Operator Declaration and Risk Assessment for Usage of Geographical Zone Art. 15 (2) IR (EU) 2019/947

National Experimental Test Center for Unmanned Aircraft Systems at Airport Magdeburg-Cochstedt

DLR

Document Properties

Titel	Operator Declaration for Usage of Geographical Zone
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1 Background of this document

Note: The German version of this document is the only legally binding version. The English version is provided solely as a translation if required.

This document describes the operational considerations and requirements towards a drone operator for the use of the geographical zone (hereafter GeoZone) established at the National Experimental Test Center for Unmanned Aircraft Systems (UAS) operated by the German Aerospace Center DLR at airport Magdeburg-Cochstedt. The GeoZone is to be permanently established to facilitate an open sandbox for flight testing of unmanned aircraft systems for research and industry. The information given hereafter will be the boundary condition for an operator to utilize the privileges of the GeoZone when flying in the extended open category. This document does not affect operations carried out under the regular rules of EASA specific or certified category.

The implemented actions described hereafter are provisions to ensure safety of uninvolved persons on ground and in the air.

The document is split into six parts giving the information of how to fly in the GeoZone:

Authorization of open category A1/A2/A3 flights

Short explanation of the facilitating GeoZone concept as enhanced operation in the open category

Risk analysis underlying the GeoZone

Requirements towards an operator to fly in the GeoZone

Handling and mitigation of ground risks

Handling and mitigation of air risks

The final part is the template operator declaration to comply to these rules and declare that all prerequisites are met.

2 UAS flights in the open category in the restricting geographical zone of the airport Magdeburg-Cochstedt

The environment of the airport Magdeburg-Cochstedt is defined as restricting geographical zone according to section 21h (3) of LuftVO, i.e. according to section § 21 i LuftVO a permission for flights in open category is required.

Details about authorization of UAS flights in the restricting geographical zone (see Figure 1, red area) in the open category A1/A2/A3 can be requested from DLR.
In the following content of this document the terms “geographical zone” or “GeoZone” always relate to the facilitating geographical zone and not the restricting geographical zone.

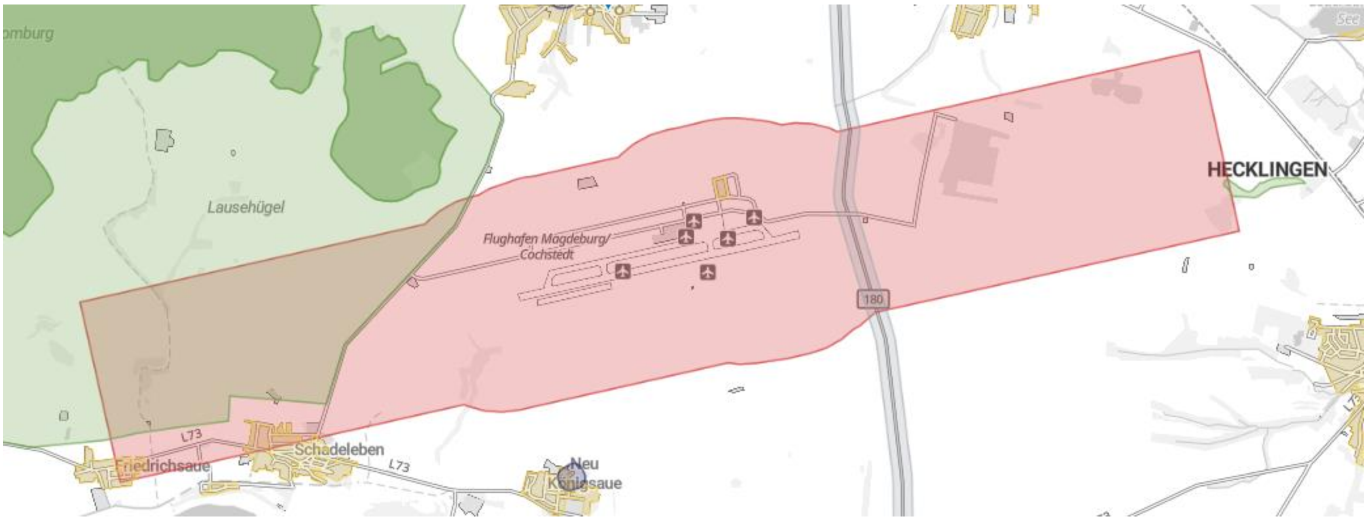

Figure 1: Restricting geographical zone airport Magdeburg-Cochstedt according to 21h (3) of LuftVO (red, graphic DiPuL)

3 Concept and Implementation of the GeoZone

A facilitating geographical zone for extension of the open category operation according to Article 15 (2) of IR (EU) 2019/947 is an area, established by EASA member states, where certain restrictions of the open category do not apply. Additionally, an operational authorization as mandatory for the specific category is not required. The exemption from one or more of the open category requirements is based on a risk assessment carried out by the competent authority, in case of Germany the Luftfahrt Bundesamt (LBA). Dedicated risk mitigation measures are put in place, which ensure that operations within this geographical zone fully comply to the safety goals of IR (EU) 2019/947.

The aim of this GeoZone is to enable safe UAS operations for research and development purposes without the administrative resources for operational authorizations in the specific category. This allows both research organizations and industry to develop and test new technology in a safe environment. The risk assessment for this GeoZone is based on SORA 2.0 as described in AMC1 of Article 11 of IR (EU) 2019/947. Even though this GeoZone enables operations in the open category, the basics of the specific category in terms of operational buffers, requirements for operators and linguistic terms are applied.

The GeoZone described here is requested by DLR as Operator of the National Experimental Test Center for Unmanned Aircraft Systems. It is granted by the Federal Ministry of Transport for the following scope of application:

Validity:	Unlimited, subject to continuous compliance with the relevant requirements of this document and publication by authorities. The competent authority according to §21h (4) Luftverkehrs-Ordnung

	reserves the right to revoke the GeoZone in case of mis compliance or safety related issues.
Place:	Airport Magdeburg-Cochstedt EDBC
Area:	{51.8383337, 11.5182729}; {51.8345260, 11.4517038}; {51.8399935, 11.3698527}; {51.8562066, 11.2672413}; {51.8876102, 11.2859076}; {51.8714560, 11.3966519}; {51.8829668, 11.4408385}; {51.8676968, 11.5100055}; {51.8383337, 11.5182729}
Airspace:	G, E, ATZ, RMZ
Max. altitude of Operational volume:	3000 ft AMSL
Max. size of the drone:	≤ 8 m in “limited area”, ≤ 3 m in “full area” (characteristic dimension, see risk analysis chapter 4)
Max. kinetic energy:	≤ 1084 kJ in “limited area”, ≤ 34 kJ in “full area”
Operating mode:	VLOS and BVLOS

The GeoZone is open to all drone operators who comply with this operator declaration. DLR is responsible for an adequate coordination between the users of this GeoZone to ensure fair and equal availability.

