innovative SMEs of the UAV industry with scope the creation of joint ventures and privately-funded innovation actions.
<b>AU</b>	AU will exploit the main findings and outputs arising from 5G!Drones to strengthening its research and technical expertise in different fields related to UAVs and 5G. As an academic institution, AU is aiming to enrich its teaching activities at different levels. Incorporating different technological aspects of the project in the teaching content will allow exposing students to real-world technologies. The project results will be also exploited as a catalyser for further research projects in relevant scientific and technological areas. Moreover, AU will leverage the research findings from 5G!Drones to continuously evolve its network facility. In addition to ICT-17 facilities, 5G!Drones will make use of the X-Network trial site of AU. The testbed is part of the Finnish national project 5GTNF (5G Test Network Finland), which is an evolving ecosystem supporting 5G and beyond technology research and validation. The site is being refined to cover drone use cases.
<b>MOE</b>	MOE will try to exploit the capabilities that will be made available after the end of this project in order to drive development of community impacting applications and services. This will be working closely with the local community and companies. MOE will further

Partner	Exploitation plan
	<p>exploit the 5G!Drones project in order to develop novel services for the citizens of the city of Egaleo, mainly focusing to the social role of the municipality. In this case, drones will be used for medicine and other services delivery to socially vulnerable groups that would benefit from the seamless door-to-door delivery via a drone. This can be in the frame of municipal social services that the corresponding local authority can provide to its citizens. This service will be also extended to cover needs of citizens belonging to vulnerable groups of people concerning COVID-19, where such groups need to be isolated from interactions with other people, in order to exchange goods and medicine.</p> <p>Furthermore, within the 5G!Drones project, we will explore whether the municipal drone fleet can be subcontracted to various SMEs, or companies in order to fulfil product/services delivery across the municipality. This paradigm can not only benefit the local community in a direct manner, but also create an additional incentive for business opportunities across multiple layers of the ecosystem.</p>
<b>FRQ</b>	<p>Frequentis will use the 5G!Drones project to expand its portfolio with respect to Flight Information Management Systems for UAVs.</p> <p>The integration of Frequentis products in 5G!Drones trials will help to build a better marketing visibility and gain deeper insights by sharing experiences and valuable know-how between the Consortium members.</p> <p>Other objectives include generating awareness for the current Frequentis UAV product portfolio among the stakeholders, creating an efficient business model, and establishing a product roadmap based on the trials output. As innovation leader, Frequentis strives to achieve a technical progress with respect to 5G networks. Additionally, Frequentis attempts to showcase solution integrations based on agreed standards and regulations.</p>

## **5 CONCLUSION**

This document presents and analyses the performed relevant activities, compared to the initially WP5 planned activities of the 5G!Drones project and specifically these on communication, dissemination and showcasing, as well as exploitation. Plans and strategies presented in this document will be applied throughout the entire remaining project life-cycle and will be regularly updated and revised, if required, as per the upcoming new needs and requirements of the project. Any future revision in plans and strategies will be described in detail in the upcoming WP5 related deliverables.

D5.2 serves as a revision tool for the comparison of initially envisaged and factually performed communication, showcasing, dissemination and exploitation activities of the 5G!Drones team among the analysed 21 months project runtime. And by considering the project general ideas and objectives, specifically these covered by the current report, as well as the performance brought, an agile planning is being delivered.

The communication, showcasing and dissemination activities, as well as the exploitation preparation, during the past 21 project months, are to be summarized as follows: Going beyond the expectations and initially set goals, despite of the challenging COVID-19 pandemic, the project consortium achieved to generate an outstanding catalogue of cutting-edge innovative systemic approach elements in the 5G-driven VTOL UAVs operations context. The excellent project outcomes have been highly professionally placed and represented at high-level international communication and dissemination platforms and events.

The broad public acceptance and involvement, aimed as a long-term objective in terms of 5G communication technologies integration for the successful VTOL UAV operations, is being strengthened by the successful showcasing activities performed by the entire project team in the partner regions and showcase-sites among the participating EU countries.

The plan for the communication, showcasing, dissemination and exploitation achievements for the second term of the project is aiming even a more ambitious setting, incl. appearance of the project team and achievements at highest level media formats and events, as EUCNC/6G Summit, Commercial UAV Expo, Amsterdam Drone Week, as well as others. On the other side, the technical concepts' testing, demonstration and validation activities play a crucial role for the immediate and tangible communication and dissemination activities, and they prepare the ground for a follow-up exploitation, by involving interested relevant stakeholders for building up, integrating and operating the designed 5G!Drones systemic approach, consisting of a system of systems.

