TRANSPORT STYRELSEN

VI MÖJLIGGÖR MORGONDAGENS **RESOR OCH TRANSPORTER**

Det här är

Transportstyrelsen och sektionen för Helikopter & Allmänflyg

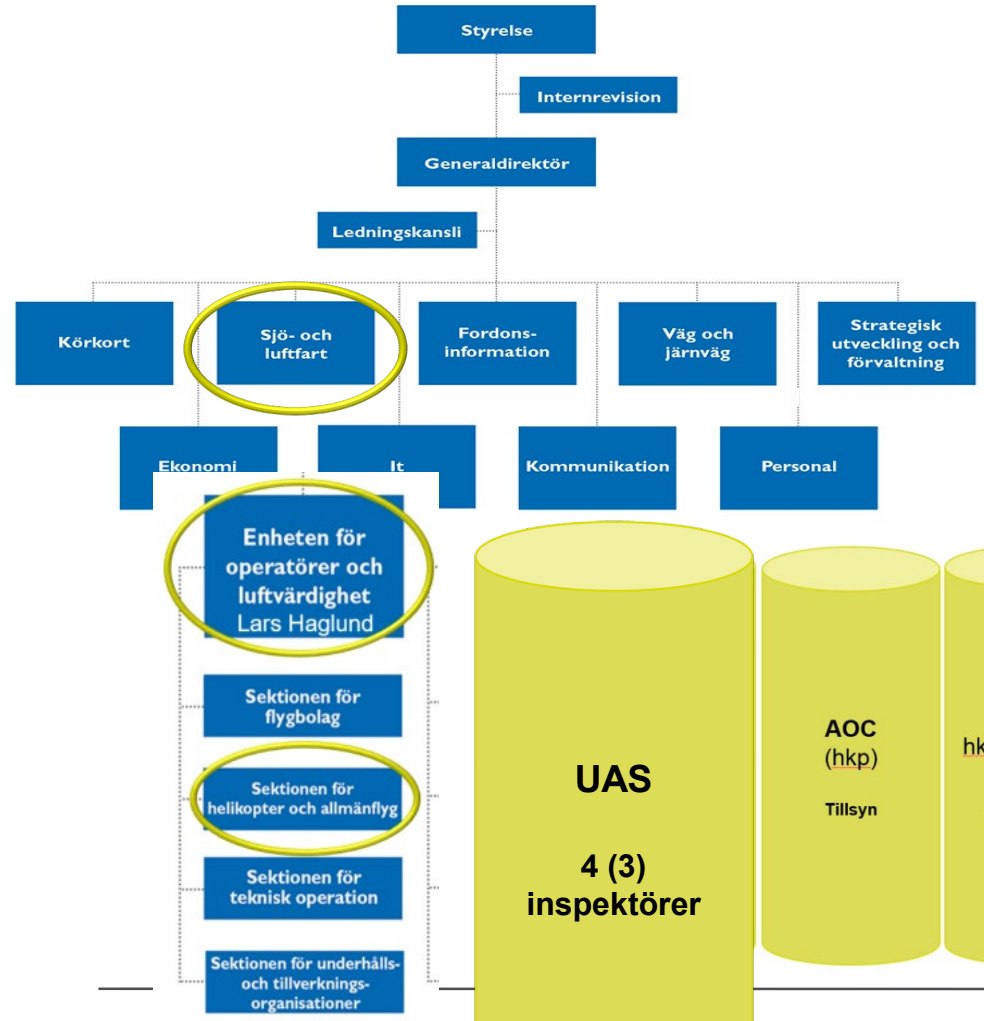
ADS skolmöte 2024-03-20

Magnus Selin

Agenda

- UAS-gruppen – vilka är vi och vad gör vi?
- Operativa auktorisationer – läget idag
- SORA-metoden
  - Några viktiga skillnader i kommande SORA 2.5(?)
- Vägen till auktorisation
  - Inledande konsultation
  - Blanketter
  - Ansökan

Transportstyrelsen



UAS

4 (3) inspektörer

AOC (hkp)

Tillsyn

SPO hkp/flygplan

Tillsyn/ ”tillstånd”

