EASA
European Union Aviation Safety Agency

SORA

Specific operation risk assessment

Your safety is our mission.

An Agency of the European Union

Διάλεξη Ναυάρχου (ε.α.) Κ. Χρηστίδη

ΣΕ ΠΟΙΟΥΣ ΚΙΝΔΥΝΟΥΣ ΑΠΕΥΘΥΝΕΤΑΙ Η ΜΕΘΟΔΟΛΟΓΙΑ SORA

ΠΡΟΣΤΑΣΙΑ ΑΠΟ

- **Θανάσιμους τραυματισμούς σε τρίτους στο έδαφος**
- **Θανατηφόρα τραύματα σε τρίτους στον αέρα**

ΕΜΠΛΕΚΟΜΕΝΑ ΠΡΟΣΩΠΑ (Λαμβάνουν μέρος στην επιχείρηση UAV)

Προστατεύεται με τον καθορισμό ασφαλών λειτουργικών διαδικασιών

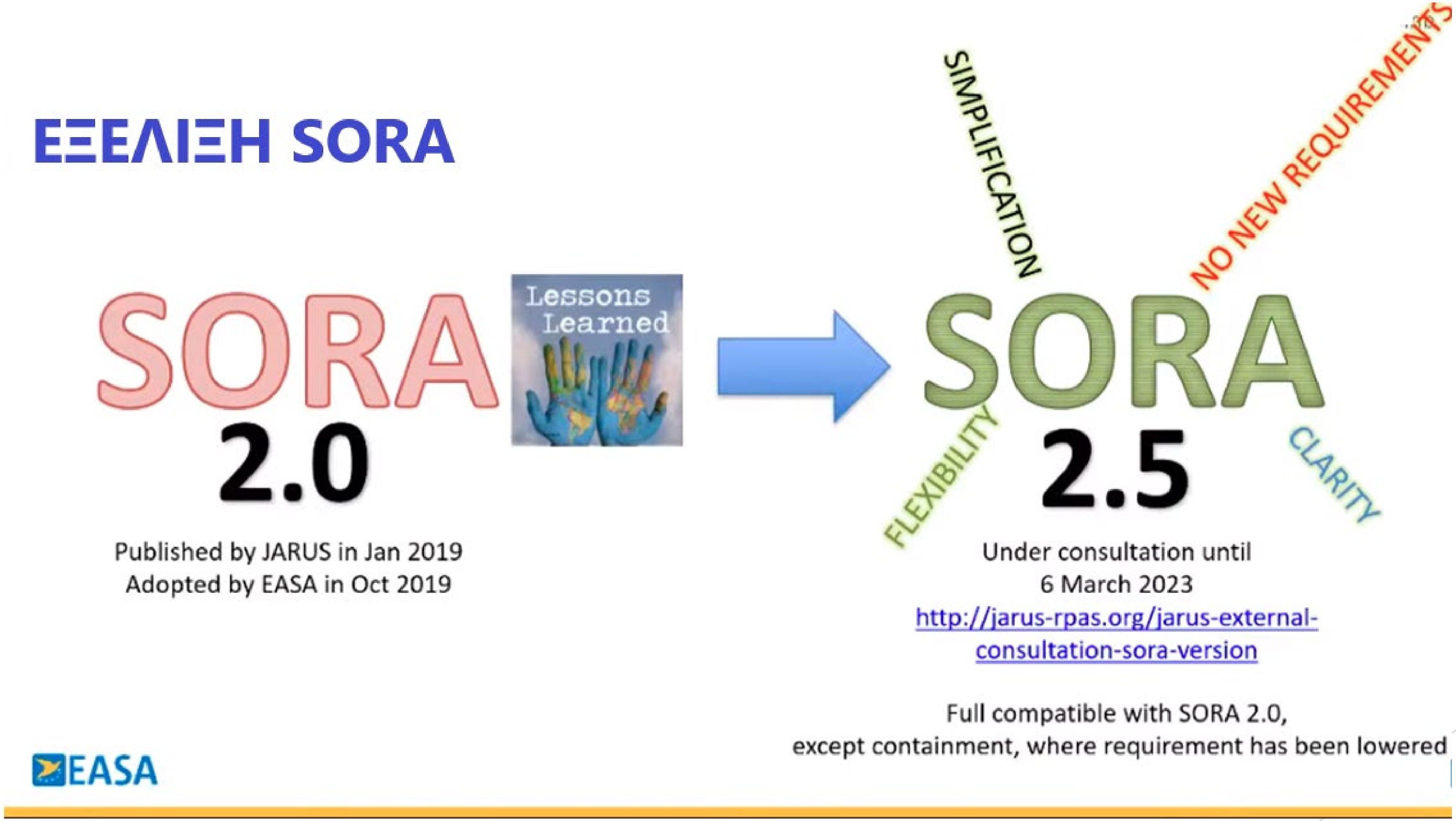
ΜΗ εμπλεκομενα Πρόσωπα

Προστατεύεται από "μετριασμούς" και ασφάλεια που εξάγονται από SORA

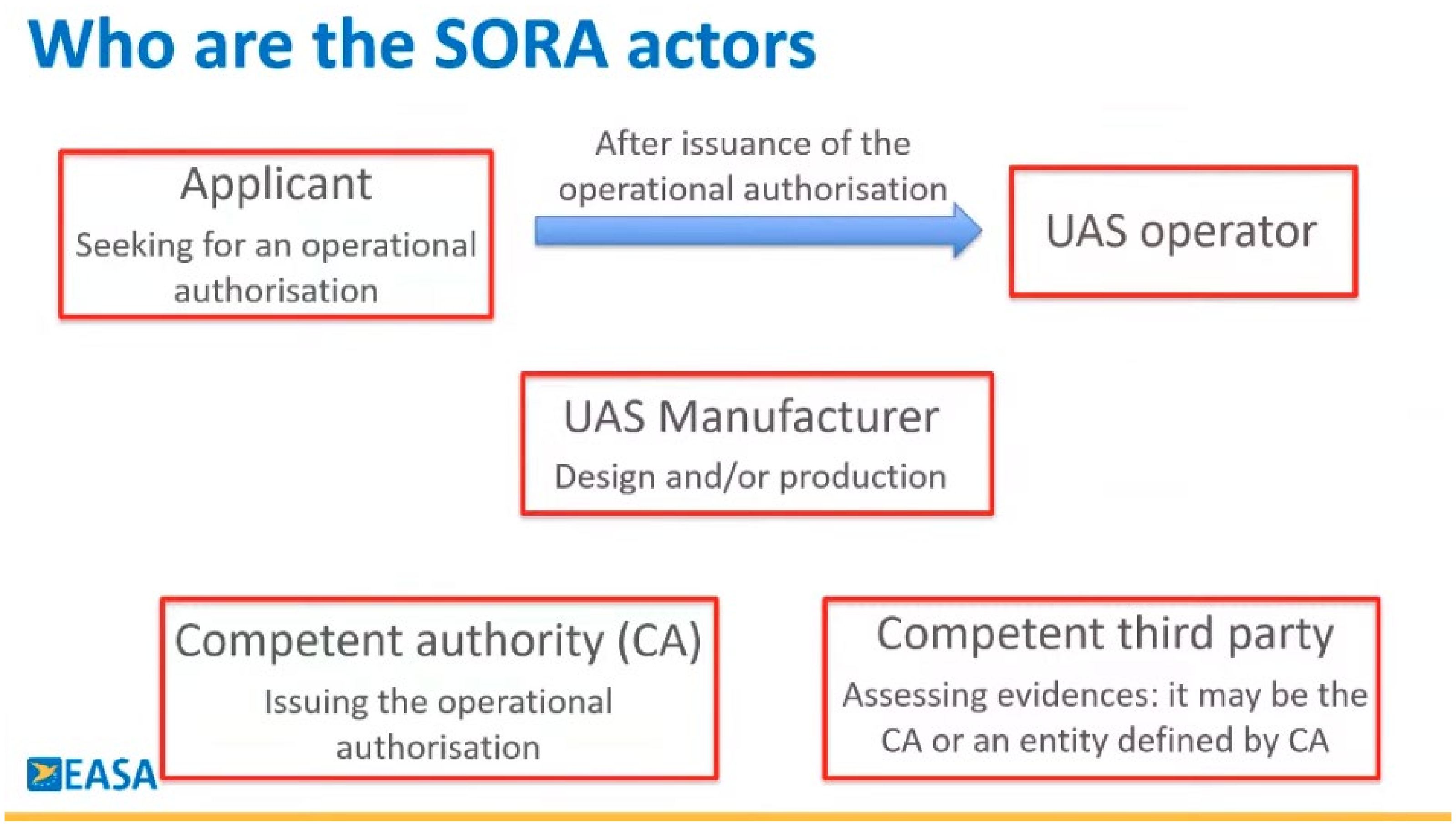
Διάλεξη Ναυάρχου (ε.α.) Κ. Χρηστίδη

ΣΕ ΠΟΙΟΥΣ ΚΙΝΔΥΝΟΥΣ <u>ΔΕΝ</u> ΑΠΕΥΘΥΝΕΤΑΙ Η ΜΕΘΟΔΟΛΟΓΙΑ SORA

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA (2.0 ➡ 2.5)



ΕΜΠΛΕΚΟΜΕΝΟΙ ΠΑΙΚΤΕΣ SORA



ΔΟΜΗ SORA 2.0

SORA 2.0 Structure (AMC 1 Art. 11 Reg 2019/947)

- → **Main body**: description of the SORA process
- → **Annex A**: *Conops*, New version was consulted by JARUS in March 2022. Final version in development. It will be renamed into 'Operator manual'
- → **Annex B**: Ground risk mitigations
- → **Annex C**: Air risk strategic mitigations
- → **Annex D**: Air risk tactical mitigations
- → **Annex E**: operational safety objectives

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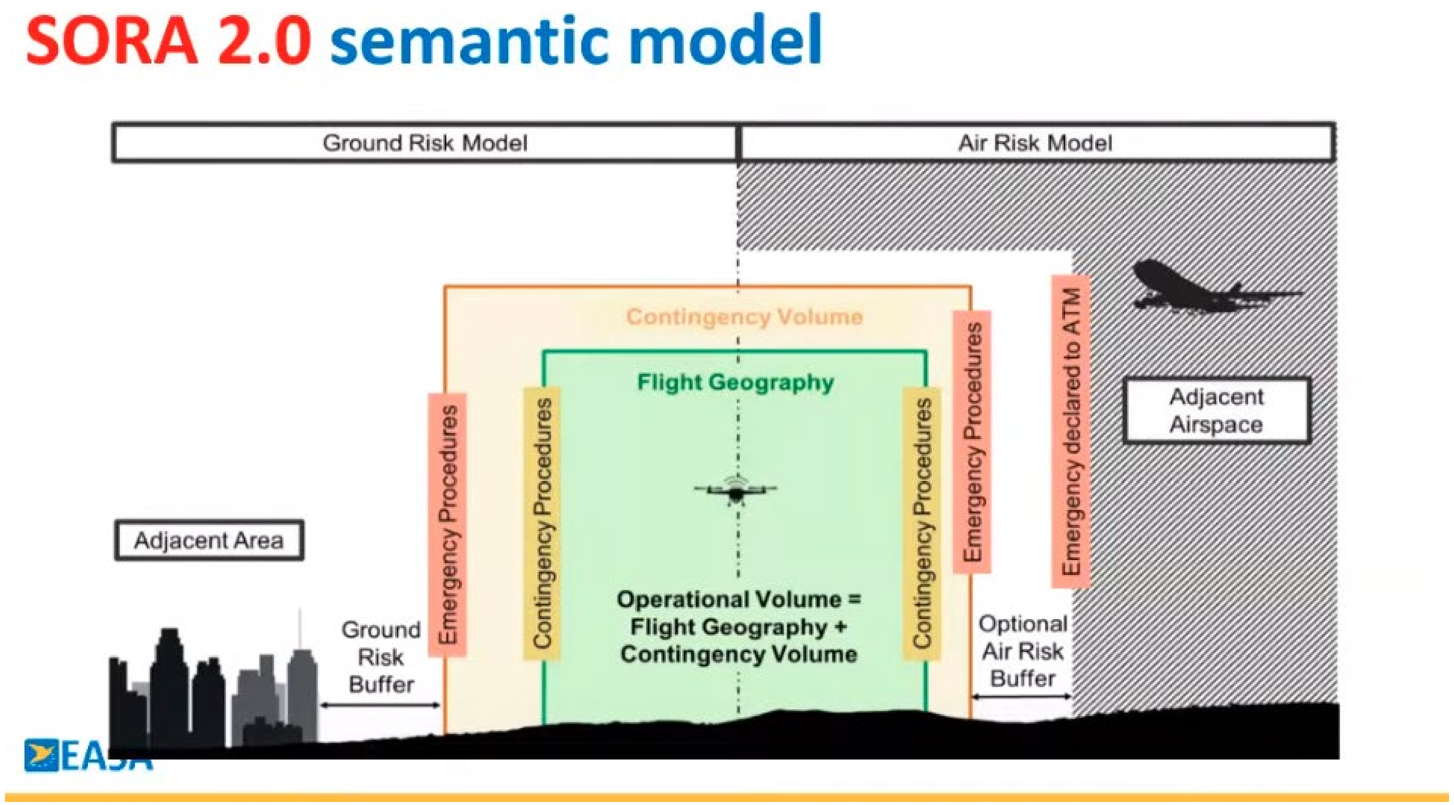
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA



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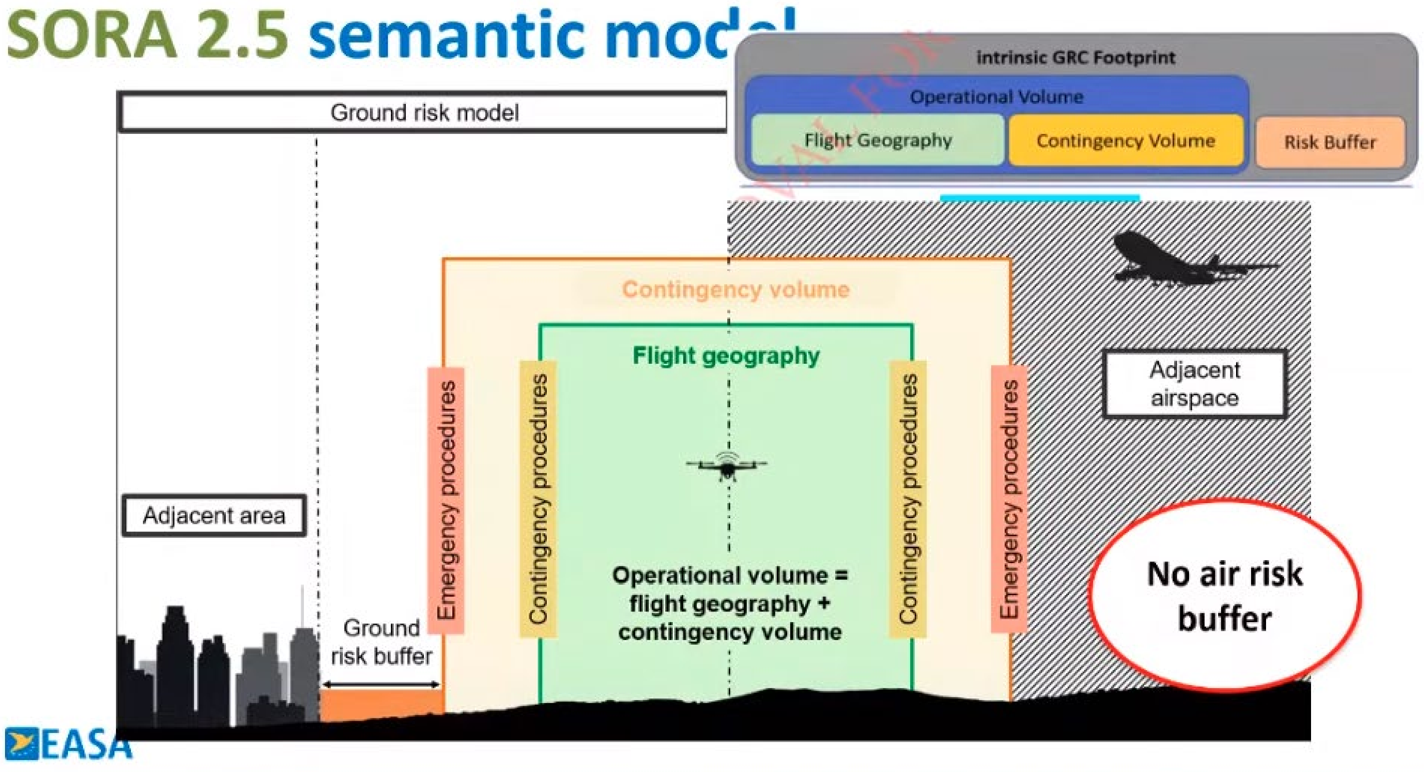

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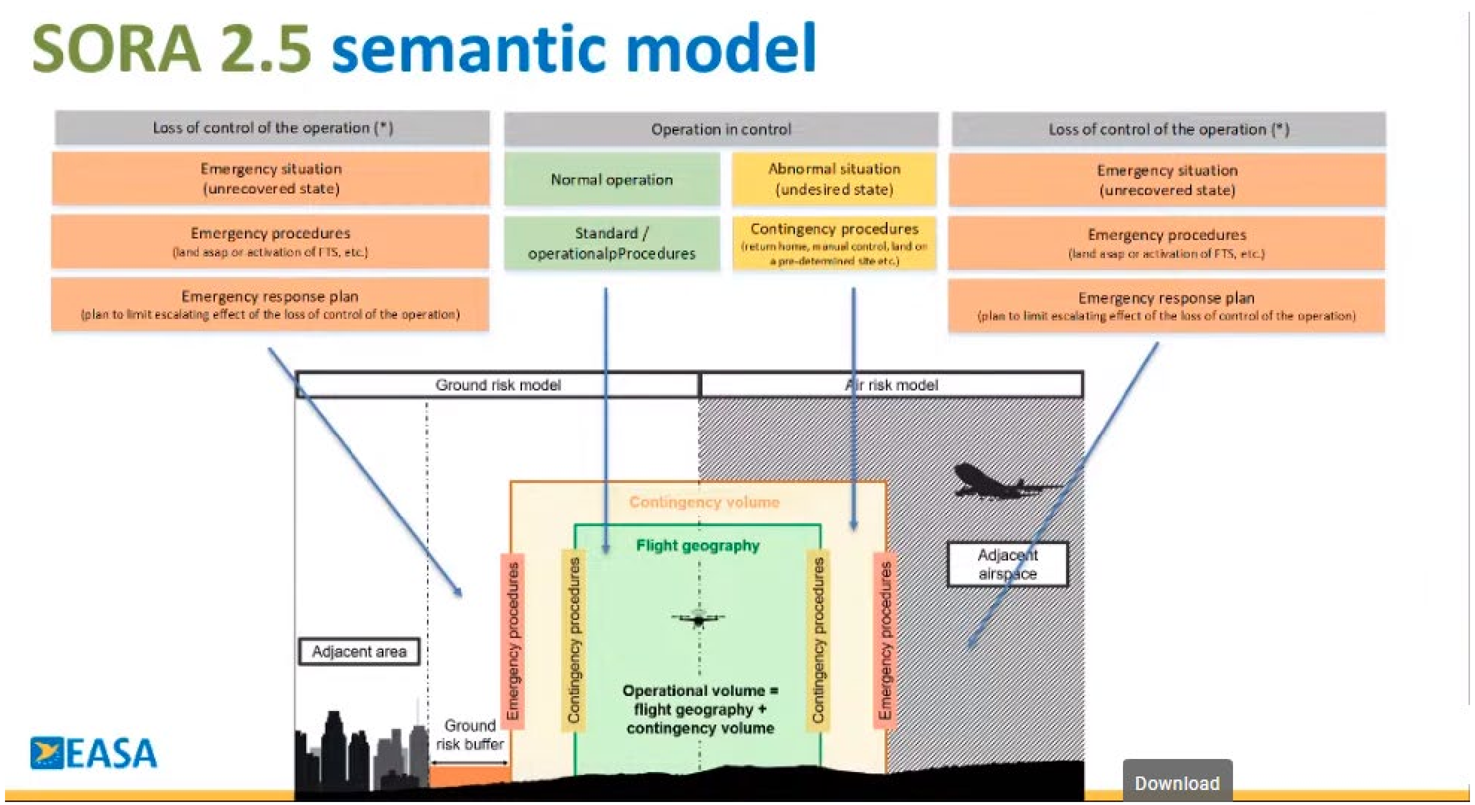

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SORA 2.0 Step#1

CONOPS description

- ✓ Applicant to collect and provide the relevant technical, operational and system information needed to assess the risk associated with the intended operation.
- ✓ It is the foundation for all other activities.

What you want to do, where you want to fly, which UAS you intend to use

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- ✓ It is the foundation for all other activities.

What you want to do, where you want to fly, which UAS you intend to use

Outcome

- ✓ Description of the intended operation.
- ✓ Familiarisation with the documents to be provided to the competent authority to apply for the operational authorisation.

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SORA 2.0 Step #1 lesson learned

The title (CONOPS) create confusion

→ CONOPS has different meaning in different domains

→ SORA Annex A is also called CONOPS

Changes in Step #1 of SORA 2.5

→ Step #1 renamed into 'Documentation of the proposed operation(s)

→ SORA Annex A renamed in 'operator manual'

NO NEED TO REVISE THE DOCUMENTATION OF OPERATIONS APPROVED USING SORA 2.0 OR PREVIOUSLY APPROVED DOCUMENTATION

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

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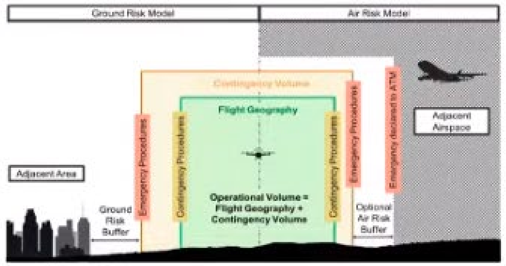
SORA Step #2 – Ground risk - Define size of operational area

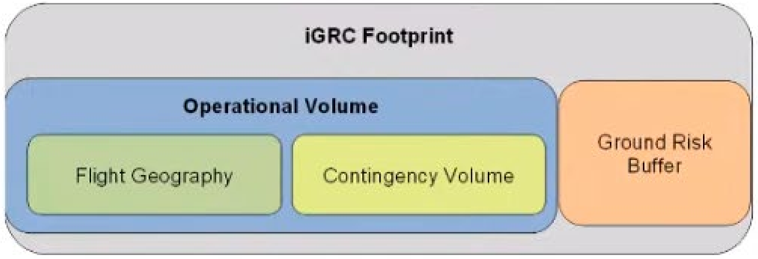
Outcome

a) identification of the size of the footprint;

b) identification of the iGRC (intrinsic ground risk class) of the footprint;

c) Documentation of information and references used to complete this Step.





