



ED-322

SYSTEM PERFORMANCE AND INTEROPERABILITY REQUIREMENTS FOR NON-COOPERATIVE UAS DETECTION SYSTEMS

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FOREWORD

1. This document was developed jointly by EUROCAE Working Group 115 'Counter UAS (C-UAS)' and RTCA SC-238 'Counter UAS' and was approved by the Council of EUROCAE on 12 December 2023.
2. This document is technically identical to RTCA DO-403. Coordination has been achieved with RTCA SC-238 'Counter UAS'.
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TABLE OF CONTENTS

FOREWORD	i
TABLE OF CONTENTS	ii
TABLE OF FIGURES	iii
TABLE OF TABLES	iii
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Scope and objectives	1
1.3 Existing standards and references	1
1.3.1 Existing standards	1
1.3.2 References.....	2
1.4 Structure of the document	2
1.4.1 Mandating and recommendation phrases	3
1.5 Definitions	3
1.6 Abbreviations	5
CHAPTER 2 COUNTER-UAS SYSTEM OVERVIEW	7
2.1 Introduction	7
2.2 Functional architecture	7
2.2.1 Concept.....	7
2.2.2 Functional blocks	8
2.3 Performance metrics	9
2.3.1 Context.....	9
2.3.2 Performance metrics.....	10
2.3.3 Testing	11
2.4 Characteristics of C-UAS systems	12
2.5 Components of C-UAS systems.....	13
2.5.1 Sensors.....	13
2.5.2 Data tracking.....	15
2.5.3 Identity correlator	15
2.5.4 Classification.....	15
2.5.5 Alerting.....	15
2.5.6 CMS and BITE	16
2.5.7 Visualisation.....	16
2.5.8 Recording.....	16
2.5.9 Performance analysis	16
2.5.10 Data streams.....	16
2.5.11 Transversal elements	17
CHAPTER 3 C-UAS SAFETY & PERFORMANCE REQUIREMENTS.....	18
3.1 Introduction	18
3.2 Service specification.....	19
3.3 Design analysis	21

3.3.1	Assumptions	21
3.3.2	Safety Support Requirements (SSR) in normal conditions of operation	21
3.3.3	Safety Support Requirements (SSR) in abnormal & faulted conditions of operation	22
CHAPTER 4	AIRPORT CRITICAL ZONES	24
4.1	Airport critical zones	24
4.2	Considerations for the airport risk assessment	27
4.3	Basic functional requirements inside the perimeter of the airport	27
4.3.1	General	27
4.3.2	Coverage	28
4.3.3	Interference Protection and Siting/Location	28
CHAPTER 5	C-UAS INTEROPERABILITY REQUIREMENTS	29
5.1	Purpose and scope	29
5.2	Interfaces identification	29
5.3	Interoperability requirements	31
APPENDIX A	SUMMARY OF REQUIREMENTS AND RECOMMENDATIONS	37
APPENDIX B	WG-115 and SC-238 MEMBERSHIP	41
	IMPROVEMENT SUGGESTION FORM	47

TABLE OF FIGURES

Figure 2-1:	C-UAS System basic architecture	8
Figure 2-2:	SCV and CAV volumes	10
Figure 3-1:	High-level C-UAS SYSTEM components	18
Figure 3-2:	Service description	18
Figure 4-1:	Airport Zones, Side, and Top view	26
Figure 5-1:	Identification of C-UAS DTI System interfaces	29

TABLE OF TABLES

Table 1-1:	Definitions	3
Table 1-2:	Abbreviations	5
Table 3-1:	Safety Support Requirements – normal operations	21
Table 3-2:	Safety Support Requirements under abnormal or faulted conditions	23
Table 4-1:	Recommendations for airport zone definitions	27
Table 5-1:	Asterix Cat015 data items to be used in C-UAS sensors target reports	31
Table 5-2:	Asterix Cat062 data items to be used in C-UAS tracked reports.	32
Table 5-3:	Data Dictionary of Interface I5	33
Table 5-4:	Data Dictionary of Interface I6	34
Table 5-5:	Data Dictionary of Interface I7	35
Table A-1:	Summary of Requirements	37
Table A-2:	Summary of Recommendations	39
Table A-3:	Summary of Optional Recommendations	40

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Sighting of Unmanned Aircraft Systems (UAS) in an airport environment can often impact the airport flight operations as well as threaten the vicinity of the airport. To prevent such disruptions as well as to mitigate possible consequences on safety or security, the airport needs to be secured and the presence of unauthorized UAS needs to be detected and reported. Thereafter, if necessary, measures should be taken before an accident or incident may occur.