Statsluftfart

Tillsyn

ÄRENDEN

Tillstånd
Kommersiell verksamhet/ statsluftfart

Regler

Allmänflyg
Exempelvis:
Segelflyg
KSAK
FFK
Skärmar
(delegerat)
Ballong

TRANSPORT STYRELSEN

Medarbetare UAS

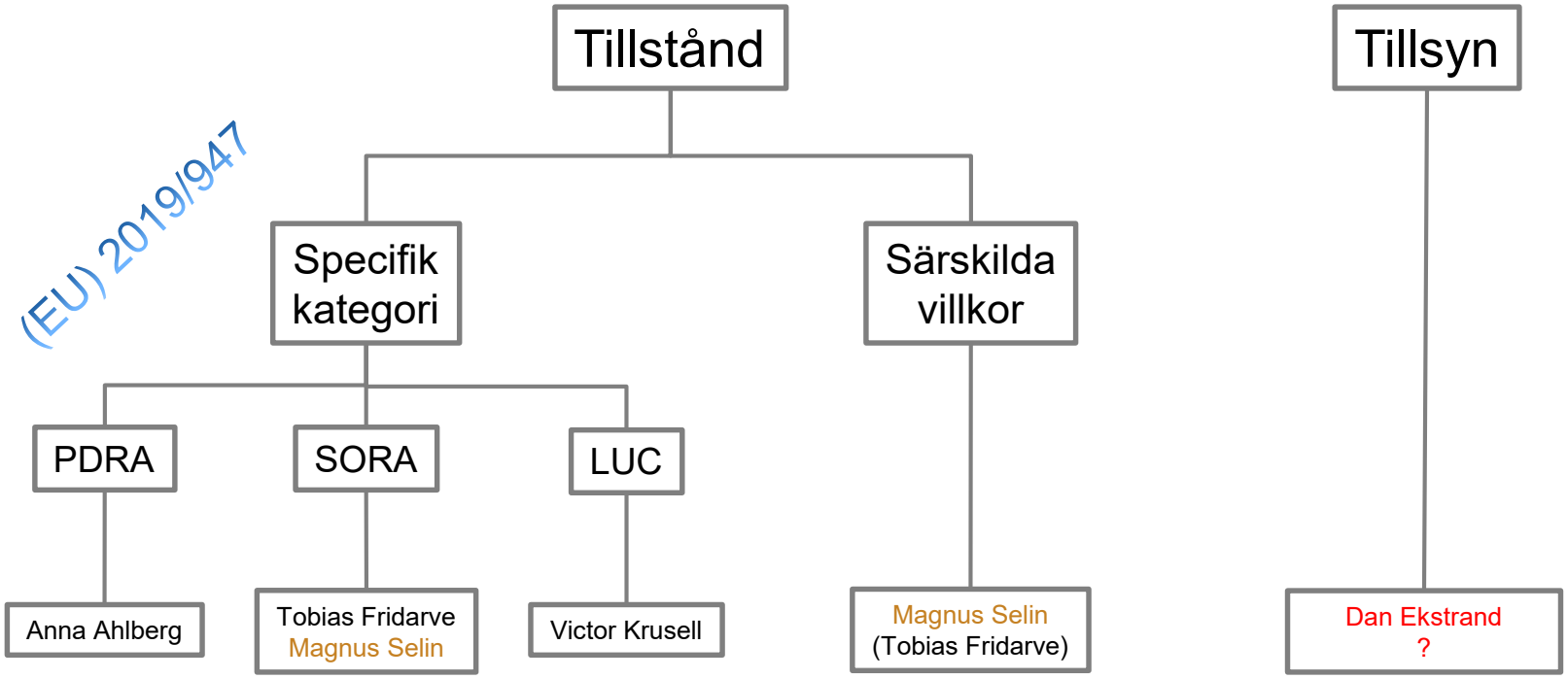
Norrköping

- Tobias Fridarve, inspektör / UAS-koordinator
- Anna Ahlberg, inspektör

Kista

- Magnus Selin, inspektör (slutar 27 mars 2024)
- Victor Krusell, inspektör

Huvuduppgifter UAS



Läget idag

LUC

1 Operatör

SORA

13 Operatörer

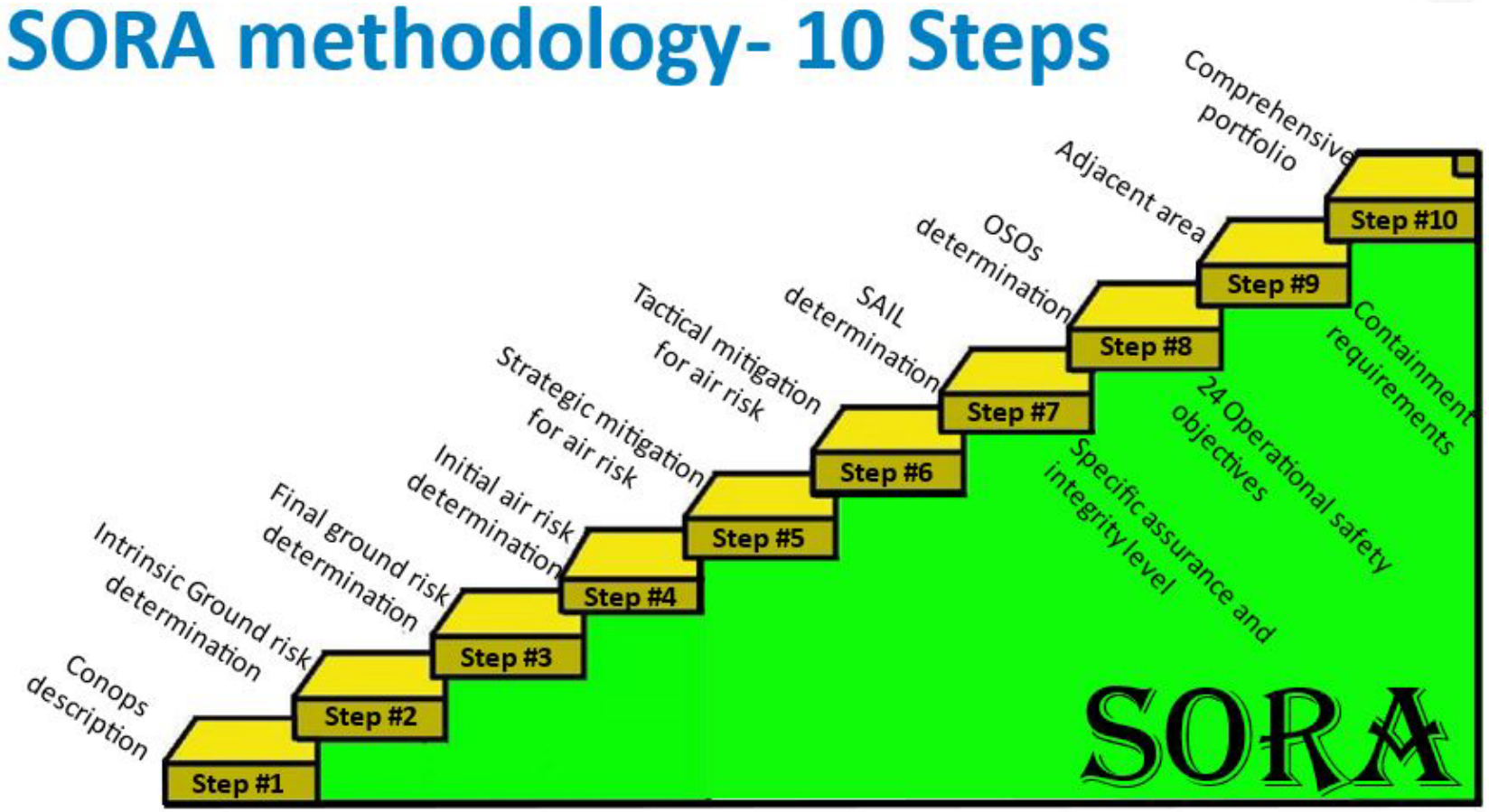
PDRA

19 Operatörer

Särskilda Villkor

58 Operatörer

SORA – Riskanalysen



TRANSPORT STYRELSEN

Steg #1 - ConOps description

Concept of Operations (ConOps)

"Operation description" (SORA 2.5)

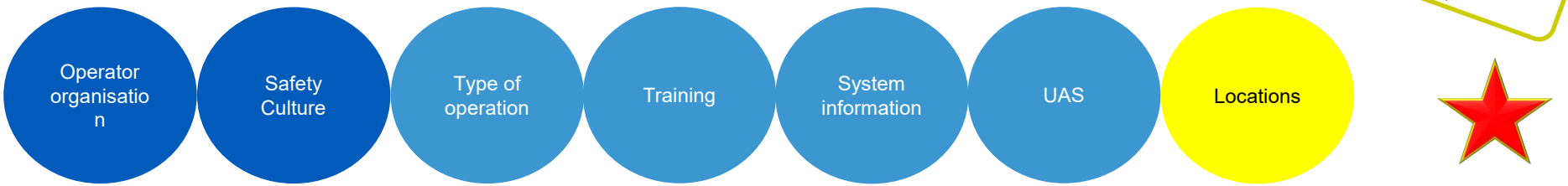
ConOps beskrivning

- ✓ Den sökande beskriver relevant information om system, tekniska delar och operativa procedurer som behövs för att bedöma risken i samband med den avsedda operationen.
- ✓ Det är grunden för alla andra aktiviteter.