Two different areas are defined which can be used based on the UAS characteristics. Both criteria (characteristic dimension and kinetic energy) must be adhered to.

The lateral boundaries of the full area are shown in Figure 2. Due to the risk considerations (see chapter 4), the full area can only be used by UAS with a characteristic dimension ≤ 3 m and kinetic energy ≤34 kJ. A limited area, which can be used by UAS with a characteristic dimension ≤8 m and kinetic energy ≤1084 kJ, is shown in Figure 3. Note that the corners 1, 2, 3 and 4 of the limited area are identical with the points 2, 3, 6 and 7 of the full area. The coordinates of the area can be accessed by the operator as kml and dipul files [1] [2] [3] [4].

The vertical boundary is equal for the full and the limited areas and correlates with the maximum altitude of the ATZ (high) airspace. The maximum altitude of the operational volume is 3000 ft AMSL, which is 2399 ft or 731 m above the EDBC airport reference point. The operational volume is defined as the flight geography including the contingency volume.

It is mandatory for all operators to define flight geography, contingency volume and ground risk buffer compliant with the definition in GM1 to Article 2(28-33) of IR (EU) 2019/947). The complete flight geography, contingency volume and ground risk buffer must be contained inside the given lateral and vertical outer boundaries defined here.

For the calculation of the contingency volumes and the ground risk buffer the operator shall adhere to the LBA guidelines [5] in the current version applying the specific characteristics of the UAS which is used in the operations. The use of the DiPuL map tool [6] for the calculations is required. If the specific UAS-configuration is not considered by the guidelines, the operator must provide an alternative calculation based on the properties and flying characteristics of said configuration which is validated by the competent authority.

Several UAS may fly in the GeoZone at the same time. Flights must be coordinated, either in responsibility of the operator (if one operator operates multiple UAS) or of Cochstedt Betriebsleitung/AFISO (Aerodrome Flight Information Service Officer) (in cases of multiple, independent operators).

The GeoZone does not exempt the operator from additional permits needed, e. g. for overflights of nature reserves.

The GeoZone does not affect the regular operation under open, specific or certified category that are not carried out under the legal framework of the GeoZone.

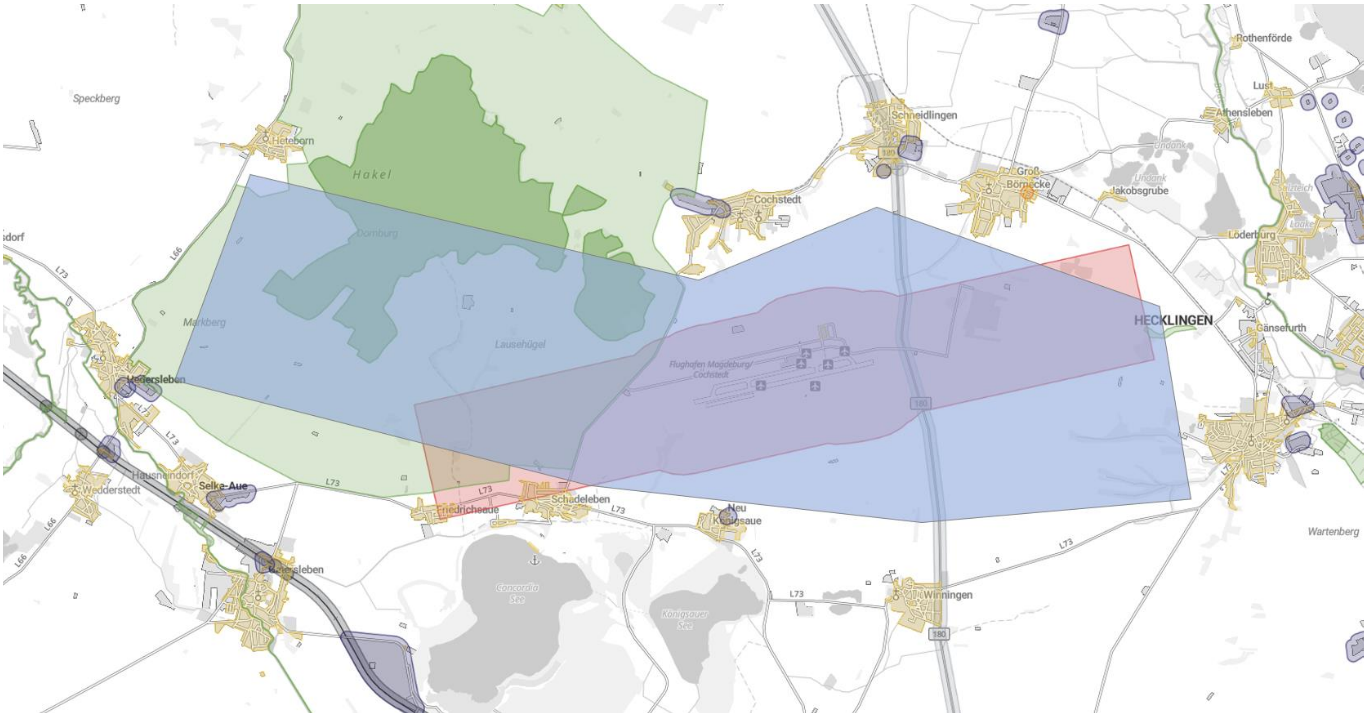

Figure 2: Full Area of the GeoZone (derived from DiPuL)