This document is intended to summarise the different aspects of the Counter UAS (C-UAS) system and to have a better understanding of the C-UAS system components at the detection level. This document will identify performance requirements parameters of the Counter UAS detection system as it has been defined in the ED-286 / DO-389 Operational Services and Environment Definition (OSED) for Counter UAS in Controlled Airspace.

1.2 SCOPE AND OBJECTIVES

The main objective of this document is to provide technical guidance to airport operators and/or other users to protect the airport operations from unauthorized UAS incursions by providing a baseline for specifying and evaluating the C-UAS detection function capabilities, including related performance parameters and interoperability requirements.

This document will concentrate on the detection component (DTI – Detection, Tracking and Identification) and its capability to offer real time situational awareness along with other complementary operational capabilities and functions of the C-UAS detection system.

Moreover, owing to the present scope of the OSED and the absence of definitive factors to characterize the C-UAS system in its entirety as a system of systems, this document focuses on the DTI elements of a non-cooperative unmanned aircraft detection system.

This document does not encompass:

- The specifications of the C-UAS system technologies.
- The C-UAS operational process integrating into other systems, actions and procedures.
- The neutralization component nor the mitigation countermeasures.
- The necessary protocols and identification of roles and responsibilities.

1.3 EXISTING STANDARDS AND REFERENCES

1.3.1 Existing standards

- [1] EUROCAE ED-286 / RTCA DO-389 – Operational Services and Environment Definition (OSED) for Counter UAS in Controlled Airspace, 2021.
- [2] EUROCAE ED-109A / RTCA DO-278A – Software Integrity Assurance Considerations for CNS/ATM Systems with Corrigendum 1, 2021.
- [3] EUROCAE ED-258 – OSED for Detect and Avoid (Traffic) in Class D-G airspaces under VFR/IFR, 2019.
- [4] EUROCAE ED-261/1 – Safety & Performance Requirements Standard for a Generic Surveillance System (GEN SUR SPR) Volume 1, 2021.
- [5] EUROCAE ED-269 – Minimum Operational Performance Standard for UAS Geo-Fencing, 2020.
- [6] EUROCONTROL – Specification for Surveillance Data Exchange ASTERIX Part 28 Category 015 Independent Non-Cooperative Sensors Target Reports, EUROCONTROL, 2021.

- [7] EUROCONTROL – Specification for Surveillance Data Exchange ASTERIX Part 9 Category 062 SDPS Track Messages, EUROCONTROL, 2010.
- [8] ISO 21384-4:2020 Unmanned Aircraft Systems - Part 4: Vocabulary.
- [9] ISO 23629-12:2022 - UAS traffic management (UTM) — Part 12: Requirements for UTM service providers.
- [10] RTCA DO-365 – Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) Systems, 2017.
- [11] RTCA DO-366 – Minimum Operational Performance Standards (MOPS) for Air-to-Air Radar for Traffic Surveillance, 2017.
- [12] RTCA DO-381 – MOPS for Ground-based Surveillance System (GBSS) for Traffic Surveillance, 2020.
- [13] RTCA DO-387 – Minimum Operational Performance Standards (MOPS) for Electro-Optical/Infrared (EO/IR) Sensors System for Traffic Surveillance, 2021.
- [14] Standard Specification for Remote ID and tracking. Designations ASTM F3411-22, International 2022

1.3.2

References

- [15] Commission Implementing Regulation (EU) 2017/373
- [16] Directive 2009/12/EC of the European parliament and of the Council of 11 March 2009 on airport charges
- [17] Drones in the Airport Environment – Concept of Operations & Industry Guidance. Airports Council International Europe (ACI). 2020
- [18] EASA – Drone Incident Management at Aerodromes Manual. 2021
- [19] ICAO Annex 2 – Rules of the Air
- [20] ICAO Annex 10 – Aeronautical Telecommunications
- [21] ICAO Annex 11 – Air Traffic Services
- [22] ICAO Annex 17 – Security
- [23] ICAO Doc 8973 – Aviation Security Manual
- [24] ICAO Doc 9859 – Safety Management Manual
- [25] ICAO Doc 9869 – Performance-based Communication and Surveillance (PBCS) Manual, 2nd edition 2017
- [26] ICAO Doc 9870 – Manual on the Prevention of Runway Incursions.
- [27] ICAO Doc. 11084 – Risk Assessment Manual for Civil Aircraft Operations Over or Near Conflict Zones

1.4

STRUCTURE OF THE DOCUMENT

This document is organised as follows:

Chapter 1: Introduction - presents the scope and objectives while also outlining the document's relationship with other related documents. The structure of the document is also explained in detail. Additionally, it provides an overview of the terminology defined in the C-UAS OSED.

