

# **STANDARDS RELATED DOCUMENT**

**AEP-84.3**

# **CONFORMANCE TEST CRITERIA FOR AEP-84**

**EDITION A VERSION 1  
APRIL 2017**



**NORTH ATLANTIC TREATY ORGANIZATION**

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## 1. Introduction

### 1.1 Purpose

This document describes the requirements and criteria necessary to demonstrate an Unmanned Aircraft (UA) Control System (UCS) or a UCS component conforms to STANAG 4586 specified requirements.

### 1.2 Description of STANAG 4586

STANAG 4586 defines common architectures and interfaces for an Unmanned Aircraft (UA) Control System (UCS) with the intention of providing interoperability within and between the various NATO allied forces at various Levels of Interoperability (LOIs). These levels range from Level 1 (indirect receipt of payload data from another UCS or C4I node) to Level 5 (flight control of a UA including launch and recovery). Particular STANAG requirements are tailored specifically to each LOI.

### 1.3 Background

Extensive coordination has allowed the NATO Joint Capability Group on Unmanned Aircraft Systems (JCGUAS), the STANAG 4586 Custodian and the STANAG 4586 Custodian Support Team (CST) to develop this document to identify/define the test criteria for validating that UCS systems and components meet the STANAG 4586 defined requirements. These STANAG 4586 defined requirements support the desired LOI of UASs used to support Joint, Coalition Combined Operations. The overall test philosophy, approach and test environment are defined in SRD Allied Engineering Publication (AEP) – 84.2, STANAG 4586 Validation/Test Guideline Document (VGD) and are offered as guidance information to be used by the national acquisition agencies in formulating their respective test programs for the acquisition of UCSs. SRD AEP- 84.2 (VGD) incorporates the concepts of NATO Common Interoperability Standards (NCIS) Testing Concepts and defines the UAS levels of testing (e.g., Component, System and Interoperability), the scope of testing to be performed and the test bed configuration.

### 1.4 Terms and Definitions

Accreditation	The result of the process to establish an approved test facility for a given standard.
Conformance	Conformance of a candidate implementation with specific characteristics required by a standard or a specific profile of a standard.
Conformance Testing	Testing of a candidate implementation for the existence of specific characteristics required by a standard or a specific profile of a standard. It involves testing the capabilities of an implementation against both the conformance requirements in the relevant standard and the statement of the implementation's capability.
Conformant	All appropriate requirements have been successfully addressed.
Deviation	A specific written authorisation to depart from a particular requirement(s) of an item's current approved configuration documentation for a specific number of units or a specified period of time, and to accept an item which is found to depart from specified requirements, but nevertheless is considered

	suitable for use "as is" or after repair by an approved method. This definition also applies to waivers, or any similar term, conveying a departure from the item's requirements.
Implementation Conformance Statement (ICS)	A statement of the options/capabilities of a standard that have been implemented in a candidate system.
Implementation Testing	Testing to assess the degree of interoperability of the multinational, mixed-vendor implementations of a standard/STANAG. It ensures that current and future systems or system components will operate effectively under a variety of conditions. Implementation Testing consists of Conformance Testing and Interoperability Testing.
Implementation Under Test (IUT)	An implementation of a standard for which Conformance Testing is being performed.
Interoperability	The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together (NATO AAP-6).
Interoperability Test	A test conducted on two or more implementations that show that when working together, the implementations can correctly function together.
Limited Conformance	Some of the requirements have been successfully.
Validation	The confirmation of the capabilities and performance of organisations, individuals, materiel or systems to meet the defined standards or criteria through the provision of objective evidence.
Validation Test	A test conducted to show that a standard or change to a standard is accurate, complete and understandable.
Waiver	See "Deviation" above.