Initial ground risk class determination

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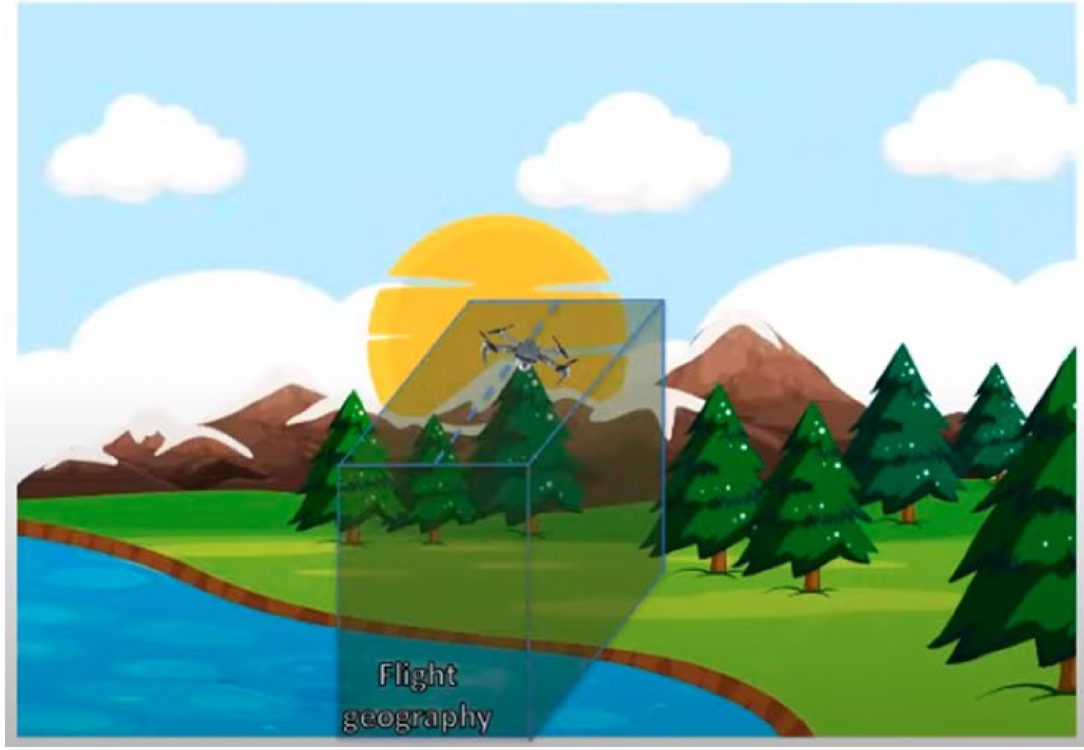
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step #2 – Ground risk - Define size of operational area



Flight geography: where the drone should fly in normal conditions

<u>Determination of flight geography</u>

Where the operation takes places and:

- Navigation System Error
- Flight Technical Error
- Path Definition Error

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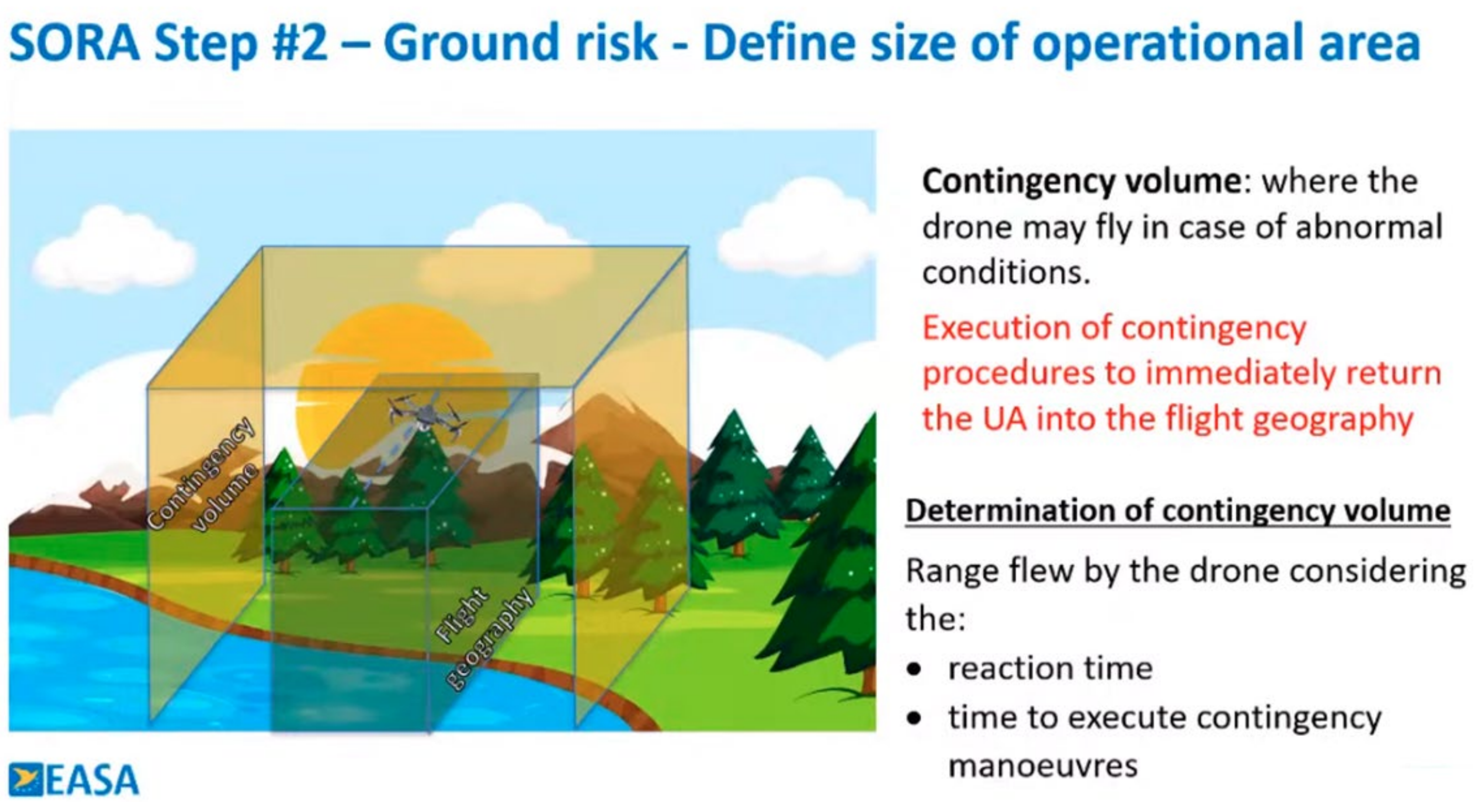
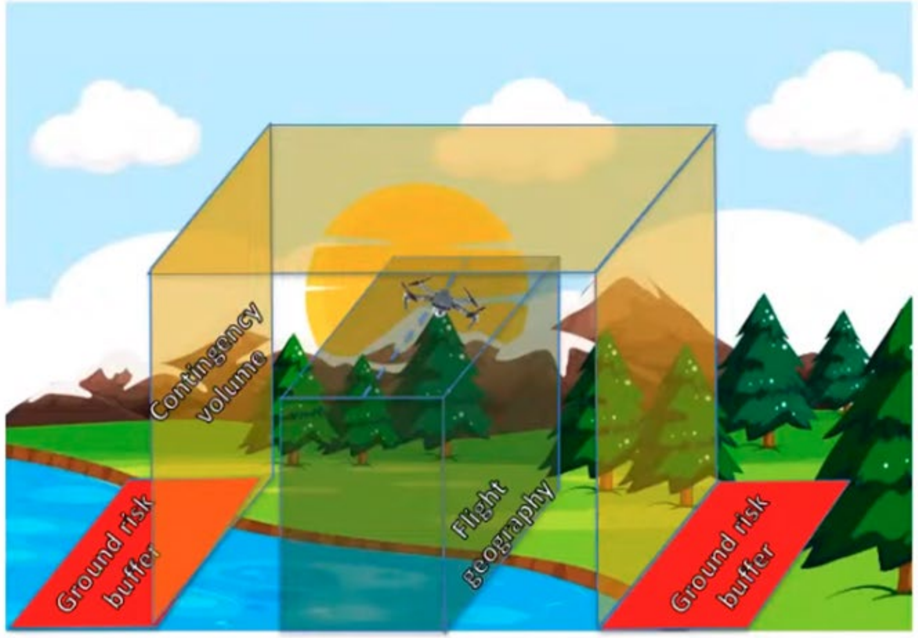


ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step #2 – Ground risk - Define size of operational area



Ground risk buffer: If an operation loses control in a way that the UA exits the operational volume, it shall be contained to end its flight inside the ground risk buffer

Determination of ground risk buffer

- 1:1 distance
- Ballistic descend

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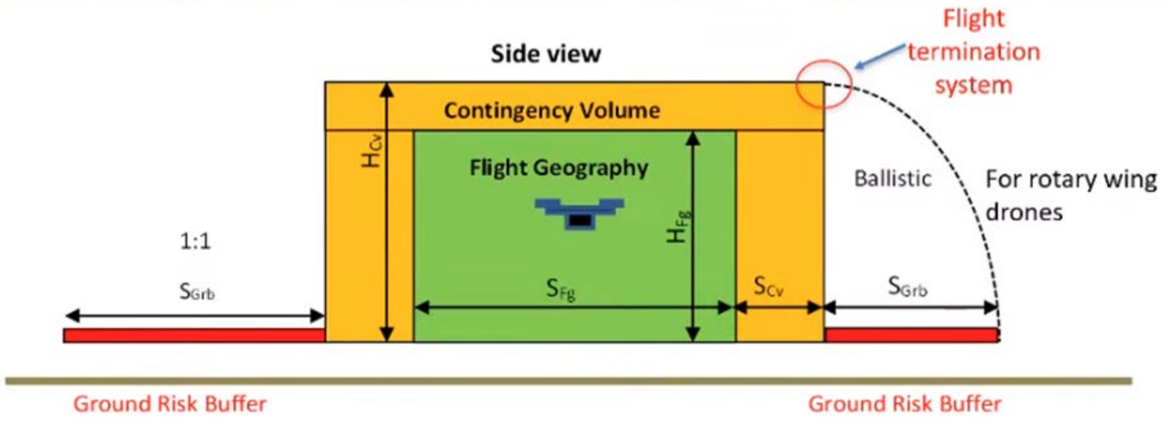
SORA Step #2 - Determine size of ground risk buffer



1:1 rule or a more accurate ground risk buffer value may be claimed based on an analysis taking into account malfunctions or failures and the following elements when the containment system is activated:

- Meteorological conditions (e.g. wind),
- UAS latencies
- UA behavior when activating a technical containment measure (e.g. parachute deployment),
- UA performance.

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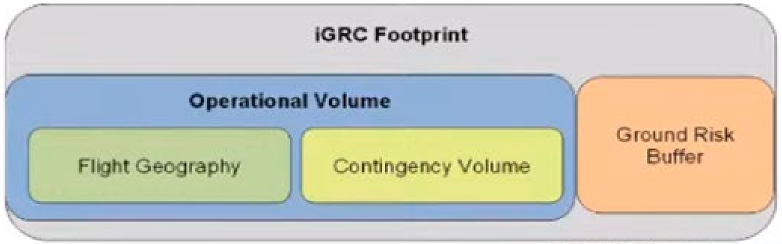
Population density (SORA 2.0)

Identify the maximum population density value of the



- → Controlled ground area →
  - → protected area with negligible probability of presence of uninvolved person

- → Sparsely populated
- → Populated
- → Assembly of people →

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Fictional example

Manna delivery
MTOM: 23kg
Payload: 2,25kg
Length: 2m

Actual local conditions may be diferent!!!

- Sparsely populated area (e.g. max pop density 200 ppl/km^2)
- Populated area (e.g. max pop density 3.000 ppl/km^2)
- Busy open shopping area, assembly of people (e.g. max pop density 250.000 **ppl/km**

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SORA Step #2 - Assessing the ground risk

Is the weight of the drone the main factor?

