STANAG 4586 – Enabling Interoperability

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Presentation Overview

- NATO STANAG 4586 Overview
- STANAG 4586 Goals
- Interoperability Concepts
- STANAG 4586 In Action
Current Problems

- UAV products - “stovepipe” designs
- Little to no standardization between systems
- Proprietary telemetry and sensor data streams
- No capability to interoperate
NATO Project Group 35 (PG/35) Background

- Conceived in 1998 to standardize UAV Control System (UCS) interfaces to help enable UAV interoperability
- NATO Specialist Team formed from industry and government to develop the standard
- USN (PMA-263) is STANAG 4586 custodian
NATO Project Group 35 (PG/35)

Background

• Lead efforts to achieve UAV interoperability in Joint, Coalition Operations

• Lead efforts for UAV Autonomous Operations
STANAG 4586 is an Interface Control Definition (ICD)

STANAG 4586 Defined two new interfaces

- Data Link Interface, DLI
  - GCS Air Vehicle interface
- Command and Control Interface, CCI
  - GCS Command Control Interface

- Non-existent
- Considered essential foundation for interoperable UAV systems
UAV Interfaces & Standards

Payload Data
- STANAG 7023 Primary Imagery
- STANAG 4545 Secondary Imagery
- STANAG 4607 GMTI Radar Data
- STANAG 4609 Motion Imagery

Data Link
- STANAG 7085

Focus of STANAG 4586

C4I Nodes
- Imagery
  - STANAG 5500: ADatP-3
  - Ground Control Station
  - Tactical Messages
  - Digital Messages
STANAG Key Development Principles

• Data Link Interface (DLI) Messages are air vehicle and payload independent
  – Vehicle/Sensor specific messages are allowed

• Command and Control Interface (CCI) is C4I System/Node independent
  – Leverage existing Standards, e.g. STANAG 5500 (USMTF)
NATO addressing “technical issues” to enable interoperability, these include:

- DLI and CCI interface definitions
- Functional architecture definition
- System, subsystem component identification

- define Common Data Elements
“Common” Data Elements

Implementation Guide:
provides the comprehensive description of the intention of each message and data element in the DLI interface, and makes recommendations on a common approach for implementation
- Removes ambiguity
• STANAG 4586 provides an interface profile that defines the specific choices applicable to UAVs within each standard, thereby ensuring interoperability.
In addition, STANAG 4586:

- uses standards, existing and developing
  - specifies other standards where possible
  - non-proprietary in nature
  - if shortfalls in standards, request updates. i.e.; CRD, extended CRD
  - not redefining standards

- defines relationship between the standards
STANAG focus: Achieve interoperability between NATO allied forces

Common view of Interoperability
A UAV overhead a compliant GCS, for which it has not been “natively” developed, could be passed for control to this compliant station with the vehicle being safely controlled to 100 percent of its required capabilities.
Multi Vehicle, Modular Networked Operations

Allows individual addressing of specific System components

- the generic interface anticipates that there will be multiple Vehicles connected to multiple CUCSs in a networked or standalone configuration, addressing a shared data link resource, or multiple data links
Interoperability

- Concept of Operations (CONOPS) and Doctrine “Neutral”
- Supports evolving CONOPS and Doctrine
CONOPS

Control a single vehicle, of a specific type

What is the advantage to using STANAG 4586?
- Sharing the asset
- Considering future expandability
CONOPS

Multiple vehicles, single type, simultaneously

Multiple Data Links

Single Common Data Link

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Many vehicle types, controlled **serially** from a common GCS

**Multiple Data Links**
- One at a time

**Common Data Link**
- one at a time
CONOPS

Multiple vehicles, multiple types simultaneously

Additional requirements
  – Co-location versus networked operation
  – DLI across RF link

Multiple Data Links

Common Data Link
Scalable Interoperability

• No always requirement to control 100% of vehicle capabilities
  – Expensive undertaking

• Only control functionality required to be interoperable
  – five Levels of Interoperability defined within the standard
Levels of Interoperability

- **Level I**: Indirect receipt/transmission of UAV related payload data.
- **Level II**: Direct receipt of ISR/other data where “direct” covers reception of the UAV payload data by the UCS when it has direct communication with the UAV.
- **Level III**: Control and monitoring of the UAV payload in addition to direct receipt of ISR/other data.
- **Level IV**: Control and monitoring of the UAV, less launch and recovery.
- **Level V**: Control and monitoring of the UAV, plus launch and recovery functions
Modular Control

Modular Architecture
- functional separation
  - situation awareness
  - AV mission execution and monitoring
  - Payload – monitor, control
  - Data Links – monitor, control

Scalable

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• VCS-4586, Common User Interface for range of controlled vehicles
VCS STANAG 4586
Applications

- US Army One System
  - RQ-7B Shadow 200 - AAI Corp
  - Warrior – GA ASI
- Barracuda (RIB) – Meggitt Defence Systems Canada
- Grasshopper – Advanced Subsonics
- Raven – AeroVironment
- Golden Eye – Auroa
- Aerosonde - AAI Corp.
- Grasshopper - Advanced Subsonics & Xiphos
- Silver Fox - Advanced Ceramics
- Scan Eagle - Boeing
- Kingfisher & Other - BAE Systems
- RTB (Research Test Bed) - CAE / CDL Systems
- Blade - Ultra
Currently, how is it that the same CUCS software can be used to control vehicles as diverse as a mini UAV and a MALE?

