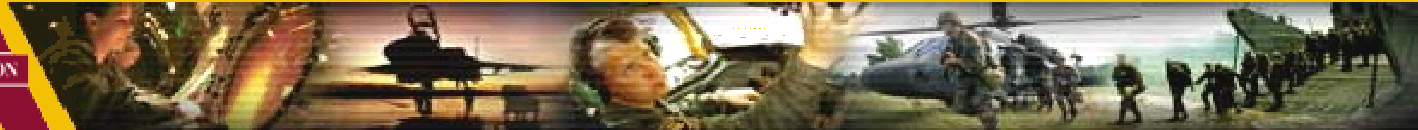




Strength through Industry & Technology



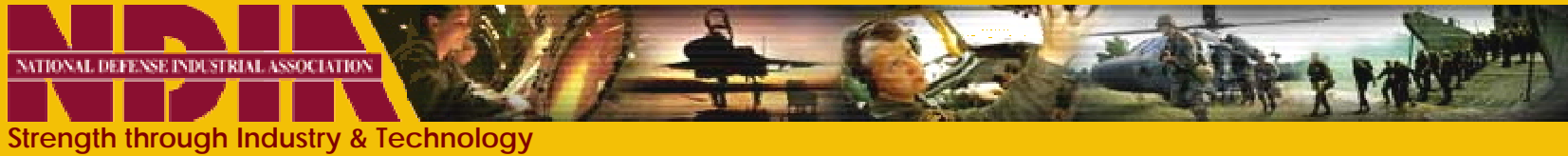
Standards Committee Report

NDIA Robotics Division

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President & CEO
RE2, Inc.

September 13, 2007 NDIA Meeting

Standards Committee Mission Statement



Mission Statement:

Assess ongoing Unmanned Systems standardization activities and recommend/advocate a DoD Unmanned Systems standardization strategy to support improved interoperability, safety, and cost reduction.



Strength through Industry & Technology

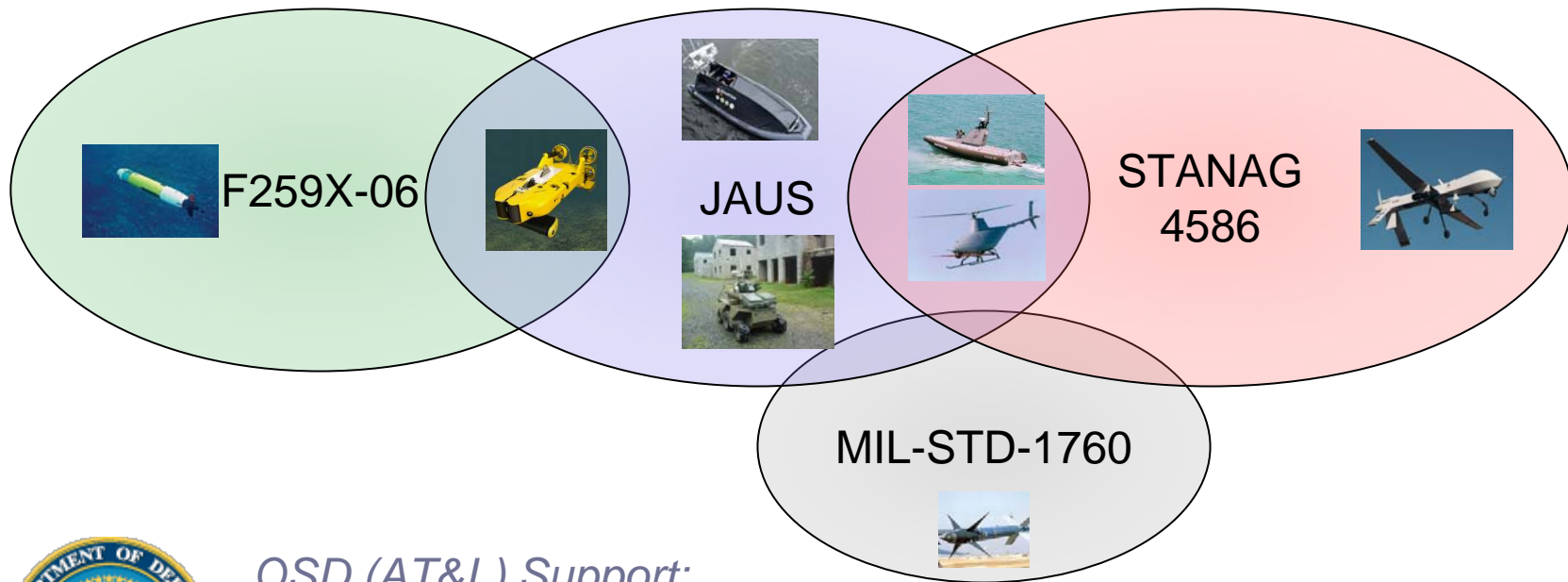


Interoperability Standards Analysis

NDIA Interoperability Standards Analysis

One of the primary objectives:

- Bridge the gap between interoperability standards



OSD (AT&L) Support:

- Joint Ground Robotics Enterprise (JGRE)
- Unmanned Aircraft Systems (UAS)



NDIA Interoperability Standards Analysis

Approach:

- ✓ Where are we now?
 - Perform an extensive analysis of existing unmanned system (and related) standards. Solicit input from leaders of each identified standard.
- Where do we need to go?
 - Describe requirements of AN interoperability standard, independent of existing standards.
- How do we get to where we need to go?
 - Perform an analysis for coordination of key interoperability standards such as JAUS and STANAG 4586.



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Questions to be Answered:

- Which standards, or combination of standards, provide the best path to interoperability across all domains?
- Which standards, or combination of standards, provide a viable path for dual-use applications (i.e. 2003 National Defense Authorization Act, Section 1401)?

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Primary focus:

- JAUS (SAE AS-4)
- STANAG 4586 (NATO)



JAUS and STANAG 4586 have strong mandates and requirements spanning multiple domains.



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Other standards/efforts currently being considered:

- MIL-STD-1760 (SAE AS-1) - weapons
- Universal Armament Interface (UAI) - weapons
- F41 (ASTM) - UUVs
- Joint Unmanned Aircraft System - UAVs
- Sub-Joint Unmanned Aircraft System - UAVs
- 4D/RCS (NIST) – unmanned system architecture
- SOSCOE (Boeing/FCS) – unmanned system architecture
- F38 (ASTM) - UAVs
- etc.

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Evaluation criteria:

- **Span and scope of the standard**
- Governance
- **Classifications and restrictions**
- Adoption audience
- Process and configuration management
- Technical approach, status, and plans

Driving force



NDIA Interoperability Standards Analysis

Where are we now? :

Evaluation criteria along Y axis and Standards along the X axis.

Items of interest:

- NATO UNCLASSIFIED
- SOA
- C4ISR data

Evaluation Criteria	Primary Standards being evaluated				Notes
	Joint Architecture for Unmanned Systems (JAUS) STANAG 4586	NATO F154 UUV Standards: 254-06, 204-07, 205-07, and WK1283	MIL-STD-1760	Universal Armament Interface (UAI)	
Supporting agencies	OSD ATAL (UAS), Army, Navy and Marine Corps (UAS)	NAVY	USAF	USAF	These are the Government agencies supporting the standard, funded or unfunded.
Mandates and Requirements	FCS UGV, UAV, UAS, LM, Navy mandate (UGV, USV, UAS), NIS/CAB (COC Non-DoD robots) OSD JISR	Army, Navy and Marine Corps (UAS), Public Law 109-163 Jan. 6 2006 mandate use of STANAG 4586 for UAS	None official; however, for new weapons, it's the only interface on all the etc. and for new jet, it's the interface on most of the weapons	None	These are the mandates and requirements for the standard. Public Law 109-163 Jan. 6 2006 states that: "(2) those vehicles use data formats consistent with the architectural standard for partial unmanned aerial vehicles known as STANAG 4586, developed to facilitate multinational interoperability among NATO member nations.
Target domains	UGV, USV, UAV, UAS, US, LM	UAS, USV	UUV, USV	Smart Strike Weapons	These are the domains for which the standard is intended.
Current domains	UGV, USV, UAV	UAS, USV	UUV, USV	Smart Strike Weapons	These are the domains in which the standard is being actively utilized.
Standard Owner	SAE AS-4	NATO, JCGUAV	ASTM F41	SAE AS-1	This is the organization/group developing and maintaining the standard.
Current document revision	Reference Architecture 3.3	Edition 2	Each of the 4 standards has its own revision (all in 1st or 2nd release)	D (though E is movement)	R01
Classification	UNCLASSIFIED	NATO UNCLASSIFIED (NATO countries only)	UNCLASSIFIED	UNCLASSIFIED / For Official Use Only (FOUO) - not releasable to foreign countries currently.	This is the classification of the standard. If any NATO nation identifies a "need to know" by a non-NATO country, it can release the documents to that country.
Restrictions	Open	NATO controlled	Open	Dissemination: (Used by all US DoD and most NATO fighters, bombers, and smart weapons)	These are any restrictions associated with using the standard.
Adoption audience	Multi-industry (DOD, Domestic Responses, Commercial, International)	UAS centric, multi-national, government and industry	Industry, Academia, Government	Low emerging standard, in "subfinder" phase	This shows who is actually using the standard.
Security Implications	Security outside scope of standard	Security outside scope of standard	Security outside scope of standard	Security outside scope of standard	This indicates whether the standard is responsible for authentication and/or authorization.
Primary "transport" medium	Messages independent of transport. UDP/IP most common transport.	Messages independent of transport. UDP/IP most common transport.	N/A. Except the ASTM Communications Standard F2594-07. This standard does cover multiple mediums (i.e. RF, Acoustic, and Light).	Wjpn-to-pdm & wjpn-to-cdr migs defined at wjpn's 1760. If migs may be routed/forwarded via other media, max 512 bytes (32 w/d x 16 bit)	This indicates the nominal transport medium for the standard.
Secondary "transport" medium	See above.	See above.	N/A	Fiber Channel	This indicates any other transport mediums used by the standard.
Transport Bandwidth Limitations	Acceptable to all domains, not ideal for underwater communications	Acceptable to all domains, not ideal for underwater communications	Acceptable to all domains, not ideal for underwater communications	Acceptable to all domains, not ideal for underwater communications	This indicates any limitations of the standard in terms of bandwidth/latency.
Messages currently support basic teleoperation	Yes	Yes	N/A - these are not messaging standards	N/A	This indicates if the message set provided by the standard supports the ability to teleoperate a UUV.
Messages currently support basic waypoints following	Yes for USV, USV, UAV. UUV waypoints are currently being investigated. Some mission functionality.	Yes, for UAS, USV, and USV	N/A - these are not messaging standards	N/A	This indicates if the message set provided by the standard supports the ability to download waypoints to a UUV and command the UUV to follow the waypoints.
Messages support basic payloads	Yes	Yes	N/A - these are not messaging standards	N/A	This indicates if the message set provided by the standard supports the ability to control various payloads such as sensors, manipulators, etc (separate from weapons). ASB supports the currently defined payloads in whatever platform they may be located.
Messages support basic world modeling	Yes	No. No requirement for full raster images at this point.	N/A - these are not messaging standards	N/A	This indicates if the message set provided by the standard supports the ability to represent the UUV's surroundings (e.g. a terrain map) and relay that information back to a control station on the standard.
Messages support mission planning	Yes	Yes	N/A - these are not messaging standards	Yes	This indicates if the message set provided by the standard supports the ability to send and update mission plans (e.g. follow this set of waypoints, upon this set).
Messages support weapons	Adopting MIL-STD-1760	Defining messages to support 1760 and UAI. Will be implemented in Edition 4.0	N/A - these are not messaging standards	Yes	This indicates if the message set provided by the standard supports the ability to control weapon payloads on UUVs.
Messages support discovery and dynamic registration	Yes	Probably in Edition 4.0	N/A. Except the ASTM Communications Standard F2594-07 plans to specify this capability.	N/A; migs designed for single-layer IP architecture.	Yes. IWT migs will support if managed at platform layer, though migs now designed for single-layer IP architecture.
Current architecture	Message Protocol with optional architectural components	Message Protocol	N/A - these are not messaging standards	Single-layer, weapon-to-platform/robot	Single-layer, weapon-to-platform/robot
Future architecture	Service-Oriented Architecture in development	Evaluating SOA for future ASB edition 4.0	N/A - these are not messaging standards	Will support future architectures, if routing protocols are managed at platform layer.	Will support future architectures, if routing protocols are managed at platform layer.

NDIA Interoperability Standards Analysis

Where do we need to go? :

Ongoing discussion: what should AN interoperability standard be?

- 1) Provide a method for transferring data between entities (where entities can be unmanned systems, manned systems, control units, payloads, etc.) across all domains
- 2) Support discovery and dynamic configuration/registration of entities
- 3) Specify all layers of communication in line with the OSI stack so there are no ambiguities?

NDIA Interoperability Standards Analysis

How do we get there? :
NO CONCLUSION YET

- ~~1) Kill one for the other?~~
- ~~2) Kill both and start fresh?~~
- ~~3) Status quo?~~

- 4) Redefine domains? – 4586 for DoD, JAUS for everything else?
- 5) Domain specific fusion? JAUS SOA with both 4586-specific services and JAUS-specific services
- 6) Other viable solutions?



JAUS



STANAG 4586

How can we better coordinate with AUVSI?

- Unmanned Systems Interoperability Conference
 - AUVSI San Diego Chapter
 - October 29-31, 2007
 - <http://consult-tlw.com/USIC1.htm>

Questions?



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