ASD-STAN
Standardization

DIRECT REMOTE ID

INTRODUCTION TO THE EUROPEAN UAS DIGITAL REMOTE ID TECHNICAL STANDARD

ASD-STAN
Standardization

AEROSPACE AND
DEFENCE INDUSTRIES
ASSOCIATION OF EUROPE
STANDARDIZATION

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Acronyms

ASD-STAN	Aerospace and Defence Industries Association of Europe - Standardization
ASTM	American Society for Testing and Materials
CEN	Comité Européen de Normalisation (European Committee for Standardization)
DRI	Direct Remote ID
EASA	European Union Aviation Safety Agency
EU	European Union
GDPR	General Data Protection Regulation
ID	Identification
NAN	(Wi-Fi) Neighbour Aware Network
NRI	Network Remote ID
OPRN	Operator Registration Number
PII	Personally identifiable information
RF	Radio Frequency
TX	Transmit
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
Wi-Fi	Wireless Fidelity

1. Purpose

Everyone understands why cars need license plates: drivers have to be accountable and enforcement of the legislation must be possible. Like for cars, operations of unmanned aircraft systems (UAS or drones) may create risks to other people's safety and result in damages and casualties. Therefore, drone operators must comply with safety regulations and be accountable for the damages they may cause. However, unlike cars, drones' ubiquity and the lack of transparency of their operation (drone pilots and drones themselves may be difficult to identify) create several other risks. These risks relate to infringement of citizens' fundamental rights to privacy and data protection[1], to security risks associated with criminal and terrorist activities, or simply to irresponsible behavior. They concern mainly operations conducted under 120m altitude with consumer drones that can be easily purchased on the Internet and are particularly prone to be used in all kinds of malicious or careless operations.

To ensure operator's accountability, enable the enforcement of the legislation (both safety and privacy) and contribute to addressing security risks, Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft imposes the registration of drone operators (article 14.5) and the affixing of the registration number on the drone (article 14.7). The twofold objective of the regulation (safety and privacy) is apparent in Article 14.5 (a) that covers both the safety risks ("*i.e., UA with a MTOM of 250 g or more, or, which in the case of an impact can transfer to a human kinetic energy above 80 Joules*") and the privacy risks ("*ii. UA that is equipped with a sensor able to capture personal data, unless it complies with EU Toy Directive (2009/48/EC)*").

However, affixing the registration number on the drone is not sufficient in most cases to achieve the intended objectives. Due to most of the drones' small size, enforcement authorities and the general public will not be able to read the drone's number in flight. For this reason, Commission Delegated Regulation (EU) 2019/945 imposes that all drones operating in the open and specific category below 120 m are equipped with a remote identification function providing wireless digital access to the operator's registration number. So far, two remote identification modes exist – direct remote identification (DRI) and network remote identification (NRI).

Some drone operations require the drone operator to be clearly identified throughout the flight by the organization overseeing the flight. This is the case for drones operating under the U-Space. In this case, the U-Space service provider must ensure the continuous processing of the remote identification of the drone throughout the duration of the flight and shall provide the remote identification of the drone to the authorized users (including the public as regards information that is considered public in accordance with applicable Union and national rules). Drones operating under the U-Space must be equipped with a NRI function ensuring their connection to the U-Space through Internet.

Operations not performed under the U-Space are not subjects to such supervision. To enable the "reading" of the registration number the drone should provide a direct digital access to it in a simple manner. To that end, the Commission Delegated Regulation (EU) 2019/945 mandates that drones intended for operations in

[1] Fundamental rights covered by Article 7 (Respect for private life) and Article 8 (Data protection) of the Charter of Fundamental Rights of the European Union, 2000/C 364/01(CFREU), by the Right to respect for private life of Article 8 European Convention on Human Rights (ECHR, Rome, 4 November 1950); UAS operations are also subject to the General Data Protection Regulation (EU) 2016/679 (GDPR).

the open category or under declaration embed in their design a DRI function. This function broadcasts the operator registration number together with drone position during the entire flight in a way that it can be received by existing mobile devices. The only exceptions are drones of class C0 for which the operator does not necessarily need to be registered and drones of class C4, which are aeromodels. The legislation also defines an add-on enabling drones not equipped with DRI to comply with additional national requirements if necessary.

The DRI function enables the general public and authorities to “read” the operator’s registration number of drone operating nearby using a common mobile device like a smartphone. Providing a direct and easy way to identify drones’ operators will increase pilot’s accountability, facilitate the identification of offenders, and the intervention of authorities. It will also support the analysis of potential threats by security forces and make it more difficult to carry out malicious actions with consumer drones that can be easily acquired. Finally, it will provide citizens a way to enforce their privacy rights. In case the drone broadcasts the pilot’s position, it will even facilitate direct interactions with the pilot. The DRI function will strongly contribute to the public’s acceptance of drones and the reduction of potential misuses. In addition, it constitutes a more proportionate solution than the NRI since the access to the operator’s registration number is limited to persons in the close vicinity of the drone and not broadly available through the Internet. Finally, the possibility offered by the function to broadcast an additional message defined by the drone operator will help the operator to comply with the transparent information requirement set by article 12 of the GDPR when applicable (it could for instance be used to broadcast the address of a website providing the required details about the operation).

The DRI function constitutes one of the main requirements imposed by the product harmonization legislation set by Chapter II of the Regulation (EU) 2019/945 amended by Regulation (EU) 2020/1058 to drones intended for operations in the open category (classes C1, C2 and C3) and under declaration (classes C5 and C6).

Operational Concept Direct Remote ID

To operate drones in the open or specific category, a registration process is in place to register the owner of a UAS as Operator.

After registering as an Operator in one EU member state (only the operator, not every UAS of this operator), the UAS operator will receive an Operator Registration Number, which needs to be uploaded as Operator ID information to the Unmanned Aircraft (UA).

The remote ID function provides a means for an observer in the vicinity to retrieve this identification information without having physical access to the UA, using regular mobile devices with specific software downloaded from usual application online stores.

The broadcasted operator identification information is encoded in such a way that authorities will have the possibility to check its validity. Furthermore, authorities may have access to the registration database to link the identification number to the drone operator’s detailed information.

Public observers will only receive the unique identification number without detailed information about the operator or the UA.

