



Strength through Industry & Technology



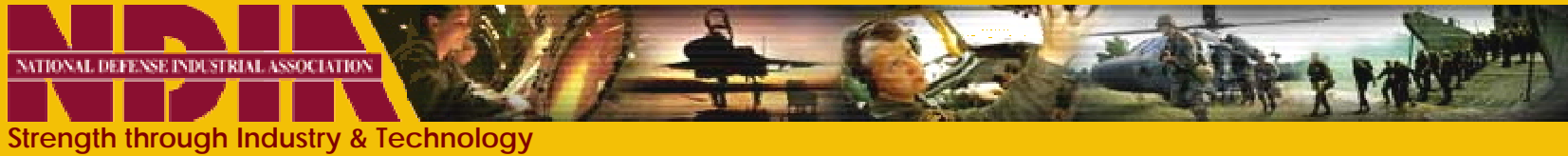
Standards Committee Report

NDIA Robotics Division

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December 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.



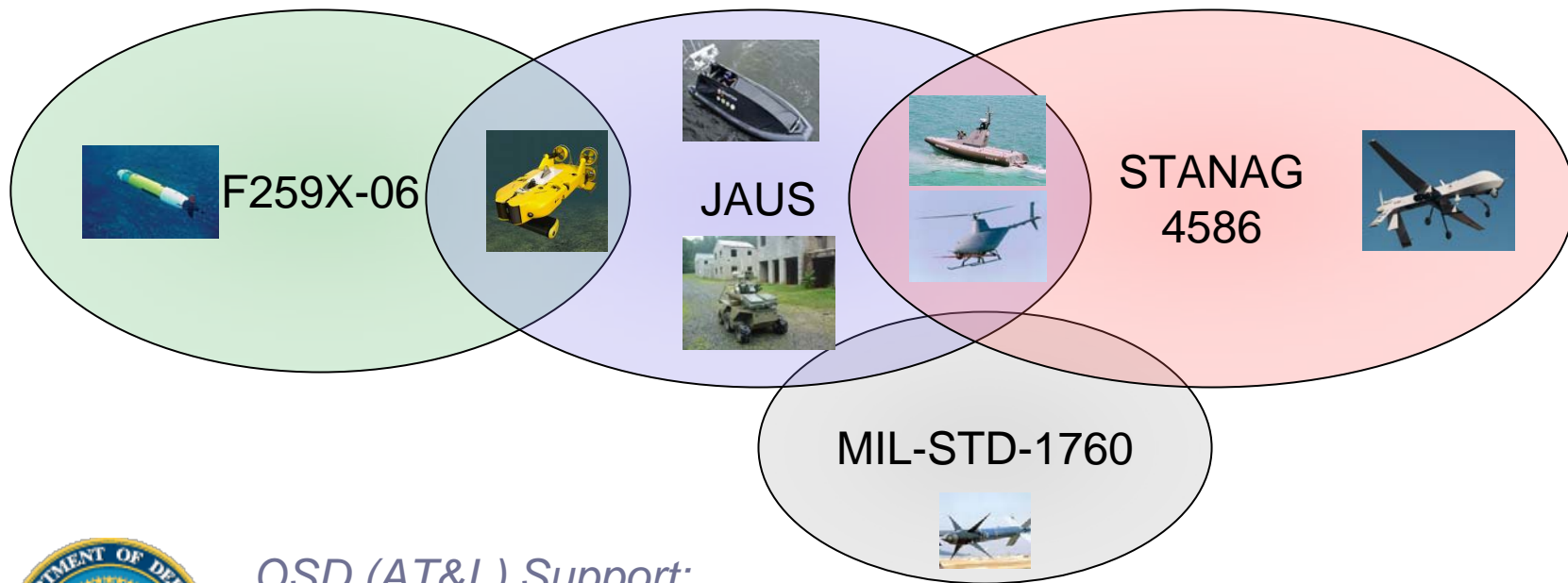
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Interoperability Standards Analysis

NDIA Interoperability Standards Analysis

Bridge the gap between interoperability standards



OSD (AT&L) Support:

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



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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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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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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				Universal Armament Interface (UAI)	NOTES
	Joint Architecture for Unmanned Systems (JAUS)	STANAG 4586	NATO F1144 UUV Standards: 254-06, 204-07, 205-07, and WK1283	MIL-STD-1760		
Supporting agencies	OSD ATAL (OAS), Army, Navy, and Marine Corps (UAS)	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	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, UAV, US, LM	UAS, USV	UUV, USV	"Smart" Strike Weapons	"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	"Smart" Strike Weapons	These are the domains in which the standard is being actively utilized.
Standard Owner	SAE AS-4	NATO, JCQUAV	ASTM F41	SAE AS-1	UAI Industry Team	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	This is the current revision of the standard.
Classification	UNCLASSIFIED	NATO UNCLASSIFIED (NATO countries only)	UNCLASSIFIED	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	Disse: A; public release	Disse: A; public release	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	UUV-centric (Used by all US DoD and most NATO Uighers, bombers, and smart weapons)	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	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).	MIL-STD-1553, but messages were recently separated from the data bus, allowing the messages to be used by other standards. IF. Msgs may be routed/forwarded via other media, max 512 packets (256 x 16 bit)	Wjpn-to-patm & wjpn-to-collatd migs defined at wjpn's 1760 (IF. Msgs may be routed/forwarded via other media, max 512 packets (256 x 16 bit)	This indicates the nominal transport medium for the standard.
Secondary "transport" medium	See above.	See above.	N/A.	Fire Channel	Fire 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	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	N/A	This indicates if the message set provided by the standard supports the ability to teleoperate a UUV.
Messages currently support basic waypoint 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	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	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	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	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, then 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	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; msg designed for single-layer IP architecture	WJPT migs will support if managed at platform layer, though migs now designed for single-layer IP architecture.	This indicates if the standard supports discovery of UUVs, control units, payloads on UUVs, etc and the dynamic registration and/or collaboration of those entities discovered.
Current architecture	Message Protocol with optional architectural components	Message Protocol	N/A - these are not messaging standards	Single-layer, weapon-to-platform/weapon-to-weapon/weapon-to-weapon	Single-layer, weapon-to-platform/weapon-to-weapon/weapon-to-weapon	This is the current embodiment of the standard.
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.	This is the future embodiment of the standard.

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Where do we need to go? :

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

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How do we get there? :

Four strategies identified:

- 1) Dissolve one standard for the other
 - a) Dissolve JAUS and adopt STANAG for all UxVs
 - b) Dissolve STANAG and adopt JAUS for all UxVs
- 2) Dissolve both standards and create a new standard for all UxVs
- 3) Maintain JAUS and STANAG separately and define translation modules between the two standards
- 4) Systematically fuse JAUS and STANAG



JAUS



STANAG 4586

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Implications of each strategy analyzed :

	Option 1A Dissolve JAUS and adopt STANAG 4586	Option 1B Dissolve STANAG 4586 and adopt JAUS	Option 2 Dissolve both JAUS and STANAG 4586 and create a new standard	Option 3 Maintain JAUS and STANAG 4586 and define translation modules	Option 4 Systematically fuse JAUS and STANAG 4586
Impact on industry	Many companies have invested in a JAUS code base for their systems. That investment would be lost. More companies will invest in STANAG 4586 because there is a clear path toward interoperability	Many companies have invested in a STANAG 4586 code base for their systems. That investment would be lost. More companies will invest in JAUS because there is a clear path toward interoperability	Many companies have invested in either JAUS or STANAG 4586 and a new code base will need to be developed by those companies. More companies will begin to support the new interoperability standard because there is a clear path toward interoperability	Whether a company invested in JAUS or STANAG 4586, that investment is not lost. Companies may still resist implementing JAUS or STANAG 4586 due to the continued segregation	Whether a company invested in JAUS or STANAG 4586, that investment is not lost. Companies currently implementing JAUS and STANAG 4586 will continue to advance the evolving standard and new companies will be more likely to adopt interoperability standards due to the clear path.
Impact on policy		STANAG 4586 is written into Public Law 109-163 (January 6, 2006), so new law would need to be established	STANAG 4586 is written into Public Law 109-163 (January 6, 2006), so new law would need to be established		
Impact on programs	Many programs have JAUS requirements	Many programs have STANAG 4586 requirements	Many programs have JAUS and STANAG 4586 requirements	Current program requirements are maintained	Current program requirements are maintained
Implications of transition	Systems using JAUS must be reimplemented to use STANAG 4586	Systems using STANAG 4586 must be reimplemented to use JAUS	There will be delays in standards technology advancement while the new standard is being developed	Standard advancement will be delayed due to continued segregation	Backward compatibility with existing JAUS and STANAG 4586 systems can be realized. Incremental fusion allows for uninterrupted standard advancement
Unified Standard	STANAG 4586 serves as the unified standard once expanded to support all UAVs	JAUS serves as the unified standard once expanded to support missing UAV functionality	The new standard would serve as a unified standard	A unified standard is never realized	JAUS and STANAG 4586 incrementally fuse into one unified standard
Knowledge retention	There is a high risk that experience and functionality embodied by the JAUS standard would be lost	There is a high risk that experience and functionality embodied by the STANAG 4586 standard would be lost	Experience and functionality from both standards are used to develop the new standard	Experience and functionality is maintained for the existing standards	Experience and functionality is maintained for the existing standards
Classification	NATO UNCLASSIFIED binders use of the standard in non-NATO applications			Knowledge remains segregated	NATO applications can continue to have a protected (i.e. NATO UNCLASSIFIED) part of the standard

NDIA Interoperability Standards Analysis

- Presenting ISA Report to OSD today
- Holding teleconference with JGRE to discuss ISA Report on January 3, 2008
- Next steps:
 - Continue to assess current standardization activities and adjust standardization strategy for improved interoperability, safety, and cost reduction
 - Update ISA Report as new information is obtained

Questions?



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