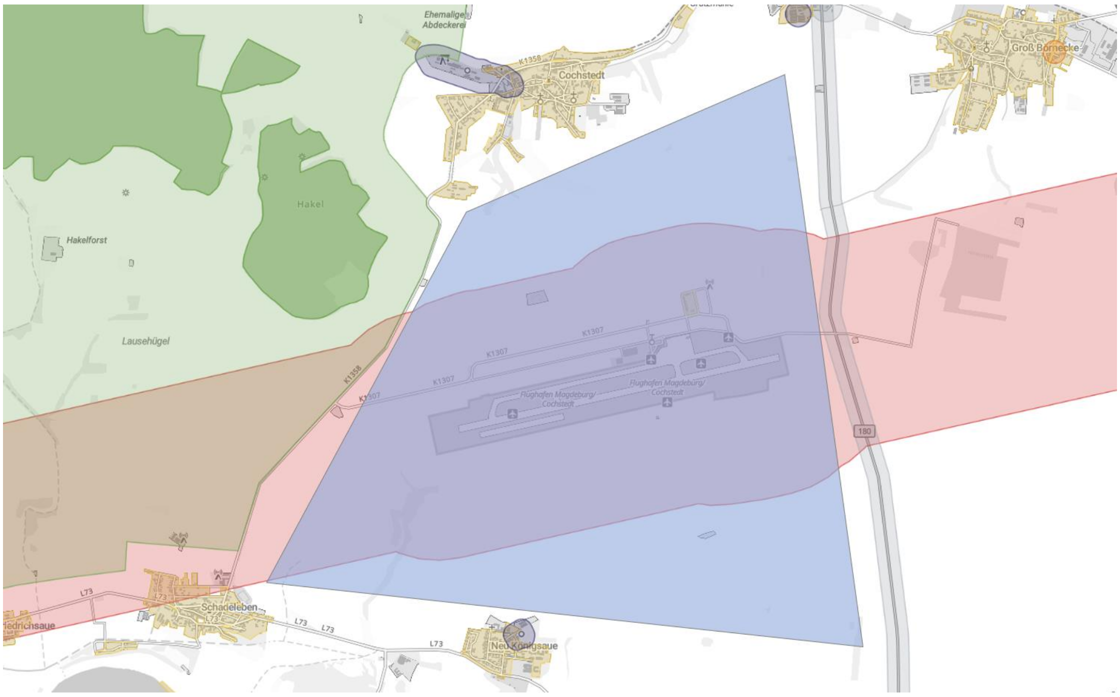

Figure 3: Limited Area of the GeoZone (derived from DiPuL)

3.1 Maiden Flight Box

Additionally to the area definitions, a maiden flight box (see Figure 4) is provided that must be used in case of maiden flights or after changes with potential safety impact. This box is located within the originally defined limited area of the GeoZone and above an area without larger ways/roads.

The flight area must be limited to the maiden flight box, if:

- It is the maiden flight of the UAS
- Safety critical functions or components of the UAS are tested for the first time
- The flight envelope of the UAS is expanded
- Major changes (software or hardware) have been performed to the UAS
  - Major changes are all changes concerning primary structure, flight controls, datalinks, safety systems (e.g. flight termination systems) or significant changes in weight & balance
- Any other special risk is identified (e.g. flying in close formation with multiple UAS for the first time)

The aim of flights in the maiden flight box is to show sufficient maturity of the UAS. Therefore, the maiden flight box must be used in these cases until

- the proper function of the UAS and changes to the UAS has been demonstrated from take-off to landing repeatedly and
- no occurrences have been observed within these flights.

The fulfillment of these points will be subject to operator declaration and must be documented (test protocols) for possible audits.

The operational requirement to use the maiden flight box shall account for any remaining uncertainties coming with major modifications and act as a ‘sandbox’ for opening the flight envelope. For maiden flights, the maximum extent of the flight geography is the ‘maiden flight box’. The contingency volume and ground risk buffer must be calculated as described above. In case either contingency volume or ground risk buffer violate the outer boundary of the limited GeoZone area, the flight geography must be reduced accordingly (until ground risk buffer is completely included in the limited GeoZone area). The coordinates of the maiden flight box can be accessed by the operator as kml and dipul files [7] [8].

Figure 4: Maximum Maiden Flight Box (derived from DiPuL)

During use of the maiden flight box an additional ground observer shall be in place to observe the southern part of the flight volume. The observer shall be in contact with the flight operations team to increase situational awareness of the flight area.

4 Risk analysis for UAS flights in the extended open category within the GeoZone

The basis for the GeoZone is a risk analysis to show that the operating risk is sufficiently low and the defined measures described in the proceeding chapters are appropriate to the operation.
The framework and language of the SORA approach is used, as it is an established means of compliance by EASA. The analysis takes the most conservative assumptions to establish the SAIL level. The operator using the GeoZone is responsible to consider this risk critically and make sure that the operation intended is within or below these considerations. The analysis is based on the SORA version 2.0 [9].

4.1 Full Area GeoZone

Generic Operational risk analysis for FULL AREA GeoZone based on AMC1 to Article 11 IR (EU) 2019/947			
Data of authorised UAS and operation			**Explanatory note**
0.1	**Type of UAS configuration**	☒Conventional airplane ☒Helicopter ☒Multirotor ☒Hybrid/VTOL ☒Lighter than air ☒Other, please specify:	*No restrictions are placed on UAS configurations in the GeoZone.*
0.2	**Is the UAS tethered during the operation?**	☒Yes ☒No	*Tethered operation is not in the focus of this GeoZone but imposes a smaller risk and is therefore allowed.*
0.3	**Maximum characteristic dimension** (including propellers)	≤ 3m	*Both requirements specify upper limits for the use of the GeoZone and must be complied with.* *The characteristic dimension is the biggest measurable dimension that can be measured between two points on the UAS* [10]. *Additionally, the* ***maximum kinetic energy shall be not more than 34 kJ*** *with max. operational speed for fixed wing or terminal velocity for VTOL configurations.*
0.4	**Maximum take-off mass (MTOM)** (indicated by the operator equal to or less than the manufacturer's specification)	≤ 600kg	
0.5	Maximum operational speed (maximum speed flown within the scope of the intended operation)	m/s	
0.6	**Type of propulsion system**	☒Electric ☒Combustion ☒Hybrid, specify type: ☒Other, please specify:	*All types of propulsion systems may be used within the GeoZone.*
0.10	**Transport of dangerous goods**	☐Yes	*No dangerous goods transportation is allowed within the enhanced open*

		☒No		*category operation of the GeoZone.*	
		If yes, please specify reference to operations manual: ______________________________			
0.11	**Type of operation**	☒Visual line of sight (VLOS) ☒Extended visual line of sight (EVLOS) ☒Beyond visual line of sight (BVLOS)			
0.12	**Does the remote pilot control more than one UA simultaneously?**	☒Yes ☒No		*The remote pilot may control several UAS simultaneously, if the UAS are designed for this kind of operations and the remote pilot workload is accounted for.*	
		Specific Operations Risk Analysis			
		Step #1 Operations manual			
#1.1	**Description of proposed operation including the locations**	Please provide the geo-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: ______________________________		*Refer to* [1] [3]. *Buffers must be appropriate for the configuration according to LBA guidelines* [5].	
#1.2	**Dimensions of the operational volume and the adjacent volume** (Rounded up to first decimal place)	Height of the flight geography + contingency volume (AGL at airport reference point)	H_{CVmax}	____731__ m	*Corresponds to 3000 ft AMSL.* *Contingency Volume and Ground Risk Buffers to be established individual to operator, see chapter 3.*
		Height of the adjacent volume Width of the adjacent volume	H_{AV} S_{AV}	________ m ________ m	H_{AV}*= 150m above* H_{CVmax} S_{AV}*= 120s ** V_0
		Step #2 UAS intrinsic ground risk class			
#2.1	**Type of operational areas on the ground** (including flight geography, contingency volume and ground risk buffer)	☐Controlled ground area ☒Sparsely populated area ☐Populated area ☐Assembly of people			
#2.2	**Specify the intrinsic ground risk class**	4 (BVLOS/EVLOS) or 3 (VLOS)			
		Step #3 Final ground risk class determination			