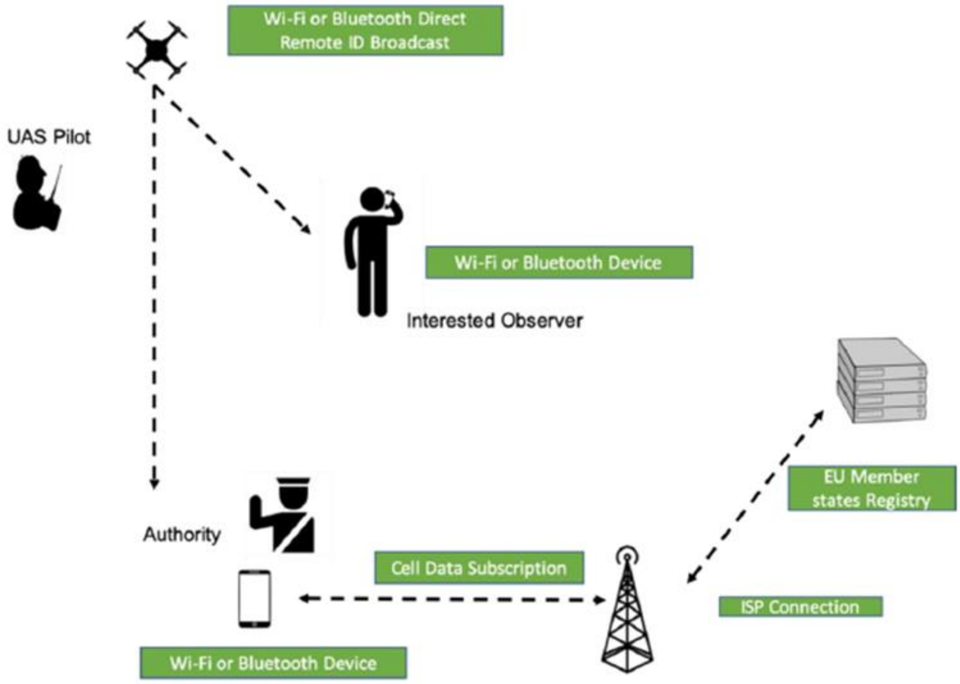

Figure 1 Remote ID operational concept

The prEN 4709-002 DRI standard only addresses the requirements of the UAS / direct remote ID (add-on or onboard) and not the requirements of the DRI receiver.

2. European regulation & standardization

As Unmanned Aircraft Systems (UAS) rapidly became a very significant component of both the civilian and military domain, the necessity for a detailed regulation on the matter has become an urgent issue for lawmakers to respond to the European civil society's concerns about privacy, security, and safety impacts. To answer those concerns, the European Commission has published two regulations targeting the production of UAS and their operations by users: Commission Delegated Regulation (EU) 2019/945 of March 12, 2019 setting the requirements imposed to unmanned aircraft systems and Commission Implementing Regulation (EU) 2019/947 of May 24, 2019 on the rules and procedures for the operation of unmanned aircraft.

The requirements imposed on drones conducting the lower risks operations (operations in the open category and under declaration) are not imposed through classical aviation procedure but through a product harmonization legislation. Chapter II of Regulation (EU) 2019/945 constitutes in consequence a product harmonization legislation setting the technical requirements applicable to drones of classes C0 to C6. These technical requirements implement the essential requirements defined in Annex IX of Regulation (EU) 2018/1139. They have been defined by EASA on the basis of an analysis of the risks involved in the operation defined by the Regulation for each class of drones. Contrary to most product harmonization legislation, Regulation (EU) 2019/945 does not require the drone manufacturer to perform a risk analysis to define the applicable requirements, all technical requirements are directly applicable.

Chapter II of Regulation (EU) 2019/945 sets also the obligations of the different economic operators with regards to the placing of drones of classes C0 to C6 on the EU market and the procedures available to demonstrate their conformity and the affixing of the CE marking. It should be noticed the placing of a drone of class Cx on the market (i.e. a drone bearing the corresponding class identification label x) is a manufacturer's decision based on the market he intends to target with his product.

In the case of requirements imposed on a product through a product harmonization legislation, harmonized European Standards constitute a useful tool to help manufacturers to ensure and demonstrate the conformity of their product. The voluntary application of a harmonized European Standard or parts thereof the reference of which has been published in the Official Journal of the European Union provides a presumption of conformity with the requirement covered by this standard or parts thereof.

The European Commission has therefore requested[2] the European Committee for Standardization (CEN) to deliver an EU harmonized standard to address the DRI requirements. Acting as the Technical body of CEN for Aerospace, the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN) is therefore developing under "D05/WG08 UAS" Working Group a set of standards (the EN4709 series) laying down technical specifications and/or the verification methods ensuring the compliance with regulatory requirements set by Chapter II of Regulation (EU) 2019/945.

These standards will give all economic operators (such as manufacturers, importers and distributors and their trade associations as well as bodies involved in the conformity assessment procedures) a viable way to prove compliance with the requirements laid out in Parts 1 to 6 of the Annex of the Delegated Regulation (EU) 2019/945. Furthermore, they will ensure a high and uniform level of safety for UAS operators, while

[2] M/567 COMMISSION IMPLEMENTING DECISION C(2020)6148 of 11.9.2020 on a standardisation request to the European Committee for Standardisation as regards unmanned aircraft systems intended to be operated in the 'open' category of operations in support of Commission Delegated Regulation (EU) 2019/945

fostering the development of the UAS market, contributing to addressing citizens' concerns regarding matters such as security, privacy, data protection and environmental protections.

prEN 4709-001	Aerospace series - Unmanned Aircraft Systems — Part 001: Product requirements and verification	Public Enquiry planned early 2021
prEN 4709-002	Aerospace series - Unmanned Aircraft Systems - Part 002: Direct Remote identification	Public Enquiry launched 3 Dec 2020
prEN 4709-003	Aerospace series - Unmanned Aircraft Systems - Part 003: Geo-awareness requirements	Public Enquiry launched 3 Dec 2020
prEN 4709-004	Aerospace series - Unmanned Aircraft Systems - Part 004: Lighting requirements	Public Enquiry launched 3 Dec 2020

Table 1: prEN 4709 series of standards developed by ASD-STAN D05/WG08

In the series, prEN 4709-002 "Direct Remote Identification" addresses the digital identification requirements for UAS classes C1, C2 and C3 based on the requirements from Regulation (EU) 2019/945. The amended requirements from Regulation (EU) 2020/1058 to include an NRI solution besides the DRI, e.g., on the classes C5, C6 as well for operations below 120m in the specific category are not covered by the current prEN4709-002 "Direct Remote Identification" draft.