Vad du vill göra, vart du vill flyga, vilken UAS tänker du använda

Resultat

- ✓ Beskrivning av den avsedda operationen.

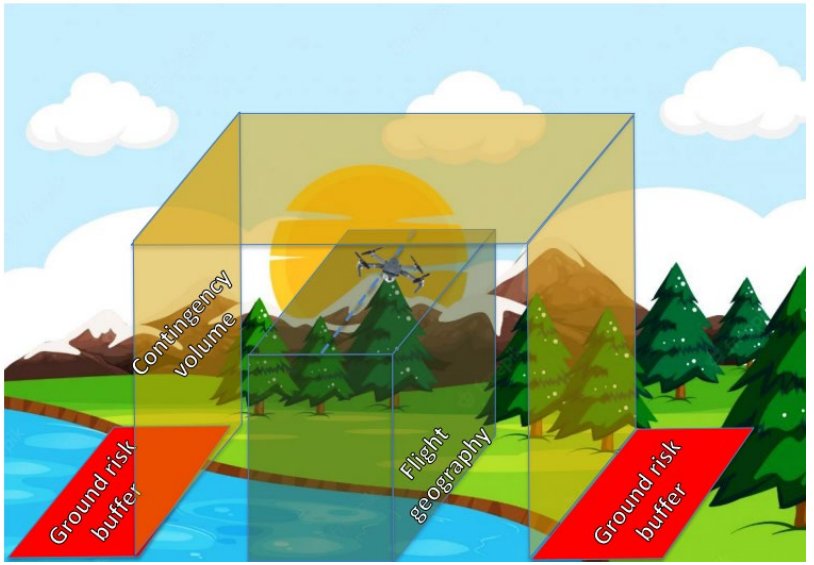


Steg #2 - Determination of the UAS intrinsic ground risk class (GRC)

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			
BVLOS over an assembly of people	8			

Table 2 — Determination of the intrinsic GRC

iGRC 5



TRANSPORT STYRELSEN

Steg #2 – SORA 2.0 vs 2.5

Ändringar i SORA 2.5

v2.0

Intrinsic UAS Ground Risk Class				
Max UAS characteristics dimension	1 m / approx. 3ft	3 m / approx. 10ft	8 m / approx. 25ft	>8 m / approx. 25ft
Typical kinetic energy expected	*< 700 J (approx. 529 Ft Lb)*	*< 34 KJ (approx. 25000 Ft Lb)*	*< 1084 KJ (approx. 800000 Ft Lb)*	*> 1084 KJ (approx. 800000 Ft Lb)*
Operational scenarios				
VLOS/BVLOS over controlled ground area	1	2	3	4
VLOS in sparsely populated environment	2	3	4	5
BVLOS in sparsely populated environment	3	4	5	6
VLOS in populated environment	4	5	6	8
BVLOS in populated environment	5	6	8	10
VLOS over gathering of people	7			
BVLOS over gathering of people	8			

Table 2 – Intrinsic Ground Risk Classes (GRC) Determination

v2.5

Intrinsic UAS Ground Risk Class						
Max UA characteristics dimension		1 m	3 m	8 m	20 m	40 m
Max 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	Category C Operations (Not part of SORA)		

Table 2 – Intrinsic Ground Risk Class (GRC) Determination

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

TRANSPORT STYRELSEN

Steg #3 - Final GRC determination

iGRC 5

		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

Table 3 – Mitigations for final GRC determination

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				
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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			
BVLOS over an assembly of people	8			

Table 2 — Determination of the intrinsic GRC

Final GRC 3 (5-1-1=3)

M1: reducering av antalet människor utsatta för risk inom operationsområdet (operationsvolym + markriskbuffert)

M2: reducering av effekterna vid en markkollision (t.ex. fallskärm)

M3: ERP – begränsa följdeffekterna vid t.ex. krasch eller fly-away

TRANSPORT STYRELSEN

Steg #3 - SORA 2.0 vs 2.5

Ändringar i SORA 2.5

v2.0

Mitigation Sequence	Mitigations for ground risk	Robustness		
		Low/None	Medium	High
1	M1 - Strategic mitigations for ground risk[e]	**0: None -1: Low**	**-2**	**-4**
2	M2 - Effects of ground impact are reduced[f]	**0**	**-1**	**-2**
3	M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	**1**	**0**	**-1**