## 2. Scope

This document establishes the test criteria to demonstrate that a UCS and/or its components conform to the provisions of STANAG 4586. This document also defines the organisational responsibilities for validating that the UCS and its components conform to STANAG 4586 requirements at the desired Level of Interoperability (LOI). A NATO listing of STANAG 4586 conforming systems will be maintained by the Custodian. The list of conformant UCS systems and components will facilitate NATO operating forces in selecting and configuring respective national Unmanned Aircraft System (UAS) assets so as to achieve the desired level of UA interoperability in Joint, Coalition Combined Operations.

### 2.1 Related Documents

STANAG 4586	Standard Interfaces of UA Control System (UCS) for NATO UA Interoperability
AEP-84 Volume I	STANAG 4586 Message Set Volume I
AEP-84 Volume II	STANAG 4586 Message Set Volume II
SRD AEP-84.2	STANAG 4586 Validation/Test Guideline Document

### **3. Applicability**

This document is applicable to all UCS systems and their components that have a requirement for conformance with STANAG 4586. As specified by STANAG 4586, "Details of Agreement", "STANAG 4586 defines the architectures, interfaces, communication protocols, data elements and message formats and identifies related STANAGs that conformance with is required to operate and manage multiple legacy and future UA in a complex NATO Combined/Joint Services Operational Environment". UAS, subsystems and components fielded within NATO and tasked by C4I nodes to control UAs and their associated payloads, to directly receive and utilise the payload data and to provide this data to C4I nodes must achieve STANAG 4586 conformance in order to facilitate UA interoperability.

In order to ensure interoperable implementations of STANAG 4586 requirements and thus facilitate interoperability in Joint, Coalition Combined operational environments, Conformance Testing to validate a UCS's conformance to STANAG 4586 requirements is highly recommended for nations employing STANAG 4586 conformant UAS.

#### **4. STANAG 4586 Conformance Test Program**

The STANAG Conformance Testing and subsequent formal documentation are national responsibilities. Each nation acquiring conformant products defines the specific Test Program that encompasses the administrative bodies (including the test facilities) and policies and procedures required to certify that selected UCSs and their components are conformant with STANAG 4586 and will thus facilitate UA system interoperability to a specified capability/configuration. The resultant Test Program must incorporate the test criteria specified in the following paragraphs.

##### **4.1 Implementation Conformance Statement (ICS)**

Evaluation of conformance for a particular implementation requires a statement of the options that have been implemented. This will allow the implementation to be tested for conformance against only the relevant requirements of STANAG 4586. Such a statement is called an Implementation Conformance Statement (ICS). The ICS shall contain only options within the framework of requirements specified in the STANAG 4586 standard.

##### **4.2 Test Criteria**

Due to the various operational capabilities possible in a UA, a UCS can be conformant with STANAG 4586 to various degrees. The degree of conformance is determined by the desired LOI, the payloads that are employed and the specific format and metadata of these payloads, and the requirement to interface with external C4I systems (i.e., a UA stand-alone system or one that is connected to an external C4I node). In order to be fully conformant with STANAG 4586, the UCS must implement all of the specified STANAG requirements (i.e., all of the “shall” statements in the STANAG). Based on the desired operational capabilities of a UAS as specified in the ICS, the UCS can be conformant to a lesser degree by implementing all of the requirements that pertain to one or more of the following:

- UA LOI 4/5 (e.g., those messages that support the desired LOI)
- Payload LOI 2/3 (e.g., those messages that support the desired LOI)
- Payloads and associated data format and metadata (e.g., those messages that support a desired payload type such as EO/IR and the associated format and metadata of that payload)
- Command and Control Interface (CCI) (e.g., a UAS connected to an external C4I node)

Conformance with an above UAS capability/configuration requires that all requirements (e.g., Data Link Interface (DLI) and CCI messages), that are specified by the STANAG as applicable to that capability/configuration must be implemented as specified. Each DLI, CCI and Human Computer Interface (HCI) requirement should be tested as per the test case/criteria identified in SRD AEP-84.2, Validation/Test Guideline Document Section 3.2.1.1 for Component Conformance Testing and Section 3.2.1.2 for System Conformance Testing. In addition to the DLI, CCI and HCI requirements, all UCS requirements must also be tested.