ASD-STAN prEN 4709-002 will also provide means of compliance to cover the "Direct Remote Identification" requirements set in Parts 2 to 4 of Regulation (EU) 2019/945 and applicable to drones of classes C1 (Part 2), C2 (Part 3) and C3 (Part 4), C5 and C6 (Part 16 and 17 of amended Regulation (EU) 2020/1058). It has to be noticed that all these 3 requirements are identical. It will also cover the requirement set in part 6 for DRI add-on. More specifically, this document will address UA capability to be identified during the whole duration of the flight, in real time and with no specific connectivity or ground infrastructure link, by existing mobile devices when within the broadcasting range. Such functionality, based on an open and documented transmission protocol (described in the document) and developed for security purposes and social acceptance, can be used by law enforcement people, critical infrastructure managers, and general public to get an instantaneous information on the UA flying around, providing various information such as UA identifier, UA navigation data and operational status, UAS Operator identifier and position as defined in the Delegated Regulation (EU) 2019/945.

The NRI requirement included in Commission Regulation (EU) 2020/1058 is not covered in the current prEN 4709-002 draft.

3. Technical standard

Communication technologies and protocols

The prEN 4709-002 standard specifies various transmission methods of getting the identification and telemetry data from the UAV to the ground observers. These methods are based on Bluetooth and Wi-Fi protocols, because they are currently the only technologies that meet the requirement of being available in common mobile phones. Both of these protocols have pros and cons, and together, they complement each other.

	Expected range	Maximum TX power	Android receive	Android update rate	iOS receive	iOS update rate
Bluetooth 4 Legacy Advertising	250 m	10 mW	All models	High	All models	High
Bluetooth 5 Long Range (Coded PHY S8)	1 km	10 mW	Selected newer models	High	None	None
Wi-Fi NAN	2 km	100 mW	Selected newer models	High	None	None
Wi-Fi Beacon	2 km	100 mW	All models	Low by default (see below)	Unknown	Unknown

Table 2: Communication technologies

A few notes on the above data:

- For the range estimates, ideal conditions are assumed (unobstructed visual line of sight, maximum allowed TX power, no other interfering elements, and an optimal antenna implementation). In real-world scenarios (e.g., flying in cities), the range can easily be halved by interference and obstructions.
- Bluetooth 4 Legacy Advertising and Bluetooth 5 Long Range can be transmitted simultaneously. For Newer Android phone models, the Android Update rate for Wi-Fi Beacon can be changed to "High" by disabling the "Wi-Fi scan throttling" option in Android developer settings
- With the correct Android phone model, receiving all four signals simultaneously is possible
- The detailed definition of receivers for DRI is not included in the standard. See further information in Chapter 4.

NRI is not included in the current version of the prEN 4709-002 standard but for completeness, a summary of the pros and cons of DRI vs. NRI is given in the table:

	Internet connection required	Cloud/server infrastructure required	Data availability	Traffic monitoring for large areas
DRI	No	No	Locally	Limited
NRI	Yes	Yes	Globally	Possible

Table 3: DRI and NRI approach comparison

Note: Traffic monitoring of Broadcast signals requires installing one or multiple receivers in the area of interest.

Message contents

The DRI system broadcasts locally the information listed below:

- The UAS operator registration number.
- The unique serial number of the UA (or exclusively the add-on) compliant with standard ANSI/CTA-2063-A-2019 [3].
- The time stamp, the geographical position of the UA and its height above the ground or its take-off point.
- The route course measured clockwise from true north and ground speed of the UA.
- The geographical position of the remote pilot, or if not available, the geographical position of the take-off point.
- The UAS emergency status for Class C1, C2, C3. Not required for add-on.

Operator registration number

The UAS operator registration number information consists of the UAS Operator Registration Number (OPRN), the public part including a checksum character, and the three randomly generated Secure Characters, the private part. Both parts are delivered to the operator from the Member State registration system. The intention is that both parts are entered into the DRI system when uploading the operator registration number.

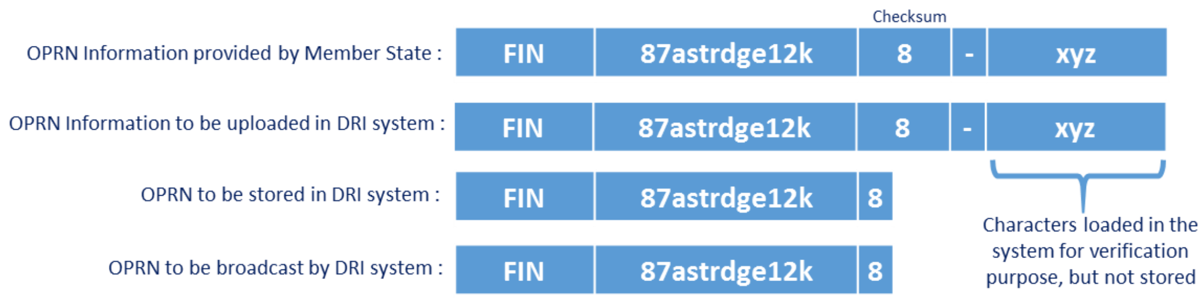

Figure 2: OPRN information for DRI system

The DRI System will only broadcast the public part (including the checksum). The private part is not stored in the UA and is not broadcasted (it is used by the UA only for verifying that the user has uploaded a valid operator registration number). Since the checksum is calculated over both the private and the public part, authorities with access to the private part from the registration database, can verify if the Operator ID is linked to a registered Dataset in the EU.

In the example used above, the public part is the string ”FIN87astrdge12k8” and the private part is the string ”xyz”.