Table 2 – Mitigations for Final GRC determination

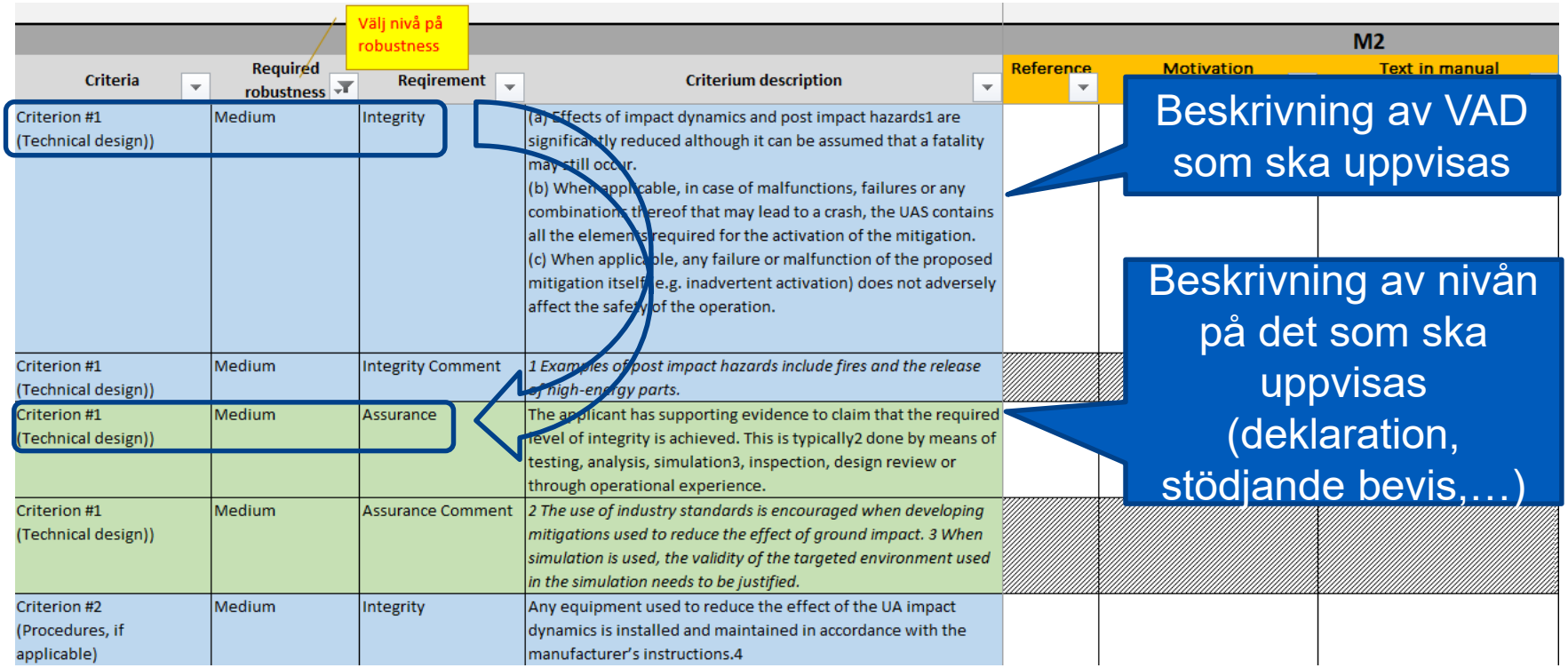
v2.5

Mitigations for ground risk	Level of Robustness		
	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**

Table 4 – Mitigations for Final GRC Determination

Steg #3 - Final GRC determination

Annex B



Criteria	Required robustness	Reqirement	Criterium description	M2 Reference	M2 Motivation	M2 Text in manual
Criterion #1 (Technical design))	Medium	Integrity	(a) Effects of impact dynamics and post impact hazards1 are significantly reduced although it can be assumed that a fatality may still occur. (b) When applicable, in case of malfunctions, failures or any combination thereof that may lead to a crash, the UAS contains all the elements required for the activation of the mitigation. (c) When applicable, any failure or malfunction of the proposed mitigation itself (e.g. inadvertent activation) does not adversely affect the safety of the operation.			
Criterion #1 (Technical design))	Medium	Integrity Comment	*1 Examples of post impact hazards include fires and the release of high-energy parts.*			
Criterion #1 (Technical design))	Medium	Assurance	The applicant has supporting evidence to claim that the required level of integrity is achieved. This is typically2 done by means of testing, analysis, simulation3, inspection, design review or through operational experience.			
Criterion #1 (Technical design))	Medium	Assurance Comment	*2 The use of industry standards is encouraged when developing mitigations used to reduce the effect of ground impact. 3 When simulation is used, the validity of the targeted environment used in the simulation needs to be justified.*			
Criterion #2 (Procedures, if applicable)	Medium	Integrity	Any equipment used to reduce the effect of the UA impact dynamics is installed and maintained in accordance with the manufacturer's instructions.4			

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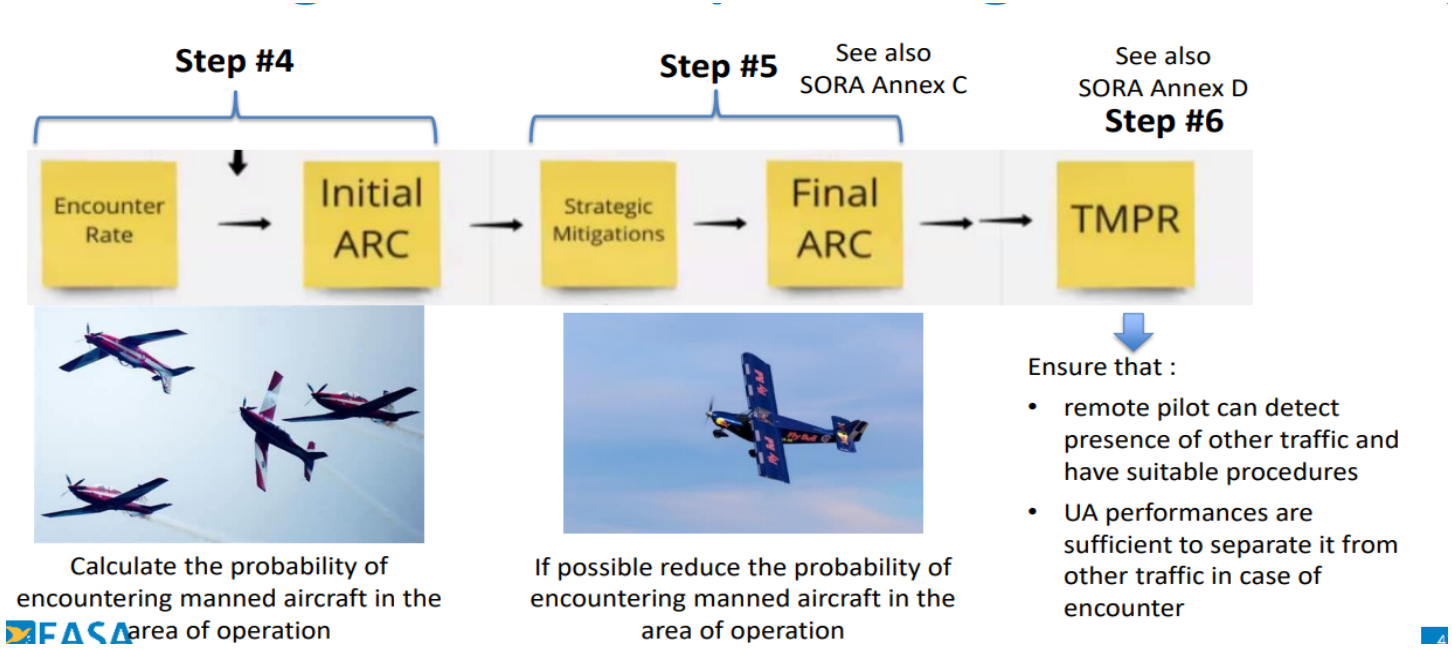
Steg #4, #5 och #6