In case of impact with a person, once the energy transmitted by the drone is higher than a lethal threshold (order of 80J), the most important parameter becomes the size of the drone

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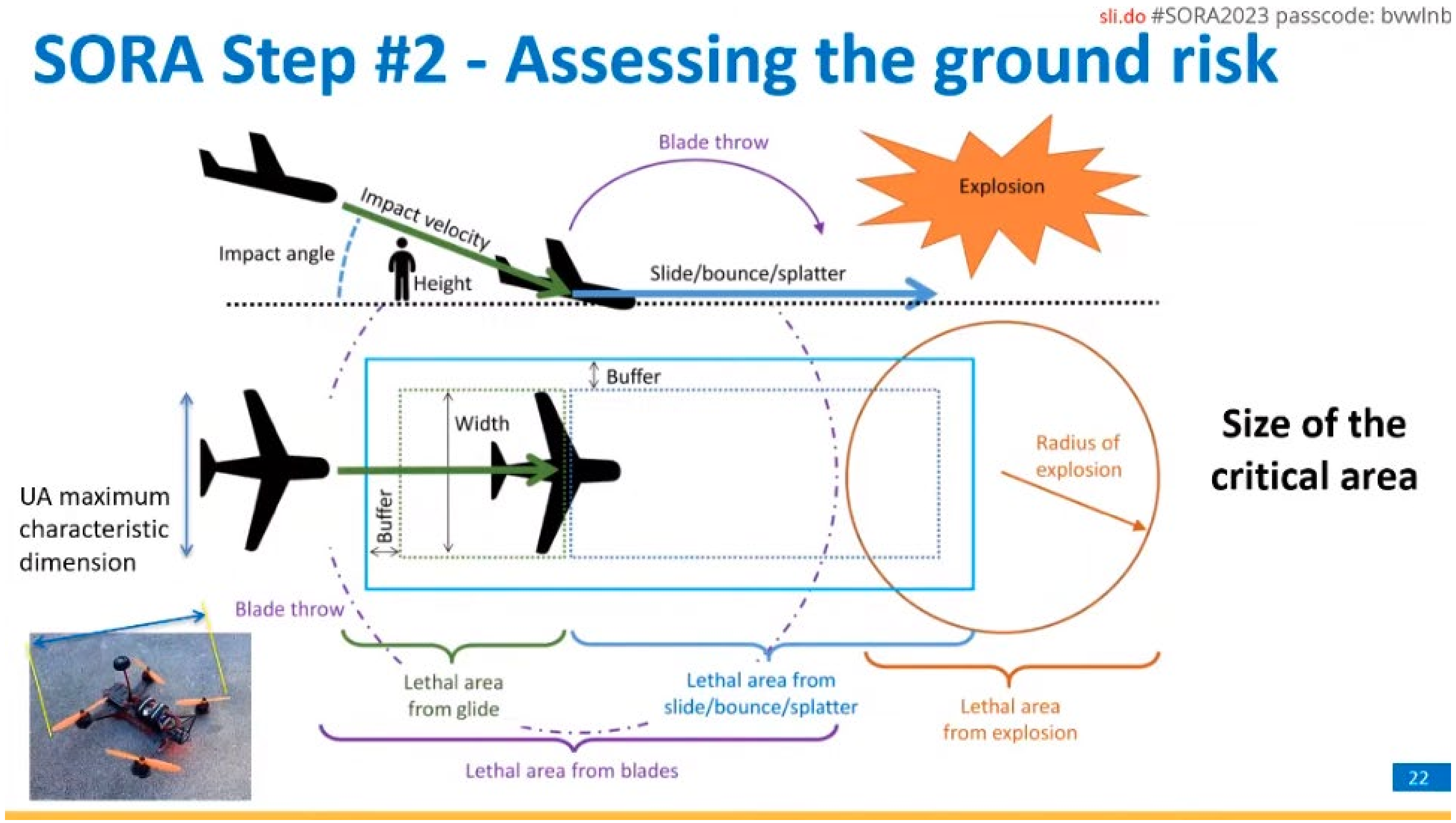

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

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SORA 2.0 Step#2

Determination of the intrinsic UAS ground risk class (GRC)

Intrinsic UAS ground risk class				
Max UAS characteristics dimension	1 m / approx. 3 ft	3 m / approx. 10 ft	8 m / approx. 25 ft	>8 m / approx. 25 ft
Typical kinetic energy expected	< 700 J (approx. 529 ft lb)	< 34 kJ (approx. 25 000 ft lb)	< 1 084 kJ (approx. 800 000 ft lb)	> 1 084 kJ (approx. 800 000 ft lb)
Operational scenarios				
VLOS/BVLOS over a controlled ground area[3]	1	2	3	4
VLOS over a sparsely populated area	2	3	4	5
BVLOS over a sparsely populated area	3	4	5	6
VLOS over a populated area	4	5	6	8
BVLOS over a populated area	5	6	8	10
VLOS over an assembly of people	7	Operation not possible in the specific category		
BVLOS over an assembly of people	8			

iGRC table in SORA 2.0

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

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SORA 2.0 Step #2 lesson learned

1. Qualitative population density values does not help in having an harmonized approach among states
2. It is not clear under which conditions VLOS may play a role in the ground risk determination, what are the requirements for the VLOS bonus?
3. Typical energy difficult to evaluate
4. Very small drones, may reach a GRC of 8
5. Fixed values in the iGRC table: A small increase in the UA dimension (e.g from 3 m to 3.1 m) may classify immediately the UA in the higher GRC
6. The identification of the adjacent area is only required in step 9 and there are no indications on how to calculate its size

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.5 Step#2

1. Quantitative ground risk assessment

Intrinsic UAS Ground Risk Class						
Maximum UA characteristic dimension		1m / approx. 3ft	3m / approx. 10ft	8m / approx. 25ft	20m / approx. 65ft	40m / approx. 130ft
Maximum cruise speed		*25 m/s*	*35 m/s*	*75 m/s*	*150 m/s*	*200 m/s*
Maximum iGRC population density (ppl/km^2)	Controlled ground area	1	2	3	4	5
	< 25	3	4	5	6	7
	< 250	4	5	6	7	8
	< 2,500	5	6	7	8	9
	< 25,000	6	7	8	9	10
	< 250,000	7	8	9	10	11
	> 250,000	7	9	Not part of SORA		

EASA iGRC table in SORA 2.5

2. VLOS removed and identified as a mitigation for the ground risk (see slide on M1)
3. Typical energy replaced by max cruise speed
4. UAS with max weight <250g and max cruise speed <25m/s are always classified GRC 1
5. Possibility to calculate the actual critical area of the UA and compare with those identified in Annex B

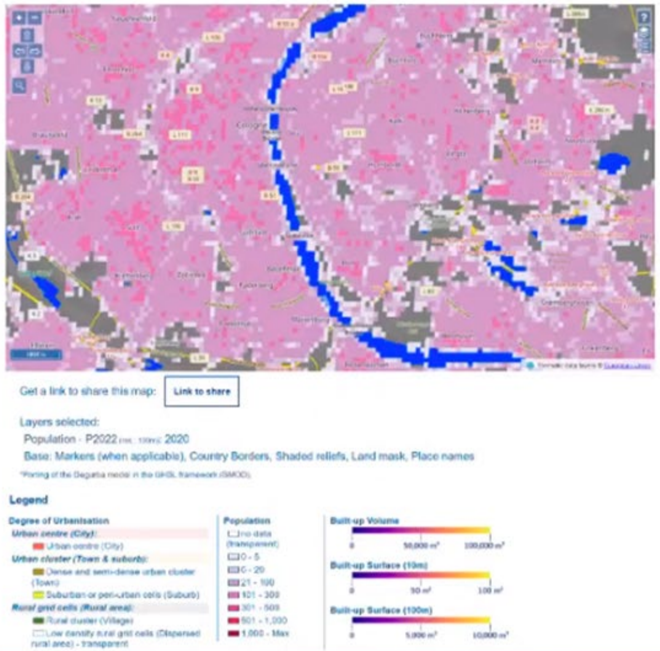
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Where can I get the population density data?

→ Each state may have their source

→ In absence the Global Human Settlement - Visualisation - European Commission (europa.eu) may be used

→ EASA is working to define the minimum requirement for a dynamic population density map service providers



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How the GRC was calculated in SORA 2.5?

- → A more refined ground risk model was developed by JARUS
- → New **Annex F** provides all details and justification for the GRC
- → Normally, applicants are not required to consult Annex F, unless they would like to propose to the NAA some more sophisticated solutions tailoring the model to their operation

A special thank for leading the development of the ground risk model

Terrence Martin (PhD)
Revolution airspace Australia
Professor at Queensland University of Technology

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Is there an increase of the iGRC of 1 point between SORA 2.0 and SORA 2.5?

Intrinsic UAS Ground Risk Class						
Maximum UA characteristic dimension		1m / approx. 3ft	3m / approx. 10ft	8m / approx. 25ft	20m / approx. 65ft	40m / approx. 130ft
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	< 250,000	7	8	9	10	11
	> 250,000	7	9	Not part of SORA		

No if you consider:

- Additional flexibility in applying mitigations in step #3 and Annex B (e.g. shelter)
- Possibility to calculate the actual critical area of the UA (e.g. if using a UA of 4m, maybe the critical area is equivalent to the one of a 3m UA)

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

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SORA 2.5 - Example of calculation actual critical area

Applying Annex F formula for actual critical area it results:

Wingspan	3.3
MTOW	23
Impact speed	32
Impact angle	35
ground friction (friction coeff)	0.65
Coeff of restitution	0.71
Heigh person	1.8
Radius person	0.3
v horizontal	26.21
d glide	2.57
rD	1.95
v non lethal	5.02
t safe	2.13
d slide reduced	25.18
circular end	11.95
Actual Critical Area	**120.18**

Actual critical area is lower than the one identified for a 3m UA in SORA 2.5 Annex B

Maximum characteristic dimension (m)	1	3	8	20	40
Critical area (m^2)	8	135	1,350	13,500	135,000

The 3m column can be used!

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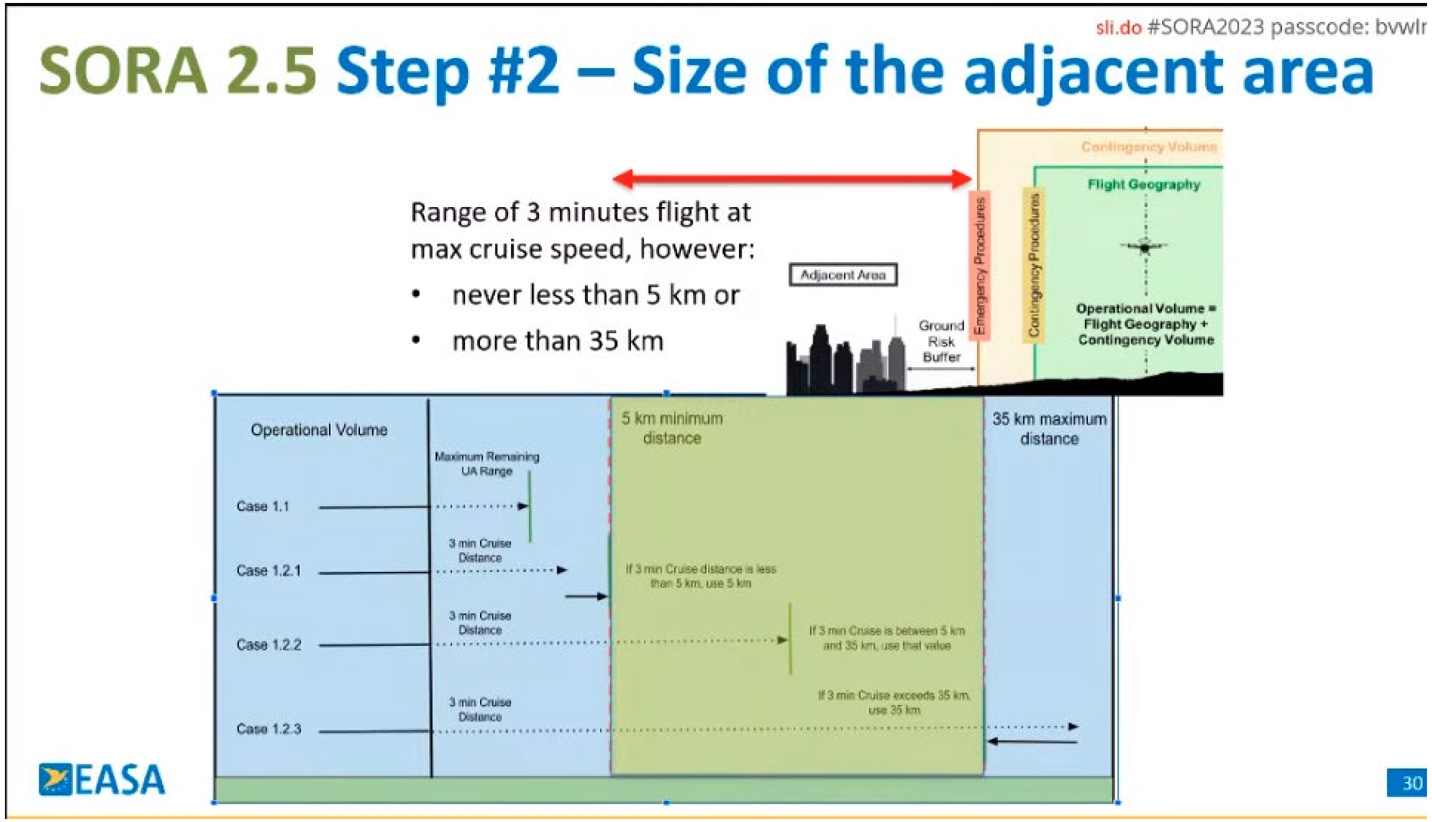

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

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How we reconcile SORA 2.0 with SORA 2.5 iGRC?

