

Drone standards state-of-the-art - Data collection and classification framework

Sebastian Cain German Aerospace Center - DLR







- What we want to do...
- Approach
- Data Sources
- Structuring
 - Domains
 - Mapping to Requirements from the SORA
- Status of the work and way forward





Data collection and analysis 1st step

Gather standards applicable to mass market drones which are already in use or in development and develop a structured overview document

Support EASA and EC in the progress of a drone regulatory framework by

providing an overview of available support of regulation

show documents & standards that support current approach proposed by SORA and allow conclusions on gaps





Structure of Approach







Data Sources







	Data Collection	of Drone (-re	lated) Standards	
	General Data	Drone Category	Manning to SOPA	
Domain Topic Subtopic	Document Data Type N° Title Organization Status Description	Open Spec Cert	requirements	
			EUSCG Rolling devel	opment plan
Standards D	ata ANSI St	andardization Ro	admap for Unmanned Airc	raft Systems
			ASTM UA	S Roadmap
	Collection of other	applicable standa	ards (ASTM, ISO, DIN, RTC	CA, SAE, …)





Categorization to Domains

General	Design & Airwort Iev	hiness (at product vel)	Avionics & Equipment	Personnel	U-Space	Opera	ations	Oversight
Definitions	Manufacturer organization (design & production)	Maintenance	General	Remote Pilot Competence	General	General	Marking and Registration	Notified bodies and Qualified Entities
Classfication of UAS Operations	Design	Management of Continuous Airworthiness	Communication	UAS Maintenance personnel competence	E-Identification	Security (operator's responsibility)	Level of Automation/ Autonomy	
Manuals	Production	Electromagnetic Compatibility and Lightning Protection	Detect and Avoid	Additional crew members competence	Service Providers	Operator organization	RPS Service Provider	
Classification of Drones	Systems safety assessement	Software Development & Assurance	Navigation	Human Factors	Tracking	C2 Link Service Provider	Take-off/Landing zones (Urban Vertiports)	
	Electrical System	Emergency capabilities & Health monitoring	Lights	Instructors	Geo-awareness	Standard Scenarios	Ground Handling Service	
	Propulsion systems	Structures	Cyber-security	Examiners		UAS-ATM (IFR above VLL and below FL 600)	Accident/Incident investigation	
	Fuel	Flight Handling	Instruments	Assessors		Risk Assessment (Operations)		
	Noise & Environment	Perfomance	Traffic surveillance (tracking)	Training Organizations				
	Level of Automation/ Autonomy	Ground Control Station	Command and Control (C2) Link					
	Flight Control System							









This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No[°]824292.







This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.







This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No[°]824292.







This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.







This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No[°]824292.



C	General Data	Drone	
Domain Topic Subtopic	Document Data Type N° Title	Category Open Spec Cert	Mapping to SORA requirements
			EUSCG Rolling development plan
Standard	s Data	ANSI Standard	dization Roadmap for Unmanned Aircraft Systems
			ASTM UAS Roadmap
	Collection	of other applica	able standards (ASTM, ISO, DIN, RTCA, SAE, …)





Data colle	ction of dr	one	(-relate	d) sta	ndard	S	Ľ
eneral Data	Drone			Cate	egorizatio	on	
Document Data Type N° Title	Category Open Spec Cert	Affect #02	ed OSOs 1 #24	Affecte M1 [12]	ed GRM M2 ERP	Affected ARM Strat Tact	SORA STEP #9
		X	X X	ХХ	X	X X	
Standards Data		X X X	X X X X	X	Х	X	
	neral Data Document Data Type N° Title Standards Data	neral Data Document Data Type N° Title Standards Data	neral Data Drone Category Document Data Type N° Title Open Spec Cert Standards Data X	neral Data Drone Document Data Open Spec Cert Type N° Title Open Spec Cert X X Standards Data X X X X X X X	neral Data Drone Category Open Spec Cert Affected OSOs #01 #24 Affected M1 [12] Standards Data X X X X X X X X	Ineral Data Drone Category Categorization Document Data Type N° Title Open Spec Cert Affected OSOs #01 #24 Affected GRM M1 [12] M2 ERP Standards Data X X X X XX X X X XX X X X XX X X	Ineral Data Drone Category Categorization Document Data Type N° Title Open Spec Cert Affected OSOs #01 #24 Affected GRM M1 [12] M2 ERP Affected ARM Strat Tact Standards Data X X X X X X X X X X X X



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.