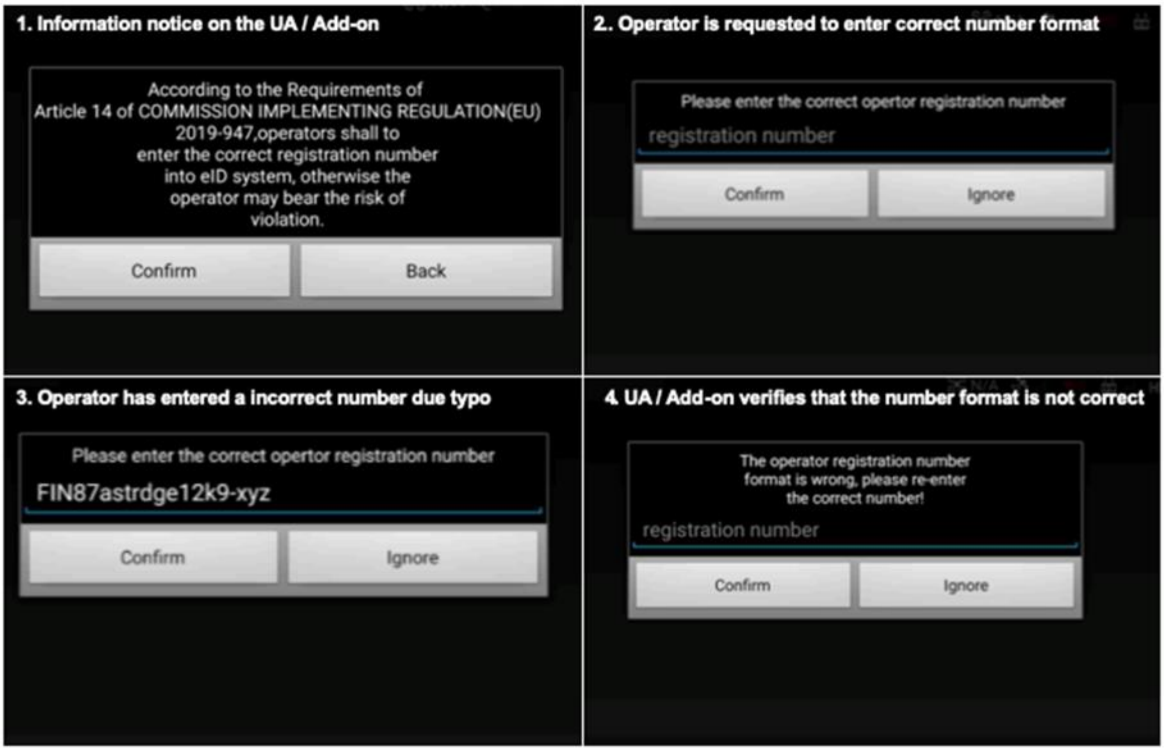

Figure 3: Operator ID number format verification on the UA / DRI add-on

When operating a UAS with a DRI solution, the UAS shall continuously broadcast all the required information to its surroundings in the broadcasting range and the operator / remote pilot shall not be able to switch off this broadcast function.

Interested observers, who see a UA flying around and are in the receiving range of the DRI system, can run a mobile app, read the identification data and visualize the UA's telemetry. However, they will not be able to link the operator registration ID to any Personally identifiable information (PII) of the operator, so the UAS operator's privacy is maintained. On the other side, law enforcement agencies can verify if the received DRI information belongs to a valid UAS operator ID in the official EU member states registration systems to identify the UAS operator.

Message structure

The ASD-STAN DRI standard defines a semantic model (data dictionary), which lists the required data fields for proper DRI function. Some data fields are identified as mandatory to ensure compliance with the EU regulation, other fields have been defined for enhanced operational benefits and interoperability with other standards such as ASTM F3411 – 19. These additional fields are identified as recommended or optional.

The data fields defined in the data dictionary are assembled into messages following a defined structure, with a message header identifying the message type and a block message containing the message payload. The content of each message payload and the syntax (encoding rules) of the data fields are specified. The defined messages are:

Msg type	Message Name	Purpose	C1	C2	C3	Add-On
0x0	Basic ID Message	It contains ID information for UA, featuring the ID type and identifying the type of UA.	M	M	M	M
0x1	Location/Vector Message	It contains information about a UA location, longitude, latitude, height, track direction, speed, and timestamp.	M	M	M	M
0x2	Reserved	Reserved				
0x3	Self-ID Message	It allows an Operators fill text to declare the mission purpose, or any other kind of value added message.	O	O	O	O
0x4	System Message	It contains information about the Remote Pilot location and a group of multiple aircraft (if any). It also may include additional system information.	M	M	M	M
0x5	Operator ID	It informs about the Operator ID=UAS Operator Registration Number	M	M	M	M
0xF	Message Pack	It allows to group several messages into a unique message. It is used with Bluetooth Extended Advertising and Wi-Fi Neighbor Awareness Network and Wi-Fi beacon	M	M	M	M

Table 4: Identification messages

Relationship with other standards

During the development of the ASD-STAN DRI standard, the emphasis was laid on creating a solution that would be compatible with the ASTM F3411 – 19 Standard Specification for Remote ID and Tracking, in order to minimize the implementation burden for transmitters and allow receiver implementations to detect remote ID signals from as many sources as possible.

However, there are some differences between the two standards. Please see a comparison in the below table. In addition to what is shown in the table, there are differences between which exact messages and fields are mandatory or optional in the two standards:

	ASD-STAN DRI	ASTM F3411-19
Broadcast via Bluetooth Legacy Advertising mode	Included Optional	Included Mandatory*
Broadcast via Bluetooth Long Range mode	Included Mandatory*	Included Optional
Broadcast via Wi-Fi Neighbour Aware Network	Included 2.4 GHz (Mandatory*)	Included 2.4 GHz (Mandatory*) 5 GHz (Optional)
Broadcast via Wi-Fi Beacon	Included Mandatory*	Not included
Transmission via Internet (NRI)	Not included (See Chapter 5)	Included
Basic ID message	Included	Included
Location message	Included	Included
Authentication message	Not included	Included
Self-ID message	Included	Included
System message	Included	Included
Operator ID message	Included	Included
Message Pack message	Included	Included
Specification of Operator ID format	Included	Not included

Table 5: European (ASD-STAN) and US (ASTM) standards compatibility

* Note. Only one of the mandatory broadcast methods is required for transmitter implementations

For the Operator ID message, the ASD-STAN DRI standard has added a few new fields for UA category and Class information. These new fields will most likely be added in a future version of the ASTM standard.

For broadcast via Wi-Fi NAN, a couple of additional discovery and synchronization frames have been defined in the ASD-STAN DRI standard, significantly improving the reception on certain Android models. These additional frames will most likely be included in a future version of the ASTM standard.

Performance requirements

The ASD-STAN DRI standard defines the power emission, periodicity of data mission, and range.