Looking forward to face challenging steps towards the 5G!Drones systemic approach elaboration, tests, integration, operation and management, covering both the UAV verticals and cutting-edge enabling communication technologies, the project team well understands the risks and has set a well-considered mitigation strategy, covering the communication, dissemination, showcasing and exploitation preparation activities.

The current mobility and transport systems are experiencing a reaching of their limits. Switching to a broad application of UAV verticals, often unmanned, and enabling their safe, sustainable and smooth operations by involving cutting-edge communication technologies solutions, is the only way for overcoming this challenge for our society. Therefore, reaching as broad as possible relevant stakeholder circles and unfolding the potential of this systemic approach at an early stage is crucial, both for the public acceptance success, but also for the successful system implementation. And it is obvious that in this sense the project consortium successfully reaches, and even exceeds the goals initially set.

Crucial will be for the second project term the precise definition and approaching of most relevant stakeholder groups and showcase opportunities' dissemination, so the efforts of the project consortium, the EC, as well as of the 5G-PPP framework could be optimally communicated and disseminated. And

this is the necessary basis for the latter successful exploitation of the innovative systemic approach of 5G!Drones.

## ANNEX 1 - 5G!DRONES Statistical Dashboards (M1-M21)

Below are provided the access links/URLs to the monthly statistical dashboards as issued at the end of each month of the period June 2019-February 2021.

### **Website Statistical Dashboards**

May - June 2019

<https://datastudio.google.com/open/17gT9-E38cRZ3vPYrGQR-zfJkWYxjrt72>

July 2019

<https://datastudio.google.com/open/1GGXsHyFSPEfkS7u-eW6CYX7VfkP60YTj>

August 2019

[https://datastudio.google.com/open/1Q\\_gmevH8aZOXpXJu2R6cPUA4Qf\\_hp4rA](https://datastudio.google.com/open/1Q_gmevH8aZOXpXJu2R6cPUA4Qf_hp4rA)

September 2019

[https://datastudio.google.com/open/1tvUPrl3RvBrlbS\\_evnsmsj0agDyhI30A](https://datastudio.google.com/open/1tvUPrl3RvBrlbS_evnsmsj0agDyhI30A)

October 2019

<https://datastudio.google.com/reporting/5bea16b8-92d4-44d8-a931-e10784355da1>

November 2019

<https://datastudio.google.com/reporting/37227ed0-d898-418c-887f-3751f072c374>

December 2019

<https://datastudio.google.com/reporting/8f1d1f14-076e-462c-a124-a216378e08b6>

January 2020

<https://datastudio.google.com/reporting/1ea561b3-3781-4461-b9f1-a14c2bca3eba>

February 2020

<https://datastudio.google.com/reporting/8b985bbc-c378-43dc-9ec1-35767f73cbca>

March 2020

<https://datastudio.google.com/reporting/edd03360-f855-4945-abdc-fc9d7e3c8907>

April 2020

<https://datastudio.google.com/reporting/b0eb991a-811d-4900-86d1-e79ce425dd55>

May 2020

<https://datastudio.google.com/reporting/86c8ac82-e96f-47ed-8390-51c69de5d486>

June 2020

<https://datastudio.google.com/reporting/1c1ed2b9-032d-492d-8250-d5b4f1d39cf1>

July 2020

<https://datastudio.google.com/reporting/366bbae0-0d21-4998-b0ce-dd21b39a2739>

August 2020

<https://datastudio.google.com/reporting/db21a0f3-7654-475f-bd19-c47c6817ad62>

September 2020

<https://datastudio.google.com/reporting/b19457f1-64df-4e55-b4b2-ee65e6cc89c9>

October 2020

<https://datastudio.google.com/reporting/46186db6-dd8d-4155-8766-08ec1d5ddaa9>

November 2020

<https://datastudio.google.com/reporting/72a3e39a-0039-429a-ae98-cddd8fe01414>



December 2020

<https://datastudio.google.com/reporting/aaa7f42b-9531-4dae-82da-b796c0b1841f>

January 2021

<https://datastudio.google.com/reporting/7fb70ce4-d953-4657-b98a-5a709e27d2b9>

February 2021

<https://datastudio.google.com/u/0/reporting/47dc56e8-67ed-406e-9446-528d4e49bb58>