Data Collection Document

69 /																				Affecte	ed SORA OSO									G M1(Generic)	round Risk M	ugations			Straf	tegic Mitigatir	Collision Ris	K (Air Nisk) Tactica	I Mitigation	<u> </u>	- 8			
612		Domain	1	Туре		Do	cument				JAS Category				Technical			0	perational	Rem	note crew trai	ining Safe	e design of	on f	Huma	an Error		Adverse Operating Conditions	Strategic	M. Tethered	operation M	(Effects of grou	and impact)	ERP	Operation Restrictio	hal Ci Stru	Common uctures and V Rules	LOS	BVLOS	105	Step i			
N'	Domain	Subtopic	Standard/Specifi cation	Best Practices f diff dian ce dian ce	Document N°	Title	Organization	Status	Description	open	specific	certified	801 BI	22 #03	#04 #05	#06	#07	108 #11	#14	#21 #09	#15 #2	22 #10	#12 #13	#16	#17 #18	8 #19	#20 #23	3 #24	M1581 N	1 582 M1 781	M1 TH2 M	#1 M2#2	M2 #3 M3	3#1	Chronology	Time of Exposure Common Flight	 Rules Comm on Airspace Structure VLOS 	e Detect Decide	command frecute	Execute Feedback loop	Containment	Comm ents	Acce ss	Responsible
5	General	Classification of drones	x		150 21895	Requirements for the categorization and classification of civil UAS	ISO TC20 / SC16 / WG	51 ongoing	Requirements for the categorization and classification	x	x	х				Τ			\square																	\square			T		N	o clear mapping found	Eurol	usc X
5	General	Definitions	х		150 21384-1	General requirements for UAS for civil and commercial applications, UAS terminology and	ISO TC20/SC16/WG	i1 ongoing	Provides the foundation and common terms, definitions and	х	х	х							\top																					T	N	o clear mapping found	Eurol	iusc X
,	General	Manuals	x		ASTM WK62744	dassification New Practice for General Operations Manual for Professional Operator of Light Unmanned Aircraft	ASTM F38 Unmanned	onging	references relevant to the This standard defines the requirements for General	x	x	х	x				x	x >	x x	x				x	x	x	,	x													A pi	draft is not available. A reliminary mapping is	Eurol	iusc X
20	Avionics &	Command and Control (C2)	x			Systems (UAS) MDPS (Terrestrial LOS)	Aircraft Systems EUROCAE WG:105	ongoing	Operations Manual for Minimum Operational Performance Standard for the	x	x	х			x >	< x						x	x											TE			T		x	x	07. 51	erformed. SO #4 "This should be a andard similar to the	Eurol	iusc X
21	Avionics &	Command and Control (C2)	x			MDPS (SATCOM)	EUROCAE WG.105	ongoing	terrestrial Line of Sight Minimum Operational Performance Standard for the	x	x	х			x >	< x						x	x																x	x	O! is	IOPS for SATCOM with SO #4 "Since the C2 Link part of the UAS, then	Eurol	iusc X
22	Avionics &	Command and Control (C2)	x			Minimum Aviation System Performance Standard	EUROCAE WG-105	ongoing	satellite Command and Control	х	x	х			x >	< x						x	x																x	x	X re	iis standard provides a IASPS define quirements at system	Eurol	iusc X
51	Avionics &	Detect & Avoid	x			Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for	EUROCAE	ongoing		x	x	x			x >	(x >	(x	x	(si Ta D	ub-system) and not at actical Mitgation: etect The DAA	Eurol	iusc X
52	Avionics &	Detect & Avoid	x			DAA of IFR Flights in class A-C airspace. Minimum Operational Performance Standard (Requirements at equipment level) for DAA of	EUROCAE WG-105	ongoing			x	x			x >						11													TE		HT -		x >	(x	x	fu TI 2	Inctionalities include The draft is still not vailable. Preliminary	Eurol	iusc X
53	Avionics &	Detect & Avoid	x			IFR Flights in class A-C airspace. Operational Services and Environment Description for DAA for DAA in Class D-G	EUROCAE	ongoing		x	x	x			x >	<																						x >		x	hi hi	apping is made taking e OSED only defines igh level requirements	Eurol	Jusc X
54	Avionics &	Detect & Avoid	x			airspaces under VFR/IFR Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for	EUROCAE	ongoing			x	x			x >				+-+													-		TE		H-	11	x >		x	an Tr 2	nd enviromental ne draft is still not vailable. Preliminary	Eurol	JUSC X
55	Avionics &	Detect & Avoid	x			DAA against conflicting traffic for RPAS operating Minimum Operational Performance Standard (Requirements at equipment level) for DAA	EUROCAE	planned			x	х			x >	<																						x >		x	TR ar	apping is made taking ne draft is still not vailable. Preliminary	Eurol	JUSC X