- **VSMs are key**, but not 100% of the answer

- **STANAG 4586 is scalable** in implementation, from a single operator, single laptop for a mini UAV, to dual operator workstations for MALE UAVs.

- **STANAG 4586 is configurable** through VSM messages and/or through configuration files
VCS-4586
Common User Interface

• Configuration Messages are used to request air vehicle and payload configuration information.
  – Expected range of vehicle parameters
  – Applicability of generic parameters to vehicle
  – Availability of generic parameters from vehicle
  – Extensibility of parameters

• The CUCS uses this information to configure the displays for the Air Vehicle/ payload.
Message #1201: Display Unit Request

The CUCS uses the Display Unit Request message to identify the display units that the VSM is required to use in Remote Displays.

Examples:
- Distance
- Altitude
- Speed
- Temperature
- Mass/Weight
- Angles
- Pressure

Message #1202: CUCS Resource Report

Used to communicate to the VSM the resources available within the CUCS for managing remote displays to be presented at the CUCS.

Examples:
- JAVA Engine Available
- PDF Reader Available
- X Window Server Available
- X Window Display Number
- X Window Screen Number
- Display Window Horizontal Width

Message #1303: Field Configuration Command

This message is used by the CUCS to configure any GUI components associated with a formatted DLI message field, where the state of the field may be altered in accordance with the contents of this message.

This message is sent from the VSM to the CUCS whenever the controllable state of a field or an enumeration within a field changes thus identifying the allowable states of control at the VSM for the specified parameter.

Examples:
- Altitude Command Type
- Heading Command
- Speed Type
- Altitude Type
- Antenna Type
- Flight Mode
- (over 30)
CUCS supports full STANAG parameter ranges, 
But **Configures** the displays to suit the selected vehicle.

**Altitude scale modified**
CUCS must be capable of supporting all generic functionality, but is expected to remove functionality unsupported by the controlled vehicle.

Flight modes removed
CUCS can not know the control logic for all vehicles, therefore the VSM identifies the current state of vehicle parameters.

Mission mode unavailable
Parameter Extensibility

Ability to extend generic capabilities with vehicle specific capabilities, for specific parameters through the DLI mechanism, for tight integration into a single application

- for operator ease of use
- for flight criticality or flight safety

Added custom Flight mode -> Roll
Private Messaging

Ability to integrate generic capabilities with vehicle specific capabilities, using *privately defined* DLI messages,
to *tightly integrate* into a single application
- for operator ease of use
Configured Panel

Compliant

Configured
What Interoperability Means

- UAV control systems can be developed to meet “national” requirements

- UAVs for Country A may use one user interface, regardless of UAV type; UAV controllers for Country B could be using a completely different user interface, even though they may be operating the same UAVs

- UAV operated by Country A can be handed off to Country B, even though the ground stations are dissimilar
What Does S4586 Do for Me?

- Reduces Costs - Capital and O&M
- Simplifies C4ISR Systems Integration
- Reduces Logistics Tail
- Decouples UAV development from GCS Integration

- Supports National GCS Development with own CONOPS and Training
- In Coalition Operations, STANAG 4586 Supports Multinational Partners Sharing Data from multiple UAVs from multiple countries.
Acquisition of UAV Systems

STANAG 4586 Standard GCS/Air Vehicle Interface

The acquisition of air vehicles can occur independent of other elements of the UAV system (e.g., the GCS).

The GCS can be sustained, upgraded, and produced in multiple configurations independent of the other elements of the system.

STANDARDIZED INTERFACE *DECOUPLES* THE GCS & AIR VEHICLE
Interoperability Does Not Mean

• Common User Interface for All Users
  – French Operator does not sit in a German shelter

• Common Training
  – Train for your own system
Trends Affecting STANAG

• Bandwidth Reduction – Common Protocol via RF Link
• Trend toward network-centric CONOPS
  - SOA (service-oriented architecture) – provide services to the network.
• Trend toward increasing system autonomy
  - Autonomy messages added to the STANAG 4586, operators become system supervisors
• Trend toward collaboration among systems
  - Ship to ship messaging and interactions
Is Interoperability possible?

- STANAG 4586 Edition 2 is ready.
- STANAG 4586 is implementable.
- STANAG 4586 is implemented on several real UAVs.
- A common User Interface per User is achievable.

UAV interoperability is now possible.
STANAG 4586: Enabling Interoperability

THANK-YOU

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STANAG 4586 Goals

• Interoperability amongst Allied Forces
• Diverse Concepts of Operations
• Network Centric Operations.

Secondary considerations:
• Common ground control station per user vrs Scalability
• One operator, many vehicles
• Modular design
US Army TUAV Project Office has introduced “ONE System” to fly:

- **Shadow 200**
  - (AAI Corp.)
- **Hunter**
  - (Northrop Grumman)
- **Sky Warrior**
  - (General Atomics - ASI)

Based on the VCS by CDL Systems Ltd.