### **Facebook Statistical Dashboards**

May - June 2019

[https://datastudio.google.com/open/1xaW\\_TEN4pAODnr7SYIU9YyetKe24R4Ei](https://datastudio.google.com/open/1xaW_TEN4pAODnr7SYIU9YyetKe24R4Ei)

July 2019

[https://datastudio.google.com/open/1EDWYw\\_g8G0As1x6ag3EgIRKf8WbjDKVX](https://datastudio.google.com/open/1EDWYw_g8G0As1x6ag3EgIRKf8WbjDKVX)

August 2019

<https://datastudio.google.com/open/1pxpKERyJI83FjecZMmSIErsRv4zMzXCp>

September 2019

<https://datastudio.google.com/open/1940b2fbAdFyeD-taMAjfpQw2EAMbAhBD>

October 2019

<https://datastudio.google.com/reporting/dcb4e181-2a11-4f15-bb94-fd5bc929c998>

November 2019

<https://datastudio.google.com/reporting/22df0211-2155-411d-8ed2-35e7acec559d>

December 2019

<https://datastudio.google.com/reporting/6bae0e95-2ef4-4494-bb7b-03c0036d2ec8>

January 2020

<https://datastudio.google.com/reporting/2f6fbdbd-f5b8-4d72-8360-0b993e69ff1f>

February 2020

<https://datastudio.google.com/reporting/967db57f-e2a5-4f6b-86c3-228e988eb64d>

March 2020

<https://datastudio.google.com/reporting/8ae6540f-e94f-4458-8bc3-e8ca18a6691d>

April 2020

<https://datastudio.google.com/reporting/4d7a4b7e-58ed-4b8b-a9de-136bfb792908>

May 2020

<https://datastudio.google.com/reporting/1ae723ca-3ca2-468f-97e9-cdaea78b4cdb>

June 2020

<https://datastudio.google.com/reporting/93d32319-823d-43f3-837c-e25234507506>

July 2020

<https://datastudio.google.com/reporting/79a224a2-d7ae-4240-bbc7-1d108ab2fcf9>

August 2020

<https://datastudio.google.com/reporting/a5ffdbba-c07f-47ce-ad12-0405025dd5e8>

September 2020

<https://datastudio.google.com/reporting/89a8ea6c-61a1-4ca5-8559-41de24aba492>

October 2020

<https://datastudio.google.com/reporting/3fdca610-e9d1-4517-8763-934a80ec636b>

November 2020

<https://datastudio.google.com/reporting/a7129956-cb07-4f77-83ca-5dd730270dc1>

December 2020

<https://datastudio.google.com/reporting/a31fcfe0-bb2a-4904-ac1d-7073b6c751bf>

January 2021

<https://datastudio.google.com/reporting/b743389c-2802-4a53-924f-6ca8ce0719c9>

February 2021

<https://datastudio.google.com/reporting/0d5f70c6-3385-4e1b-9c90-7919f5f865d0>

### **Twitter Statistical Dashboards**

May - June 2019

<https://datastudio.google.com/open/1G6ENy-Lb1R00iwGE6wLBKINIOvHnuRgg>

July 2019

[https://datastudio.google.com/open/1BeKVUEsVZ\\_teqV7jj5lD-mLpvGQ5-JtW](https://datastudio.google.com/open/1BeKVUEsVZ_teqV7jj5lD-mLpvGQ5-JtW)

August 2019

<https://datastudio.google.com/open/1G4G7DGrfwBbROPxb9qeblyjFjM4YV0L0>

September 2019

[https://datastudio.google.com/open/1GoDPq-dJoQ6807V-gr\\_EsWzb9UgwSR2a](https://datastudio.google.com/open/1GoDPq-dJoQ6807V-gr_EsWzb9UgwSR2a)