56	Avionics &	Detect & Avoid	x	-		against conflicting traffic for RPAS operating OperationalServices and Environmental	EUROCAE	ongoing		x	x	x			x			x	+	x							,	x				-						x >		×	Ta N	apping is made taking actical litigation:Detect : The	Eurol	JUSC X
57	Avionics &	Detect & Avoid	x			Minimum Operational Performance Standard (Requirements at equipment level) for DAA at	EUROCAE	planned		x	x	x			x	(x		x								x							+			x)	(x	x	A tř	AA functionalities draft is not availabe at ie moment. Preliminary	Eurol	usc X
58	Avionics &	Detect & Avoid		×	STANREC 4811 Ed. 1/ AEP	Very Low Level (VLL)	NATO	published	To detail comprehensive guidance and recommended	x	x	x	x	×	x	(X		x	×	xx							x									×		× 1		×	St e	apping is made andard: "UAV mergency procedures	TUDe	elft X
3	Equipment Design &	Level of	x	-	101 Ed. A Ver. 1 ED-252 OSED	1	EUROCAE	published	practice for the development of Operational Services and Enimoment Description for	x	x	x	~		x x			x x	x x	x x							~					+				\vdash	× ×				sh O	sould mirror those for SO #4:ATOL capability on be included as a core	Eurol	usc ¥
54	Ainworthiness Design &	Automation/Autonomy	x		MASPS	Minimum Aviation System Performance Standard (End-to-end Renuirements at system level) for	EUROCAE	planned	Automatic Take-Off and Landing.	×	x	x			x			x x		× –	+ +											-				<u> </u>		++	++	++	D	andard for certain UASs raft not available yet. A reliminary manning is	Eurol	ausc v
55	Ainworthiness Design &	Automation/Autonomy	x		ED-251 OSED	Automatic Take-Off and Landing	WG-105 EUROCAE	published	Operational Services and	x	x	x			x			x x		<u> </u>															+-/	H			++		0	ade considering what is SO #4: Automatic taxing mability can be	Eurol	
56	Ainworthiness Design &	Automation/Autonomy	v		MASPS	Minimum Aviation System Performance Standard	EUROCAE	planned	Automatic Taxiing	v	v	v			, v			x /														-		-++-	+	\vdash	4-+		++	++	in	cluded as a core o draft published.	Furg	
57	Ainworthiness Design &	Automation/Autonomy	x		OSED	Automatic Taxiing	WG-105 EUROCAE	oneoine	Operational Services and Enironment Description for	x	x	x			x			x x		x		×	x			x									+-	H	++		+		X B	erived from the OSED. SO #4 Emergency & ecovery functions can	Eurol	
68	Ainworthiness Design &	Emergency canabilities	×		MASPS	Minimum Aviation System Performance Standard (End-to-end Renuirements at system level) for	EUROCAE	planned	Automation and Emergency	×	x	x			×			x x		× ·			x			×									+	\vdash	4-+		++	ŦŦ	X Å	e included in the UAS draft is not available	Furg	
17	Ainworthiness Design &	Emergency conshilition	v		ASTM	automation and Emergency Recovery	WG-105 ASTM E28 Jamannad	onnoine	Develop a draft standard that defines the requirements for a	v	v	v			^			<u> </u>	Ĥ	Â		- Â				^						_			+		++			÷		apping is made ith current hypothesis,	controlled DELA	
18	Ainworthiness Design &	Emergency canabilitier	Ŷ		WK59171	Standard Specification for Small Unmanned	Aircraft Systems ASTM F38 Ubmanned	Published	parachute system that would This specification covers the design and manufacture	x	^ Y	×								-														+	┯	\square	++	++	++	++	• to	other ASTM parachute PEN: ntentialy to meet 80	controlled DELA	
20	Airworthiness Design &	Electrical System	Ŷ		F2490-	Aircraft System (sUAS) Parachutes Standard Guide for Aircraft Electrical Load and	Aircraft Systems	nubliched	requirements for deployable This guide covers how to prepage an electrical load	^	^ v	^ V			, ,	`			+		+	×			$\left \right $							^			+	\vdash	+		++	÷	th	reshold, but not	controlled DELA	X
100	Airworthiness Design &	Management of Continuos	Ŷ		05(2013)	Power Source Capacity Analysis Standard Practice for Maintenance of Aircraft	F39 Aircraft Systems ASTM	oublich- d	analysis (ELA) to meet Federal Damaged wiring or equipment		~	v			^						++	×												++	+	\square	++	++	++	++	E/ 0	ectrical stds Not PEN:	controlled Drive	×
	Airworthiness	Airworthiness	^		14	Electrical Wiring Systems	F39 Aircraft Systems	poolished	mananciano, regarditess or now		^	^	1	- I *	1				1 1	.		1								1				11	1 '	1 1					EN C	economiscus NOL	Componed DED4	~ ×