#3.1	**Specify the applied ground risk mitigations** (if applicable)	**M1** Strategic mitigations for ground risk <u>Specify the level of robustness:</u> ☐None ☒Low ☐Medium ☐High	*Based on an assessment of aerial imagery as well as on-site inspections, the full flight area is very sparsely populated, with a population density which is 10 times lower than sparsely populated. Details see Chapter 6.*
		M2 Effects of the ground impact are reduced <u>Specify the level of robustness:</u> ☒None ☐Low ☐Medium ☐High	*Operators may use parachutes or similar mitigations but are not necessarily required as per this risk analysis*
		M3 An emergency response plan (ERP) is in place, the UAS operator is validated and effective <u>Specify the level of robustness:</u> ☐None ☐Low ☒Medium ☐High	*An emergency response plan must be provided by the operator to DLR as a prerequisite. The ERP must consider the local requirements (e.g. contacts for fire fighting) and the Betriebsleitung/AFISO is notified about the ERP activation during execution. A table-top exercise of the ERP must be performed prior to operations. An ERP template will be provided on demand by DLR.*
#3.2	**Specify the final ground risk class**	3 (BVLOS/EVLOS) or 2 (VLOS)	
Remarks/Reasoning for Step #3			
Step #4 Initial air risk class			
#4.1	**Classification of the airspace where the operation is intended to be conducted** (multiple answers possible)	☐A ☐B ☐C ☐D ☒E ☐F ☒G ☐Restricted area (ED-R) ☐Danger area (ED-D) ☐TMZ ☒RMZ ☒ATZ	
#4.2	**Specify the initial air risk class and the reasoning for choosing it** (refer to Figure 4 of AMC 1 to Article 11 of IR (EU) 2019/947)	**Operational volume** ☐ARC-a ☐ARC-b ☒ARC-c ☐ARC-d	
Remarks/Reasoning for Step #4 *Following the SORA process, the airspace within the operational volume is classified as an airport environment in Class G and class E airspace within an ATZ and RMZ, resulting in the initial ARC-c.*			
Step #5 Strategic air risk mitigations and final air risk class			
#5.1	**Specify, if strategic mitigations of the air risk class were applied**	☒Yes ☐No	*The Air Risk is mitigated by activated ATZ during operations as per AIP AIC VFR 03/21.* *Pilots are obliged to avoid the activated ATZ unless they intend to land or take off*

				within it. Details see Chapter 7.
#5.2	**Residual air risk class** (after strategic mitigation)	**Operational volume** ☐ARC-a ☒ARC-b ☐ARC-c ☐ARC-d	**Adjacent airspace** ☐ARC-a ☐ARC-b ☐ARC-c ☒ARC-d	
Remarks/Reasoning for Step #5				
Step #6 TMPR and robustness level				
#6	**Tactical mitigations performance Requirements** (refer to Annex D to AMC 1 to Article 11 of IR (EU) 2019/947)	☐VLOS ☒BVLOS ☐No requirement (ARC-a) ☒Low (ARC-b) ☐Medium (ARC-c) ☐High (ARC-d)		*BVLOS flight in ARC-b classified airspace requires low TMPR (see chapter 7.2 for implementation details). VLOS operations do not necessarily need a TMPR as implemented. However, the TMPR acc. to chapter 7.2 shall be in place for all operations to consider airport environment.* *The ATZ in Cochstedt separates UAS operations from manned air traffic. Procedures are used to ensure a very low risk of mid-air collisions. Flight operations are carried out within the Cochstedt ATZ(HX) above and next to Cochstedt Airport. The maximum operating altitude is fully covered by the ATZ limits.* [11]
Remarks/Reasoning for Step #6				
Step #7 SAIL determination				
#7	**Specific Assurance and Integrity Level**	☐SAIL I ☒SAIL II ☐SAIL III ☐SAIL IV ☐SAIL V ☐SAIL VI		*There is a low risk resulting from operating under the described conditions.*
Step #8 Identification of operational safety objectives (OSOs)				
#8	**Operational safety objectives**	As per identified SAIL from Step #7 and 2.5.2 of AMC1 to Article 11 (Table 6) of RG (EU) 2019/947		*See chapter 4 for implementation of requirements.*
Step #9 Adjacent area / airspace considerations (choose #9.1 **OR** #9.2 **OR** #9.3!)				
#9.1	Safety requirement for containment (if one of the checkboxes is ticked, enhanced containment	Safety requirement for containment according to AMC1 Article 11, section 2.5.3, Step #9 of the IR (EU) 2019/947		Not applicable

	measures apply, consider #9.2 alternatively)	Please specify:	
		The adjacent areas ☐ contain assemblies of people ☐ are ARC-d	
		If the operational volume is in a populated area: ☐ The M1 mitigation was applied. ☐ The operating area is a controlled ground area	
#9.2	**Alternative means of compliance SORA 2.0 containment – version 01** (if one of the checkboxes is ticked, enhanced containment measures apply)	Alternative means of compliance SORA 2.0 containment (AltMoC to AMC1 Article 11, section 2.5.3, Step #9 of the IR (EU) 2019/947) Please specify:	*The adjacent areas do not contain large assemblies of people (around 20,000 people or more) within 1 km distance from the operational volume and are not populated areas, thus enhanced containment measures do not apply (see LBA 'Informative letter of the German federal aviation office (Luftfahrt-Bundesamt) on the implementation of the "Alternative Means of Compliance SORA 2.0 Containment" for operators in the specific category according to Article 12 of the Implementing Regulation (EU) 2019/947').*
		The adjacent areas ☐ contain large assemblies of people (around 20,000 people or more) within 1 km distance from the operational volume.	
		If the adjacent area is a populated area: ☐ The M1 mitigation on medium or high robustness has been applied. ☐ The operation is conducted over a controlled ground area.	
#9.3	No enhanced containment (only applicable if no other checkboxes in #9.1 or #9.2 are ticked)	☒Enhanced containment measures do not apply	