October 2019

<https://datastudio.google.com/reporting/8c180ef2-a450-439f-9579-2ccf58be5729>

November 2019

<https://datastudio.google.com/reporting/de7c3df0-9f41-45bf-9926-a754ea5aba86>

December 2019

<https://datastudio.google.com/reporting/93f8a9a1-ec15-423b-b40c-57fcb4345015>

January 2020

<https://datastudio.google.com/reporting/b6258003-b8ef-4591-91b5-49952ff97707>

February 2020

<https://datastudio.google.com/reporting/4a76646a-8838-47df-b9ce-31b3d646c0c6>

March 2020

<https://datastudio.google.com/reporting/ac7c58fd-b0ac-4d0c-8994-9e991f7e334f>

April 2020

<https://datastudio.google.com/reporting/96ce4e50-de3c-4965-8d24-f14ed34a5826>

May 2020

<https://datastudio.google.com/reporting/b7bad04e-4d7e-4fc5-9be4-89e58d5b5433>

June 2020

<https://datastudio.google.com/reporting/3a5f8be2-42ac-4080-a21d-0bea2498c607>

July 2020

<https://datastudio.google.com/reporting/fbd754bd-c05e-4157-bf5b-78a15bd536d5>

August 2020

<https://datastudio.google.com/reporting/7ba95fb2-0023-4f40-a84c-aed2e5cdfcde>

September 2020

<https://datastudio.google.com/reporting/090f1f86-6805-4127-80f6-0acc4d336607>

October 2020

<https://datastudio.google.com/reporting/24b31243-9bbd-48f3-ba2c-6dc96f3d91c7>

November 2020

<https://datastudio.google.com/reporting/60ca9f8f-911d-47ed-b8c1-ef01a08cc75c>

December 2020

<https://datastudio.google.com/reporting/77ce59d2-8b02-493b-9b98-157c3a642817>

January 2021

<https://datastudio.google.com/reporting/f07a8e64-e739-4522-8ec8-ac030d0ddaa6>

February 2021

<https://datastudio.google.com/reporting/0c5514af-66df-4056-894b-34c2c5993180>

### **LinkedIn Statistical Dashboards**

May - June 2019

<https://datastudio.google.com/open/1wSH07FBBeljqeZqeidiVNFdSImDRkKG>

July 2019

<https://datastudio.google.com/open/18WpQQCuCdsDHIMZ5pDQSCPQ68UoJ8xf>

August 2019

[https://datastudio.google.com/open/1M5DlrM-\\_ua0-BLhsEfH8wdA59LK9N0Nx](https://datastudio.google.com/open/1M5DlrM-_ua0-BLhsEfH8wdA59LK9N0Nx)

September 2019

<https://datastudio.google.com/open/13A85McdkV15b4gY0prfJnG1YAAAd7I9qf>

October 2019

<https://datastudio.google.com/reporting/7700e840-254a-4a43-ac2b-fcda7ee0f36b/page/IMxr>