Data Collection Document

			G	ieı	ne	eral Dat	a				Category												N	lap	piı	ng	to) S	OF	۶A									Edit	or	ial
69 / 612		Domain	Тур	e			Document				UAS Category	r			Technical				Operation	al	Affected SC Remote	DRA OSO e crew training	Safe design	eno ion H	luman Error	Adv Ope Conc	lverse erating ditions	M: Strategic M.	G L (Generic) Tethered	operation	gations Effects of gro	ind impact) ER	RP O	Strategic Mitig perational estrictions	Collision Risk ation Common Structures and Rules	(Air Risk) Tactica	al Mitigation BVLDS	SORA Sorp #9	via deser		
N°	Domain	Subtopic	Standard/Specification	 Information/Gui dance 	locument N°	Title	Organization	Status	Description	open	specific	certified	801 802	#03	804 B	05 #06	#07	#08 ¥	#11 #14	#21	#09 #	#15 #22	#10 #12 #1	#16 #17	#18 #19	#20 #23	#24	M1581 M15	12 M1 TH1	M1 TH2 M2	1 M2#2	M2 #3 M3 #	ti ti	Chronology	Common Fragm. Common Difference Airspace VLOS	e Detect F Decide	command command Execute	Feedback loop ¢ Containment	e Comments	Access	Responsible
5	General	Classification of drones	x	ISI	0 21895	Requirements for the categorization and dassification of civil UAS	ISO TC20/SC16/	WG1 ongoing	Requirements for the categorization and classification of civil UAS. The standard Browides the foundation and	x	x	x																								Щ			No clear mapping found		EuroUSC X
6	General	Definitions	x	ISI	0 21384-1	commercial applications, UAS terminology and dassification New Practice for General Operations Manual fo	ISO TC20/SC16/	WG1 ongoing	common terms, definitions and references relevant to the This standard defines the	х	x	x				_	-		_										_										No clear mapping found		EuroLISC X
7	General	Manuals	x	AS W	STM (K62744	Professional Operator of Light Unmanned Aircr Systems (UAS)	Aircraft Systems	onging	requirements for General Operations Manual for Minimum Operational	х	x	х	x				X	x	x)	< X				x x	x	x							_			44			preliminary mapping is performed. OSO #4 "This should be a		EuroUSC X
20	Equipment Avionics &	Link	² X			MOPS (Terrestrial LOS)	WG-105	ongoing	Performance Standard for the terrestrial Line of Sight Minimum Operational	x	x	X			x	x)	•		_	_			X X						_								x	x	standard similar to the MOPS for SATCOM with OSD #4 "Since the C2 Lini	k	EuroUSC X
21	Equipment Avionics &	Link Command and Control (C2	²⁾ X	+ +		MOPS (SATCOM) Minimum Aviation System Performance Standa	WG-105 ard EUROCAE	ongoing	Performance Standard for the satellite Command and Control	X	x	X			X	x)	•		_	_			X X						-		_		_		+++		x	x	is part of the UAS, then this standard provides a MASPS define		EuroUSC X
	Equipment Avionics &	Link	X			for the Command and Control Link Minimum Aviation System Performance Stands	WG-105 ard EURDCAE	ongoing		x	x	X			x	x	•			_			XX						-						++		x	XX	(sub-system) and not at Tactical Mitgation:		
51	Equipment Avionics &	Detect & Avoid	×	+ +		(End-to-end Requirements at system level) for DAA of IFR Flights in class A-C airspace. Minimum Operational Performance Standard	EURDCAE	ongoing		×	×	×		-	×	×	-		-	_									+		-				+++			×	functionalities include The draft is still not		
52 53	Equipment Avionics &	Detect & Avoid	×			(Kequirements at equipment level) for DAA or IFR Flights in Cass A-C airspace. Operational Services and Environment	WG-105 EURDCAE	ongoing		v	×	x			×	×	-			_									+						++			×	mapping is made taking he OSED only defines		
54 54	Equipment Avionics &	Detect & Avoid	^ 			airspaces under VFR/IFR Minimum Aviation System Performance Standa (Sed. to and Requirements of outper Januar) for	WG-105 ard EUROCAE	ongoing		^	Ŷ	×		-	×	^ v				_													_					^ 	and environmental The draft is still not		
55	Equipment Avionics &	Detect & Avoid	Î.			DAA against conflicting traffic for RPAS operati Minimum Operational Performance Standard (Requirements at acciment level) for DAA	NG-105 EUROCAE	nianned			Ŷ	×			v	~	-																					^ 	mapping is made taking The draft is still not		
