

Nuovi paradigmi di mobilità aerea: scenari di impiego e implicazioni tecnologiche e normative

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Summary

- Overview of new scenarios for air mobility
- National and European regulation schedule
- The technical and design challenges
- NATO Applied Vehicle Technology (AVT) group 233

New aerial mobility



- Goods transportation and delivery
- Medical emergency services (blood, organs, life-saving drugs...)
- Human mobility (aerotaxis, flying buses)
- Environmental monitoring
- Monitoring of infrastructures
- Surveillance

From *Study on the societal acceptance of Urban Air Mobility in Europe*, EASA 2022

New aerial mobility



UBER Elevate

Fast-Forwarding to a
Future of On-Demand
Urban Air Transportation

October 27, 2016



Amazon Prime Air seeks FCC to authorise 60-64 GHz band
collision avoidance system bandwidth operations

- High interest from private and public operators
- Major implications on business plans and commercial system evolution

High pressure on regulation authorities

High impact on urban communities

New aerial mobility

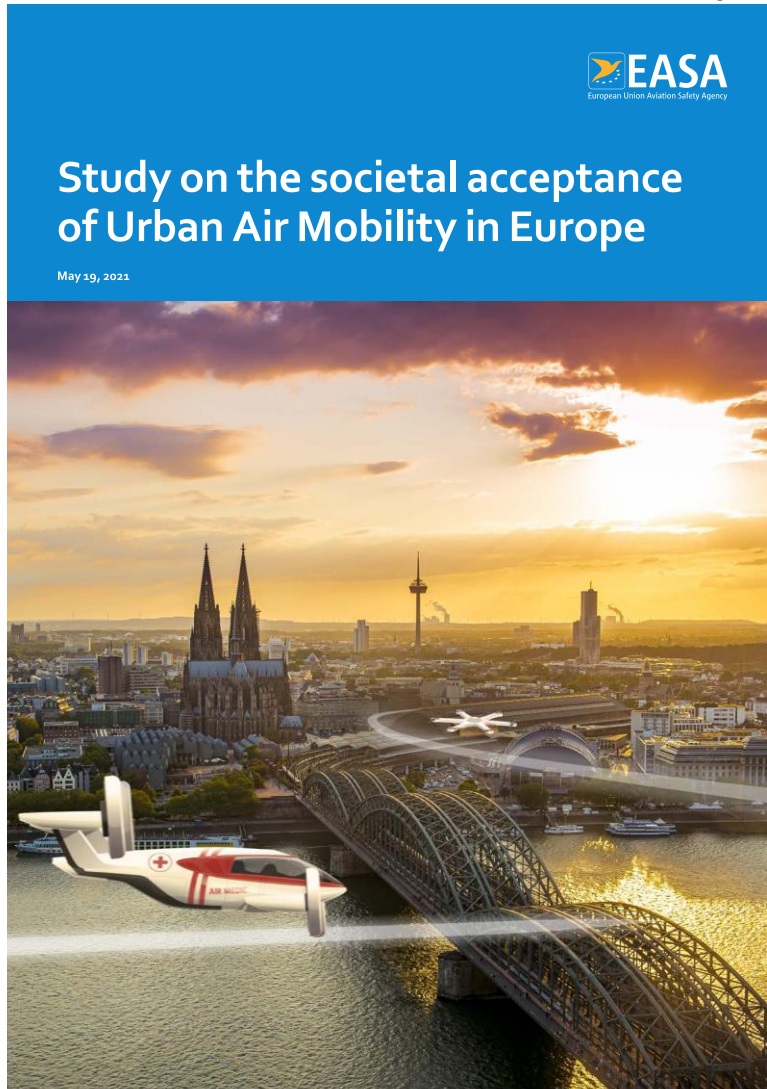


From www.nasa.gov

A revolution for urban and sub-urban communities !

- Personal Mobility
- Real estate value and development
- Urban planning
- Completely different *soundscape*

New aerial mobility



In this context, **societal acceptance** is a concern of regulation authorities.