It is the responsibility of the nation acquiring the UAS to define, implement and execute a test program that will demonstrate the desired degree of conformance with the STANAG 4586 requirements. The characteristics of such a test program are presented in Annex 1 of this document.

### 4.3 STANAG 4586 Conformance Documentation

The Custodian will maintain a listing in the form of a database of components and systems that have been validated by the national acquisition agency for their degree of conformance with STANAG 4586.

To support the STANAG 4586 Conformance Database, each nation shall provide the information, as illustrated in the Table 4-1 example below, to the Custodian for each UAS validated as STANAG 4586 conformant.

Item	Supported (Example)		
System	XYZ Corp, Model A1		
Nation	GBR		
Manufacturer	Dilbert UAs		
Service Sponsor (of nation)	Navy		
Point of Contact	Mr. John Doe; Organisation; Contact information		
CUCS (Hardware and software configuration identification)	ABC Corp, Model 123; S/W version 1.2.1		
VSM(s) (Hardware and software configuration identification)	DEF Corp, Model 567; S/W version 2.0		
	GHI Corp, Model 987		
AEP-84	AEP-84 Volume II Edition A, Version 1		
Edition	Edition 4		
AV LOI	4 Control (C) & Monitor (M), 5 (C & M) (use boxes)		
CCI standards/version and profile complied with	ADatP3, Baseline 11; CRD ICD, Version 2.0.2.0 w/UA Extensions		
Payload Type(s)	EO/IR	SAR	GMTI
Payload LOI	2	3 (C & M)	3 (C & M)
Payload Format(s)	4609, 4545	4545	4607
Metadata Format	4609, KLV IAW E.G 601.1	Embedded in the format	Embedded in the format
Conformant	Fully Partial – All deviations listed Non-Conformant Not Provided		
Requirements Not Met	1, 2, 3, ...		
Waivers	Yes/No		

**Table 4-1 Conformance Documentation Data**

The database may be used by NATO and National Strategic Forces, e.g., the Allied Command Transformation (ACT) and the Allied Command Operations (ACO), in support of planning joint/coalition operations utilising UAS assets.

## **5. Organisational Responsibilities**

### **5.1 Nations**

- Define, implement and execute a Test Program that incorporates the Test Criteria specified in this document.
- Validate the degree of conformance of the UAS with STANAG 4586 requirements.
- Provide Conformance Documentation Data to the STANAG 4586 Custodian as per 4.3 above.

### **5.2 NATO C3 Board (NC3B) Interoperability Sub-Committee**

- Maintain overall responsibility for NATO interoperability of C3 systems.
- Coordinate the activities of the STANAG 4586 Test Program within the NATO Interoperability Framework Testing Infrastructure.

### **5.3 NATO Naval Armaments Group (NNAG) Joint Capability Group on UAS (JCGUAS)**

- Sponsor the UCS Custodian and oversee the UCS standards (e.g., STANAG 4586) development/update and test process. This sponsorship provides the Custodian full authority and responsibility for the maintenance and update of STANAG 4586 and associated support documentation, including this Conformance Test Criteria.
- Assist in ratification and promulgation of STANAG modifications.
- Provide necessary resources to the Custodian as required.

### **5.4 STANAG 4586 Custodian**

- Maintain a list of STANAG 4586 Certification Tools used by nations to verify conformance with STANAG 4586.
- Coordinate with the NATO Common Interoperability Standards (NCIS) Test Coordinating Authority (TCA) as necessary.
- Produce and maintain SRD AEP-84.3, STANAG 4586 Conformance Test Criteria.
- Arbitrate any testing issues as they relate to STANAG requirements and test criteria.
- Resolve UCS STANAG 4586 related issues presented during development, validation, implementation, testing and operations that impact UAS interoperability.
- Provide assistance to test sponsors by identifying available test facilities and resources.
- Publish and maintain a master register of STANAG 4586 conformant systems, implementations and components.