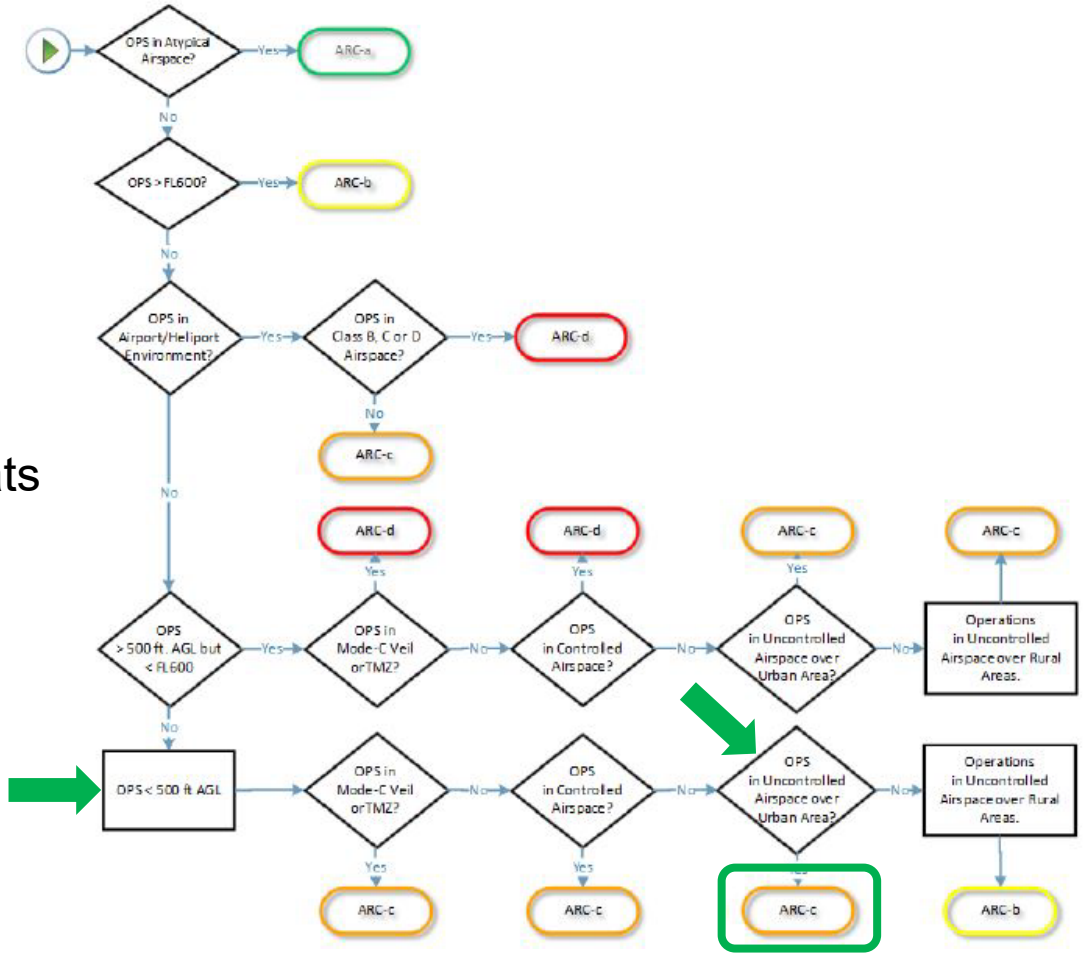
Air risk assessment - Air risk classification and strategic mitigations - Tactical mitigation performance requirement (TMPR) and robustness levels



Steg #4 - Determination of the initial air risk class (ARC)

Exempel

- G-luft
- Ej nära flygplats
- <120 m AGL
- Över tätort



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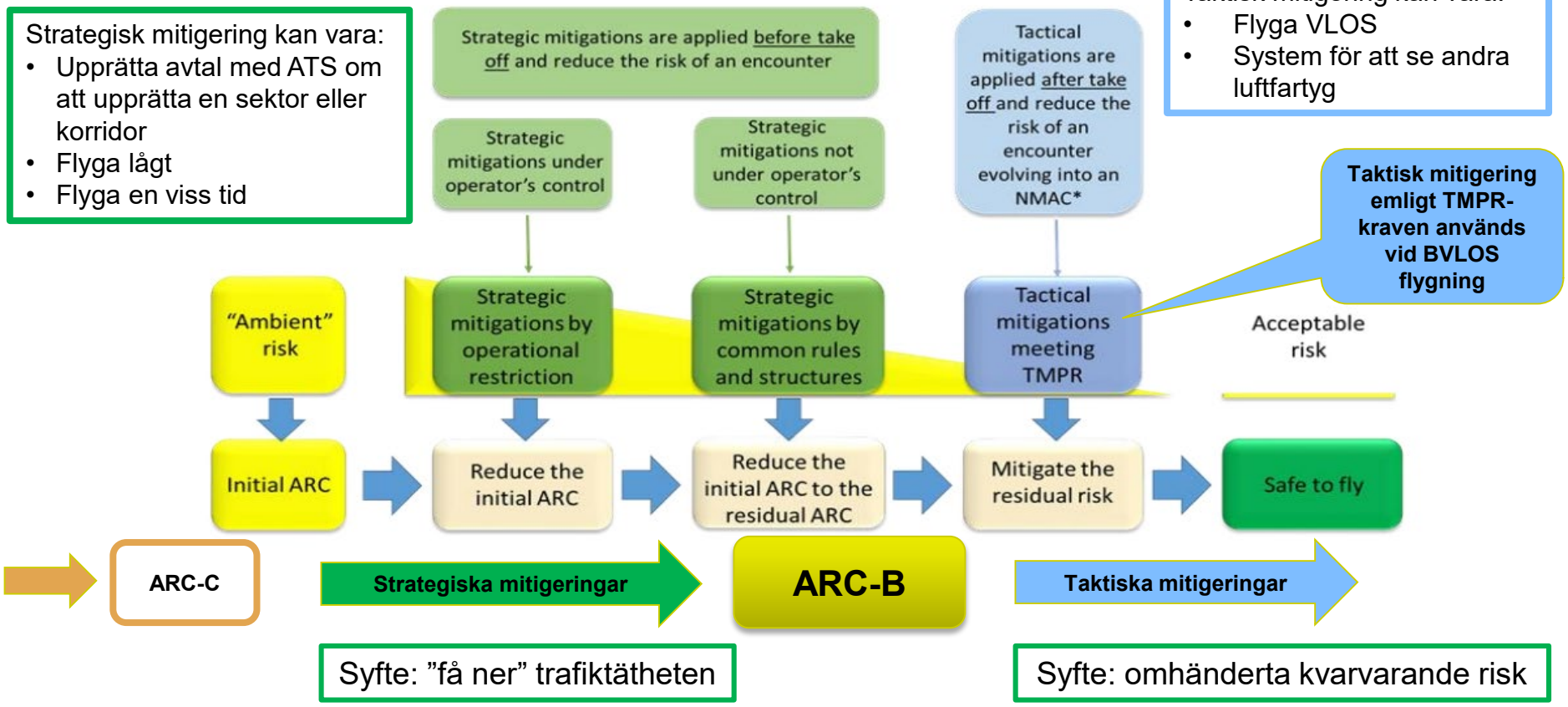
Steg #5 – Strategic mitigations
Steg #6 Tactical mitigations