4.2 Limited Area GeoZone

Generic Operational risk analysis for LIMITED AREA GeoZone based on to AMC1 to Article 11 IR (EU) 2019/947			
Data of authorised UAS and operation			**Explanatory note**
0.1	**Type of UAS configuration**	☒Conventional airplane ☒Helicopter ☒Multirotor ☒Hybrid/VTOL ☒Lighter than air ☒Other, please specify:	*No restrictions are placed on UAS configurations in the GeoZone.*
0.2	**Is the UAS tethered during the operation?**	☒Yes ☒No	*Tethered operation is not in the focus of this GeoZone but imposes a smaller risk and is therefore allowed.*
0.3	**Maximum characteristic dimension** (including propellers)	≤ 8m	*Both requirements specify upper limits for the use of the GeoZone and must be complied with.* *The characteristic dimension is the biggest measurable dimension that can be measured between two points on the UAS* [10]. *Additionally, the* ***maximum kinetic energy shall be not more than 1084 kJ*** *with max. operational speed for fixed wing or terminal velocity for VTOL configurations.*
0.4	**Maximum take-off mass (MTOM)** (indicated by the operator equal to or less than the manufacturer's specification)	≤ 2000kg	
0.5	**Maximum operational speed** (maximum speed flown within the scope of the intended operation)	m/s	
0.6	**Type of propulsion system**	☒Electric ☒Combustion ☒Hybrid, specify type: ☒Other, please specify:	*All types of propulsion systems may be used within the GeoZone.*
0.10	**Transport of dangerous goods**	☐Yes ☒No	*No dangerous goods transportation is allowed within the enhanced open category operation of the GeoZone.*
		If yes, please specify reference to operations manual: ____________________________	
0.11	**Type of operation**	☒Visual line of sight (VLOS) ☒Extended visual line of sight (EVLOS) ☒Beyond visual line of sight (BVLOS)	
0.12	**Does the remote pilot control more than one UA simultaneously?**	☒Yes ☒No	*The remote pilot may control several UAS simultaneously, if the UAS are designed for this kind of operations and the remote pilot workload is accounted for.*

Specific Operations Risk Analysis					
Step #1 Operations manual					
#1.1	**Description of proposed operation including the locations**	Please provide the geo-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: _____________________________________			*Refer to* [2] [4]. *Buffers must be appropriate for the configuration according to LBA guidelines* [5].
#1.2	**Dimensions of the operational volume and the adjacent volume** (Rounded up to first decimal place)	Height of the flight geography + contingency volume (AGL at airport reference point)	H_{CVmax}	___731___ m	*Corresponds to 3000 ft AMSL. Contingency Volume and Ground Risk Buffers to be established individual to operator, see chapter 3.*
		Height of the adjacent volume Width of the adjacent volume	H_{AV} S_{AV}	________ m ________ m	*H_{AV}= 150m above H_{CVmax}* *S_{AV}= 120s * V_0*
Step #2 UAS intrinsic ground risk class					
#2.1	**Type of operational areas on the ground** (including flight geography, contingency volume and ground risk buffer)	☐Controlled ground area ☒Sparsely populated area ☐Populated area ☐Assembly of people			
#2.2	**Specify the intrinsic ground risk class**	5 (BVLOS/EVLOS) 4 (VLOS)			
Step #3 Final ground risk class determination					
#3.1	**Specify the applied ground risk mitigations** (if applicable)	**M1** Strategic mitigations for ground risk Specify the level of robustness: ☐None ☐Low ☒Medium ☐High			*Based on an assessment of aerial imagery as well as on-site inspections, the full flight area can be characterized as very sparsely populated. The claim is supported by evidence of low population density confirmed by the local communities. With a population density which is 100 times lower than sparsely populated, an M1 mitigation with medium robustness is applied. Details see Chapter 6.*

		M2 Effects of the ground impact are reduced Specify the level of robustness: ☒None ☐Low ☐Medium ☐High	*Operators may use parachutes or similar mitigations but are not necessarily required as per this risk analysis*
		M3 An emergency response plan (ERP) is in place, the UAS operator is validated and effective Specify the level of robustness: ☐None ☐Low ☒Medium ☐High	*An emergency response plan must be provided by the operator to DLR as a prerequisite. The ERP must consider the local requirements (e.g. contacts for fire fighting) and the Betriebsleitung/AFISO is informed about the ERP activation during execution. A table-top exercise of the ERP must be performed prior to operations.* *An ERP template will be provided on demand by DLR.*
#3.2	**Specify the final ground risk class**	**3 (BVLOS/EVLOS)** **3 (VLOS)**	
Remarks/Reasoning for Step #3			
Step #4 Initial air risk class			
#4.1	**Classification of the airspace where the operation is intended to be conducted** (multiple answers possible)	☐A ☐B ☐C ☐D ☒E ☐F ☒G ☐Restricted area (ED-R) / ☐Danger area (ED-D) ☐TMZ / ☒RMZ / ☒ATZ	
#4.2	**Specify the initial air risk class and the reasoning for choosing it** (refer to Figure 4 of AMC 1 to Article 11 of IR (EU) 2019/947)	**Operational volume** ☐ARC-a ☐ARC-b ☒ARC-c ☐ARC-d	
Remarks/Reasoning for Step #4 *Following the SORA process, the airspace within the operational volume is classified as an airport environment in Class G and class E airspace within an ATZ and RMZ, resulting in the initial ARC-c.*			
Step #5 Strategic air risk mitigations and final air risk class			
#5.1	**Specify, if strategic mitigations of the air risk class were applied**	☒Yes ☐No	*The Air Risk is mitigated by activated ATZ during operations as per AIP AIC VFR 03/21.* *Pilots are obliged to avoid the activated ATZ unless they intend to land or take off within it. Details see Chapter 7.*
#5.2	**Residual air risk class** (after strategic mitigation)	**Operational volume** ☐ARC-a ☒ARC-b ☐ARC-c ☐ARC-d **Adjacent airspace** ☐ARC-a ☐ARC-b ☐ARC-c ☒ARC-d	