Quantitative Population Value (ppl/km2)	< 25	< 250	< 2,500	< 25,000	< 250,000	> 250,000
Qualitative Description	Rural	Sparsely Populated	Suburban	Urban	Dense Urban	Assembly of people 10,000 is the minimum number of people to qualify for assembly of people

Populated area

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Fictional example SORA 2.0

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Manna delivery
Length: 2m

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BVLOS over an assembly of people	8			

- Sparsely populated area (e.g. max pop density 200 ppl/km^2)
- Populated area (e.g. max pop density 3.000 ppl/km^2)
- Busy open shopping area, assembly of people (e.g. max pop density 250.000 ppl/km^2)

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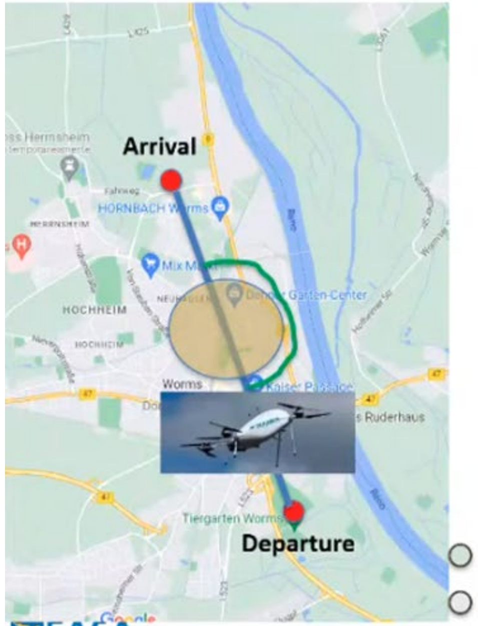
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Fictional example SORA 2.0



Intrinsic GRC 6

Manna delivery
Length: 2m

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Fictional example SORA 2.5

Manna delivery
Length: 2m

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- Sparsely populated area (e.g. max pop density 200 ppl/km²)
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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step#3 Final GRC Determination

→ Reduce the intrinsic risk of a person being struck by the UA

Outcome

(a) Identification of the mitigations applied to reduce the iGRC for the footprint;

(b) Identification of the applicable mitigations requirements;

(c) Identification of the final GRC;

(d) Collection of information and references used to substantiate the application of the ground risk mitigation(s).

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.0 Step#3 Final GRC Determination

		Robustness		
Mitigation Sequence	Mitigations for ground risk	Low/None	Medium	High
1	M1 — Strategic mitigations for ground risk[1]	0: None -1: Low	-2	-4
2	M2 — Effects of ground impact are reduced[2]	0	-1	-2
3	M3 — An emergency response plan (ERP) is in place, the UAS operator is validated and effective	1	0	-1
		Declaration	Declaration supported by data	Third party verification

This is possible only for very special cases

<u>For each point of credit the applicant needs to demonstrate a reduction of 1 order of magnitude in the population density at risk</u>

SORA Annex B provides details for the ground risk mitigation requirements

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step#3 – M1 strategic mitigation

Reduce the risk of a person being struck by the UA

Depending on the weight of the drone people may be protected by a **shelter**

Operation may be conducted during **night** when most of people are home

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step#3 – M1 strategic mitigation

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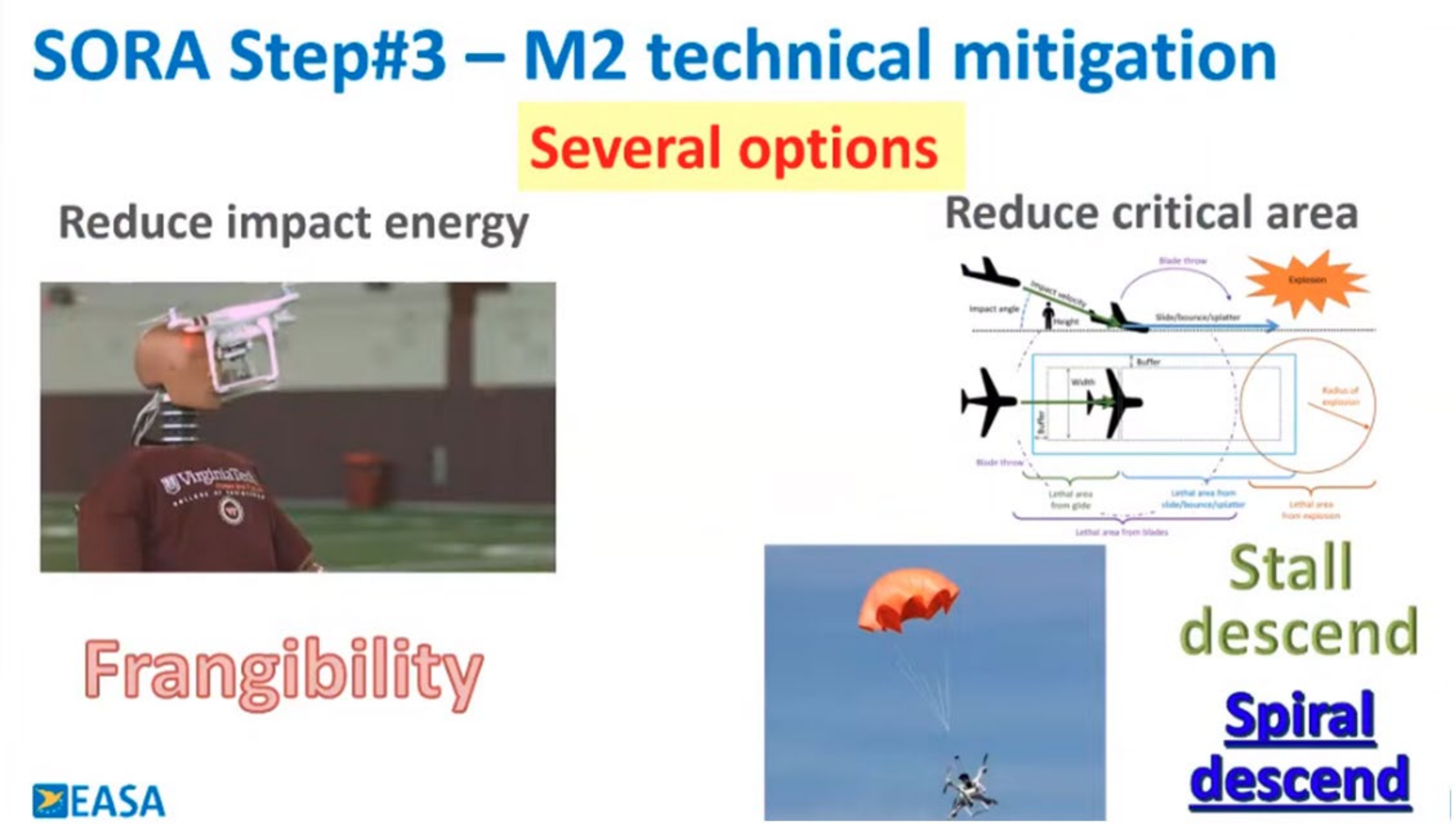
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA



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SORA 2.0 Step #3 - Lesson learned

→ Reduction of 4 points for M1 high is unrealistic

→ Through an emergency response plan is possible to reduce the number of people at risk, only in very special cases

→ Annex B is inflexible (e.g. shelter cannot be used for low robustness)

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SORA 2.5 Ground risk mitigations

	Level of Robustness		
Mitigations for ground risk	**Low**	**Medium**	**High**
M1(A) - Strategic mitigations for ground risk	-1	-2	-3
M1(B) - Visual Line of Sight (VLOS) - avoid flying over people	-1	N/A	N/A
M2 - Effects of UA impact dynamics are reduced	0	-1	-2/-3

- M3 mitigation removed. Requirement for emergency response plan included in OSO 8
- VLOS is a mitigation meaning that the remote pilot is able to locate people on ground and avoid to fly over people

More flexibility in Annex B.
Applicant may propose any approach: the final GRC will be the one resulting from the actual population density at risk in the operational area and the actual critical area

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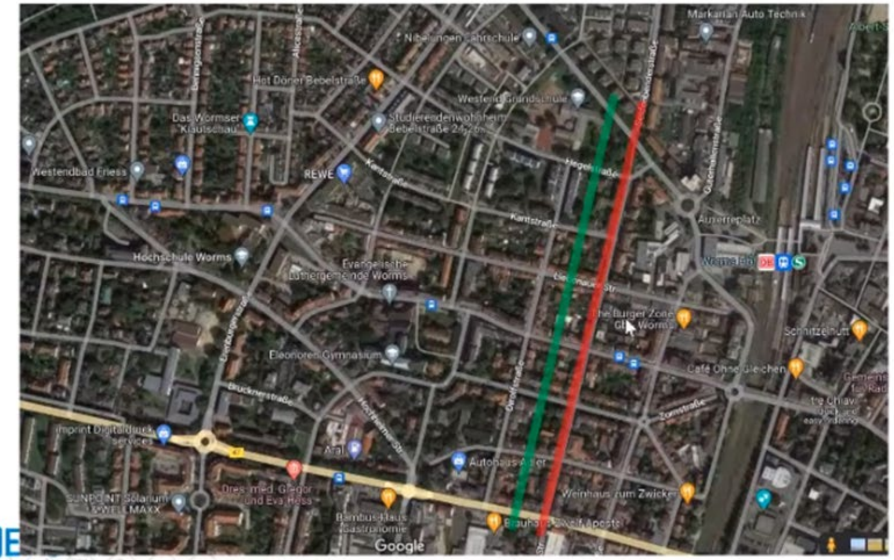
Fictional example SORA 2.5

How to apply M1



To use shelter factor:

- (red) avoid to fly directly over a street where people may be present
- (green) Cross street perpendicularly as much as possible

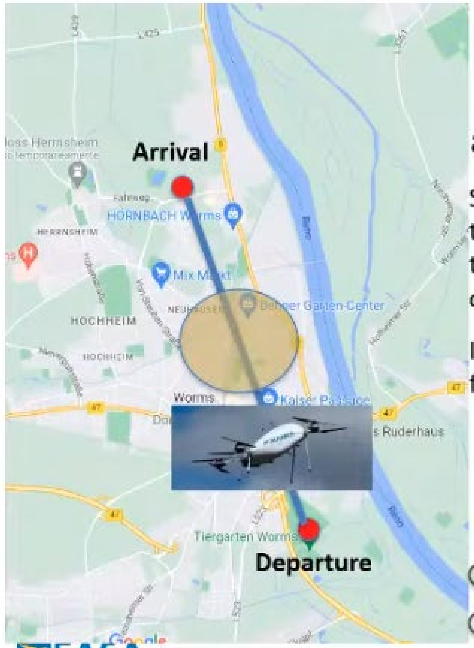
ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

Fictional example SORA 2.5

ode: bvwlnb

Manna delivery
Length: 2m

How to apply M1



How many persons are actually exposed to the risk?

Selecting an operational area where the population density at risk is less than 2.500 ppl/km², qualifies for 1 credit.