56	Equipment Avionics &	Detect & Avoid	^			against conflicting traffic for RPAS operating OperationalServices and Environmental	EURDCAE	onsoins		×	Ŷ	×		-	×	^ x		×		×						×			-									×	mapping is made taking Tactical Mitigation Detect - The		EuroLISC X
57	Equipment Avionics &	Detect & Avoid	× ×			Description for DAA in very Low Level Operation Minimum Operational Performance Standard (Reminements at eminment level) for DAA at	EURDCAE	planned		x	x	x			x	x		x		×						× ×									++			x	DAA functionalities A draft is not available at the moment. Preliminar		EuroLISC Y
58	Equipment Avionics &	Detect & Avoid		ST X Ed	TANREC 4811	Very Low Level (VLL) UAS sense and avoid	NATO	published	To detail comprehensive suidance and recommended	x	×	x	x	×	x	× v		x		/ x	x					x A									×		× ^	x	mapping is made Standard: "UAV emerge ncv procedures	1	TUDelft Y
63	Equipment Design &	Level of	x	10 ED	01 Ed. A Ver. 1	1	EUROCAE	published	practice for the development of Operational Services and Enironment Description for	x	x	x	~		x	× ,		x	x	< x	~					~									x			~	should mirror those for OSO #4:ATOL capability can be included as a core	2	EuroUSC X
64	Design &	Level of	x		IASPS	Minimum Aviation System Performance Standa (End-to-end Requirements at system level) for	ard EUROCAE	planned	Automatic Take-Off and Landing	x	x	x			x			x	x	< x											-				x				standard for certain UAS Draft not available yet. A preliminary mapping is	5	EuroUSC X
65	Design &	Level of	x	ED	0-251 OSED	Automatic Take-Off and Landing	EUROCAE	published	Operational Services and Enironment Description for	x	x	x			x			x	x	<																			made considering what i OSO #4: Automatic taxin capability can be	is 8	EuroUSC X
66	Design &	Level of	x	м	IASPS	Minimum Aviation System Performance Standa (End-to-end Requirements at system level) for	and EUROCAE	planned	Automatic Taxiing	x	x	х			x			x	x	,																+++			Included as a core No draft published. Preliminary mapping		EuroUSC X
67	Design & Ainworthiness	Emergency capabilities	x	05	SED	Automatic Taxiing	EUROCAE WIS-105	ongoing	Operational Services and Enironment Description for	x	x	х			x			x	x	< x			x x		x													x	derived from the OSED. OSD #4 Emergency & Recovery functions can		EuroUSC X
68	Design & Ainworthiness	Emergency capabilities	x		IASPS	Minimum Aviation System Performance Standa (End-to-end Requirements at system level) for	eUROCAE	planned	Automation and Emergency	x	x	х			x			x	x	< x			x x		x											++		×	be included in the UAS A draft is not available yet. A preliminary		EuroLISC X
97	Design & Airworthiness	Emergency capabilities	x	AS	STM (K59171	automation and Emergency Recovery New Specification for SUAS parachutes	ASTM F38 Unmanned	ongoing	Develop a draft standard that defines the requirements for a	x	x	х				+	+												+									×	mapping is made with current hypothesis, assumed to be identical	controlled	DELAIR X
98	Design & Airworthiness	Emergency capabilities	x	B	8322-18	Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes	Aircraft Systems ASTM F38 Unmanned	Published	parachute system that would This specification covers the design and manufacture	х	x	х				x							x x								(×	DPEN: potentialy to meet 80J	controlled	DELAIR X
99	Design & Airworthiness	Electrical System	x	F2	2490- 5(2013)	Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis	ASTM F39 Aircraft System	ms published	This guide covers how to prepare an electrical load		x	х			x								x x																OPEN:	controlled	DELAIR X
100	Design & Airworthiness	Management of Continuos Airworthiness	s x	F2	2799-14	Standard Practice for Maintenance of Aircraft Electrical Wiring Systems	ASTM F39 Aircraft System	ms published	Damaged wiring or equipment in an aircraft, regardless of how minor it may appear to be.		x	х		×																									OPEN: Electrical stds Not mentioned in ASD-STAN	controlled	DELAIR X