New aerial mobility

UAV Development roadmap



Noise source level

- Quick models for noise source evaluation
- Tests in anechoic wind tunnel for validation
- Investigate the benefit of enhanced models developed elsewhere
- Noise reduction techniques



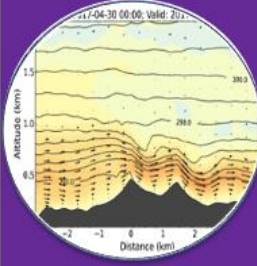
System level

- Shielding & Acoustic Installation Effects
- Perform static test in anechoic rooms for validation purpose
- System Integration
- Noise mitigation systems
- Flight test demonstration



Propagation effects

- Ground effects in Urban Environment
- Integrated tools for in-flight aircraft prediction including complex trajectories / Urban environment
- Validate methodology through testing



Trajectory impact on Noise

- Investigate low-noise trajectories
- Operational constraints
- Propose methodology for defining low-noise impact trajectories

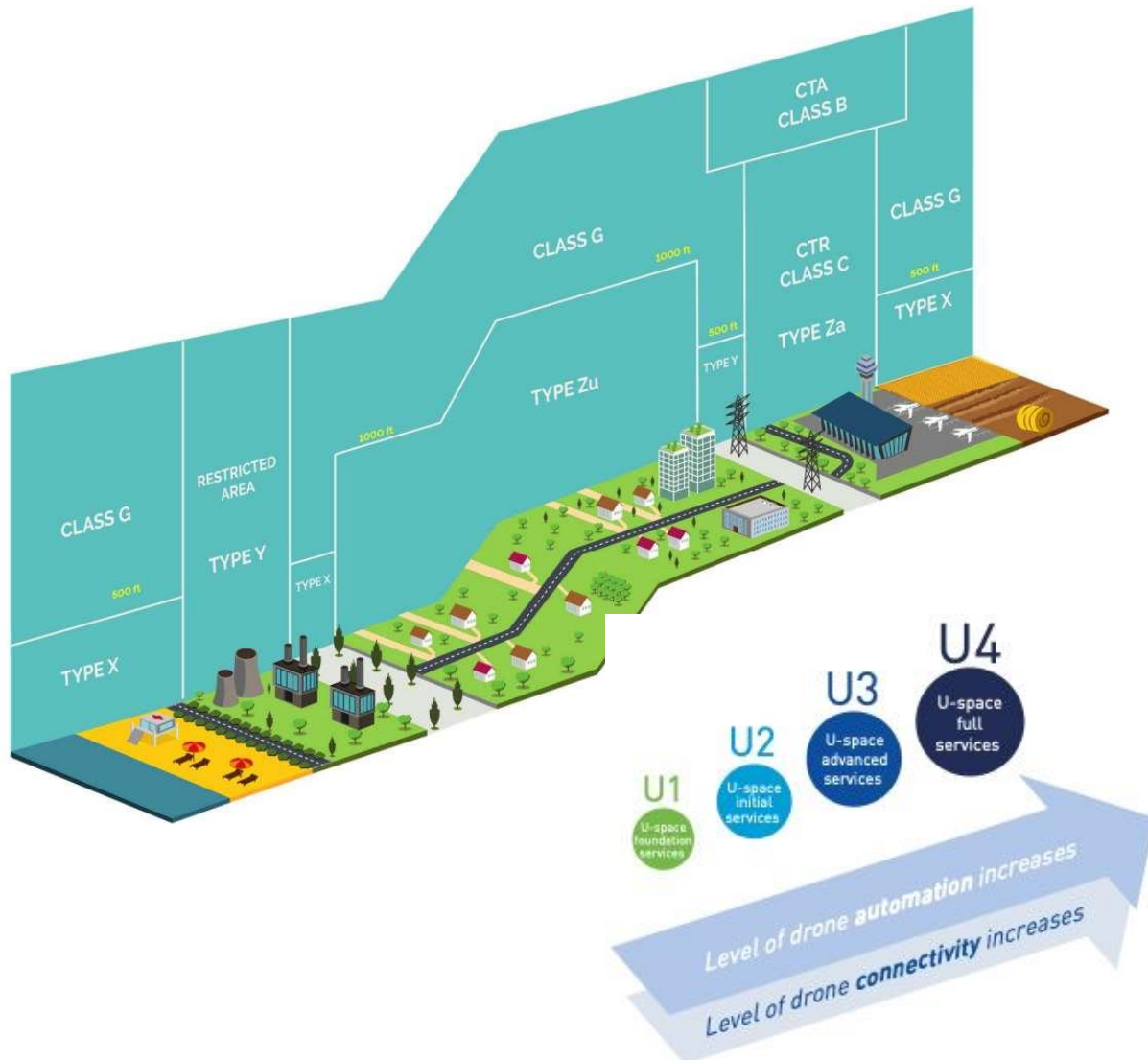


Public acceptance

- Psychoacoustic surveys
- Public acceptance including non-acoustic factors
- Define strategies for low impact on citizens
- Regulation

In this context, **societal acceptance** is a concern of regulation authorities.