If it is less than 250 ppl/km² qualifies for 2 credits and so on

Intrinsic UAS Ground Risk Class						
Maximum UA characteristic dimension		1m / approx. 3ft	3m / approx. 10ft	8m / approx. 25ft	20m / approx. 65ft	40m / approx. 130ft
Maximum cruise speed		25 m/s	35 m/s	75 m/s	150 m/s	200 m/s
Maximum iGRC population density (ppl/km²)	Controlled ground area	1	2	[illegible]	[illegible]	[illegible]
	< 25	3	4	5	6	7
	< 250	4	5	6	7	8
	< 2,500	5	6	7	8	9
	< 25,000	6	7	8	9	10
	< 250,000	7	8	[illegible]	[illegible]	[illegible]
	> 250,000	7	9	Not part of SORA		

2.450 ppl/km²

3.000 ppl/km²

- Sparsely populated area (e.g. max pop density 200 ppl/km²)
- Populated area (e.g. max pop density 3.000 ppl/km²)
- Busy open shopping area, assembly of people (e.g. max pop density 250.000 ppl/km²)

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.0 Step#3 – determination of the final GRC

Intrinsic UAS ground risk class				
Max UAS characteristics dimension	1 m / approx. 3 ft	3 m / approx. 10 ft	8 m / approx. 25 ft	>8 m / approx. 25 ft
Typical kinetic energy expected	< 700 J (approx. 529 ft lb)	< 34 kJ (approx. 25 000 ft lb)	< 1 084 kJ (approx. 800 000 ft lb)	> 1 084 kJ (approx. 800 000 ft lb)
Operational scenarios				
VLOS/BVLOS over a controlled ground area[3]	1	2	3	4
VLOS over a sparsely populated area	2	3	4	5
BVLOS over a sparsely populated area	3	4	5	6
VLOS over a populated area	4	5	6	8
BVLOS over a populated area	5	6	8	10
VLOS over an assembly of people	7	Operation not possible in the specific category		
BVLOS over an assembly of people	8			

M2

M1

Length: 2.2m

M1: reduction of the <u>maximum value</u> of population density at risk in the operational area + ground risk buffer

M2: reduction of the critical area (e.g. parachute)

Final GRC 4

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.5 Step#3 – determination of the final GRC

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Maximum UA characteristic dimension		1m / approx. 3ft	3m / approx. 10ft	8m / approx. 25ft	20m / approx. 65ft	40m / approx. 130ft
Maximum cruise speed		25 m/s	35 m/s	75 m/s	150 m/s	200 m/s
Maximum iGRC population density (ppl/km²)	Controlled ground area	1	2	3	4	5
	< 25	3	4	5	6	7
	< 250	4	5	6	7	8
	< 2,500	5	6	7	8	9
	< 25,000	6	7	8	9	10
	< 250,000	7	8	9	10	11
	> 250,000	7	9	Not part of SORA		

M2 M1

Final GRC 4

Length: 2.2m

M1: reduction of the maximum value of population density at risk in the operational area + ground risk buffer

M2: reduction of the critical area (e.g. parachute)

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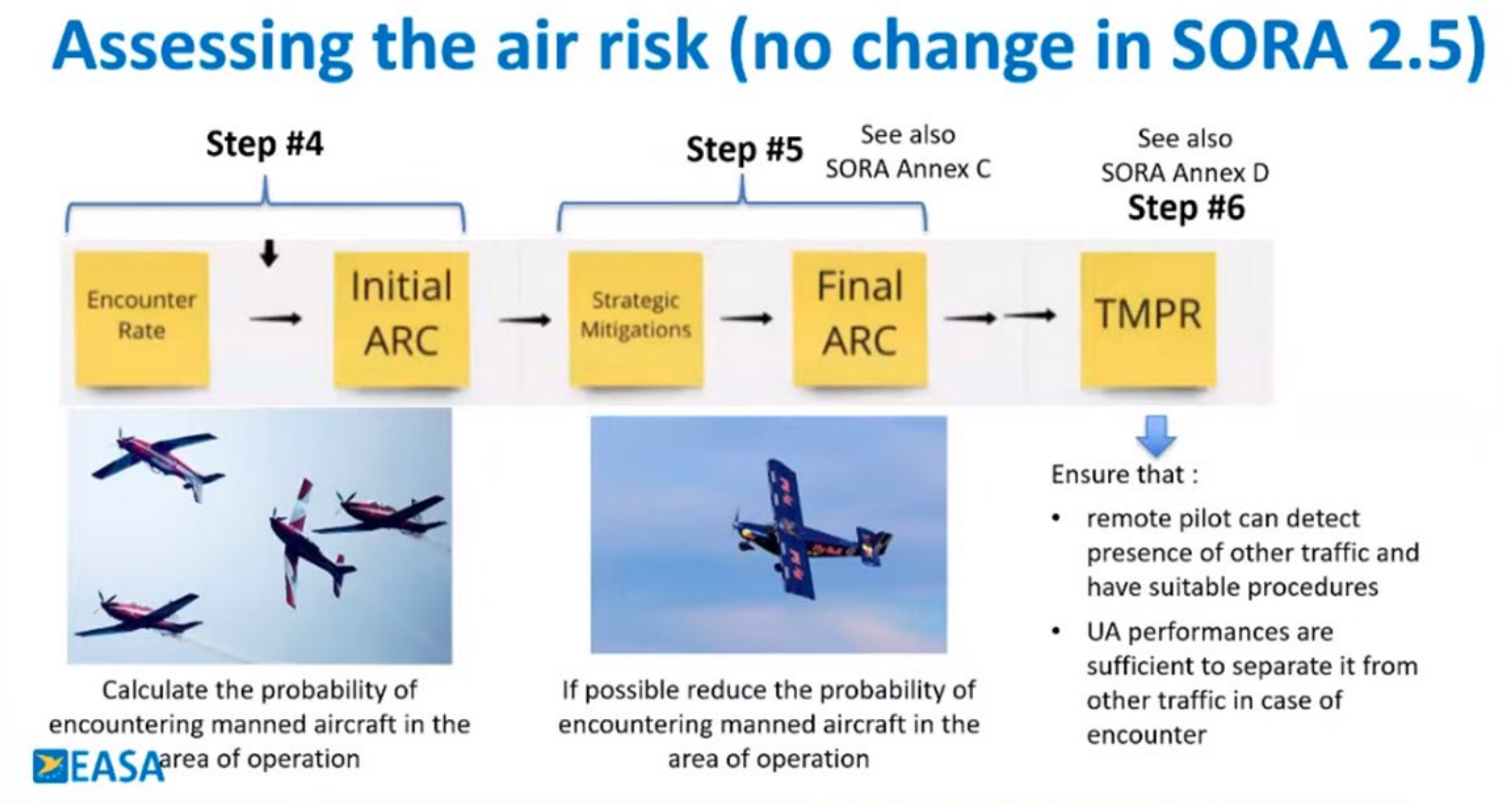

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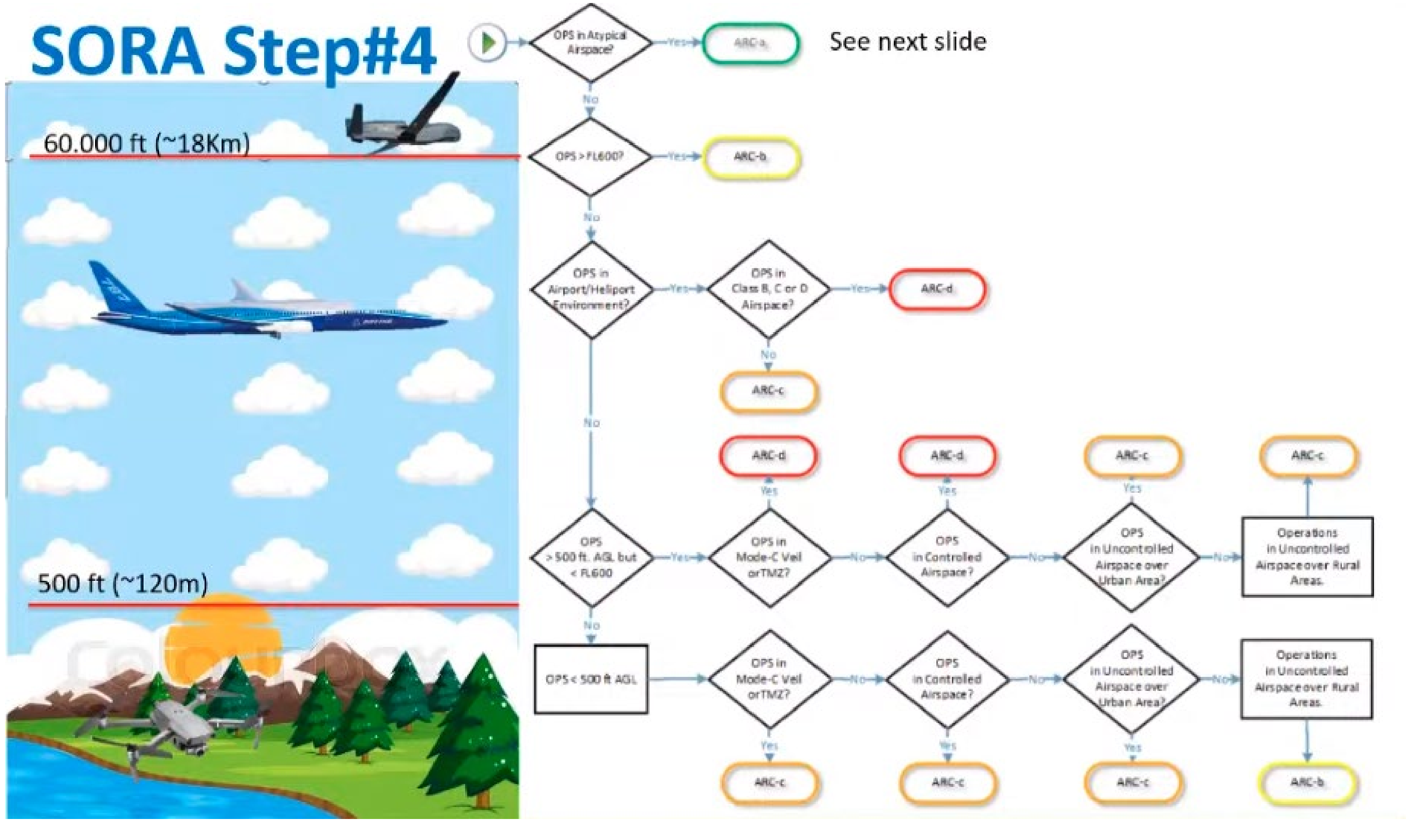

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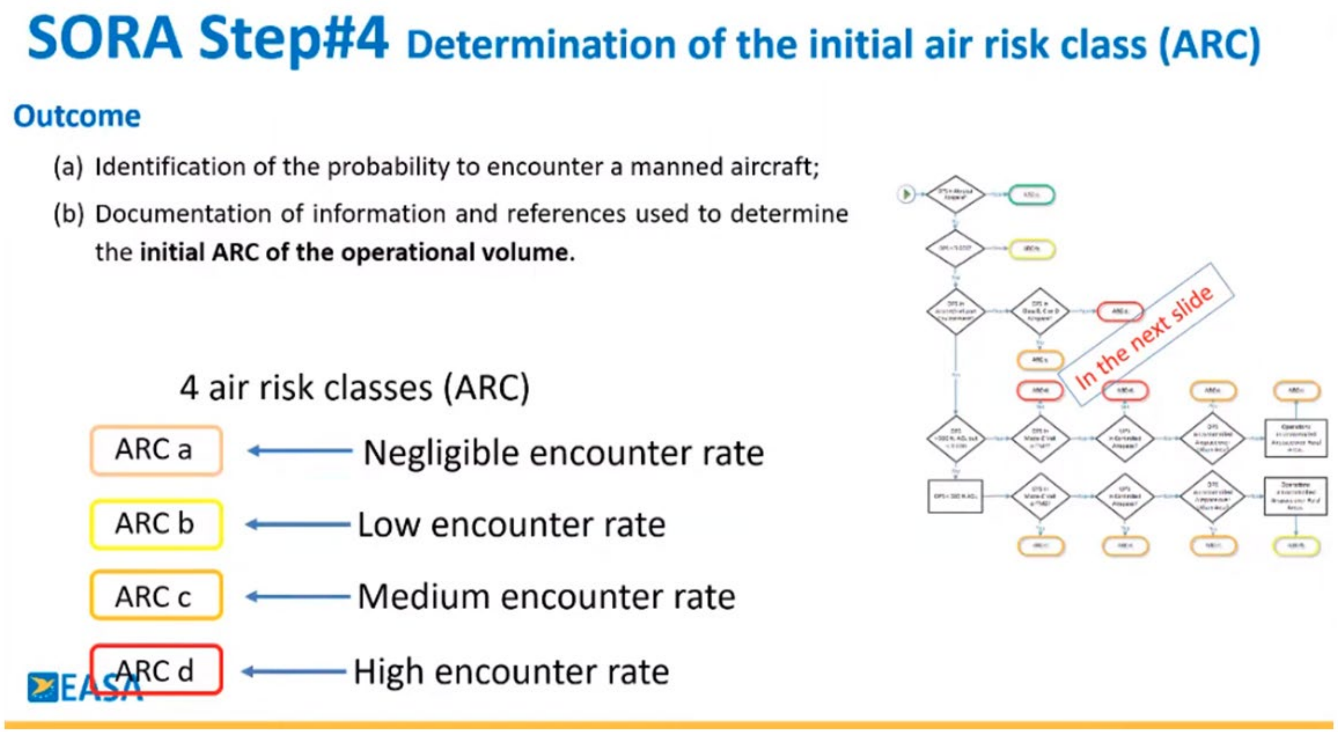