Chapter 2: Counter UAS System Overview - provides a detailed overview of the C-UAS system and its functionalities. The document presents a thorough overview of the C-UAS detection system and its diverse capabilities.

Chapter 3: C-UAS Safety and Performance Requirements - defines the safety support assessment and entails the identification of the service specification to satisfy the needs of the user, followed by the identification of safety support requirements to meet the service specification.

Chapter 4: Airport Critical Zones - provides guidance to airport operator by outlining fundamental principles and top-level recommendations that ought to be considered when acquiring a C-UAS detection system. Additionally, it introduces airport critical zones where various levels of surveillance needs to be conducted, based on the severity of the impact resulting from an UAS incursion. It is out of the scope in this first version

of this document to determine the potential threat zones within an airport or locations where C-UAS can be deployed.

NOTE: *Chapter 4 has solely focused on the airside and has not taken into account the landside areas. However, this aspect will be addressed in future versions of this document. This will be accomplished after the current OSED (ED-286 / DO-389) is reviewed and the scope is broadened.*

Chapter 5: C-UAS Interoperability Requirements - aims to pinpoint the interfaces linking C-UAS DTI systems with pertinent external systems and the internal interfaces linking the system components. Future versions of the standard will address these aspects in greater detail, along with the protocols for data interchange.

1.4.1

Mandating and recommendation phrases

For the expression of requirements or recommendations, this document uses “shall”, “should” and “may” statements with the following meanings:

- **“Shall”**
The use of the word “Shall” indicates a mandated criterion; i.e. compliance with the particular procedure or specification is mandatory and no alternative may be applied.
- **“Should”**
The use of the word “Should” (and phrases such as “It is recommended that...”, etc.) indicate that though the procedure or criterion is regarded as the preferred option, alternative procedures, specifications, or criteria may be applied, provided that the manufacturer, installer or tester can provide information or data to adequately support and justify the alternative.
- **“May”**
The use of the word “May” indicates an optional (but recommended) criterion. Alternative procedures, specifications or criteria may be applied, provided that the manufacturer, installer, or tester can provide information or data to adequately support and justify the alternative.

1.5

DEFINITIONS

TABLE 1-1: DEFINITIONS

Term	Definition	Source
Airport	Any land area specifically adapted for the landing, taking off and manoeuvring of aircraft, including the ancillary installations which these operations may involve for the requirements of aircraft traffic and services, including the installations needed to assist commercial air services ¹ .	Directive 2009/12/EC of the European parliament and of the Council of 11 March 2009 on airport charges, art.2(2) [16]
Authorised UAS operation	Any UAS activity with authority or permissions to operate in the airport environment.	Adapted from ACI Ref [17] Developed for the purpose of this document. ²
Controlled airspace	An airspace of defined dimensions within which air traffic control services are provided in accordance with the airspace classification.	Adapted from ICAO Annex 11 [21]

¹ It includes the entire movement area, but also other installations outside the movement areas, such as passenger or freight terminals or maintenance areas.

² There are other definitions for “authorized” related to the legal authorization or permission of the UAS flight but this is not relevant in the context of the SPR. Therefore, this document uses what has been defined in this Item 1.5 DEFINITIONS for the purpose of this standard.

Term	Definition	Source
Detection	1) Global: Set of capabilities, technologies and procedures used to get the situational awareness in real time about the UAS operating in the airport airspace. Global detection stream includes four stages: initial detection ³ , data fusion & tracking, classification, and identification. 2) Initial: First stage of the global detection stream. Initial detection refers to the capability to recognize the presence of an object in a location or ambiance.	Adapted from technical literature for this document.
Disruption of operations	The interruption of airport ground-based or airborne flight operations, due to an established risk from UAS.	Developed for the purpose of this document.
Hazard	A condition or an object with the potential to cause injuries to personnel, damage to equipment or structures, loss of material, or reduction of the ability to perform a prescribed function	ICAO Doc 9859 [24]
Hot spot	A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary.	ICAO Doc 9870 [26]
Non-cooperative (UAS)	UAS not equipped with an electronic means such as a transponder, ADS-B or e-identification, or not operating such equipment due to malfunction or deliberate action	Adapted from ICAO Annex 10 [20], EUROCAE ED 258 [3], and RTCA DO-365 [10]
Performance requirements	Set of performance specifications applied to the provision of the UAS detection function ⁴ .	Adapted from ICAO Doc 9869 [25]
Risk	The combination of the overall probability or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect.	Commission IR (EU) 2017/373 [15], ICAO Doc. 9859 [24]
Restricted area	An airspace of defined dimensions above the land areas or territorial water of a State, within which the flight of aircraft is restricted in accordance with specific conditions	ICAO Annex 2 [19]
Safety	It is regarded as being driven by unexpected, non-nominal conditions that cause hazards of a certain safety severity class.	ED-261/1 Chapter 2, definition of "Performance and Safety" [4]

³ A target may be detected by several sensors.