- Output power: The UAS DRI system's output power should be set as high as possible but still in compliance with national rules and limits to achieve the maximum possible range of the DRI system.
- Emission Directivity: The DRI broadcasted signal should be emitted omni-directionally to allow its detection in any direction.
- Interoperability: The DRI information shall be received by existing mobile receiver devices such as smartphones.
- Transmission rate: The DRI information shall be broadcasted periodically in real-time to the Mobile receiver device:
    - Dynamic messages (UAS location/vector) shall be sent at least every one second(s).
    - Static messages (identification data) shall be sent at least every three second(s).
    - The maximum potential time elapsed since the time of applicability of the dynamic fields in the Location/Vector Message shall be no older than one second.

The ASD-STAN DRI standard does not define other radio-frequency characteristics since the DRI system is based on selecting industry standards RF technologies. Therefore, the DRI system shall comply with relevant radio-transmitting equipment standards, such as ETSI EN 301489-1, ETSI EN 301489-17, ETSI EN 300328.

Demonstration of compliance

The ASD-STAN DRI standard provides test methods to verify compliance with the standard for the set of information broadcasted by the UA or add-on, the protocol description and the bearer technology. These test methods include:

Inspection of the design documentation to verify:

- DRI Security
- DRI Broadcast transport protocols
- DRI Output power
- DRI Emission directivity

Demonstration and tests following practical step-by-step procedures with explicit pass/fail criteria. To verify:

- DRI correct information uploading verification
- DRI data transmission accuracy and completeness
- DRI data transmission rate and data update rate

Receiver

The ASD-STAN standard does not cover the receiver side of the DRI application scenario. However, it gives some guidelines for the development of smartphone applications that receive and display DRI. The reception of DRI is not limited to smartphones. Any radio receiver device supporting the defined transportation methods (Wi-Fi NAN, Wi-Fi Beacon or Bluetooth 4/5) can be used to receive the DRI messages.

4. Implementation

The practical implementation of DRI on the UAS can be foreseen in two manners. For most of the drones already sold to customers or that are on the market right now, firmware update from UA manufacturers to fulfill the DRI requirements is expected. The UAS that will not receive this kind of support from manufacturers or those that do not have the appropriate Wi-Fi or Bluetooth hardware onboard still have a chance to retrofit by using add-on devices from 3rd party companies. The first approach's advantage is the ease of installation – users don't have to do anything except the firmware update. On the other hand, the add-on's benefit is that it brings additional features to the UA, possibly providing NRI. The disadvantage of the add-on is that additional equipment must be purchased and installed.

Receiver devices for DRI data will often be smartphones. Several models are already on the market, capable of receiving UAS ID data from all transmission methods. However, due to the vast amount of Android models, it has not been possible to do an exhaustive compatibility test, but some data has been collected, listed in Appendix B.

Please note that many new models have become available after these test results were gathered (~Q1 2020). The number of models capable of receiving all four broadcast methods is most likely larger, than what is indicated.

Due to the complexity of the testing, unfortunately many phone models have only been tested for some of the possible four transmission methods.

Please also note that there are differences in the antenna/signal strength receive capabilities between different phone models. Although two different models are listed as capable of receiving a certain broadcast type, they are not necessarily able to receive the signals equally well at equal distances. The Samsung Galaxy S10 has proven to be a very good reference receiver device. There may be better devices available now.

Primarily Android devices were tested, since it was known that iOS (Apple/iPhone) devices do not yet support Bluetooth Long Range/Extended Advertising or Wi-Fi NAN. This is true at least for iOS version 14 and earlier. Apple devices can receive Bluetooth Legacy Advertising signals. Any implementation work to test whether they can receive Wi-Fi Beacon signals has unfortunately not been done yet.

Additional information on compatible devices is provided in Appendix B.

Testing and Usage

The various implementations of DRI by the UAS and add-on device manufacturers participating in the definition of the European Standard prEN 4709-002 have been tested using multiple applications on different smartphones. To give an impression of the usage of DRI, sample screenshots for the different transport methods defined in the standard are presented in the following sub-chapters.

Wi-Fi NAN broadcast

A Wi-Fi NAN DRI solution has been implemented by DJI into a Mavic Air UA. The sample screenshots show DRI received by the Dedrone Drone Scanner app running on a Samsung Galaxy S10+ smartphone. The yellow diamond on the map shows the UA with the flight path in red and the pilot also in yellow, while the blue dot is the smartphone's position. The info screen gives a detailed view of the data received, e.g. the operator ID or the UAS speed.

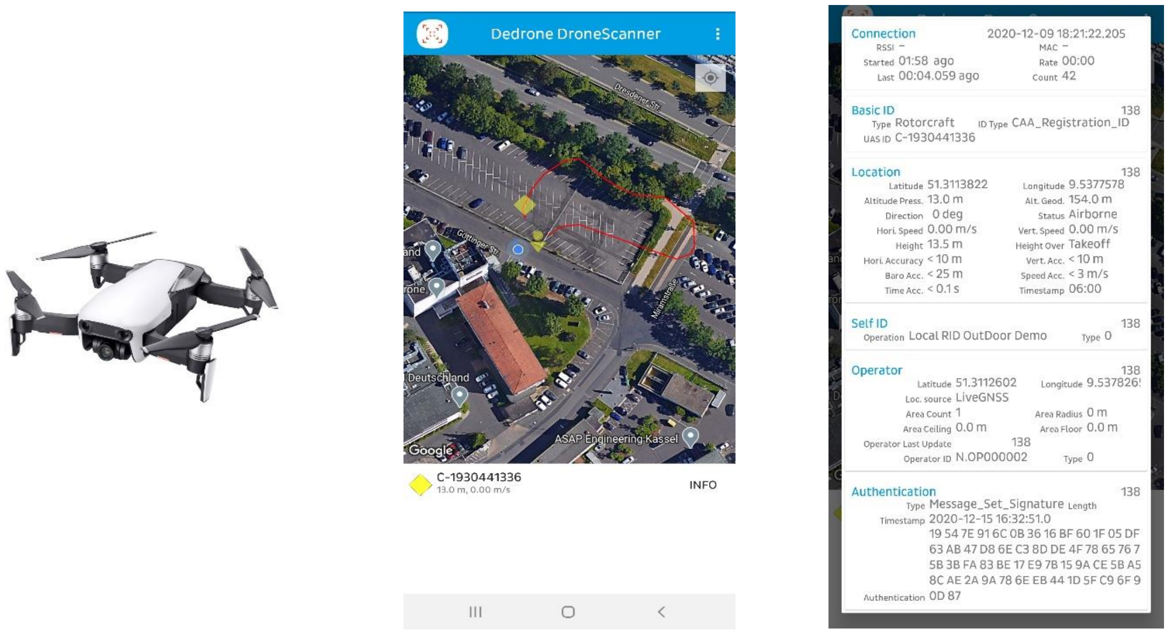

Figure 4: Screenshot of Wi-Fi NAN remote ID (DJI)

Another Wi-Fi NAN DRI solution has been implemented by senseFly into an eBee X UA. The sample screenshots show DRI received by the Dedrone Drone Scanner app running on a Samsung Galaxy S10 smartphone. The yellow diamond on the map shows the UA with the flight path in red and the pilot also in yellow, while the blue dot is the smartphone's position. The info screen gives a detailed view of the data received, e.g. the operator ID or the UAS speed.