Remarks/Reasoning for Step #5			
Step #6 TMPR and robustness level			
#6	**Tactical mitigations performance Requirements** (refer to Annex D to AMC 1 to Article 11 of IR (EU) 2019/947)	☐VLOS ☒BVLOS ☐No requirement (ARC-a) ☒Low (ARC-b) ☐Medium (ARC-c) ☐High (ARC-d)	*BVLOS flight in ARC-b classified airspace requires low TMPR (see chapter 7.2 for implementation details). VLOS operations do not necessarily need a TMPR as implemented. However, the TMPR acc. to chapter 7.2 shall be in place for all operations to consider airport environment.* *The ATZ in Cochstedt separates UAS operations from manned air traffic. Procedures are used to ensure a very low risk of mid-air collisions. Flight operations are carried out within the Cochstedt ATZ(HX) above and next to Cochstedt Airport. The maximum operating altitude is fully covered by the ATZ limits.* [11]
Remarks/Reasoning for Step #6			
Step #7 SAIL determination			
#7	**Specific Assurance and Integrity Level**	☐SAIL I ☒SAIL II ☐SAIL III ☐SAIL IV ☐SAIL V ☐SAIL VI	*There is a low risk resulting from operating under the described conditions.*
Step #8 Identification of operational safety objectives (OSOs)			
#8	**Operational safety objectives**	As per identified SAIL from Step #7 and 2.5.2 of AMC1 to Article 11 (Table 6) of RG (EU) 2019/947	*See chapter 4 for implementation of requirements.*
Step #9 Adjacent area / airspace considerations (choose #9.1 **OR** #9.2 **OR** #9.3!)			
#9.1	Safety requirement for containment (if one of the checkboxes is ticked, enhanced containment measures apply, consider #9.2 alternatively)	Safety requirement for containment according to AMC1 Article 11, section 2.5.3, Step #9 of the IR (EU) 2019/947 Please specify:	Not applicable
		The adjacent areas ☐ contain assemblies of people ☐ are ARC-d	

		If the operational volume is in a populated area: ☐ The M1 mitigation was applied. ☐ The operating area is a controlled ground area	
#9.2	**Alternative means of compliance SORA 2.0 containment – version 01** (if one of the checkboxes is ticked, enhanced containment measures apply)	Alternative means of compliance SORA 2.0 containment (AltMoC to AMC1 Article 11, section 2.5.3, Step #9 of the IR (EU) 2019/947) <u>Please specify:</u> The adjacent areas ☐ contain large assemblies of people (around 20,000 people or more) within 1 km distance from the operational volume. If the adjacent area is a populated area: ☐ The M1 mitigation on medium or high robustness has been applied. ☐ The operation is conducted over a controlled ground area.	*The adjacent areas do not contain large assemblies of people (around 20,000 people or more) within 1 km distance from the operational volume and are not populated areas, thus enhanced containment measures do not apply (see LBA 'Informative letter of the German federal aviation office (Luftfahrt-Bundesamt) on the implementation of the "Alternative Means of Compliance SORA 2.0 Containment" for operators in the specific category according to Article 12 of the Implementing Regulation (EU) 2019/947').*
#9.3	No enhanced containment (only applicable if no other checkboxes in #9.1 or #9.2 are ticked)	☒Enhanced containment measures do not apply	

5 Requirements for operators to fly in the GeoZone

To achieve an equivalent level of safety, all requirements for operators follow principles, defined by specific category operation of drones, according to SAIL II. Each operator confirms to fully comply to all of the following requirements (defined in 5.1 – 5.4). The compliance to these requirements has to be declared to DLR by signing this Operator Declaration and Risk Assessment for Usage of Geographical Zone.
All documents, conditions and agreements may be inspected by DLR or the competent authority. Audits of the flight operation may be conducted. For completeness and compliance, the LBA template "Formulation template for the creation of an operations manual (Word)" – in its currently valid revision – and the preparation of documents needed for a regular application for a SAIL II operation is recommended.

5.1 Preconditions

The operator shall comply with all requirements of IR (EU) 2019/947 and DR (EU) 2019/945 excluding the exceptions defined in this operator declaration

The operator has an adequate aviation liability insurance that covers the flight operations to be carried out within the GeoZone

Qualification of the drone pilot includes A2 or comparable

Authorization of data links for command and control or other radio communication if not in the free use of 'spectrum plan' of Bundesnetzagentur (BNetzA)

Use of the airport facilities is coordinated by DLR (initial contact e.g. via cochstedt@dlr.de)

No transport of dangerous goods

All following criteria must be fulfilled: UA characteristic dimension ≤ 3 m if full area will be used or ≤ 8 m if limited area will be used, max. kinetic energy at max. operational speed ≤ 34 kJ if full area will be used or ≤ 1084 kJ if limited area will be used.

Basic containment requirements must be fulfilled (e.g. by automatic return home behavior, fully redundant command links, failsafe settings prohibiting a fly-away or combination thereof)

5.2 Planning and preparation

The operator must check the compliance with area(s) and LBA guidelines [5] regarding contingency volume and ground risk buffer sizes and the conditions and limitations of the risk analysis presented in Chapter 4

Roles and responsibilities of crew are documented, the person leading the flight operations (e.g. flight test lead) has been appointed

Personnel involved in the UAS operation has received adequate training and is qualified, especially:

- The remote pilot shall have proven sufficient experience, suitable for the type of operations e.g. extensive RC flying experience or dedicated simulator training

(if the purpose of the operations is remote pilot training, this requirement does not apply to the trainee, but to the instructor)

- The remote crew shall have specific knowledge for the intended operation, the operational procedures and details of the UAS (operations manual)
- In case the conditions described in chapter 3.1 are met (and therefore the maiden flight box is used), additionally the operator shall ensure that:
  - Personnel must be aware of the special risks arising from new or changed systems. This may be achieved by personnel actively involved in the development of the UAS being present during the operations or specific crew training to enable recognizing and assessing any unintended behavior of the system.
  - It is recommended to perform a test hazard assessment.

Crew fitness requirements are defined and adhered to

Appropriate maintenance of UAS is performed by trained maintenance personnel

Attendance to a safety briefing for access to airport, apron and runway for all crew members

Attendance to a preflight briefing with the Betriebsleitung/AFISO for notification, mission briefing, coordination of ground and airspace deconfliction (see also chapter 7.2) and signing of the Air Risk Operating Agreement at least once before starting operations with daily updates on any changes.

The notification uses a form and includes:

- aircraft details,
- a specification of the desired operation,
- operating crew details,
- needed infrastructure,
- the UAS callsign.

Preparation of an Emergency Response Plan (ERP), adapted for Airport Magdeburg-Cochstedt conditions and ERP trained in a table-top exercise

5.3 Conduction of operations

The defined flight volumes must be adhered to at all times e.g. using a suitable monitoring system (live GNSS-position of aircraft displayed on a map with marked volume limits)

Obtaining permissions for access for persons on apron and runway via radio is mandatory

Documentation and reporting of take-off and landing times, incidents and accidents is mandatory

Flight data must be stored in case of occurrences until the event has been clarified

Procedures or checklists to make the UAS flight ready are available and adhered to and should establish at least:

- Technical readiness (e.g. assembly, connectors, free from damage)
- System readiness (e.g. power supply, status and modes, datalinks, sensor health)
- Mission readiness (e.g. mission items, handling of degradation and contingency)

Normal, contingency and emergency procedures are available and adhered to.

Flight and weather limitations (Wind, precipitation, visibility conditions) for UAS are defined and adhered to.