The U-space concept



U-space is a set of services to **guarantee the safe integration of traditional air traffic with that of UAS.**

UTM zones:

- **X** - No conflict resolution service is offered
- **Y** - Pre-flight (“strategic”) conflict resolution is offered only
- **Z** - Pre-flight (“strategic”) conflict resolution and in-flight (“tactical”) conflict resolution are offered

Progressive entry into service.
 Connettivity and automation are key words

Drones typologies (aero-design viewpoint)



multicopters



Fixed wing



Hybrid

Drones typologies (aero-design viewpoint)

- Drugs delivery

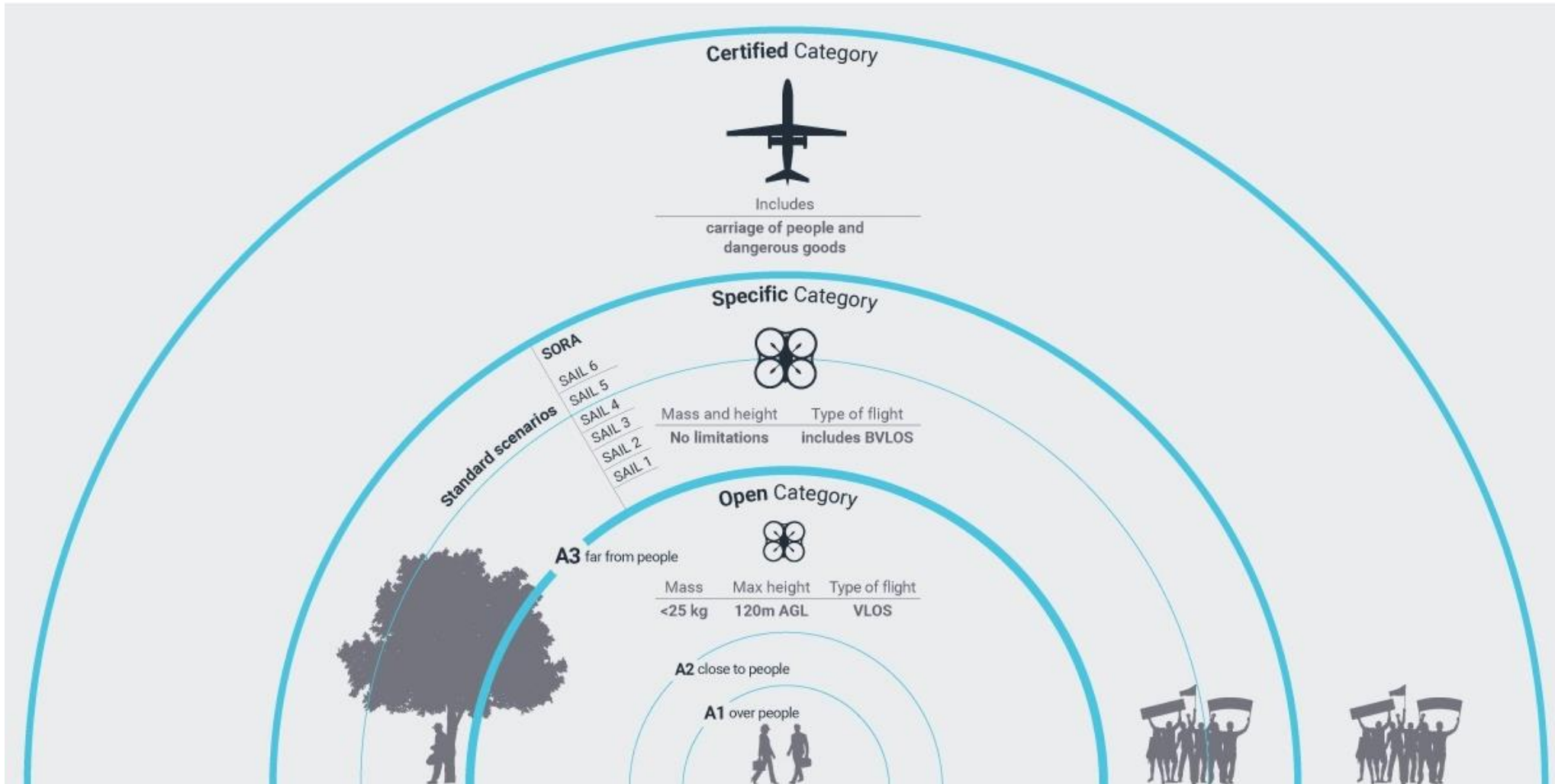


- Organs delivery

- Air Ambulance



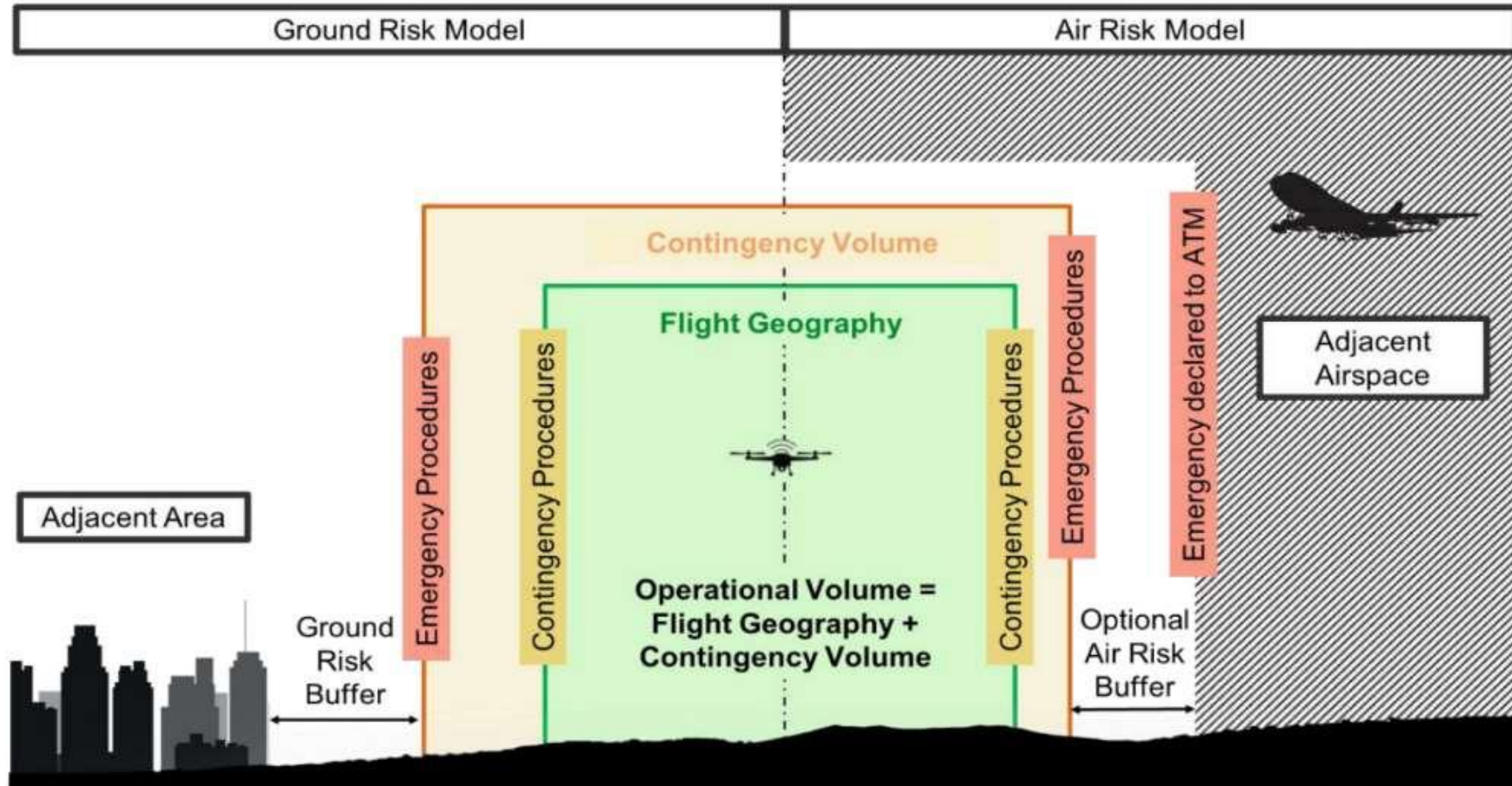
Operations categories



Operations categories (open limited)

