Handbook for
C4I information interoperability
– which standards to use and when

Discover how to compare, contrast, and choose the right
C4I interoperability standard to match
your purpose and partners.

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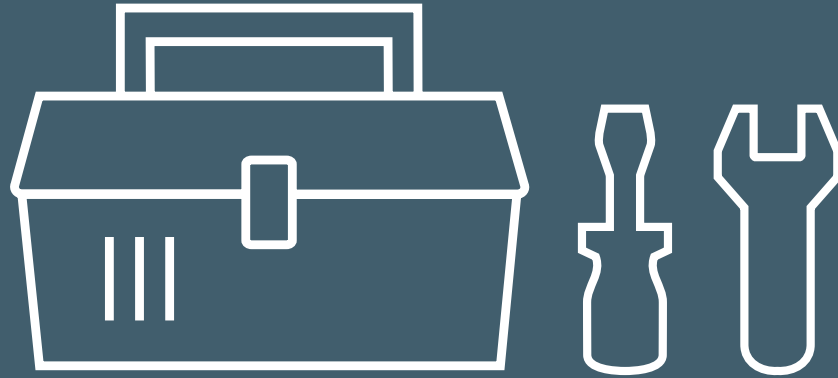# The intricate world of C4I interoperability

The ability to communicate and coordinate with allied partners is essential to modern-day combined and Joint operations. However, since most nations use individual communications hardware and standards, the challenge to ensure interoperability between several partners can quickly seem overwhelmingly complex.

This handbook is designed to help you understand which interoperability standard to use – and when. We encourage you to provide feedback on this handbook and to tell us about your own challenges with interoperability so that we can take this into consideration in future editions.

Send your comments and suggestions to:
interoperability@systematic.com

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Choose the right tool for the job

No matter the task, you always benefit from choosing the right tool at the beginning. And while it is possible to hammer in a screw, the process – and result – is far from ideal. Similarly, to achieve optimum interoperability on the battlefield, you must first choose the interoperability standard that best suits your operational needs.

Every interoperability standard is designed to fulfill a specific purpose, and some are intentionally more sophisticated – and, consequently, more complex – than others.

In addition, successful interoperability is also a question of conforming to the standards of your coalition partners and allies. Of course, while matching your own needs as well. As a result, choosing the right tool is no easy task when the job involves interoperability.

ADatP-3
Allied Data Publication 3

ADS-B
Automatic Dependent
Surveillance – Broadcast

AIS
Automatic Identification
System

APP-6
Allied Procedural
Publication 6

APP-11
Allied Procedural
Publication 11

COP / JCOP
(Joint) Common Operational
Picture

CSD
Coalition Shared Data

ISR / JISR
(Joint) Intelligence, Surveillance,
Reconnaissance

KML
Keyhole Markup Language

Link 16
Tactical Data Link 16

MIL-STD-2525
Joint Military Symbology

MIP
Multilateral Interoperability
Programme

NFFI / FFI
(NATO) Friendly Force
Information

NVG
NATO Vector Graphics

OTH-GOLD
Over-The-Horizon GOLD

RP
Recognised Picture

VMF
Variable Message Format

W-AIS
Warship Automatic
Identification System

WMS
Web Map Service

XMPP
Extensible Messaging and
Presence Protocol

Interoperability acronyms you should know

Ensuring military interoperability with coalition partners often proves to be a complicated challenge, with the wide variety of standards as a main reason.

To add an extra level of complication, each standard not only goes by a name but also by an acronym. In the list above, you find some of the most common standards and their acronyms – pairs that are good to know when working with interoperability.