⁴ Specifications may include requirements allocated to system components such as probability of detection, associated data delivery time, continuity, availability, integrity, accuracy of the surveillance data, safety and functionality needed in a particular airport environment.

Term	Definition	Source
Scenario	Description of symbolic situations including collaborative and non-collaborative unmanned aircraft operating in airport environment (restricted area, restricted airspace, or hot spot) with the aim to demonstrate the key components of the C-UAS system and its functions to guide the reader towards the composition of C-UAS system components needed for its own specific scenario type.	Adapted from ED-286 / DO-389 Chapter 5 for the purpose of this document [1]
Threat	A man-made occurrence, individual, entity, or action that has, or indicates, the potential to harm life, information, operations, the environment and/or property	ICAO Doc. 11084 [27]
Threat assessment	The estimation of the probability for a threat to be enacted against a target during a specific time frame, that will help to determine the threat level that a UAS may pose and will help decision makers to select the appropriate and most effective countermeasure	EASA – Drone Incident Management at Aerodromes Manual [18], adapted from ICAO Annex 17 [22]
Threat level	Indicates the likelihood and/or severity of a safety / security incident caused by UAS operations	EASA – Drone Incident Management at Aerodromes Manual [18], adapted from ICAO Doc. 8973 [23]

1.6

ABBREVIATIONS

TABLE 1-2: ABBREVIATIONS

Abbreviation	Definition
ANSP	Air Navigation Service Provider
AOA	Angle of Arrival
ASM	Assumption
A-SMGCS	Advanced Surface Movement Guidance and Control System
ATC	Air Traffic Control
ATM	Air Traffic Management
BITE	Built-In Test Equipment
CAA	Civil Aviation Authority
CAV	Compliance Assessment Volume
CMS	Control and Monitoring System
C-UAS	Counter Unmanned Aircraft System(s)
C2	Command and Control
DF	Direction Finding
DSS	Discovery and Synchronization Service
DTI	Detection, Tracking and Identification
DVB-T	Digital Video Broadcasting – Terrestrial

Abbreviation	Definition
EO	Electro-Optical
FAT	Factory Acceptance Test(s)
FM	(Radio) Frequency Modulation
GNSS	Global Navigation Satellite System
ICAO	International Civil Aviation Organisation
ICNS	Independent Non-Cooperative Systems
ID	Identification
IR	Infrared Radiation
LEA	Law Enforcement Agency
LIDAR	Light Detection and Ranging
MI	Measurement Interval
MLAT	Multilateration
OA	Operational Acceptance
OSD	Operational Services and Environment Definition
PBS	Performance-Based Surveillance
RFI	Radio Frequency Interference
SAT	Site Acceptance Test(s)
SCV	Surveillance Coverage Volume
SSR	Safety Support Requirements
SVS	Service Specification Items
TDOA	Time Difference of Arrival
UAS	Unmanned Aircraft System(s)
UTM	UAS Traffic Management

CHAPTER 2

COUNTER-UAS SYSTEM OVERVIEW

2.1 INTRODUCTION

A C-UAS system is a comprehensive system of systems that is designed to detect, track, identify (DTI) and provide information to support mitigation of the risk posed by unmanned aircraft operating in a designated area. This document offers a comprehensive summary of the C-UAS detection system and its various functionalities. It should be noted, however, that although a C-UAS system may encompass countermeasures intended to neutralize or reduce the risk posed to airport operations by UAS, this document does not cover these capabilities.

The C-UAS system comprises several complementary components, each with its own specific function, that collectively provide comprehensive coverage against UAS threats.

The first element of a C-UAS system is the detection function. This function is responsible for detecting UAS within the designated area of protection. The detection function can use a variety of sensors, such as radar, lidar, cameras, thermal and acoustic sensors, or radio-frequency detectors, to identify any UAS activity.