UAS	Operation		Drone Operator/pilot		
Max weight	Subcategory	Operational restrictions	Drone Operator registration	Remote pilot competence	Remote pilot minimum age
< 250 g	A1 (can also fly in subcategory A3)	<ul style="list-style-type: none"> - No flying expected over uninvolved people (if it happens, should be minimised) - no flying over assemblies of people 	No, unless camera / sensor on board and a drone is not a toy	- no training needed	No minimum age
< 500 g			Yes	<ul style="list-style-type: none"> - read user manual - complete the training and pass the exam defined by your national competent authority 	16*
< 2 kg	A2 (can also fly in subcategory A3)	<ul style="list-style-type: none"> - no flying over uninvolved people - keep horizontal distance of 50 m from uninvolved people 	Yes	<ul style="list-style-type: none"> - read user manual - complete the training and pass the exam defined by your national competent authority 	16*
< 25 kg	A3	<ul style="list-style-type: none"> - do not fly near or over people - fly at least 15m from residential, commercial or industrial area 	Yes	<ul style="list-style-type: none"> - read user manual - complete the training and pass the exam defined by your national competent authority 	16*

SORA (Specific Operations Risk Assessment)



SAIL (Specific Assurance and Integrity Level)

The SAIL represents the level of confidence that the UAS operation will remain under control.

Depends on

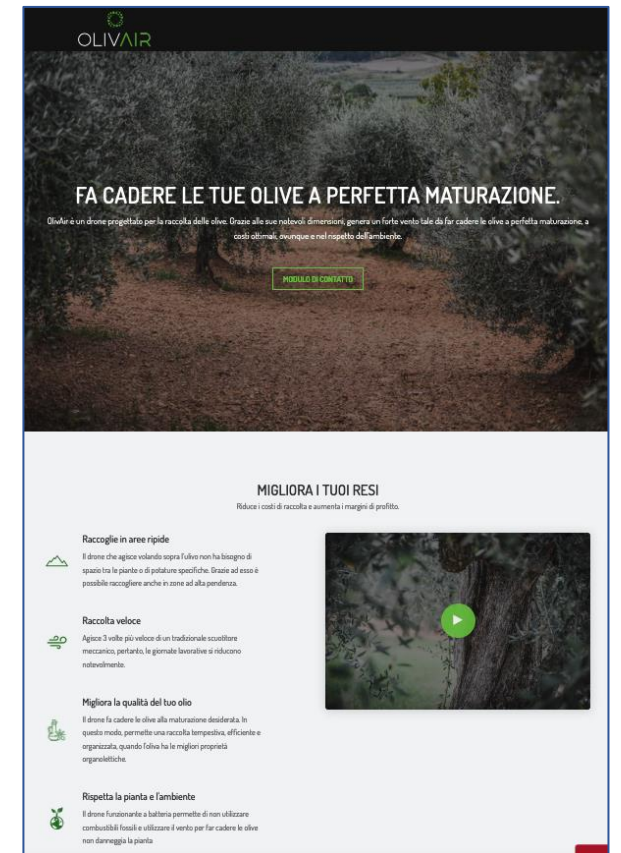
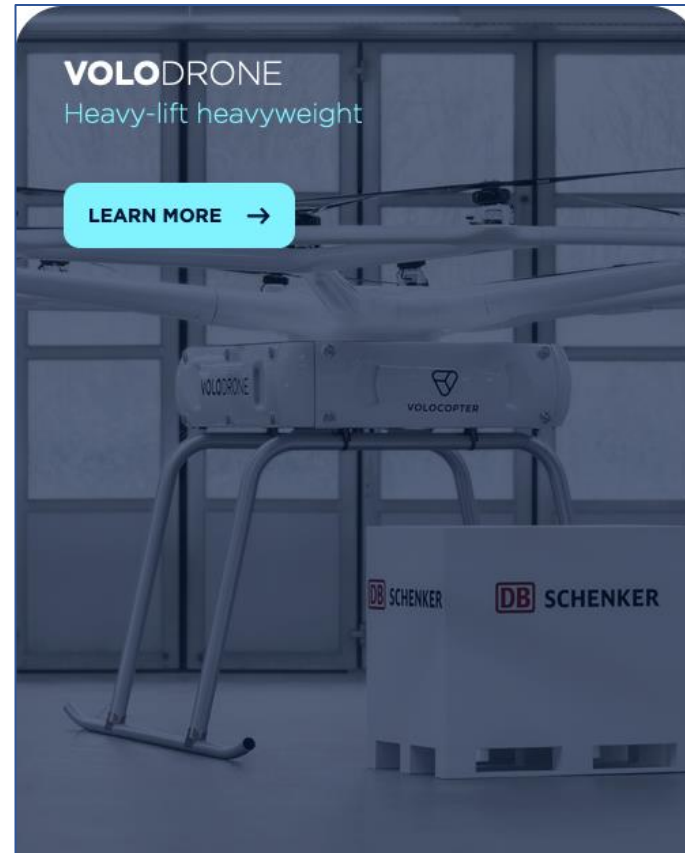
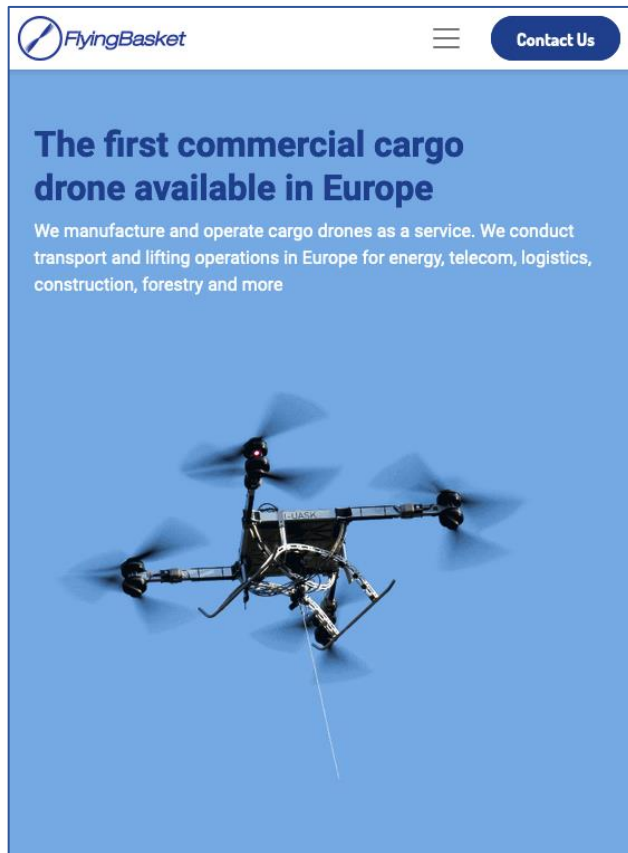
- GRC Ground Risk Class
- ARE Aerialim Risk Class