5.4 GeoZone Safety Reporting

To ensure compliance with the requirements for the use of the GeoZone, as established in the legal relationship defined by this declaration, the UAS operator is obligated to promptly notify DLR of operational disruptions, accidents, hazards, complaints, and any other circumstances that raise specific suspicions that the applicable requirements can no longer be met. This includes especially any loss of control (e.g. flight termination, crash or major damage to any component), any damage to airport installations, unplanned landings outside of the airport area or any other occurrence inflicting potential danger, independent if caused by flight operations or other causes.
In such cases, the UAS operator must provide DLR with all information necessary for assessing the general risk potential of the situation (including documents, conditions, statements, evidence, agreements, and reports), insofar as this is reasonable and legally permissible for them.
If DLR learns of such a circumstance, either through a notification from the UAS operator or by other means, it is entitled to demand the immediate provision of all information from the UAS operator necessary for assessing the situation within the framework of a risk prognosis, including any knowledge of previous violations, as appropriate, necessary, and reasonable.

DLR may specifically request the submission of the following documents and records:

Logs of flight data

Buffer calculations

Operations manual or procedures used

Qualification certificates of personnel

Insurance

Any other related documents to operation safety

If, after assessing the respective situation, it is determined that there is indeed reason to suspect a violation of the requirements applicable to the UAS operator under this declaration, DLR may revoke the permission to conduct flights until it is clearly proven that the violation is resolved.
Obligations for incident reporting to German Federal Bureau of Aircraft Accident Investigation and any other legally required incident reporting obligations remain untouched from the content of this chapter.

6 Handling and mitigation of ground risk

This chapter describes the handling of the ground risk for the use of this GeoZone and how safety on the ground is ensured.

6.1 General ground risk mitigations

The operational risk of the GeoZone considers a sparsely populated area as characteristic area for the intrinsic ground risk. Based on an assessment of aerial imagery as well as on-site inspections, the full flight area can be characterized as very sparsely populated, with a population density which is factor 10^{-1} less than the population density underlying the risk matrix of the SORA approach. In SORA-terms, the intrinsic ground risk is reduced by one point by means of an M1 mitigation, low robustness.

Even lower population density can be concluded for the limited flight area with a proven population density which is factor 10^{-2} less than the population density underlying the risk matrix of the SORA approach. With the supporting evidence [12] [13] [14], this is equivalent to an M1 mitigation, medium robustness or two points reduction from the intrinsic ground risk class . Additionally, the robustness of ground risk buffer dimensioning must be ensured by operators by application of [5].

For both areas the final ground risk class is 3 or lower, equivalent to SAIL II, which equals a low risk.

Additional considerations for the ground risk are given to the airport facilities and the roads that cross the flight area. Overflying of airport facilities and buildings in the flight geography shall be avoided. Overflights of roads shall be limited to the minimum amount required to complete the mission. Roads shall be overflown as close to perpendicular as possible, and not below a height of 100 m AGL. Flying parallel to roads is not permitted within a 1:1 rule.

The operational safety objectives of SAIL II have only very few technical requirements. During flight testing of new systems, testing new functions and finding new operational limitations a higher than average loss-of-control rate due to technical issues or operational errors can be expected which could potentially violate the SORA safety assumptions. The idea of the maiden flight box is to account for this by adding an additional layer of safety, as described in chapter 3.1.

6.2 Dropping and setting down of payload

The GeoZone in general is intended for tests of various kinds of payloads. The transport of dangerous goods is prohibited.
A payload may intentionally be dropped or set down (e.g. winched) under § 13 LuftVO. The following preconditions must be met to drop items during flight tests:

- The payload shall be secured against unintended release
- Items are only dropped within the fenced area of the airport
- The type of dropped items and the planned drop locations must be coordinated with DLR in advance and with Cochstedt Betriebsleitung/AFISO in the daily briefing

- Prior to starting the tests, it is ensured that no personal is endangered in the dropping area (area clear or personal sufficiently sheltered)
- The operator must have procedures for the dropping during the flights that at least give: limits for environmental conditions applicable (e.g. wind), clear communication among flight team about the dropping, sequence of recovery of dropped good (when will it be secured/recovered and clearance for flight continuation) with assigned roles for personal involved
- The case that the good is (accidentally) dropped outside the airport area shall be accounted for by having a vehicle and personal ready to do the recovery in this case while the lead of the test team communicates with the Betriebsleitung/AFISO
- Radio contact must be established to the personal responsible for recovery of dropped goods

This shall enable load delivery tasks or drop test, e.g. for compliance demonstration of components.

In case a dropped item lands outside of the fenced area this must be reported immediately to the Betriebsleitung/AFISO (Aerodrome Flight Information Service Officer) and in a debriefing after the flights to DLR. It must be reasonably ensured that a repetition of an outside landing is prevented after this to continue the flights either by technical or operational matters.

7 Handling and mitigation of air risk

This chapter describes the handling of air risk for the use of the GeoZone and how safety in the air is ensured.
As in the other chapters, the implementation is valid for drone flights within the area of the GeoZone and under the requirements imposed thereby.
The description hereafter is split in two parts: First, the Strategic Mitigation of Air Risk and second, the implementation of Tactical Mitigation Performance Requirements (TMPR).
The Mitigation acts as a reduction from the intrinsic ARC-c to a final ARC-b classification of the airspace in the GeoZone. The low-robustness TMPR is, in a SORA-based authorization, a derived requirement of the operation. Both requirements shall be fulfilled for the use of the GeoZone.
The drone crew must be aware of the routines described hereafter and follow communication paths required from the mitigation and TMPR. The mitigation related document [11] must be signed prior to operation and change of flight test lead.

7.1 Mitigation of Air Risk

This chapter describes how the air risk is mitigated. The classification of the airspace from the SORA analysis is ARC-c. This is mitigated to an ARC-b airspace by the means described hereafter. The referenced document [11] is binding for operators under the GeoZone conditions. The residual air risk is mitigated by the TMPR implementation, which is described in the next chapter.

7.1.1 General information

The operation will take place at (and around) the National Experimental Test Center for Unmanned Aircraft Systems. The Center is located at the Magdeburg-Cochstedt Airport (Aerodrome Reference Point (ARP): N 51° 51,36’ , E 11° 25,08’, 599 ft Mean Sea Level (MSL)). The Air Traffic Services (ATS) are provided by the Flughafen Magdeburg-Cochstedt Betriebsgesellschaft mbH (FMCB).