Once a UAS is detected, the tracking function of the C-UAS system enhances the information from the sensor(s) to provide a more comprehensive understanding of the situation with real-time updates. This enables the system to determine more accurately the position, speed, and trajectory of the UAS.

Following the tracking, the identification function of the C-UAS DTI system is designed to correlate identity information that will later support the distinction between friendly and hostile UAS. This function relies completely on external cooperative information received by the C-UAS DTI system.

At the end of these processes, and after several possible subfunctions for classification and categorisation, there is an alerting function that can provide immediate alerts to the relevant authorities when the UAS has been classified as a risk. This function supports decision making and enables the authorities to take the necessary reactive actions, including neutralization, to mitigate any potential threat posed by the detected UAS.

2.2 FUNCTIONAL ARCHITECTURE

This section provides an overview of the functional architecture of a C-UAS DTI system. It should be noted that while the following components are presented as distinct functions, some of them may be combined into the same physical unit for improved efficiency and effectiveness.

2.2.1 Concept

The functional architecture presented in this document is based on the principles that have been successfully implemented in surveillance systems designed for Air Traffic Management (ATM) purposes. Over the last few decades, these systems have been designed, deployed, operated, and exhaustively tested, making them an ideal foundation for the functional architecture of C-UAS DTI systems.

Today, the surveillance infrastructure use for ATC services is evolving based on Performance-Based Surveillance (PBS) standards. This approach allows for the determination of minimum performance requirements for each surveillance application, in a technology-agnostic way, at the final output of the surveillance chain. This enables a common understanding of performance requirements, irrespective of the specific technology used by distinct surveillance sensors.

Adopting the PBS approach, the C-UAS DTI system can be treated as a "black box", providing the C-UAS operator with the freedom to combine different components in the most cost-effective way, without architectural restrictions, as long as the performance requirements are met at the C-UAS DTI system output interfaces. This approach promotes competition and innovation, while still ensuring a common understanding of the required performance levels.

By leveraging the proven principles of PBS and applying them to C-UAS DTI systems, it is possible to create a robust and effective system, while maintaining high levels of performance and interoperability.

2.2.2

Functional blocks

A C-UAS DTI system is composed of several interconnected functional blocks, which are described in a logical level and can be grouped into unique or separate physical components.

At a minimum, a C-UAS DTI system is expected to include functions for:

- **Detection:** This function is based on one or more types of surveillance sensors, such as radar, lidar, cameras, thermal and acoustic sensors or radio-frequency detectors.
- **Tracking:** The tracking function enhances data from the sensor(s) and provides a consolidated state vector ("track") for the detected UAS.
- **Identification:** This function identifies unmanned aircraft, taking into account available identity metadata, and includes this information into the track of the detected UAS.
- **Classification:** This function identifies the target reports associated with UAS and enables the sorting of the detected UAS based on their type, size, material, speed and other characteristics.
- **Alerting:** The alerting function reports the presence of any identified unmanned aircraft that may pose a threat in a designated area, according to the predefined alerting parameters.
- **Control and Monitoring:** This function manages the settings and status of the C-UAS DTI system and ensures that it is functioning properly.
- **Recording and Visualization:** This function records historical data and provides visualisation tools to observe the data.
- **Performance Analysis:** This function monitors the system performance in real-time and provides tools to analyse the compliance with the performance requirements.

FIGURE 2-1 provides an example of the functional blocks of the basic architecture and their interfaces:

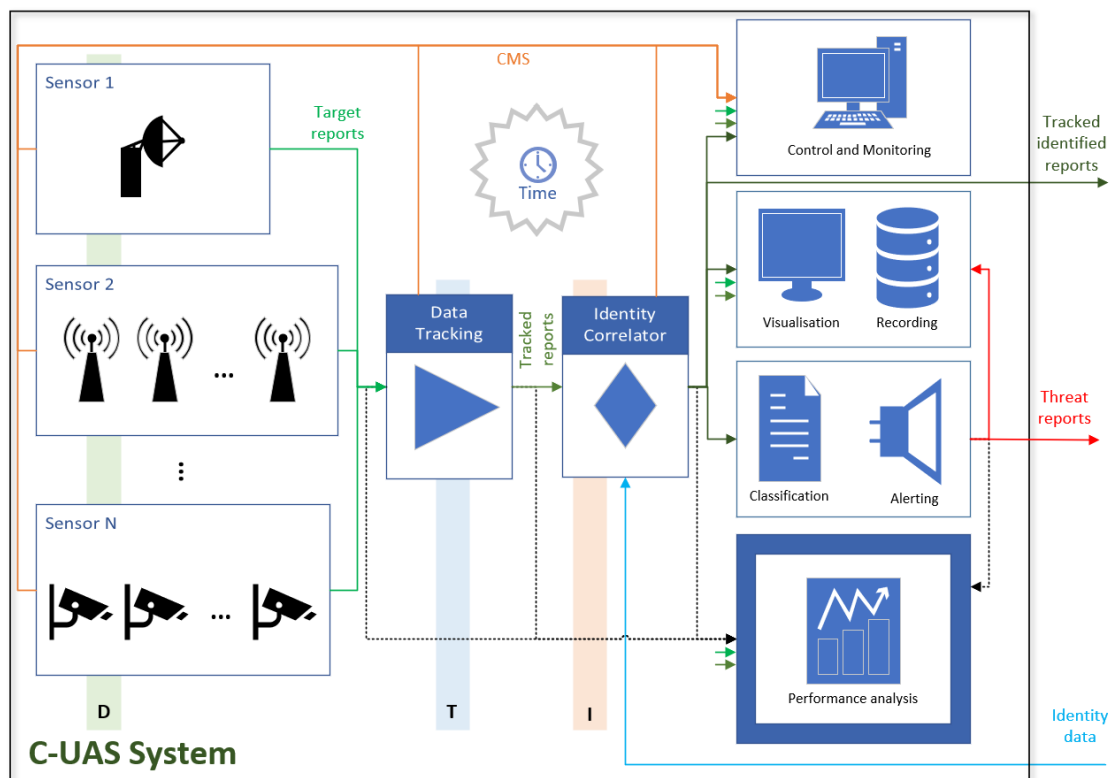


FIGURE 2-1: C-UAS SYSTEM BASIC ARCHITECTURE

The basic architecture of a C-UAS DTI system is designed to ensure a seamless flow of data among different functional blocks, and to define three data streams going to or coming from external interfaces:

- **Tracked identified reports:** These reports are generated based on the information gathered by the surveillance sensors and after the tracking and identification functions. This is an output stream of the C-UAS DTI system.
- **Threat reports:** These reports are generated based on the tracked (identified) reports, the classification of the UAS and certain predefined alerting parameters. This is an output stream of the C-UAS DTI system.
- **Identity data:** This information is used to correlate the detected and tracked UAS with the cooperative information available. Identity data may contain fields such as Remote ID, state vector or flight plan. This data stream is an input for the identity function of the C-UAS DTI system.

The communication between the different functional blocks is critical to the success of the C-UAS DTI system. Therefore, the basic architecture assumes that all the components of the C-UAS DTI system are able to communicate through well-defined and efficient interfaces that do not cause data loss or introduce delays.

Additionally, the basic architecture includes a transversal time function that provides accurate timing information to all the functional blocks for time stamping and synchronization purposes.

It is important to note that while these functions represent the minimum requirements for a C-UAS DTI system, additional functions may be added to enhance the system's performance and effectiveness. By utilizing a comprehensive set of functional blocks, a C-UAS DTI system can effectively detect, track, identify, and provide information to support neutralisation of unmanned aircraft that pose a threat to a designated area.

2.3

PERFORMANCE METRICS

Performance metrics are measurable indicators used to assess the performance of a system or function. They are essential in determining the effectiveness and efficiency of a C-UAS DTI system and can help identify areas for improvement.

In the context of C-UAS DTI systems, performance metrics are used to evaluate the effectiveness of the system in detecting, tracking, and identifying unmanned aircraft and determining their threat potential. These metrics can include factors such as the probability of detection, the accuracy of positional data, the delay in reporting threats and the density of false alarms.

Performance metrics provide a way to compare the effectiveness of different C-UAS DTI systems and technologies, which is important for making informed decisions about system design, deployment, and operation. By measuring and monitoring these performance metrics, system operators can also identify areas of the system that may require improvement or optimization, and take corrective actions as needed.

In this section, a set of basic performance metrics are defined.

2.3.1

Context

While defining performance metrics, it is also crucial to establish certain parameters that provide context for the measurement of these metrics. In this section some parameters to define where and how the performance metric will be measured are described.

Surveillance Coverage Volume

The Surveillance Coverage Volume (SCV) defines the airspace in which the C-UAS DTI system is able to detect UAS targets.

The SCV depends on the performance of the different C-UAS DTI system components and the geographical constraints, and shall always be at least equal to the area of interest.

Compliance Assessment Volume

The Compliance Assessment Volume (CAV) is a subset of the Surveillance Coverage Volume, where the C-UAS DTI system is expected to meet the performance requirements and provide a reliable C-UAS DTI service.