## **6. Reporting**

A Conformance Test Summary Report, resulting from Conformance Testing by the respective National Validation Agency, should be reported to the STANAG 4586 Custodian. The test summary is to include the following:

1. System Title
2. Proponent/Test Sponsor
3. Program Manager
4. System Under Test Overview Description
5. System Configuration
6. Testing Limitations (if any)
7. Degree of Conformance with STANAG 4586 (as per STANAG 4586 ICS and Conformance Documentation Data, Table 4-1)

## 7. Conformance Retesting

There may be a need to re-validate a STANAG 4586 conformant UAS component or system due to any of the following reasons:

- Changes to a STANAG 4586 product to incorporate new capability or functionality in accordance with an updated version of STANAG 4586.
- Changes to a validated STANAG 4586 conformant item (e.g., CUCS).
- Latent functional problems discovered with previously tested implementations.
- Addition of a new component (e.g., UA or payload) to a validated STANAG 4586 conformant UAS.

In addition to testing conformance with the specific changes in the conformant component or system, a selected set of previously executed testing, or regression testing, may need to be performed in order to validate that the implemented changes have not impacted the overall conformance and performance of the component or system in accordance with the applicable edition of STANAG 4586. At a minimum, the regression tests should validate the proper operation of the modified component or system in performing its major allocated functions in accordance with the requirements of the applicable edition of STANAG 4586.

The process for re-validation of a STANAG 4586 conformant component or system should be the same as for the original validation.

## **ANNEX 1 TESTING CONCEPTS**

Testing the quality of NATO Common Interoperability Standards (NCIS) documentation and the resulting implementation of NCIS in information systems forms an integral part of the NATO interoperability strategy. NCIS quality is ensured through strict adherence to the established process of standards development, configuration management and implementation of NCIS. Testing confirms the success of this process. Reference I, NATO Common Interoperability Standards (NCIS) Testing Concept, a document drafted by the NATO C3 Board (NC3B), Interoperability Sub-committee (ISC), establishes the framework for the testing of NATO Common Interoperability Standards.

To satisfy the goal of NCIS testing during the phases of development, configuration management and implementation of NCIS, different types of testing are required. The types of testing are grouped into two categories and are defined in the following paragraphs:

### **1. Standards Testing**

Standards (e.g., STANAG) Testing was initially performed as part of the STANAG development process. Information Exchange Requirements (IERS) from potential users, lessons learned from national UA development and operational experience as well as industry inputs via NATO Industrial Advisory Group (NIAG) were utilised to support STANAG 4586 development to ensure a quality product that will meet the user requirements in support of interoperability in Joint, Coalition Combined Operations. The STANAG Custodian will utilise the approach, process and lessons learned during STANAG 4586 development for future updates and validation of STANAG 4586.

### **2. Implementation Testing**

Implementation Testing is essential to ensure that current and future systems or system components implementing STANAG 4586 will meet the specified requirements and that they will operate effectively under a variety of conditions. To achieve this, the following types of testing are recommended:

- Conformance Testing
  - Component Conformance Testing
  - System Conformance Testing
- Interoperability Testing
  - Accomplished in accordance with national policies and procedures and NATO interoperability demonstrations and exercises and is beyond the scope of this document

Conformance Testing addresses the technical conformance of the UCS with the requirements as specified in STANAG 4586 (and summarised in SRD AEP-84.2) and is comprised of Component Level and System Level Tests.

The purpose of Component Conformance Testing is to show that the various components (e.g., Core UCS [CUCS], Vehicle Specific Module [VSM] and Command and Control Interface [CCI] Specific Module [CCISM]) of a UCS conforms to the STANAG 4586 requirements. This is the first step in constructing STANAG 4586 conformant UCS and UAS(s) that are interoperable in the



NATO environment and is normally done in preparation to performing the System Conformance Testing.