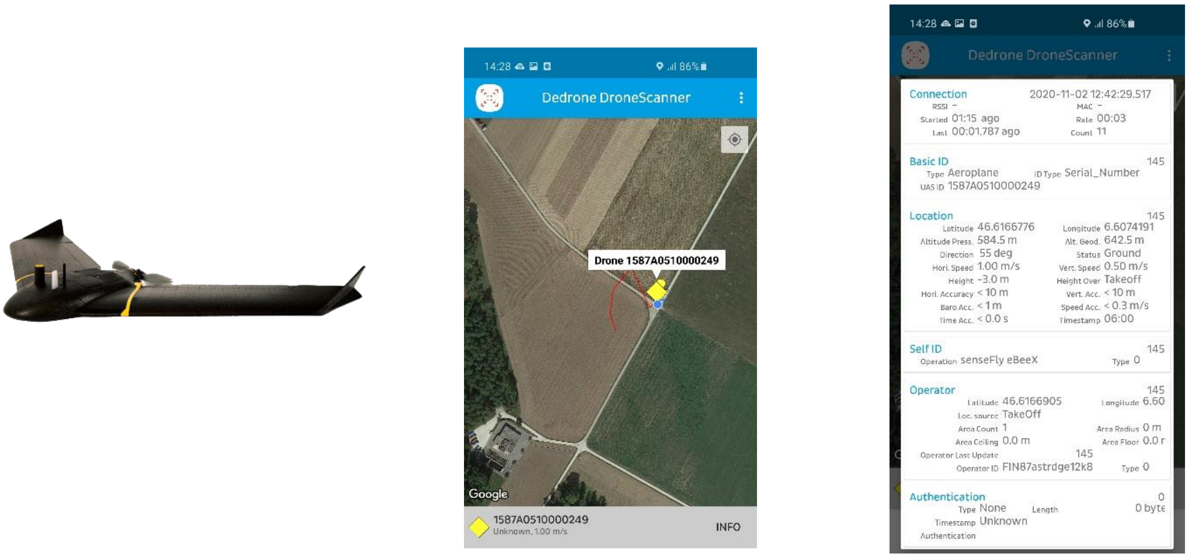

Figure 5: Screenshot of Wi-Fi NAN remote ID (senseFly)

Wi-Fi Beacon broadcast

The Parrot Anafi drone has been developed to broadcast the DRI messages through the Wi-Fi Beacon technology. Beacon frames are broadcasted openly and can be detected by cellular phones as part of a standard channel scan operation that is applied within any operational client device automatically. Remote ID information can be extracted from the Beacon messages easily.

As illustrated below on the Dedrone Drone Scanner application, a red line traces Parrot Anafi's path while the flight information details are available on the info screen.

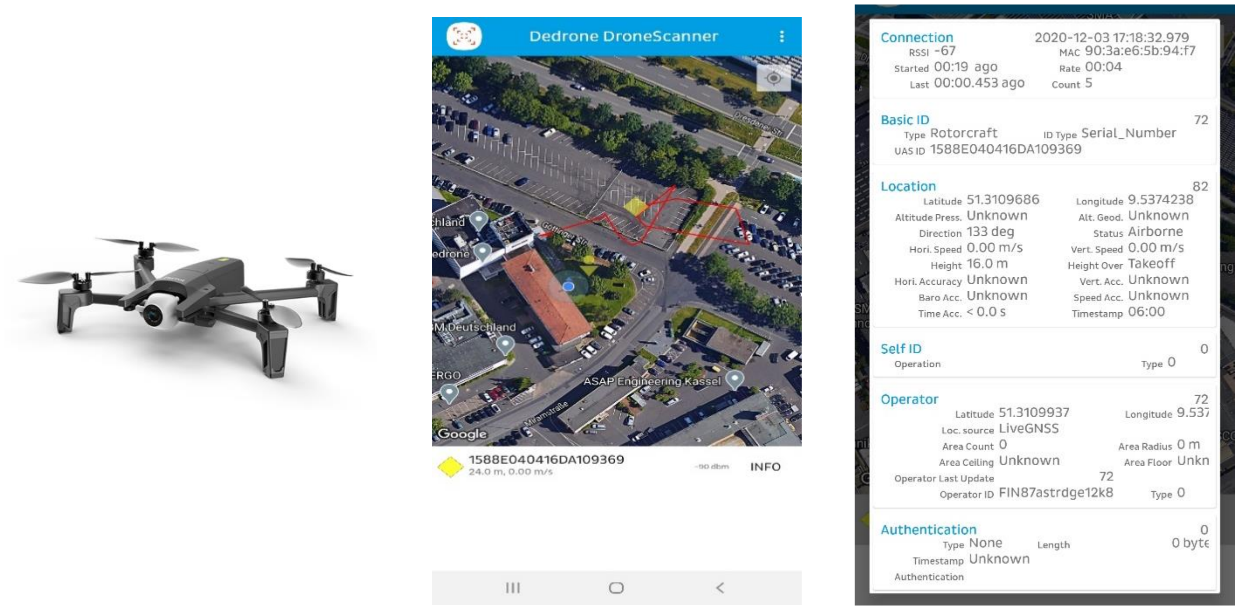

Figure 6: Screenshot of Wi-Fi beacon remote-ID (Parrot)

Bluetooth 4 Legacy Advertising broadcast

A Bluetooth add-on DRI solution is available by Unifly to retrofit on drones. The sample screenshots above show the DRI received by the Unifly OpendroneID scanner app running on a Samsung Galaxy A5 smartphone. The info screen gives a detailed view of the data received, e.g. the operator ID or the UAS speed