The CAV can be equal to or smaller than the SCV, depending on various factors such as the capabilities of the C-UAS DTI components, the operational requirements, and the local regulations. When different performance requirements are applied in different areas, it is possible to define distinct Compliance Assessment Volumes to address separately the performance requirements of each area.

Measurement Interval (MI)

The measurement interval refers to the frequency at which surveillance information is expected to be available. This parameter is not a requirement in itself, but rather a parameter used to measure other performance metrics such as the probability of update. For example, an measurement interval of 1 second means that new surveillance information is expected to be available every second.

FIGURE 2-2 presents an example for the SCV and CAV volumes and a MI for one trajectory.

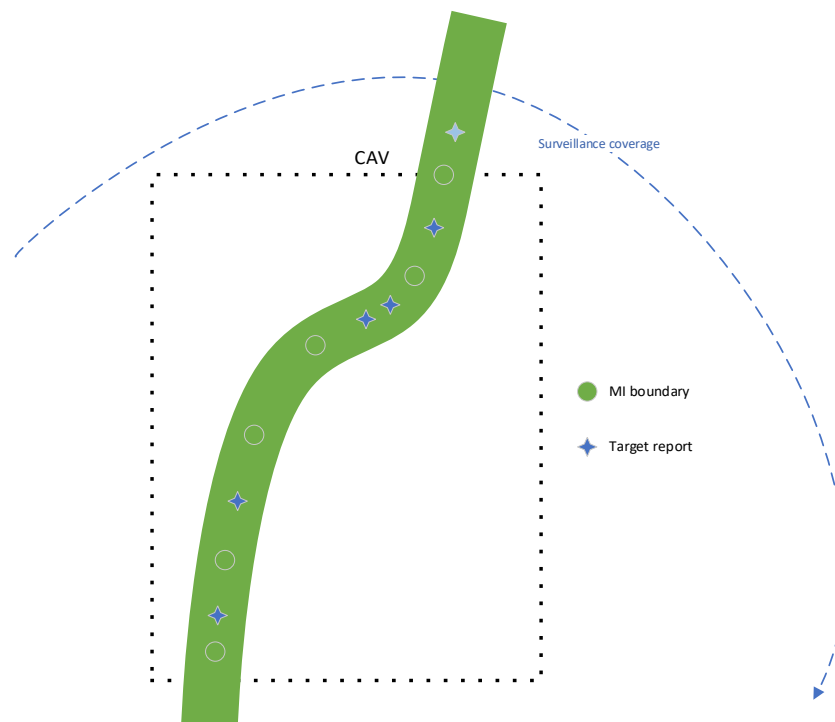


FIGURE 2-2: SCV AND CAV VOLUMES

Minimum detectability

This concept refers to a collection of essential physical attributes that a target needs to possess to ensure its detectability within a specified volume. Various elements influence the detectability of an UAS, encompassing factors like size, material, relative position and velocity. The minimum detectability can be different between distinct types of surveillance sensors.

2.3.2

Performance metrics

This section describes different performance metrics that are considered essential in evaluating the effectiveness and efficiency of a C-UAS system to perform its function. Each of them may be applicable to the distinct surveillance reports used by the C-UAS DTI system, including target, tracked, tracked identified and thread reports.

Probability of update of position

This metric is used to assess the likelihood of a system to provide an update in a surveillance report of the horizontal position of a UAS, optionally with a vertical component, during one measurement interval. This probability is usually expressed as a percentage.

Accuracy of position

The utilization of this metric allows for the evaluation of the error of the positional information included in a surveillance report. The position error is defined as the Euclidean horizontal, and optionally vertical, distance(s) between the position incorporated in the surveillance report and the real position. The metric is often defined through an RMS error that is calculated as the square root of the average of the squared distance errors.

False surveillance reports

The purpose of this metric is to assess the amount of false surveillance reports in an area during a certain time. False surveillance reports do not correspond to real UAS, contain incorrect information or are outliers with larger error than specified thresholds. This metric is usually expressed as a density, counting the number of false surveillance reports per measurement interval in a given volume.

Delay in surveillance reports

This metric provides means for evaluating the time delay between the availability of information for a UAS and the generation of the related surveillance report. The delay is typically measured in seconds and, ideally, should be kept to a minimum when designing the system, e.g. to enable early threat reporting.

2.3.3

Testing

Testing is an essential process to ensure compliance with specifications, verify required performance, and identify any possible design and configuration faults.