Strategisk mitigering kan vara:
- Upprätta avtal med ATS om att upprätta en sektor eller korridor
- Flyga lågt
- Flyga en viss tid

Taktisk mitigering kan vara:
- Flyga VLOS
- System för att se andra luftfartyg



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Steg #7 - SAIL determination

Specific Assurance and Integrity Level

Final GRC: 3
Residual ARC: B

	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	Certifierade kategorin			

SAIL II

Steg #8 - Identification of operational safety objectives (OSOs)

OSO number (in line with Annex E)		SAIL					
		I	II	III	IV	V	VI
	Technical issue with the UAS						
OSO#01	Ensure the UAS operator is competent and/or proven	O	L	M	H	H	H
OSO#02	UAS manufactured by competent and/or proven entity	O	O	L	M	H	H
OSO#03	UAS maintained by competent and/or proven entity	L	L	M	M	H	H
OSO#04	UAS developed to authority recognised design standards[1]	O	O	L	L	M	H
OSO#05	UAS is designed considering system safety and reliability	O	O	L	M	H	H
OSO#06	C3 link performance is appropriate for the operation	O	L	L	M	H	H
OSO#07	Inspection of the UAS (product inspection) to ensure consistency with the ConOps	L	L	M	M	H	H
OSO#08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#09	Remote crew trained and current and able to control the abnormal situation	L	L	M	M	H	H
OSO#10	Safe recovery from a technical issue	L	L	M	M	H	H
	Deterioration of external systems supporting UAS operations						
OSO#11	Procedures are in-place to handle the deterioration of external systems supporting UAS operations	L	M	H	H	H	H
OSO#12	The UAS is designed to manage the deterioration of external systems supporting UAS operations	L	L	M	M	H	H

Optional
Low
Medium
High

- **Technical issue with the UAS**
  OSO #1-10
- **Deterioration of external systems supporting UAS operations**
  OSO #11-13
- **Human error**
  OSO #14-20
- **Adverse operating conditions**
  OSO #21-24

Steg #8 - Identification of operational safety objectives (OSOs)

Annex E

Exempel OSO #3 UAS maintained by competent and/or proven entity

				Operatör			TS	
OSO	Criteria	Required robustnes	Criterium description	Reference	Motivation	Text in manual	Compliant Y/N	TS Comment
OSO #03	TECHNICAL ISSUE WITH THE UAS			OSO #03 UAS maintained by competent and/or prov				
OSO #03				Integrity requirements				
OSO #03		Low	(a) The UAS maintenance instructions are defined, and, when applicable, cover the UAS designer's instructions and requirements.					
OSO #03			(b) The maintenance staff is competent and has received an authorisation to carry out UAS maintenance.					
OSO #03			(c) The maintenance staff use the UAS maintenance instructions while performing maintenance.					
OSO #03				Assurance requirements				
OSO #03	Criterion #1 Procedure	Low	(a) The maintenance instructions are documented					
OSO #03			(b) The maintenance conducted on the UAS is recorded in a maintenance log system.					
OSO #03			(c) A list of the maintenance staff authorised to carry out maintenance is established and kept up to date.					
OSO #03	Critereon #2 Training	Low	A record of all the relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.					
OSO #03								

Beskrivning av VAD som ska uppvisas

Beskrivning av nivån på det som ska uppvisas (deklaration, stödjande bevis,…)

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Steg #9 - Adjacent area / airspace considerations

Steg #2 till steg #8
Omhändertar riskerna för att garantera säkerhet i den **operativa volymen**

Steg #9
Omhändertar riskerna för att garantera säkerhet i den **angränsande volymen**

Enhanced eller **Basic**
Containment

Steg #9 - Adjacent area / airspace considerations

→ **If the adjacent volume contains**:

(i) assemblies of people unless the UAS is already approved for operations over assemblies of people; or

(ii) ARC-d unless the residual ARC of the airspace area within the operational volume is already ARC-d;

→ or if the operational volume is in a populated area where:

(i) M1 mitigation has been applied to lower the GRC; or

(ii) operating in a controlled ground area

Ska vara ett oberoende system

Enhanced containment

The probability of the UA leaving the operational volume should be less than 10-4/FH; and no single failure.

Declaration ← Procedures

UAS Design

Or

Declaration ← EASA MoC 2511

DVR

Applicable only in some cases

EASA

TRANSPORT STYRELSEN

Steg #9 - Adjacent area / airspace considerations

→ In all other cases

Basic containment

No probable failure of the UAS or any external system supporting the operation should lead to operation outside the operational volume.

Declaration for :

- adequate procedures and
- using a UAS with no probable failure to exit the operational volume

Some drones with a system to terminate the flight qualifies for basic containment. Since it is not independent, it does not qualify for enhanced containment

EASA

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Steg #9 - Adjacent area / airspace considerations

Ändringar i SORA 2.5

v2.5

Adjacent area final GRC	SAIL					
	I	II	III	IV	V	VI
≤3	N					
4	L	N				
5	L[16]	L	N			
6	M	M	L	N		
7	H	H	M	L	N	
8	C	C	C	M	L	N
9				C	M	L
10					C	M

Table 7 – Adjacent Area Containment Requirements

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

Table 8 – Adjacent Airspace Containment Requirements

Adjacent Airspace Containment Requirements		Adjacent Area Containment Requirements			
		None	Low	Medium	High
	None	None	Low	Medium	High
	Low	Low	Low	Medium	High