SAIL Determination				
	Residual ARC			
Final GRC	a	b	c	d
≤2	I	II	IV	VI
3	II	II	IV	VI
4	III	III	IV	VI
5	IV	IV	IV	VI
6	V	V	V	VI
7	VI	VI	VI	VI
>7	Category C operation			

Technical and design challenges (some of the...)

- Gravimetric and volumetric energy storage density for electric propulsion;
- Noise emissions (intensity and directivity!!)
- Automation and connectivity
 - UAS-to-UAS, UAS-to-GRD, UAS-to-A/C
 - Large swarms
- Aeronautical-standards-certified design and manufacturing for robustness and reliability of heavy duty drones (also in presence of uncertainties)
- ...

Technical and design challenges (some of the...)



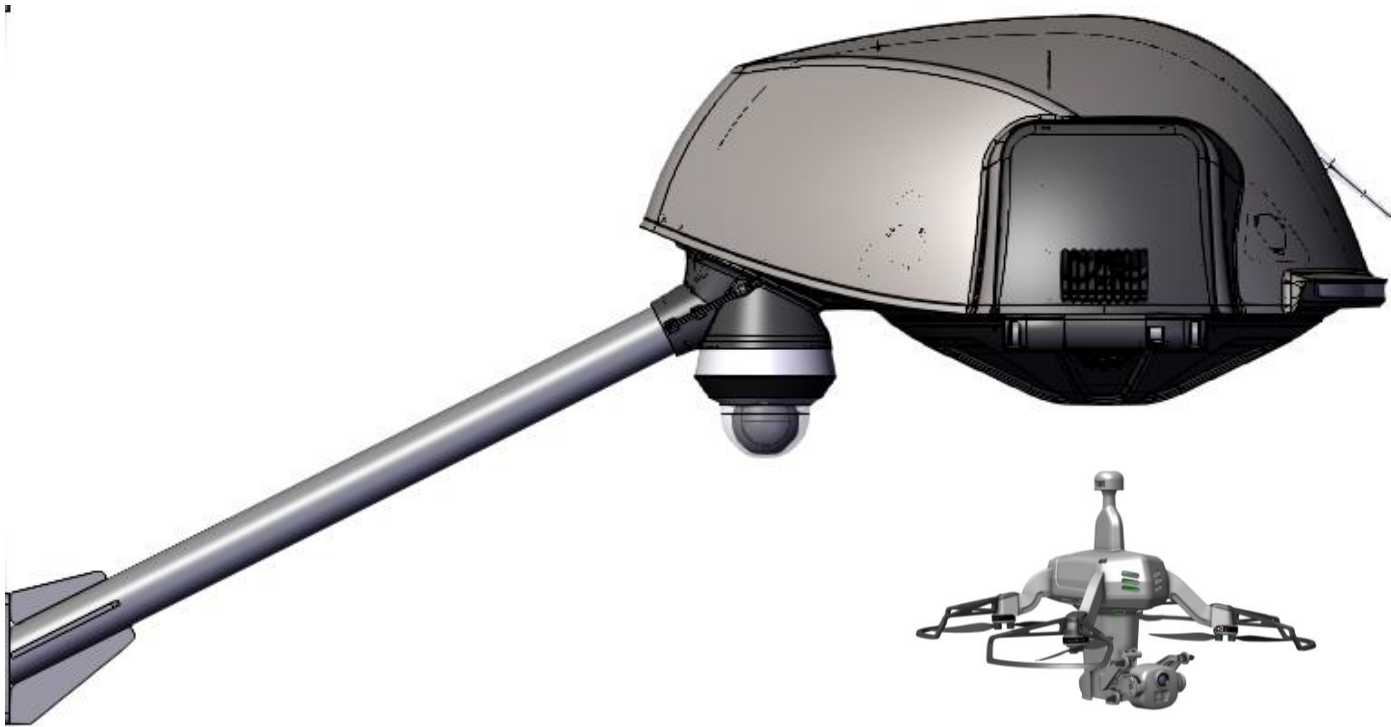
Heavy multicopters for civil applications

Technical and design challenges (some of the...)



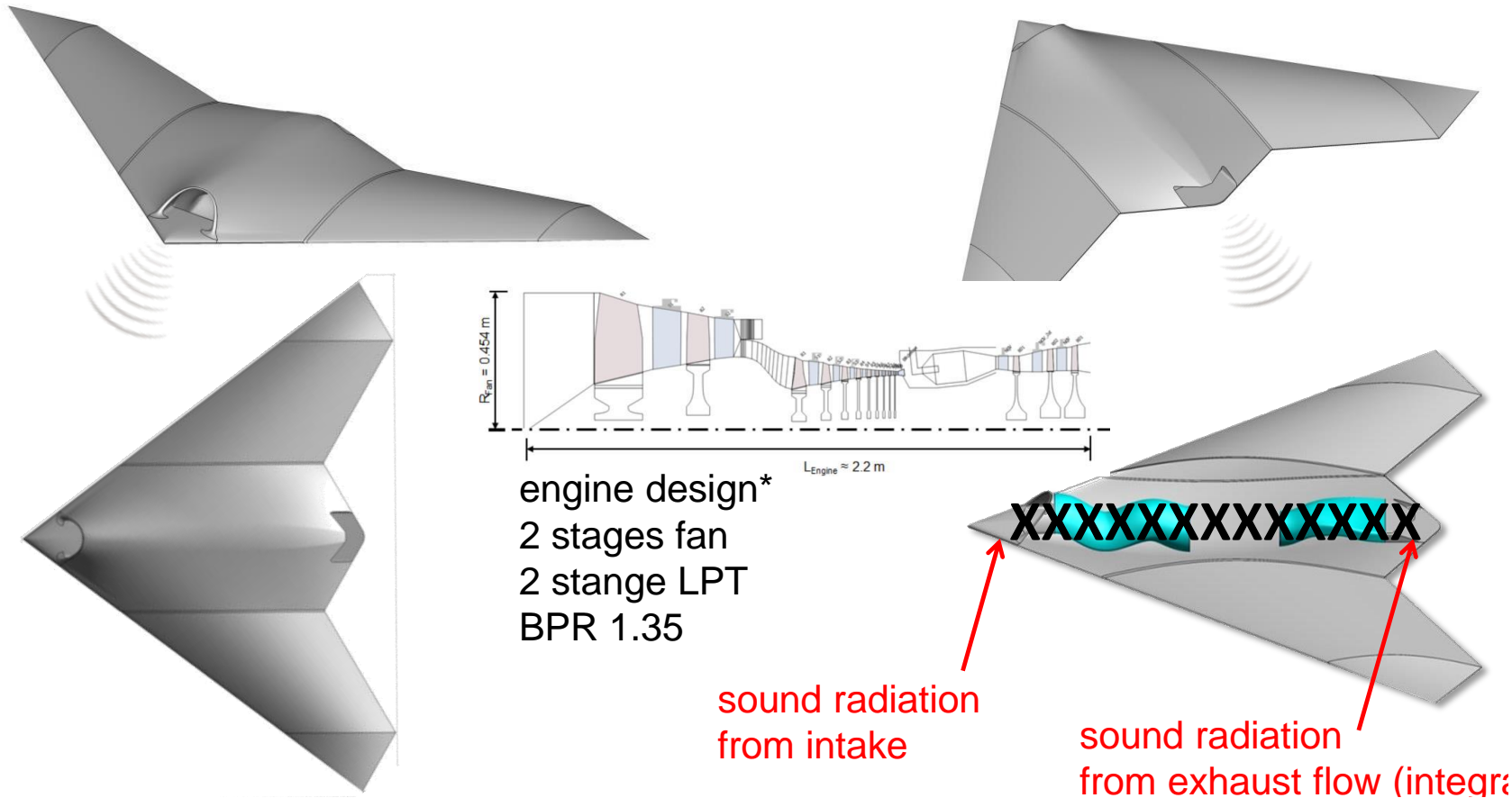
Volocity operation in Rome ready by 2024

