BUBBLES at a Glance

30 months

May 2020 — October 2022

5 partners
→
4 countries

H2020-SESAR-2019-2
Work programme

BUBBLES™ PARTNERS

UNIVERSIDADE Đ COIMBRA

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

EUROCONTROL

indra

SAPIENZA UNIVERSITÀ DI ROMA

https://bubbles-project.eu/

This unique combination will maximize the project impact and future market development.

BUBBLES Objectives

The **main goal** of BUBBLES is to formulate and validate **a Concept of Operations for providing separation management by means of the U-space**, defining the basic blocks supporting it and describing how they must be assembled and operated.

Develop	**Validate**	**Promote**
procedures to define separation minima and methods for UAS suitable to operations in a U3 environment, safety and performance requirements and methods for compliance assessment.	BUBBLES separation management concept by executing simulations and flight trials using a representative variety of UAS in a suitable environment and the methods for assessing the compliance with the defined requirements.	the public embracement of UAS and their applications by making the stakeholders and general public aware of the safety levels that can be attained through the separation management provision.

BUBBLES Results I

1.- TLS specification.

- **Overall TLS** for the U-space of **1e-6 FAT/FH**.
- **Specific TLS for MAC** due to human/operational issues of **2.5e-7 FAT/FH**.

2.- Traffic classification.

Traffic characteristics			Traffic class
Unmanned Open	Non-carrying people	A1	I
		A2	II
		A3	III
Unmanned Specific		SAIL I-II	IV
		SAIL III-IV	V
		SAIL V-VI	VI
Unmanned Certified	Carrying people	No passenger	VII
		Passenger	VIII
Manned Certified		VFR	IX
		IFR	X

3.- Scenario definition.

UAS Density / Airspace Type	Low	Medium	High
Uncontrolled	UC_LD	UC_MD	UC_HD
Controlled	C_LD	C_MD	C_HD
Airport Environment	APT_LD	APT_MD	APT_HD

Traffic Class		Mix %
Open	A1	4,00%
	A2	5,00%
	A3	2,00%
Specific	SAIL I-II	12,00%
	SAIL III-IV	46,00%
	SAIL V-VI	30,00%
Certified	No pass.	0,80%
	Pass.	0,20%
Manned	VFR	0,00%
	IFR	0,00%

Scenario of 25km² with 3FL between 20m and 120m. N=15 UAS/layer

4.- F(MAC)_max computation (mitigated).

$$F(MAC)_{max} = 2.37 \times 10^{-06}$$

F MAC	F NMAC	F IC	F SL	F TC
2,03E-06	2,23E-04	1,60E-01	9,47E-01	3,64E+01

60 m ≤ **SP_min** ≤ 260 m
165 m ≤ **TC_thr** ≤ 820 m
3 Vertical layers.

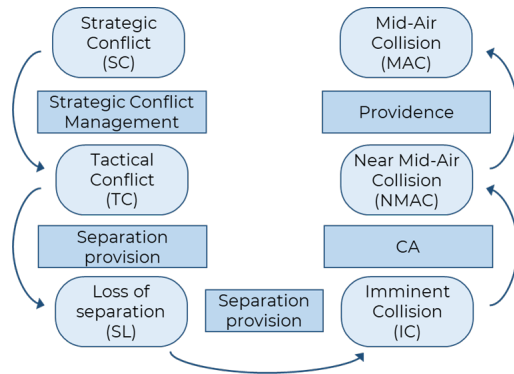$$N_{ref} = 17.35 \; UAS/layer$$

ALS: one fatality every 8 years.

5.- Risk Ratios.

BUBBLES Results II

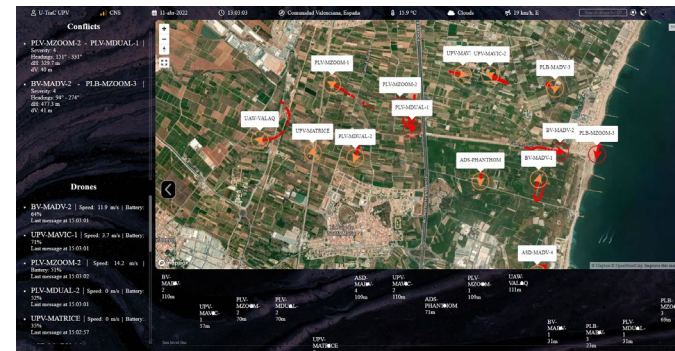**4.- F(MAC)_max computation (mitigated).**
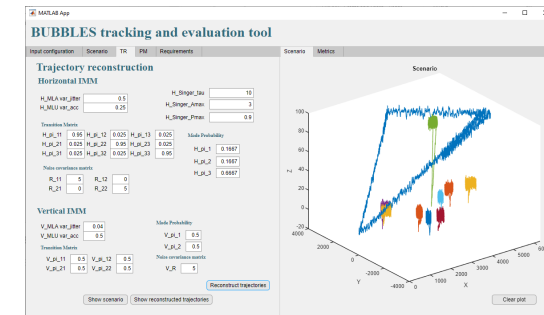
5.- Risk Ratios.

6.- SPR

7.- Performance monitoring tool

	MAC	NMAC	IC	SL	TC
RR Strategic	0,040	0,008	0,681	0,919	0,989
RR Tactical	0,050	0,100	0,130	0,150	1
RR CA	0,5	0,5	1	1	1

Strategic Conflict (SC)

Strategic Conflict Management

Tactical Conflict (TC)

Separation provision

Loss of separation (SL)

Separation provision

Mid-Air Collision (MAC)

Providence

Near Mid-Air Collision (NMAC)
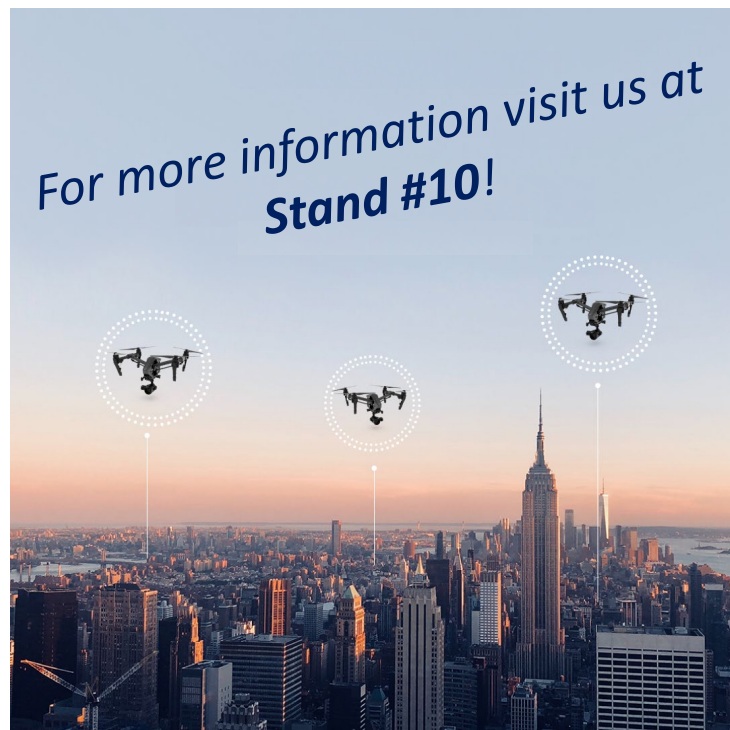
CA

Imminent Collision (IC)

Validated beyond TRL2/V1
Not yet at TRL4/V2

BUBBLES Contact details

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EU Drone Days
Brussels, 29-30 November 2022