The key components of testing are defined in the test plan, a document that outlines the approach, scope, objectives, and resources required for the testing effort. It is a critical component of the overall testing process, as it provides a roadmap for the testing team to follow and ensures that all aspects of the testing effort are properly planned and executed.

There are several ways to implement testing, each with its own unique steps and processes. However, some common phases can be identified:

a) Initial evidence

Before acquiring a C-UAS DTI system, it is good practice to require evidence that proves the system will meet the specified requirements. This supporting evidence can take many forms, such as theoretical calculations, simulations, expert analysis, demonstrations, or acceptance test results of similar C-UAS DTI systems in comparable environments.

b) Factory Acceptance Tests

Factory Acceptance Tests (FAT) are designed to test the requirements of C-UAS DTI systems after production but before deployment at the final site. The FAT is performed by the manufacturer(s), typically including project, engineering, and quality representatives, and, when possible, with the purchaser (or a representative) as a witness.

During FAT, a variety of tests are performed to verify the hardware and software requirements as well as the functional and performance requirements under a range of environmental conditions. Tests are conducted for each available component of the C-UAS DTI system and, when feasible, for the integration of all components. Data injection and partial simulations may be used to replicate functional and environmental characteristics not available in a factory or laboratory location.

The FAT is performed according to a specific test script, and after finalization, a report is produced to compile the results, assess compliance with requirements (traceability), list faults detected, and indicate overall acceptance of the C-UAS system. If faults are present, the overall C-UAS system or specific components may be accepted with remarks (compliance to requirements to be demonstrated during Site Acceptance Tests) or not accepted, requiring correction of faults and further testing before factory acceptance.

c) Site Acceptance Tests

Site Acceptance Tests (SAT) are designed to test the requirements of C-UAS DTI systems after deployment and adaptation (parametrisation) to the final site. The SAT is performed by manufacturer(s) and purchaser representatives, sometimes with support from independent third parties to increase objectivity or enable additional testing possibilities.

During SAT, the C-UAS DTI system is tested under actual operating conditions to ensure it operates correctly and meets specified performance requirements. Tests may use Traffic of Opportunity or dedicated UAS Trials to generate several scenarios and test the system under different environmental conditions.

The SAT is performed according to a specific test script but may also include the repetition of failed FAT tests or additional ad-hoc testing not previously foreseen but considered necessary due to results already obtained from other SAT tests. After SAT finalization, as after the FAT tests, a report is produced to compile the results, assess compliance with requirements (traceability), list faults detected, and indicate site acceptance (or not acceptance) of the C-UAS DTI system, including possible minor actions to be corrected during an agreed period of time.

d) Operational Acceptance

Once the C-UAS DTI system is accepted at the final site, an Operational Acceptance (OA) period begins. During this time, C-UAS operators use the system, and its long-term behaviour is assessed. Operational Acceptance can detect hidden faults or the need for small changes in the site adaptation of the system.

The OA is not following any specific test script but rather is based on the normal operation of the C-UAS DTI system, assessing whether it is fit-for-purpose for Counter UAS activities. After OA finalization, a report is produced to indicate the results and the operational acceptance of the C-UAS system.

e) Regression Tests

Over the lifetime of a C-UAS DTI system, it is possible that the system will go through upgrades and modifications to correct defects, to adapt to evolving operational requirements, environmental factors, or to enhance system performance. To ensure the integrity and stability of the system, regression testing becomes crucial.

Regression testing is a meticulous process aimed at verifying that any changes or updates, whether they involve hardware or software components, do not introduce defects or negatively impact existing functionality. It involves retesting the C-UAS DTI system, or at least some of its components, to ensure that the modifications have not inadvertently introduced unintended side effects.

The scope of regression testing will vary depending on the significance of the changes and the parts of the system they affect. It may encompass comprehensive testing, covering factory, site, and operational test aspects, or focus on testing a specific subset of these elements.

f) UAS flight check

A UAS flight check is an optional routine procedure conducted to assess the performance of a C-UAS DTI system and its components within a controlled environment. It serves both maintenance purposes, helping identify hidden issues or malfunctions, and safety/compliance protocols, providing evidence for regulatory authorities to ensure operational safety. These checks can be performed periodically or upon demand, particularly after system modifications or when issues are suspected.

2.4

CHARACTERISTICS OF C-UAS SYSTEMS

While this document does not provide specific design requirements for C-UAS DTI systems, it is important to note some general characteristics and good practices that can be identified to guide their development:

- **Service-specific:** A C-UAS DTI system shall be designed and developed to meet the specific needs and requirements of a particular service or organisation. For