Data Collection Document – Example

F3330 - 18 Standard Specification for Training Manuals for the UAS Operator A <th></th> <th>General Data</th> <th>Category</th> <th></th> <th>Mapping to SORA</th> <th>Editorial</th>		General Data	Category		Mapping to SORA	Editorial
V + V + V + V + V + V + V + V + V + V +	F3330 - 18	Standard Specification for Trand the Development of Tr Manuals for the UAS Opera	Training aining tor	Image: Second	published I.1 This specification defines the requitraining and the development of training and	rements for ng manuals for the ator.
Image: Note of the state	brogati Anisotharia Accession/bacasary	Indexersion and the second and the s	× × ×			portes navy mapping in transmit.
National All National All<	Desgale seed of the second sec	In semantic sectors by these Reference accession for a sector of a sector of the sector of accession for a sector for				The second secon
Name Name <th< td=""><td>Animathine in Animathing Animatry X</td><td>Automatic based</td><td></td><td></td><td></td><td>deared from the Obio.</td></th<>	Animathine in Animathing Animatry X	Automatic based				deared from the Obio.
a x	brogeni Armothanos integencycopolatines X	to newwork writen by data. Reference Randolf all INDEXES NASH'S under an ell Respective at a system kinely for under an ell Respective at a system kinely for Reference at all Respective at Reference	X X X			XXXXX
Ministry Ministry <th< td=""><td></td><td></td><td></td><td></td><td></td><td>X · · X</td></th<>						X · · X
	- · · · · ×		x x x			X X Addressessability summer X propagation X X
	brogeń Arweicheren Arweicheren	All and a second	x x x x x	x		X X X X X Antiferrance and processing of the procesing of the proces of the procesing of the processi