7.1.2 Airspace

The operation will take place inside an activated ATZ(HX) according to the valid operational agreement with Magdeburg-Cochstedt airport [11], with following general properties:

- To ensure safe operations of unmanned aircraft systems (UAS) at Magdeburg-Cochstedt Airport, an ATZ (HX) was established with effect from 09 September 2021 [15].
- In order to minimize restrictions on IFR/VFR traffic, the ATZ will be activated only as necessary (HX).
- The ATZ is additionally divided vertically into two sectors [16]:
  - Sector Low: The lower/upper limit is GND/1600 ft MSL
  - Sector High: The lower/upper limit is 1600 ft MSL/3000ft MSL

Depending on the respective type of UAS operation it is not always necessary to activate the entire airspace.

The dimension of the ATZ(HX) can be found in the official publications.

Regulations:

- The ATZ (HX) is activated by NOTAM.
- Pilots are obliged to avoid the activated ATZ unless they intend to land or take off within it.

7.2 TMPR Implementation

In the following section, the implemented Detect and Avoid (DAA) system and how it fulfills the TMPR, are described.

1. Detect

The complete flight takes place inside the activated Cochstedt ATZ. In general, air traffic with no intention to land, is required to avoid the ATZ. If a manned aircraft intends to land during UAS-operations (e. g. due to an emergency), the first means of the DAA strategy is the aeronautical radio communication. The aeronautical radio communication from the air traffic is first handled by Cochstedt Betriebsleitung/AFISO.
In the event of uncooperative air traffic penetrating the ATZ without radio contact, the detection is based on an ATC software by Deutsche Flugsicherung (DAS Phoenix system), which is available and monitored at the Betriebsleitung/AFISO. The Phoenix system has a web-based system which provides a traffic display with a data-fusion of several data sources: secondary-surveillance radar (SSR), primary surveillance radar (PSR), automatic dependent surveillance – broadcast (ADS-B) and multilateration (MLAT). Based on this system, a detection rate of more than 50% is ensured.

The Betriebsleitung/AFISO monitoring the DAS Phoenix system will additionally observe the airspace visually with and without binoculars.
From Betriebsleitung/AFISO a warning will be directly given to the flight crew in case of any incoming traffic with the potential to endanger the operation.

2. Decide

The deconfliction strategy depends very much on the type of UAS (e. g. fixed wing vs. VTOL) and the area of operation. Therefore, the deconfliction strategies shall be determined in every daily briefing with Cochstedt Betriebsleitung/AFISO. The following deconfliction scheme and communication phraseology shall be used as exemplary reference and shall be modified to suit each specific UAS operation. Note that the “*UAS callsign*” has to be defined before flights, to avoid any confusion.

1. Manned aircraft intends to land at Cochstedt airport (radio contact)
If area south of the runway guarantees adequate separation (similarly, north, east or west may be used by the Betriebsleitung/AFISO):

Betriebsleitung/AFISO: "*UAS callsign* Manned traffic in area, fly south of runway and hold!" Drone operations team: "*UAS callsign* Flying south and holding."

2. Uncooperative manned air traffic enters ATZ (no radio contact), but no immediate collision risk with UAS is imminent.
Betriebsleitung/AFISO: "*UAS callsign* Traffic, traffic, traffic, return for landing!" Drone operations team: "*UAS callsign* returning to land." After landing: Drone operations team: "*UAS callsign* landed." When runway is clear: Drone operations team: "*UAS callsign* runway clear."

3. Separation not possible, immediate danger. Highest de-escalation.
Betriebsleitung/AFISO: "*UAS callsign* Close traffic, descend, descend, descend!" Drone operations team: "*UAS callsign* descending."

3. Command

The requirement that the command link latency is less than 5 seconds shall be fulfilled by the UAS system design.

4. Execute

The requirement is for the descent speed and max altitude to be sufficient to descend from the maximum operating altitude to an altitude below obstacles in less than 60 s. The operator has to ensure the UAS is capable of complying with this requirement.

5. Feedback Loop

The latency and update rate of the Phoenix system are significantly better than the 5-second update rate and 10-second latency, which are required for a 3 NM threshold. The Phoenix system is used in ATC services such as Tower and Center. Therefore, the performance is adequate.

8 Operator Declaration

By signing this declaration, the operator of the unmanned aircraft system (UAS) assures the German Aerospace Center (DLR) that

- he/she has fully acknowledged and understood the document "Operator Declaration and Risk Assessment for Usage of Geographical Zone Art. 15 (2) IR (EU) 2019/947" including the documents referenced therein, as well as this operator declaration, accepts it, and commits to implementing it,
- the UAS designated for operation meets the requirements outlined in this document under which UAS may be operated in the extended open category of the geographic area (GeoZone),
- the requirements imposed on the UAS operator in this document and the referenced documents will be fulfilled by the UAS operator at the appropriate time, particularly, but not limited to, that
    - the procedures for achieving flight readiness are implemented and adhered to,
    - the procedures for flight operations and dealing with abnormal behavior are implemented and observed,
    - all personnel involved in the operation of the UAS have the necessary qualifications,
    - an Emergency Response Plan is in place,
    - the fulfillment of the risk mitigations described in this document and the risk handling are the responsibility of the UAS operator,
    - flight data will be stored.

We acknowledge that the operational documents and flight operations may be subject to review.
We acknowledge that flights may be prohibited in case of a violation of the operating regulations listed in this document, even if the violation was unintentional.

____

valid operator registration (e-ID) of LBA
(or comparable National Aviation Authority)

____

Type/Name of UAS

____

Place, date, signature of UAS operator*

____

Place, date, signature of person leading flight operations

Name in block letters: ________________________

Name in block letters: ________________________

*in case of legal entities, a person being entitled to represent the entity

9 References

[1] DLR Institute of Flight Systems, *geozone_full_area.kml.*

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[5] Luftfahrt Bundesamt, *Guidance for dimensioning of Flight Geography, Contingency Volume and Ground Risk Buffer.*

[6] Bundesministerium für Verkehr, „DiPuL Map Tool," [Online]. Available: https://maptool-dipul.dfs.de/.

[7] DLR Institute of Flight Systems, *geozone_maiden_flight_box.kml.*

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[10] Bundesministerium für Digitales und Verkehr, *NfL 2022-1-2554 Gemeinsame Grundsätze des Bundes und der Länder für den Betrieb von unbemannten Luftfahrzeugen.*

[11] DLR National Experimental Test Center for Unmanned Aircraft Systems, *Air Risk Operating Agreement Cochstedt.*

[12] Stadt Aschersleben, „Bevölkerungsdichte_Stadt_Aschersleben.pdf," 2023.

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[15] DFS Deutsche Flugsicherung GmbH, *AIP VFR Germany, AIC VFR 03 21 Page-1, 29.07.2021.*

[16] DFS Deutsche Flugsicherung GmbH, *AIP IFR Germany, ENR 2.2-5, 30.11.2023.*