Technical and design challenges (some of the...)



Dronus Nest[®]
concept for
surveillance

The NATO AVT 251/318 panel



Design (251) and
aeroacoustic
assessment (318) of
an attack drone.

A commitment for educators

Next generation of engineers must be prepared and trained for this challenge.

2022 Students' Projects

Masters in Aeronautical Engineering – Roma Tre

Air Bombero	Wildfire detection of large wild areas
DM Rush	Medical delivery (drugs, organs)
Moltres	Agridrone for olives harvesting
WildFireUAV	Wildfire suppression STOL UAV
Poseidon	Ocean temperature monitoring
Fair-Prandtl	Unconventional medium range AC

Almost all students' projects focused on drones for civil services

A commitment for educators

New program in Roma Tre University to cope with this challenge...



CONTATTI

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ROMA TRE **INGEGNERIA**
UNIVERSITÀ DEGLI STUDI DIPARTIMENTO DI ECCELLENZA

DIPARTIMENTO DI INGEGNERIA

INGEGNERIA DELLE TECNOLOGIE AERONAUTICHE E DEL TRASPORTO AEREO

OBIETTIVI FORMATIVI

L'Università Roma Tre propone un percorso innovativo orientato all'ingegneria aeronautica, con l'inclusione di competenze trasversali dettate dalla moderna evoluzione della tecnologia e delle applicazioni.

Questo corso di laurea triennale coniuga le conoscenze tipiche di una robusta preparazione di base nei settori dell'ingegneria aeronautica e industriale (sono presenti corsi riguardanti strutture aeronautiche, aerodinamica, propulsione convenzionale ed elettrica, meccanica del volo, materiali aeronautici convenzionali e innovativi), con l'acquisizione di competenze nell'ambito dei trasporti, delle infrastrutture e della logistica di interesse nel settore aeronautico, e della gestione di sistemi complessi con l'uso di tecniche di intelligenza artificiale, machine learning, ottimizzazione multi-obiettivo, big-data e data-analytics.

L'assetto formativo che si propone agli allievi ingegneri è ispirato dagli attualissimi temi di interesse che riguardano l'ecosostenibilità dell'aviazione e lo sviluppo di nuovi servizi di trasporto aereo in aree urbane e suburbane, mediante l'utilizzo di velivoli di nuova concezione, anche a guida autonoma.

INTERNAZIONALIZZAZIONE

- Preparazione nella lingua inglese a livello B2
- Ampia disponibilità di sedi per soggiorni ERASMUS

Thank you for your attention

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