17



Data Collection Document – Example

	Genera	l Data	Category		Mappin	g to SORA			Edit	orial
F3330 - 18	Standard Sp and the Dev Manuals for	ecification for relopment of the UAS Op	or Training ^T Training ASTM erator	1	Image: Normal System Image: No				Constraints of participation of the second sec	
An and it is a final state of the second state and	X Internet of pro- X Internet of pro- Internet	na teologi ile effantea ese Materiale al La e equencie a la esta factoria al La e equencie a la esta constante constante a esta esta esta esta esta esta esta						x x x x x x x x x x x x x x	The data to station as a lable. Protest many management of calls the op-	Kuessic X
Ano disco la Bagiagona est	X Statements		Domain			UAS Category	/		the draft is still not available. Preken many mappings create taking	issue X
An anach A Repopular An anna Anna Anna A Repopular An Anna Anna Anna Anna Anna Anna Anna A	X Image: Constraint of the second secon	Domain	Sub	topic	open	specific	certified		Lonical Margineradiate (C. Be- Both Special date) (C. Be- Both Special date) (C. Berner (C. Berner) (C. Berner) (C	Kacant X Kacant X Kasant X Kasant X Kasant X
	Anna Anna Anna Anna Anna Anna Anna Anna	Personnel	Remote Pilot c	ompetence		x	Х		rander and drong what is rander and drong what is relation and in a parage designed from the Calcill X AddD1 science accelerate response reade	Fuence X Fuence X Fuence X Fuence X Fuence X Fuence
Image: A set of the s	Allow X Allow Allow X Allow Allow X Allow Allow X Allow Allow Datawat Allow Allow X Allow Allow Datawat Allow Allow	Former for small sense and RETURN and R	Interpretation encoder X X Interpretation encoder X X						X CONS. X pomentaly to reserve the therebold, barware CONS. Benetical rate mark	oralied block X



	=/	AW	DR	ON	ES	/				D	ata	A C		<u>ect</u>	ior	<u>ח</u> D	00	<u>un</u>	ner	<u>nt –</u>	- E	xaı	mp	le
F3330 - 18	St 3 ai N	andar nd the Ianual	d Spe Deve s for t	cificat lopme he UA	ion fo ent of S Ope	r Trair Traini erator	ning ng A	STM									ernal systems							
			Te	echnic	al				Opera	ationa	I	Ren	note (rainir	crew Ig	Sa des	afe sign	eterioration of extersion of extersion of externation of the supporting UAS of the support of the second se	-	Hu	man E	rror		Adv Oper Cond	erse ating itions
лания лания нарадия 																	ŏ							
	#01	#02	#03	#04	#05	#0 6	#07	#08	#11	#14	#21	#09	#15	#22	#10	#12	#13	#16	#17	#18	#19	#20	#23	#24
La paparente de la construir d	Ensure the operator is	competent and/or proven UAS manufactured by meetent and/or proven	UAS maintained by competent and/or proven	UAS developed to authority recognized desion standards	UAS is designed considering system safety and reliability.	calink characteristics (e.g. calink characteristics (e.g. performance, spectrum use) are appropriate for the operation	Inspection of the UAS (product in spection) to ensure consistency to the ConOns	Operational procedures Operational procedures are defined, validated and adhered to (to address athered to (to address athered to (to address)	Procedures are in-place to handle the deterioration of external systems	Operational procedures are defined, validated and adhered to (to adress human procedures	Operational procedures are defined, validated and adhered to (to address Adverse Operating	Remote crew trained and current and able to control the abnormal and emergency situations (i.e. emergency situations (i.e. 1145)	Remote crew trained and current and able to control the abnormal and emergency situations (i.e.	The remote crew is The remote crew is thread to dentify critical environmental conditions and to avoid them	Safe recovery from technicaliseue	The UAS is designed to manage the deterioration of external systems	External services supporting UAS operations are adequate to the operation		Multi crew coordination Remote crew is fit to	operate Automatic protection of the flight envelope from	numan er 015 Safe recovery from Human Frror	A Human Factors evaluation has been performed and the Human-Machine Interface (HMI) found appropriate (Frithe mission	Environmental conditions for safe operations defined, measurable and adhered to	UAS designed and qualified for adverse environmental conditions (e.g. adequate sensors, DO-160 qualification)
Angeni Macada Angeni Angeni Angeni Angeni Angeni Angeni							x					x	x	x				x			x		x	