Table 9 – Final Containment Requirements

SORA – Riskanalysen hos TS

Steg #1	Concept of Operation (ConOps) / “Operation description” enligt SORA 2.5
Steg #2	Determination of the intrinsic UAS ground risk class
Steg #3	Final GRC determination
Steg #4	Air risk assessment
Steg #5	Air risk classification and strategic mitigations
Steg #6	Tactical mitigation performance requirement (TMPR) and robustness levels
Steg #7	SAIL determination
Steg #8	Identification of Operational Safety Objectives (OSOs)
Steg #9	Adjacent area/airspace considerations
Steg #10	Comprehensive safety portfolio (Compliance with mitigations and OSOs)

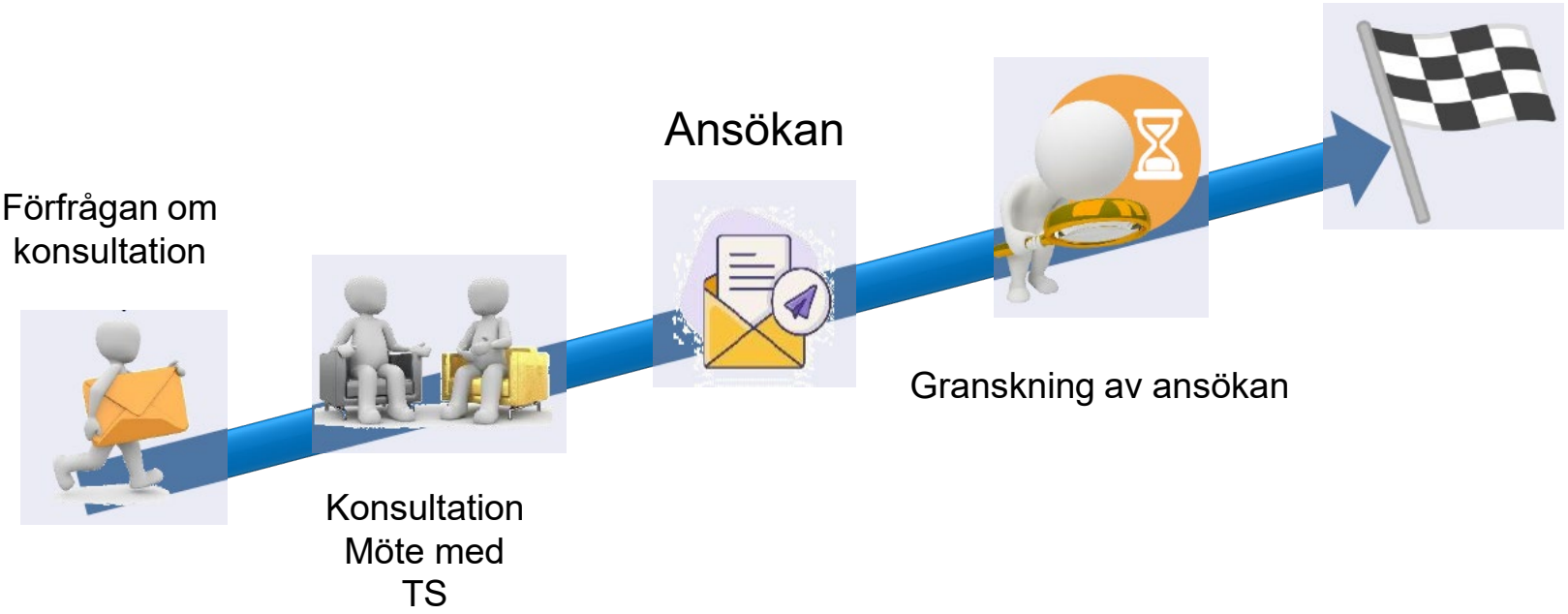
Samordning internt hos Transportstyrelsen gällande de delar som berör luftrummet.

- Sektionen för helikopter och allmänflyg (Sloh)
- **Sektionen för luftrum och flygplatser (SLia)**

Möte med TS

Vägen till en Operativ Auktorisation

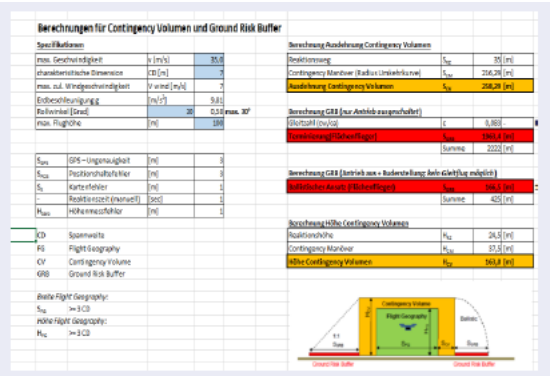
Vägen till en Operativ Auktorisation är alltid densamma för varje ansökan som skickas in till Transportstyrelsen.



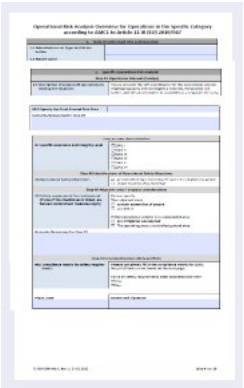
Förfrågan om konsultation

- Begäran om konsultationsmöte via mejl
- Konsultmötet är en gratistjänst!

Koordinater för flygområdet enligt WGS84
(kan som tillägg även anges enligt kml eller kmz)



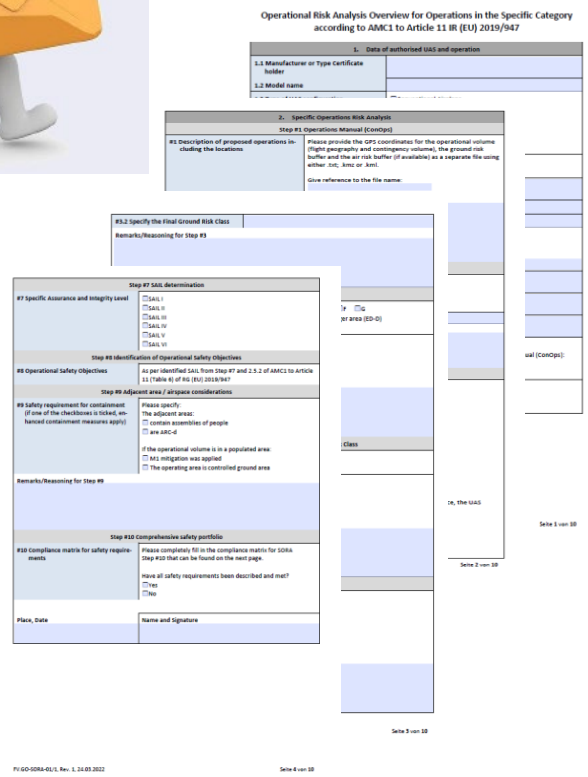
Beräkning av yta för Flygområde, Beredskapsbuffert och Markriskbuffert



SORA-blankett
(sida 1-5)

TRANSPORT STYRELSEN

Förfrågan om konsultation


Operational Risk Analysis Overview for Operations in the Specific Category according to AMC1 to Article 11 IR (EU) 2019/947

1. Data of authorised UAS and operation

1.1 Manufacturer or Type Certificate holder

1.2 Model name

2. Specific Operations Risk Analysis

Step #1 Operations Manual (ConOps)

#1 Description of proposed operations including the locations

Please provide the GPS coordinates for the operational volume (flight geography and contingency volume), the ground risk buffer and the air risk buffer (if available) as a separate file using either .txt; .kmz or .kml.