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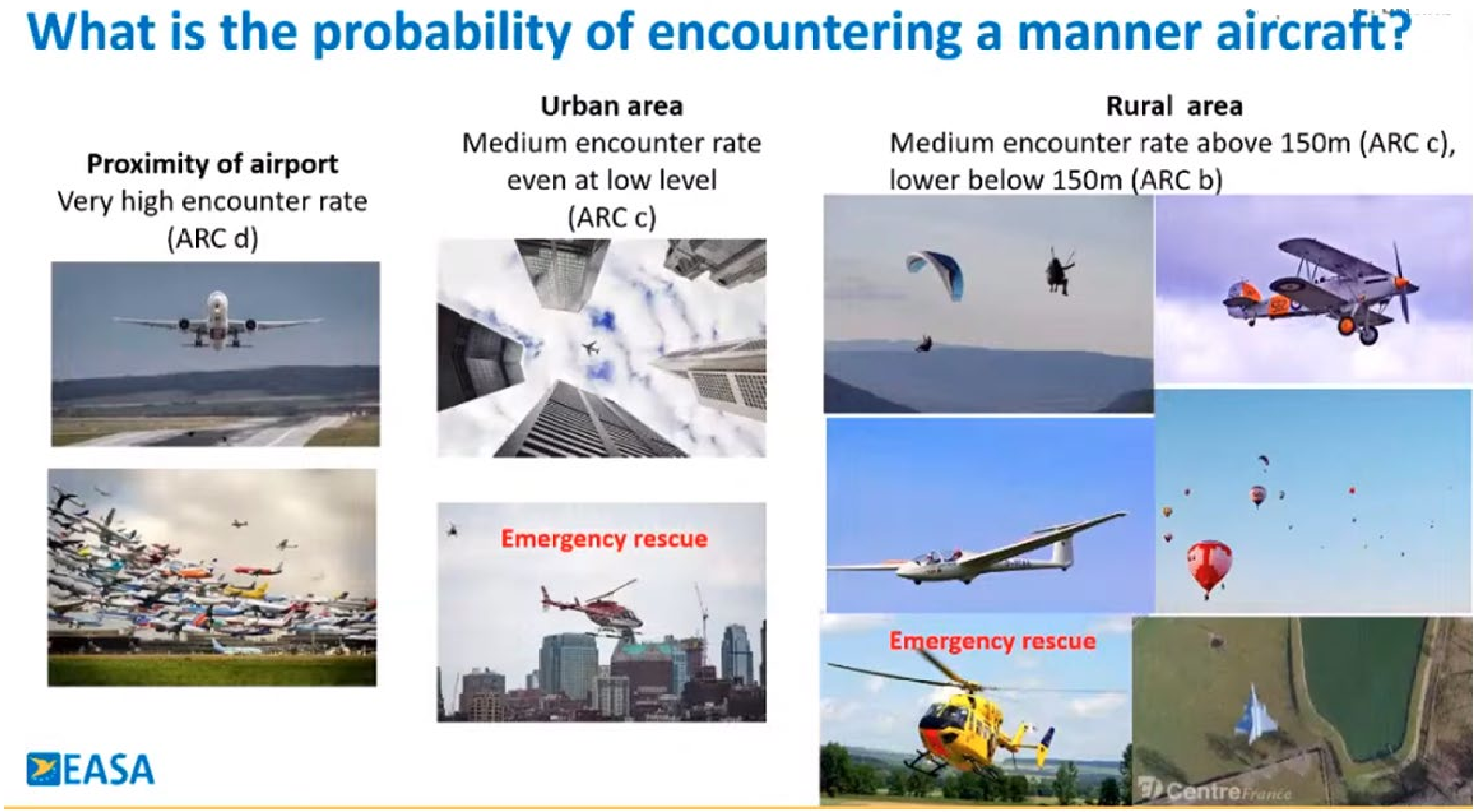

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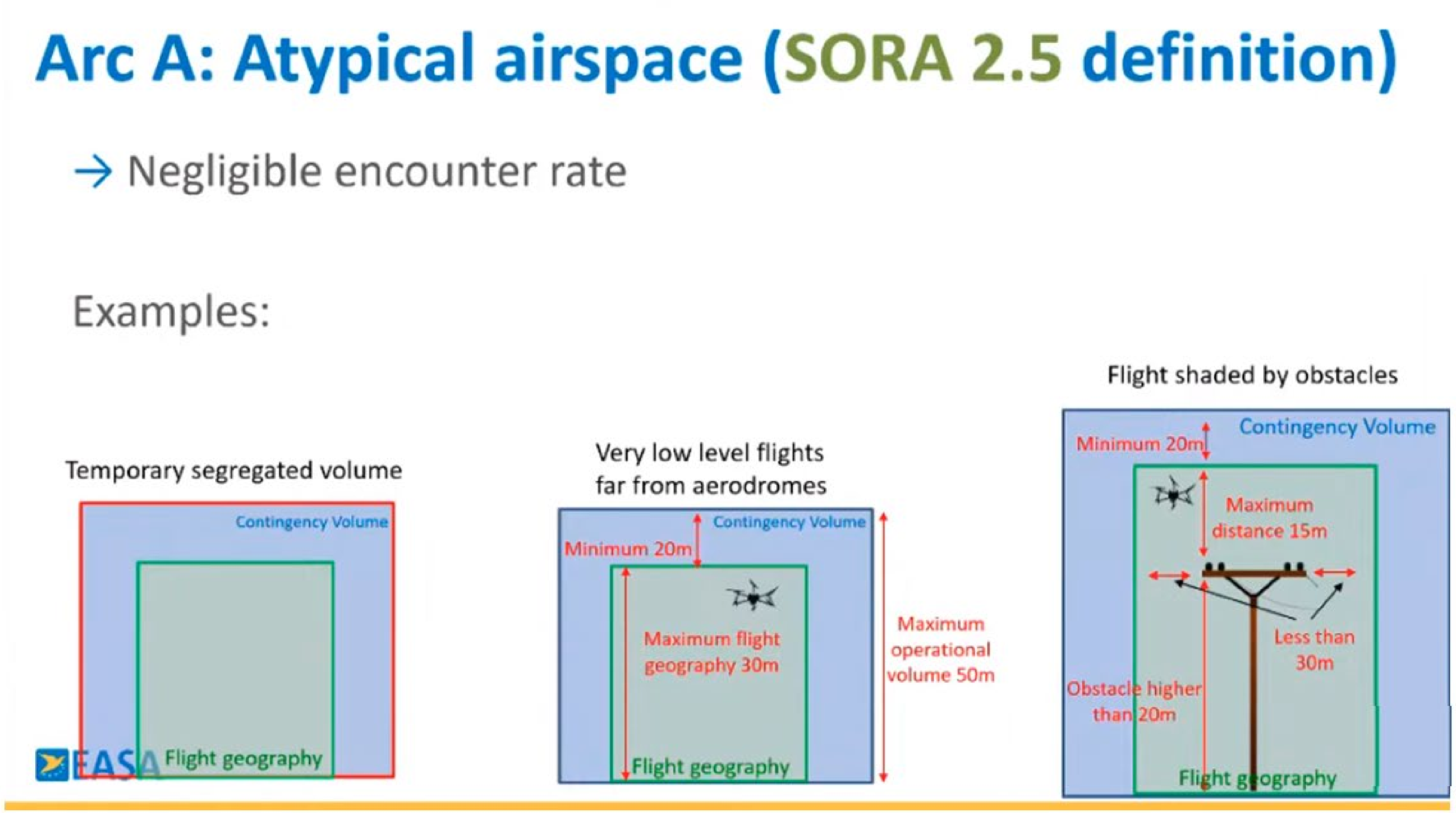

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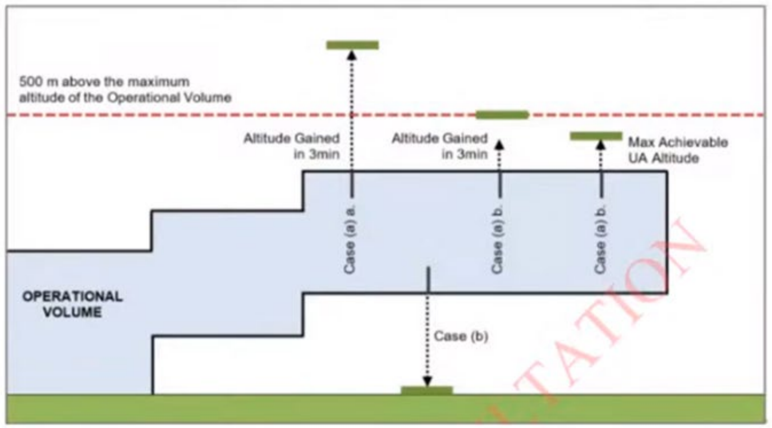
SORA 2.5: step #4 – Adjacent volume determination



- Height of adjacent volume:
  - No less than 500m or
  - altitude gained in 3 m
  - Operational volume may also have a lower limit

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sli.do #SORA2023 passcode: bvwlnb

SORA Step#5 - Application of strategic mitigations (optional)

Outcome

(a) Identification of the strategic mitigations applied to reduce the initial ARC in the operational volume.

(b) Identification of the residual ARC.

(c) Documentation of information and references used to support the application of strategic mitigations.

See Annex C for additional information

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SORA Step #5 - #6 - Application of mitigations

Mitigations: **Strategic** vs **Tactical**

Strategic
Step #5 (optional)
(Annex C)

- Limit the UAS operation in a portion of airspace or during time when the probability to encounter another aircraft is lower OR
- Demonstrate that the probability to encounter a manned in the operational volume aircraft is lower than the one identified in the initial ARC

Determination of the residual ARC

Tactical
Step #6
(Annex D)

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SORA Step #5 – Strategic mitigations

Initial ARC c

How it is possible to reduce the ARC?

- Ask for a temporary segregated airspace → ARC a
- Conduct the operation during night when there may be less traffic → ARC b
- Use aerial observers to scan the sky
- Conduct the operation in VLOS (however the range will be drastically reduced). This can support the reduction of 1 ARC class (clarification in SORA 2.5)
- Contact the national aviation authority/ traffic service provider to gain data on the traffic in the area

SITUATION WILL CHANGE WHEN WE WILL HAVE AN ACCEPTABLE DETECT AND AVOID SYSTEM (DAA)

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SORA Step #5 – Strategic mitigations

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SITUATION WILL CHANGE WHEN WE WILL HAVE AN ACCEPTABLE DETECT AND AVOID SYSTEM (DAA)

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA Step #6 – TMPR

- Depending on the final ARC, demonstrate compliance with TMPRs with the applicable level of robustness

Residual ARC	TMPRs	TMPR level of robustness
ARC-d	High	High
ARC-c	Medium	Medium
ARC-b	Low	Low
ARC-a	No requirement	No requirement

Table 4 — TMPRs and TMPR level of robustness assignment

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.0 Step #8 OSO identification

Outcome

(a) Definition of the robustness associated to the OSOs

(b) Collection of information and references to be used to show compliance with the OSOs requirements.