System Conformance Testing treats the UAS as a whole and verifies the VSM, CUCS, CCISM, etc. interactions against the requirements in STANAG 4586. This phase includes verification that the components and functions of the UAS interoperate correctly and meet the functional and operational requirements of the system. This phase of testing also may include flight trials as well as bench testing of the functional capabilities of the UCS. Traditionally these tests would be the responsibility of the UAS provider; however, a set of tests could be specified by an external authority.

Component and System Conformance Testing may be combined into one test phase where that approach provides a more cost-efficient method to validate the system.

Note that the above tests, although necessary for demonstrating a UAS's conformance with STANAG 4586, may not be sufficient for flight qualification of the UAS.

The goal of Interoperability Testing is an operational evaluation that assesses the overall capability and behaviour of a complete UA operational system integrated with other Joint, Coalition Combined Battlefield systems (system of systems). Testing is performed by users with operational scenarios in an operational environment using live and/or simulated data. This level of testing (e.g., operational testing) is performed in accordance with and in support of the respective national policies and is beyond the scope of this document.

In NATO environments, Interoperability Testing will require a cooperative effort by multiple nations and is normally executed via a NATO demonstration such as Coalition Warrior Interoperability Demonstration (CWID).

### **3. STANAG Conformance Testing**

STANAG Conformance Testing is essential to ensure that current and future STANAG 4586 conformant UCS and UCS components implement the requisite STANAG requirements effectively under a variety of conditions. This is a prerequisite for supporting interoperability with other non-native components. Conformance Testing can be comprised of two phases, Component Conformance and System Conformance Testing.

#### **3.1 Component Conformance Testing**

The purpose of Component Conformance Testing is to show that the various components of a potentially STANAG conformant UCS conform to the STANAG 4586 requirements. This is normally the first step in constructing a STANAG 4586 conformant UCS and UAS that is interoperable in the NATO environment. Typically, in this phase, UA test bed testing or ground station C4I communication tests can be performed in standalone test configurations.

The UCS architecture consists of a CUCS that interacts with UA, human operators, and command and control networks via STANAG defined interfaces. These components are:

- CUCS; architecture and STANAG specified functionality and capability; Interface with VSM and CCISM defined functions via DLI and CCI, respectively, and STANAG specified HCI requirements
- VSM Functions; Interface with CUCS via DLI
- CCISM Functions (if required); Interface with CUCS via CCI

These components are tested, and possibly validated, against their respective requirements and external interfaces.

### **3.2 System Conformance Testing**

System Conformance Testing treats the UAS as a whole and verifies the UCS interactions against the requirements in STANAG 4586 as well as the UCS interactions with other UAS elements (e.g., UA, C4I nodes, Launch and Recovery). This phase includes verification that the DLI and CCI messages result in the desired operation of the UAS. This phase of testing may also include flight trials as well as bench testing of the functional capabilities of the UCS. Traditionally these tests are the responsibility of the UAS acquisition office and its UAS integrator/provider; however, a set of tests could be specified by an external Test Authority (TA).

The system integrator will develop representative operational scenarios for the mission components. These scenarios will consist of listing operator functions performed via the HCI, CCI and simulated components and the expected system outcomes.

## **4. Interoperability Testing**

Generally a prerequisite for Interoperability Testing, which is done in accordance with respective national policy and process, is successful completion of System Conformance Testing. NATO Interoperability Testing requires a cooperative effort by multiple nations and is generally accomplished via a Joint Allied Demonstration or exercise.

## **5. Digital Video And Imagery**

The VSM transmits digital video and imagery to the CUCS when required. The CUCS receives and processes (as applicable) digital video and imagery. These functions will be tested per the applicable STANAGs (e.g., 4545, 4609 and 7023) imposed on the system and their test requirements. The appropriate test plan and procedures should be provided by the developer. The digital video and imagery test data should be provided by the appropriate test authority or the applicable STANAG Custodian.

## **6. VSM Real-Time Displays**

If a particular UAS requires a real-time display, it must be provided as part of the VSM functionality. Additional test procedures must be developed and executed by the VSM developer to ensure proper functioning of this display.