Give reference to the file name:

#3.2 Specify the Final Ground Risk Class

Remarks/Reasoning for Step #3

Step #7 SAIL determination

#7 Specific Assurance and Integrity Level

SAIL I
SAIL II
SAIL III
SAIL IV
SAIL V
SAIL VI

Step #8 Identification of Operational Safety Objectives

#8 Operational Safety Objectives

As per identified SAIL from Step #7 and 2.5.2 of AMC1 to Article 11 (Table 4) of RG (EU) 2019/947

Step #9 Adjacent area / airspace considerations

#9 Safety requirement for containment (if one of the checkboxes is ticked, enhanced containment measures apply)

Please specify.
The adjacent areas:
contain assemblies of people
are ARC-d

If the operational volume is in a populated area:
M1 mitigation was applied
The operating area is controlled ground area

Remarks/Reasoning for Step #9

Step #10 Comprehensive safety portfolio

#10 Compliance matrix for safety requirements

Please completely fill in the compliance matrix for SORA Step #10 that can be found on the next page.

Have all safety requirements been described and met?
Yes
No

Place, Date

Name and Signature

Class

Seite 1 von 10

Seite 2 von 10

Seite 3 von 10

Seite 4 von 10

SORA-blankett (TSL7628)

- Sida 1-5
  - Detaljer om operationen och UAS
  - Mitigeringar
- Sida 6-8
  - OSOs och deras robusthetsnivå
  - Hänvisningar till OM och riskanalys
- Tillgängliga på Transportstyrelsens hemsida https://www.transportstyrelsen.se/sv/Blanketter/Luftfart/dronare3/

Konsultation - Möte med TS

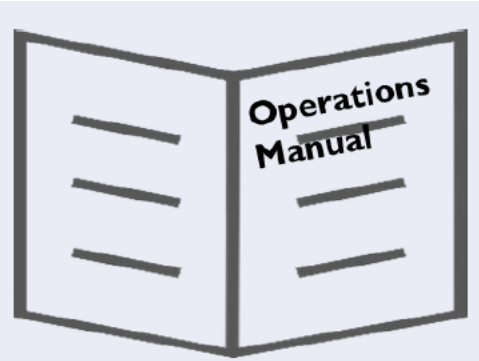
Fram till steg #7 samt steg #9 i riskanalysen

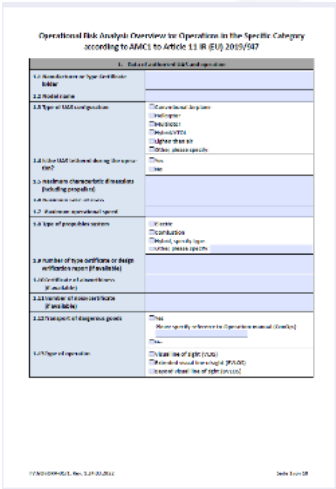
Baserat på den lämnade informationen och SORA-blanketten (sidan 1-5), diskutera och gemensamt komma överens om:

- iGRC och iARC
- Mitigeringar, TMPR, containment
- Final-GRC och final-ARC
- SAIL-klassificering

- Ingen granskning av OM, men råd om hur man skriver en bra
- Frågor angående UAS operationen kan ställas
- Konsultationstid: 1h
- Efter mötet - utskick av SORA blanketten med TS återkoppling till den sökande

Ansökan





- **Operativ Manual / ConOps**
- **Riskanalys**
- **Ev. stödjande dokumentation**

- **SORA / PDRA blankett** (alla 8 sidor)
- **Ansökningsblankett**

Koordinater för flygområdet enligt WGS84
(kan som tillägg även anges enligt kml eller kmz)

Drönare - Transportstyrelsen

Skicka in ansökan

- Via mejl till luftfart@transportstyrelsen.se
- Mottagningsbekräftelse från TS

TRANSPORT STYRELSEN

Granskning av ansökan

- Detaljerad granskning av OM, OSO:er och mitigerande åtgärder enligt kraven beroende på robusthetsnivå.
- Direkt feedback i ansökningsformuläret för varje OSO, grön bock eller en detaljerad kommentar om vad som saknas.
- Den sökande får tillbaka kravuppfyllnadsblanketten med Transportstyrelsens kommentarer.
- Återkoppling kan även ske på annat sätt om det passar bättre.

Granskning av ansökan

Operational Risk Analysis Overview for Operations in the Specific Category
SORA – AMC 1 to Article 11 IR (EU) 2019/947

6 (8)

Operational Safety Objectives

	Level of containment				Remarks (e.g. EASA design verification)	Reference to documentation		
						Document name	Page number	Chapter number
hat the proven	☐ Optional	☐ Low	☐ Medium	☐ High				
OSO #02 UAS manufactured by competent and/or proven entity	☐ Optional	☐ Low	☐ Medium	☐ High				
OSO #03 UAS maintained by competent and/or proven entity		☐ Low	☐ Medium	☐ High				
OSO #04 UAS developed to authority recognised design standards	☐ Optional	☐ Low	☐ Medium	☐ High				
OSO #05 UAS is designed considering system safety and reliability	☐ Optional	☐ Low	☐ Medium	☐ High				
OSO #06 C3 link characteristics are appropriate for the operation	☐ Optional	☐ Low	☐ Medium	☐ High				
OSO #07 Inspection of the UAS (product inspection) to ensure consistency with the Co-nOps		☐ Low	☐ Medium	☐ High				
OSO #08 Operational procedures are defined, validated and adhered to		☐ Low	☐ Medium	☐ High				
OSO #09 Remote crew trained and current and able to control the abnormal situation		☐ Low	☐ Medium	☐ High				

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