F333	0 - 18	S a N	tanc nd t 1ani	dard Sp he Dev uals for	ecificat elopmo the UA	ion for T ent of Tra S Opera	raining aining tor	ASTM		ć	a (Col	lleo	ctio	n [Doc	um	ien	nt —	E	kai	mp	le
					Gro	ound Risl	< Mitiga	tions							Со	llision I	Risk (A	ir Risl	k)				
				M1 (G	eneric)		M2 (Ff	fects of	ground			:	Strate	egic M	itigatio	on		Tact	ical M	litigat	ion		SORA Step #9
	Nanganetit Image: State S	Str	ate	gic M.	Tet ope	hered ration		impact)	biound	ERP		Op Re:	eratio stricti	onal ons	Con Strue and	nmon ctures Rules	VLOS		E	3VLOS			
	Access B Responses Respons	M1 9	5#1	M1 S#2	. M1 T#	1 M1 T#2	M2 #1	M2 #2	M2 #3	M3 #1	-	Boundary	Chronology	Time of Exposure	Common Flight Rules	Common Airspace Structure	VLOS	Detect	Decide	Command	Execute	Feedback loop	Containment
	Chengels An austriane on Chengels An austriane on An austriane on An austriane on An austriane on An austriane on		Definition of the ground risk buffer	Evaluation of	peopre at t br Technical Desgin of	tether Procedures for tether installation	a concord Fechnical Design For Pround immach	Procedures for equipment installation	X Training for ground imact measures		emergency Response Plan	Mitigations that bound the geographical volume in which the UAS operates	Mitigations that bound the pperational time	Mitigations that bound the time of exposure	Mitigations by setting a common set of rules which Mitigations togeting nountitation bubwith	airspace nfrastructure through, physical characteristics, procedures, and techniques	Tactical mitigation with the remaining well clear and avoiding collisions Refune Retection	with adequate precision for the avoidance manoeuvre (ARC-a to ARC-d)	Define Décide with adequate precision for the avoidance manoeuvre (ARC-a cettes ommand	with acceptance precision for the avoidance manoeuve (ARC-a Deathe Evecute	precision for the avoidance manoeuvre (ARC-a ชิรี่มีRE เ ต ้อุต่อส่วะ	oop wun adequate precision for the avoidance manoeuvre (ARC-a ເຈົ້າການ	requirements for adjacent airspace and area considered





Data Collection Document – Example

	► Standard Specification for Training	Mapping to SORA			Editori
F3330 - 18	and the Development of Training ASTM Manuals for the UAS Operator				
	Comments		Access	Responsible	Assessed
Thi ma rec pro tra The coe	is specification defines the requirements for training a anuals for the unmanned aircraft systems (UAS) operat quirements or best practices, or both, for documentat ofessional operator (that is, for compensation and hire ining programs. e standard may cover the development of a training sy ordination	and the development of training tor. The standard includes ion and organization of a e) for the purposes of internal yllabus that includes Multi Crew	controlled	DBL	X





Current Status

Status

Currently >600 documents in the table ~50% of documents mapped Feedback from partners & EASA experts

Progress

Data collection Data mapping to SORA Adaption to new proposed Domain system Data assessment (first step)



22



Thank you!

Sebastian Cain

German Aerospace Center DLR

Lilienthalplatz 7, D-38108 Brunswick

Sebastian.Cain@dlr.de