→ The applicant is required to show compliance with 24 OSOs with the required Level of robustness (High, Medium or Low) depending on the SAIL

- ✓ UAS technical requirements
- ✓ Remote crew training and human errors
- ✓ Operation procedures
- ✓ Adverse operating conditions

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SORA 2.0 – Step 8 lesson learned

- → Is it correct to assess OSOs in Step 8 and only after address containment in Step 9?
  - → SORA 2.5: Step 8 (OSO) and Step 9 (containment) swapped
- → Why we have 24 OSOs if in Annex E we have only 18?
  - → SORA 2.5 list only 18 OSOs as in Annex E
- → Which are under the responsibility of operators or manufacturers?
  - → SORA 2.5 indicates for which OSOs evidences should be provided by manufacturers, which from operators
- → Is the order in which the OSOs are shown the right one?
  - → SORA 2.5: order of OSOs follows the order of topics of the operator manual

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OSO table in SORA 2.5: renamed Step #9!

- → **No change in intent (text updated for clarification)**
- → Reflects Annex E (e.g. OSOs #8,11,14 and 21 are merged)
- → Reorganised to reflect the order used when developing an OM, according to Annex A

New OSO	Old OSO		SAIL I	SAIL II	SAIL III	SAIL IV	SAIL V	SAIL VI	Operator	Remote pilot	Manufacturer
OSO# I	OSO#01	Ensure the UAS operator is competent and/or proven	NR	L	M	H	H	H	x		
OSO# II	OSO#02	UAS manufactured by competent and/or proven entity	NR	NR	L	M	H	H			x
OSO# III	OSO#17	Remote crew is fit to operate	L	L	M	M	H	H	x	x	
OSO# IV	OSO#08, #11, #14, #21	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H	x		
OSO# V	OSO#03	UAS maintained by competent and/or proven entity	L	L	M	M	H	H	Crit. 1 Crit. 2		Crit. 1
OSO# VI	OSO#07	Inspection of the UAS (product inspection) to ensure consistency with the ConOps	L	L	M	M	H	H	Crit. 1	Crit. 2	
OSO# VII	OSO#23	Environmental conditions for safe operations are defined, measurable and adhered to	L	L	M	M	H	H	Crit. 2	Crit. 3	Crit. 1
OSO# VIII	OSO#13	External services supporting UAS operations are adequate for the operation	L	L	M	H	H	H	x		
OSO# IX	OSO#16	Multi-crew coordination	L	L	M	M	H	H	Crit. 1 Crit. 3	Crit. 2	
OSO# X	OSO#09, #15, #22	Remote crew trained and current and able to control the abnormal situation	L	L	M	M	H	H		x	
OSO# XI	OSO#19	Safe recovery from human error	NR	NR	L	M	M	H	Crit. 1 Crit. 2	Crit. 2	Crit. 3
OSO# XII	OSO#04	UAS developed to authority recognised design standards	NR	NR	NR	L	M	H			x
OSO# XIII	OSO#05	UAS is designed considering system safety and reliability	NR	NR	L	M	H	H			x
OSO# XIV	OSO#18	Automatic protection of the flight envelope from human error	NR	NR	L	M	H	H			x
OSO# XV	OSO#20	A human factors evaluation has been performed and the human machine interface (HMI) found appropriate for the mission	NR	L	L	M	M	H			x
OSO# XVI	OSO#06	C3 link performance is appropriate for the operation	NR	L	L	M	H	H			x
OSO# XVII	OSO#24	UAS is designed and qualified for adverse environmental conditions	NR	NR	M	H	H	H			x
OSO# XVIII	OSO#10, #12	Safe recovery from a technical issue	L	L	M	M	H	H			x

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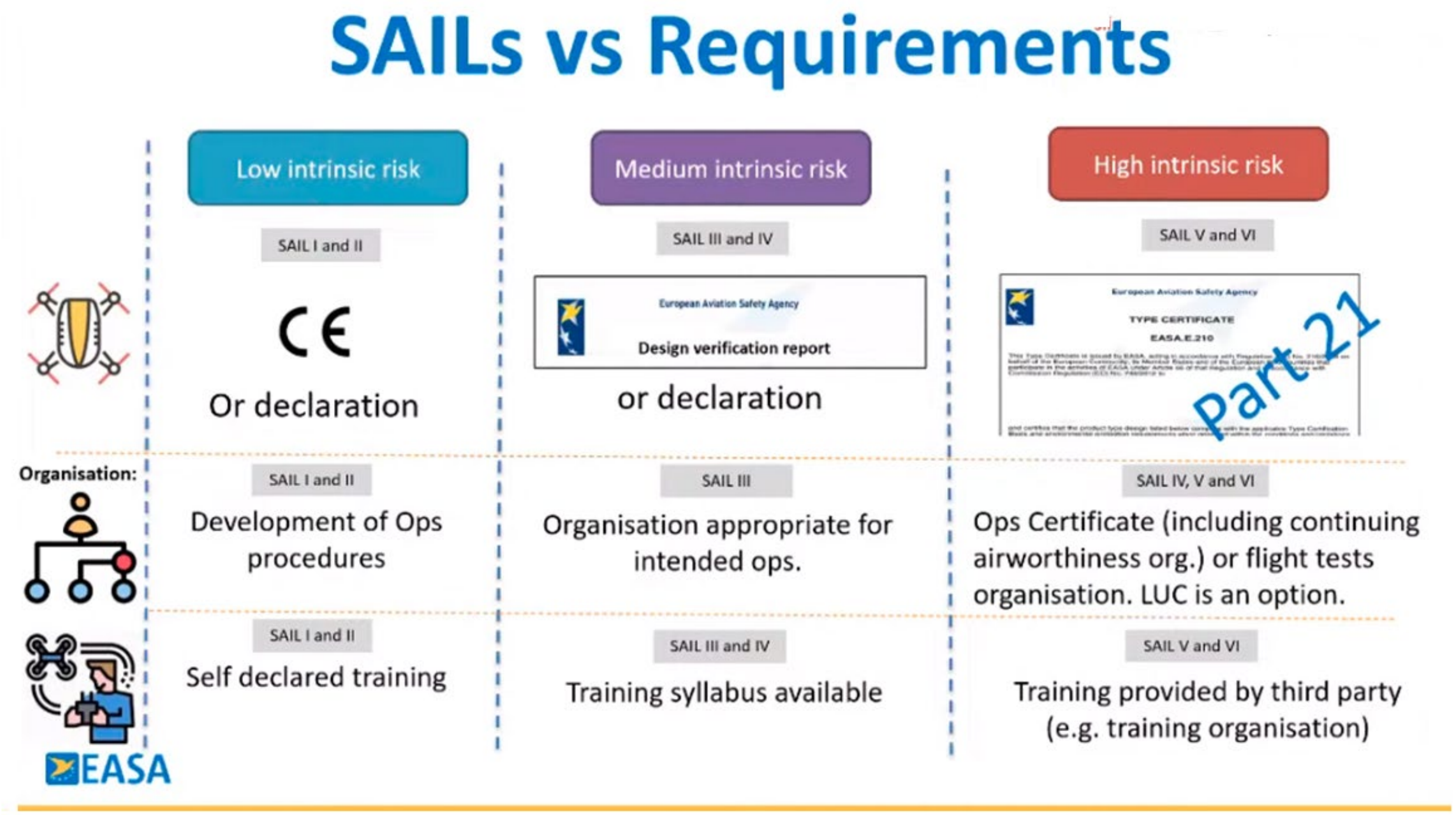

ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.5 containment

→ New structure

- → Identification of size of adjacent area (ground risk) included in Step #2
- → Identification of size of adjacent volume (air risk) included in Step #3
- → Definition of the containment requirement in step 8

SORA 2.0	SORA 2.5
Step #1 – CONOPS	Step #1 – Operation description
Step #2 – iGRC	Step #2 – iGRC
Step #3 – Final GRC	Step #3 – Final GRC
Step #4 – iARC	Step #4 – iARC
Step #5 – Residual ARC	Step #5 – Residual ARC
Step #6 – TMPR	Step #6 – TMPR
Step #7 – SAIL	Step #7 – SAIL
Step #8 – OSO	Step #8 – Containment
Step #9 – Containment	Step #9 – OSO
Step #10 – Comprehensive portfolio	Step #10 – Comprehensive portfolio

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SORA 2.5 Step #8 - Containment

→ 5 levels

- → None
- → Low (equal to basic containment of SORA 2.0)
- → Medium (equivalent to MoC SC Light UAS 2511)
- → High (equal to enhanced containment of SORA 2.0)
- → Consult (for corner cases)

None in EU will be only applicable for SAIL V and VI operations

The last 2 levels will be applicable for exceptional cases

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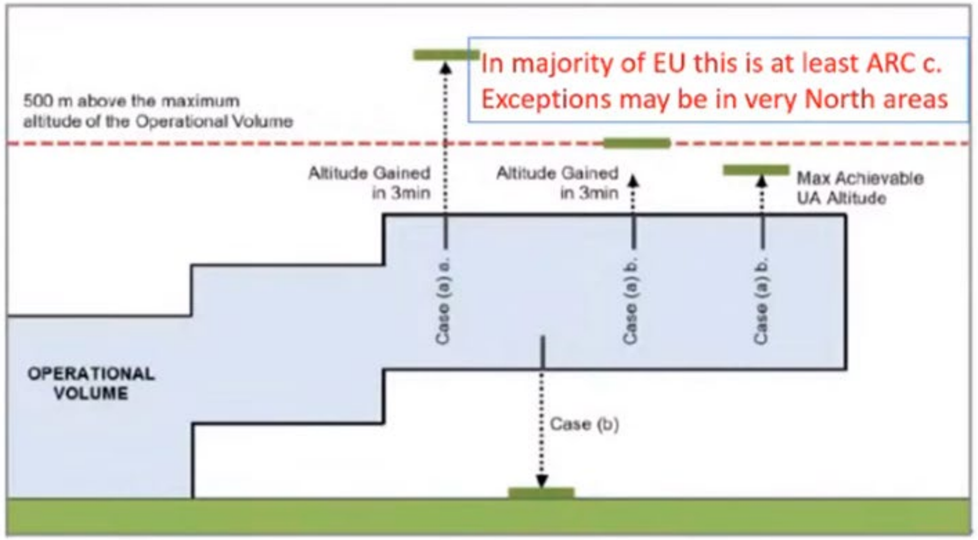
SORA 2.5 containment – air risk



Highest Adjacent Airspace	SAIL I, II, III, IV	SAIL V, VI
ARC-a or ARC-b	None	None
ARC-c or ARC-d	Low	None

Not applicable in majority of EU

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.5 containment

Ground risk

- → Assess the GRC of the adjacent area considering the **AVERAGE POPULATION DENSITY**
- → Mitigations might be applied to reduce the GRC of the adjacent area.
  - → M1 for using the assumption of sheltering;
  - → M2 mitigations based on passive designs or inherent UA characteristics, like frangibility, may be used to lower the adjacent area intrinsic GRC.
  - → M2 mitigations like parachutes or special descent maneuver <u>may not</u> be used by default.

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SORA 2.5 containment

Adjacent area final GRC	SAIL					
	I	II	III	IV	V	VI
≤3	L	L	L	L	L	L
4	L	L	L	L	L	L
5	L	L	L	L	L	L
6	M	M	L	L	L	L
7	H	H	M	L	L	L
8	C	C	C	M	L	L
9				C	M	L
10					C	M

Due to the air risk in EU this will be Low

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ΑΝΑΠΤΥΞΗ ΜΕΘΟΔΟΛΟΓΙΑΣ SORA

SORA 2.5 containment

Adjacent area final GRC	SAIL					
	I	II	III	IV	V	VI
≤3	L	L	L	L	L	L
4	L	L	L	L	L	L
5	L	L	L	L	L	L
6	M	M	L	L	L	L
7			M	L	L	L
8				M	L	L
9					M	L
10						M

Due to the air risk in EU this will be Low

These are corner cases

This is how in reality the table will look like in EU for majority of cases

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