November 2019

<https://datastudio.google.com/reporting/63f2f786-9089-483e-ac37-e59d0482d7f7>

December 2019

<https://datastudio.google.com/reporting/195ef29c-5598-4e08-9d28-273b7c0f5b81>

January 2020

<https://datastudio.google.com/reporting/48eafb7d-8c06-4063-bdeb-ab0efc1dd176>

February 2020

<https://datastudio.google.com/reporting/ac0bb7f8-0642-4a4b-9bef-81906ec0379e>

March 2020

<https://datastudio.google.com/reporting/c4769731-e0ff-42ff-8812-cf22b7f9e32b>

April 2020

<https://datastudio.google.com/reporting/b7b39dd9-bd04-4bbd-bcde-266f719cc30d>

May 2020

<https://datastudio.google.com/reporting/12f4032c-93cd-4a55-b84e-5c1eb329b7a6>

June 2020

<https://datastudio.google.com/reporting/86a37f93-46f5-4d74-afa2-ce76e34564bf>

July 2020

<https://datastudio.google.com/reporting/01073db5-8dad-4ad9-9b37-c7f4f6f729c1>

August 2020

<https://datastudio.google.com/reporting/87a043b9-e102-4811-9e3c-c5404120adf3>

September 2020

<https://datastudio.google.com/reporting/937974db-6add-4dd1-84f2-fa0543a2da5b>

October 2020

<https://datastudio.google.com/reporting/dd8775d3-12a8-4b92-aace-842fd385150b>

November 2020

<https://datastudio.google.com/reporting/e9e2b649-4253-4fdb-ae9-37b659cdd46c>

December 2020

<https://datastudio.google.com/reporting/ec891ea5-051a-4f98-ab79-9ebe90c48273>

January 2021

<https://datastudio.google.com/reporting/fadefb72-4e01-4ff8-b1fa-00bd83a4a20e>

February 2021

<https://datastudio.google.com/reporting/cae900fe-5d39-4628-83ba-38b983e290a5>

### **Instagram Statistical Dashboards**

May - June 2019

<https://datastudio.google.com/open/1CuOHMc6CrDkpr6Q603gAFT84ojl7h1YQ>

July 2019

<https://datastudio.google.com/open/1BaldDyv8oVP369hAXl-PCun5cxH7heIU>

August 2019

<https://datastudio.google.com/open/14pIGHbWxEaHjxlpxyB-SGhGQ2pDXVYNR>

September 2019

<https://datastudio.google.com/open/1-6MaLAQnmbViQ2Oinqdf1ehRtG72Jd48>

October 2019

<https://datastudio.google.com/reporting/9de12dd9-90cd-4e50-a627-d23a7fff190>

November 2019

<https://datastudio.google.com/reporting/9cf7fac9-e9b7-4793-870c-ac96480e0e50>

December 2019

<https://datastudio.google.com/reporting/de4be22c-ad6d-4507-81b4-2ccf3c2e626e>

January 2020

<https://datastudio.google.com/reporting/14fb1010-2fb0-46f7-aa21-8293045dddc3>

February 2020

<https://datastudio.google.com/reporting/f5d515ef-54e1-480f-92c4-4b20d5a37c97>

March 2020

<https://datastudio.google.com/reporting/8ae6540f-e94f-4458-8bc3-e8ca18a6691d>

April 2020

<https://datastudio.google.com/reporting/05b60102-6898-492d-82c5-7696f60a35b1>

May 2020

<https://datastudio.google.com/reporting/b9616c2a-6a67-44d8-9674-c68bebadbd5a>

June 2020

<https://datastudio.google.com/reporting/bb75edbb-7377-4c90-bd74-c3308acd1ba4>

July 2020

<https://datastudio.google.com/reporting/f7ab0c97-7a17-4101-9995-7ebb91eee442>

August 2020

<https://datastudio.google.com/reporting/00923fa0-20d4-49cb-abdd-8ecbc4313d18>

September 2020

<https://datastudio.google.com/reporting/422aa662-5f18-4d13-8e7d-c3ce3c991dbd>

October 2020

<https://datastudio.google.com/reporting/ba9b6d60-b002-40ea-8e3a-7bcc06341166>

November 2020

<https://datastudio.google.com/reporting/a63a2ae7-85e2-4a84-9c7b-4b7b8be03680>

December 2020

<https://datastudio.google.com/reporting/3d075e1a-59b8-4c33-9f8d-4c45d42bb6f5>

January 2021

<https://datastudio.google.com/reporting/682275c0-7c5c-456d-a6bd-ad497a499fc1>

February 2021

<https://datastudio.google.com/reporting/89aa0599-23e9-4353-8f7b-d0639af14b82>



## ANNEX 2 – NEWSLETTER RELEASED ISSUES

During the period June 2019 - February 2021, 7 5G!Drones Newsletter issues have been published (all of the available online through the 5G!Drones website and social media channels):

Issue 1: June - August 2019

<https://5gdrones.eu/wp-content/uploads/2019/09/5GDrones-Newsletter-Issue-1.pdf>

Issue 2: September – November 2019

<https://5gdrones.eu/wp-content/uploads/2019/12/5GDrones-Newsletter-Issue-2.pdf>

Issue 3: December – February 2019:

<https://5gdrones.eu/wp-content/uploads/2020/03/5GDrones-Newsletter-Issue-3-v1.0.pdf>

Issue 4: March – May 2020:

<https://5gdrones.eu/wp-content/uploads/2020/06/5GDrones-Newsletter-Issue-4-v1.0.pdf>

Issue 5: June – August 2020

<https://5gdrones.eu/wp-content/uploads/2020/09/5GDrones-Newsletter-Issue-5-v1.0.pdf>

Issue 6: September – November 2020

<https://5gdrones.eu/wp-content/uploads/2020/12/5GDrones-Newsletter-Issue-6-v1.0.pdf>

Issue 7: December – February 2021

<https://5gdrones.eu/wp-content/uploads/2021/03/5GDrones-Newsletter-Issue-7-v1.0.pdf>

Issue 8: March – May 2021

(Under editing)

## References

- [1] Osterwalder, A. (2014). Value proposition design: how to create products and services customers want. John Wiley and Sons.
- [2] Osterwalder, A., & Pigneur, Y. (2013). Designing business models and similar strategic objects: the contribution of IS. Journal of the Association for Information Systems, 14(5), 237-244.
- [3] Osterwalder, A., & Pigneur, Y. (2010). Business model generation: a handbook for visionaries, game changers and challengers. John Wiley & Sons.
- [4] <https://5gdrones.eu/wp-content/uploads/2020/01/D5.1-Communication-showcasing-dissemination-and-exploitation-plan-and-standardization-roadmap.pdf>