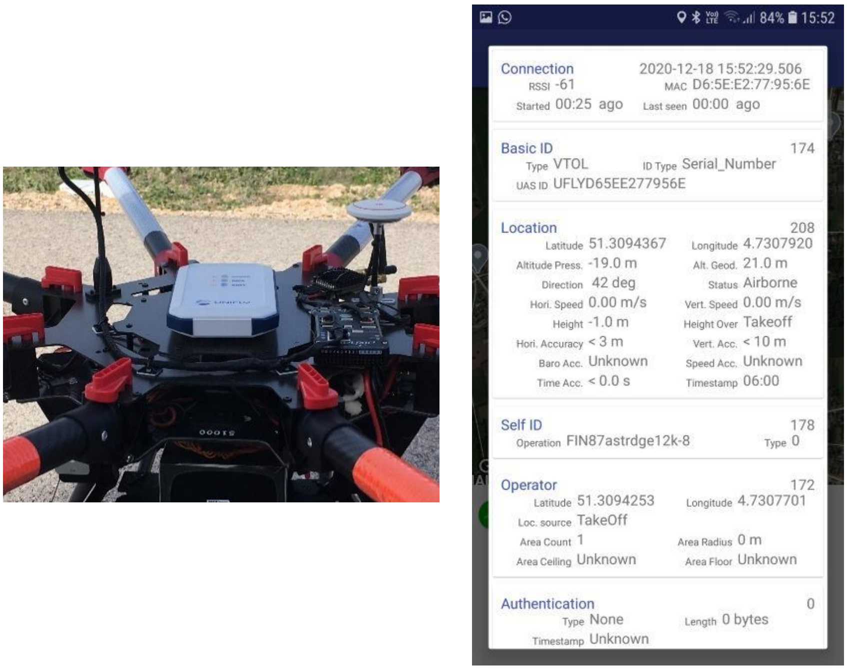

Figure 7: Add-on implementation and a screenshot of Bluetooth Android receiver remote ID (Unifly)

A sample screenshot of a demonstration application for showing the reception of Bluetooth 4 (Legacy Advertising) signals on iOS can been seen below. The blue drone symbol on the map shows the UA with the flight path in green and the pilot with the brown marker, while the blue dot is the position of the smartphone.

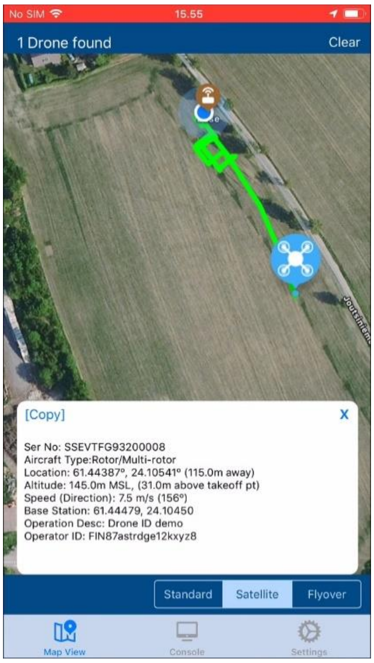

Figure 8: Screenshot of Bluetooth iOS receiver application

Bluetooth 5 Long Range broadcast

Czech startup Dronetag offers a remote identification add-on device compatible with all drones on the market. It can simultaneously broadcast Bluetooth 4 Legacy Advertisements and Bluetooth 5 Long Range ones.

Figure 9: Dronetag Mini add-on DRI and NRI implementation with the commonly available receiver app

Note: as the screenshots above show, thanks to the standardization of the messages and transmission protocols, UA DRI and receiver applications are interoperable and not vendor-specific.

UAS operator registration number validation

The UAS operator registration number, provided by the European local authorities, can be manually entered by selecting the Registration ID's underlined text. The Operator Registration ID is "NULL" by default. To ensure a valid Registration ID is broadcasted, the format entered must be compliant with the EASA regulation format described in Figure 2.

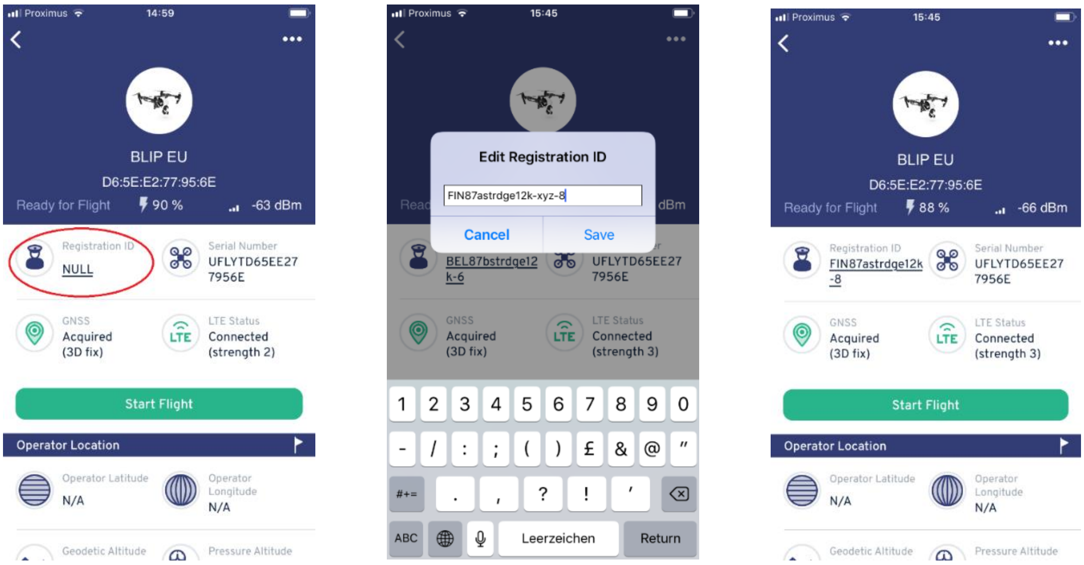

Figure 10: Entering a valid UAS Operator Registration number

When entering a valid registration ID number (using the three Secure Characters), the Operator ID is stored in the DRI and broadcasted, without the three Secure characters which are available only to Authorities to check the Operator ID validity.