## **7. Test Sponsorship**

A Test Sponsor is any Government or commercial organisation that is developing or acquiring a STANAG 4586 conformant UAS, UCS or UCS component and wants to demonstrate through Conformance Testing that the UAS, UCS or specific UCS component is conformant with the STANAG. Normally, the Test Sponsor provides the funding for the purpose of testing an implementation. The Test Sponsor is the focal point for coordinating the testing from the customer side.

## **7.1 Government Organisation**

The UAS, UCS or UCS component acquisition organisation from the respective NATO nation will normally sponsor UCS Implementation Testing using their national test policies and assets/facilities.

The Test Sponsor for System Conformance Testing is normally the UAS acquisition office, whose system integrator will normally be responsible for the development of the scenarios and the supporting test plan and procedures, conformant with test objectives and conformance criteria defined by this document.

National Interoperability Testing will be accomplished by the respective nation in accordance with its national policies and is out of scope of this document.

## **7.2 Commercial Vendor**

Commercial developers or vendors may sponsor UCS Component Conformance Tests. In this situation they will be the Test Sponsor and will fund the effort. As in the case of the Government Test Sponsor above, the test plan and procedures should be developed by the commercial vendor and must be conformant with test objectives and conformance criteria defined in this document. A commercial vendor may also sponsor System Conformance Tests. If it does, it must fund the effort and provide the requisite test procedures and facilities or arrange for use of applicable Government facilities.

## **8. Test Facilities**

Implementation Testing may be conducted at various national Government or Industrial facilities having the test bed capabilities as identified in Reference 2.b of this document. The following general guidelines and recommendations relative to test locations, however, may result in an overall benefit to the UAS acquisition organisation.

### **8.1 Component Conformance Tests**

Although the component acquisition agency/office will determine the location for component conformance and acceptance testing, the component developer/provider is in the best position to host the testing using the identified or similar test tools and acquisition agent approved test plan. The component developer should have the appropriate test and development tools in place as well as personnel who are familiar with their use. In addition, the expertise required to address and solve any problems should be already on site. A “central” Government or commercial facility having the capability to execute the Component Level Tests may provide a more cost-effective approach to Component Conformance Testing than having each acquisition agency/developer provide its own.

### **8.2 System Conformance Tests**

The UAS acquisition agency/office will determine the location of the test facilities where the system conformance testing will be performed.

It is, however, recommended that in order to eliminate duplication of facilities, the test facilities support distributed testing or be centralised at a single location. The use of centralised or distributed test facilities should be determined in accordance with respective national objectives and policy.

System Testing can either use a real or a simulated environment as determined by the procuring agency.

### **8.3 Interoperability Tests**

Test organisations and facilities for National Interoperability Testing are in accordance with the respective national policies and are out of scope of this document.

## **ANNEX 2     RATIONALE**

This section provides a history of how issues were discussed and what the rationale was that did or did not result in changes to this document. The intent of this section is to help a new reader to understand why certain issues were resolved as shown in this document.

### **1.     Conformance Testing and Validation**

**Q:** Is conformance to extra STANAGs considered to be part of the 4586 conformance testing? Can we include instructions to perform other STANAG documents testing prior to 4586 testing?

**A:** Yes, conformance with STANAGs identified by 4586 as “Mandatory” is required in order to be compliant with a UAS configuration that utilises the respective payloads (e.g., UAS with EO/IR FMV payload must be conformant with STANAG 4609). As to requiring UCS compliance with those other standards, although it makes sense and is feasible, I’m not sure that it’s mandatory since STANAG 4586 is focused on command and control rather than the format of payload data.

### **2.     Validation Guides for Referenced Standards**

The question was asked if there should be references included for the validation guides for the additional STANAG documents. The general view is that the Custodians of the respective STANAGs would include those references in their STANAGs. Many thought that having references in this STANAG would be a maintenance issue and it was decided not to put them in this document.