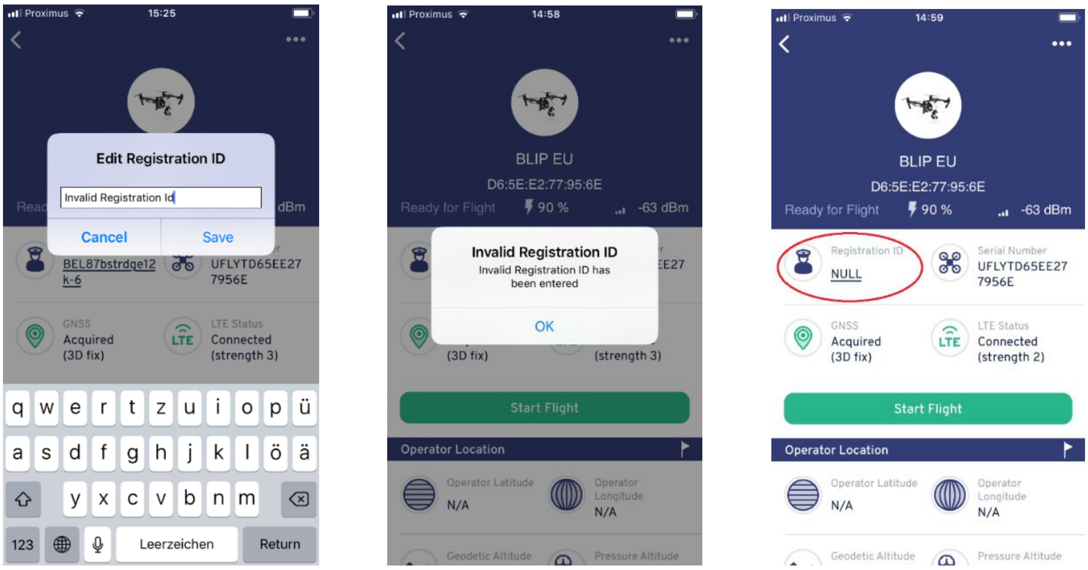

Figure 11: Entering an invalid UAS Operator Registration number

When entering an invalid registration ID number (resulting in a wrong checksum), an ”Invalid Registration ID” message is displayed. The Registration ID field remains or becomes ”NULL” and this value is then broadcasted.

5. Future work

ASD-STAN has been developing the prEN 4709 series for about one year to answer the standardization request M/567 issued by the European Commission to CEN (see section 2).

Several draft standards were finalized in 2020 by ad-hoc working groups of experts, including prEN 4709-02 dedicated to DRI.

These texts issued by ASD-STAN have been transferred to CEN-CENELEC who submitted them as draft standards (prEN) for public enquiry to the National Standardization Bodies. This process, known as CEN Enquiry, has started on the 3rd of December 2020 and will be closed on the 25th of February 2021.

All comments will be provided to the working groups to process them and deliver an updated standard document within one to three months, depending on the comments received. The updated document will be published in 2021 as an ASD-STAN prEN standard, which will be later translated into several languages and published as an Harmonised European Standard by CEN. There is no change between the ASD-STAN prEN publication and the CEN EN publication on the technical content and ASD-STAN prEN standard can be used for any training and/or certification activity.

Future standardization work for remote identification

Commission Delegated Regulation (EU) 2020/1058 of 27 April 2020 amended the initial regulation to extend its applicability to the drones of Class C5 and C6 (Specific). As a consequence of this new regulation, a new request for standardization has been issued by the European Commission and accepted by CEN and ASD-STAN. Further work will be performed in 2021 to develop a new standard matching the amended regulation. Drone identification now includes the NRI requirements applicable to both Open (C1, C2 and C3) and Specific (C5 and C6) drones.

Developing this new standard will repeat the current one, with a target to have a new standard ready no later than 2022.

APPENDIX A - Reference documents

Ref.	Document title
[1]	COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems; amended by COMMISSION DELEGATED REGULATION (EU) 2020/1058 of 27 April 2020
[2]	COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; amended by COMMISSION IMPLEMENTING REGULATION (EU) 2020/639 of 12 May 2020 and COMMISSION IMPLEMENTING REGULATION (EU) 2020/746 of 4 June 2020
[3]	ANSI/CTA-2063 Small Unmanned Aerial Systems Serial Numbers https://shop.cta.tech/products/small-unmanned-aerial-systems-serial-numbers

APPENDIX B - List of tested phones

A list of compatible smartphones that have been tested for receiving the Direct Remote ID signals from an Unmanned Aircraft (UA) or add-on device following the ASD-STAN prEN 4709-002 standard can be obtained following the link below:

https://github.com/opendroneid/receiver-android/blob/master/supported-smartphones.md

Although this standard does not cover the receiver side of the Direct Remote ID, this document provides a quick overview of the compatibility of community tested smartphones with the specified broadcast Remote ID technologies.

Disclaimer: The list of tested devices is not exhaustive and comes without any guarantees. It might contain some errors and misleading information. There might even be some changes via SW updates from the smartphone manufacturers that can either improve or degrade the receiving capabilities. If you find any incomplete, inconsistent, or wrong information, please feel free to open a GitHub issue.

ABOUT ASD-STAN

ASD-STAN is an industrial non-profit association (AISBL) that develops and maintains European standards for the European aerospace & defence industry.

As an associated body to CEN (European Committee for Standardization) we are the sole provider of European Norms (EN) and harmonised European norms (hEN) for the aerospace industry.

To enhance the competitiveness of European companies, we established a protocol with CEN to shorten the process of European standardization. ASD-STAN publishes projected-EN standards (ASD-STAN prEN) which are technically identical to the final European Norm (EN). Our cooperation with CEN ensures compliance with the openness and transparency requirements for standard development included in the **Regulation (EU) 1025/2012, WTO/TBT Agreement** and the relevant provisions of CEN-CENELEC Internal Regulations.

To date, our 45 Working Groups divided into 10 domains of activities have published over **2550 European Standards (EN)** and have registered more than 500 standards which are on their way to be published as ENs.

Our values of openness, transparency, consensus and balance are at the core of our Working Groups. By bringing experts from all across Europe and the industry together, we guarantee the safety of our standards by having Original Equipment Manufacturers (OEMs) and Type Certificate (TC) holders chairing our Working

This document was created with the support from the European Commission,
the European Aviation Safety Agency (EASA) and expertise of the following organisations:
BNAE (Bureau de Normalisation de l'Aéronautique et de l'Espace) · Dedrone · Deutsche Flugsicherung (DFS)
DIN (Deutsches Institut für Normung) · DJI · Dronetag · Intel · Parrot · SenseFly · Thales · Unifly

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