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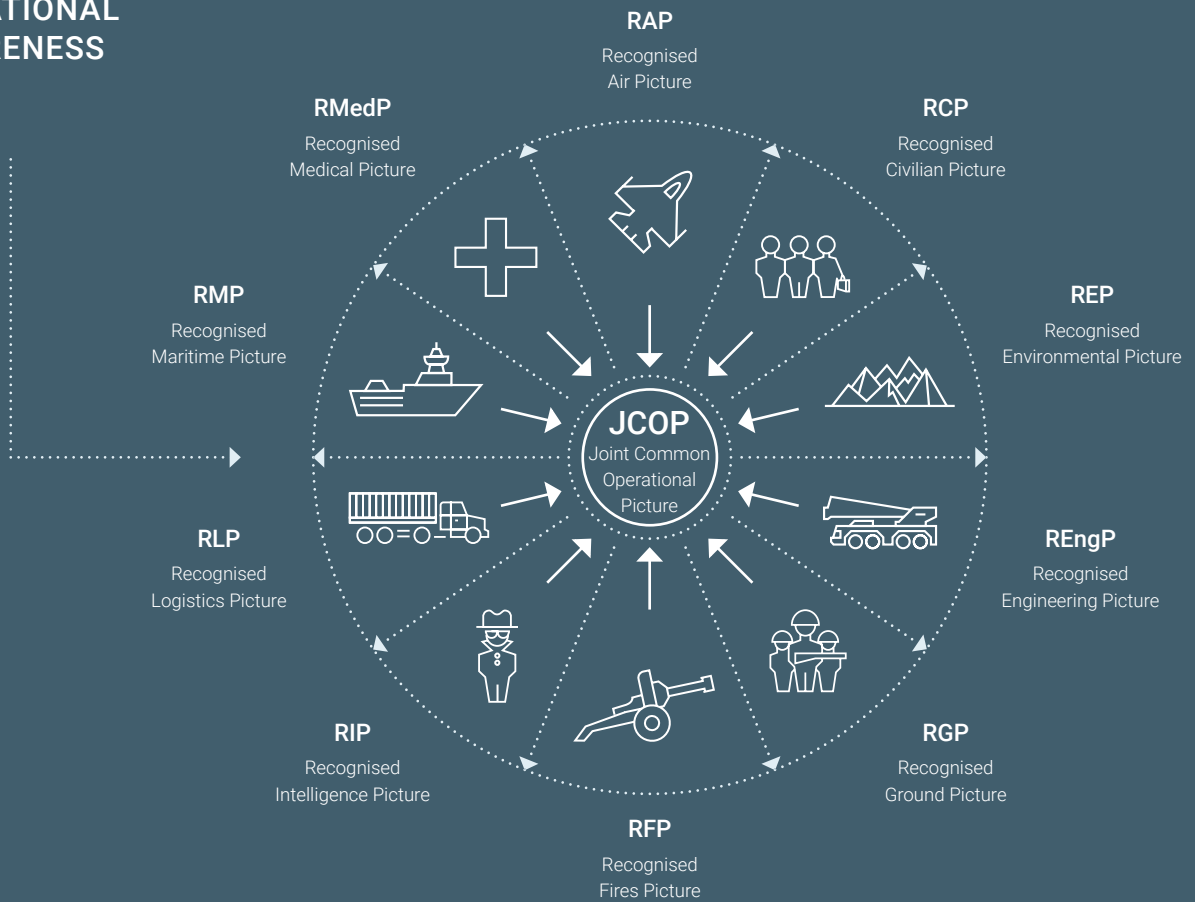
Recognised Pictures – situational awareness

Recognised Pictures play an integral part in the collaborative planning, combined execution of orders, and situational awareness of modern military operations. Sharing data allows forces to coordinate rapidly, avoid blue-on-blue engagements, and achieve information superiority.

Recognised Pictures are collected from each of the participants in an operation – the armed forces as well as civilian and government actors – to compose the Joint Common Operational Picture (JCOP).
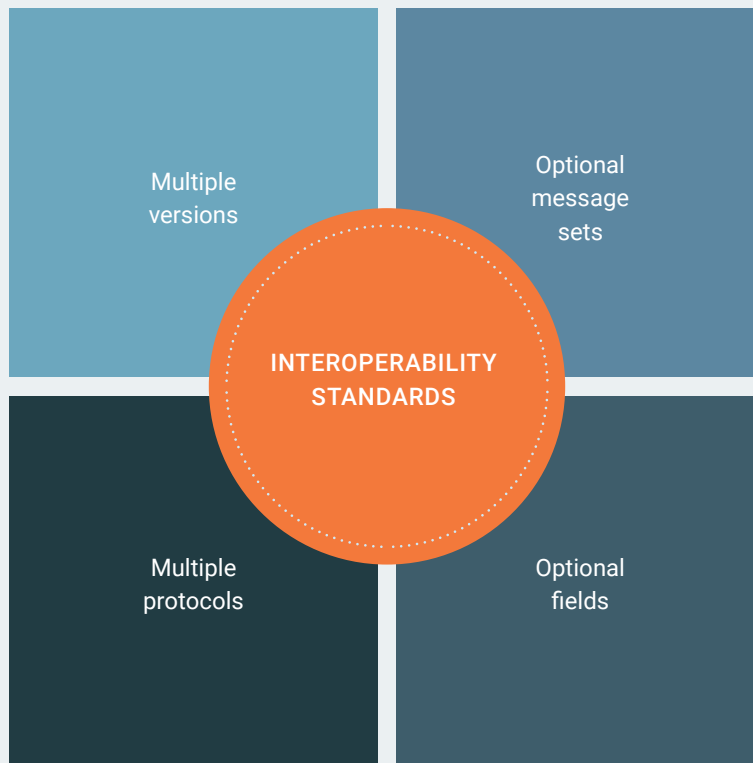
Based on received Recognised Pictures and individual analysis, higher echelon command correlates and composes the JCOP which provides complete situational awareness for all coalition partners.

The success of combined Joint operations relies greatly on collective situational awareness and the ability to coordinate battle plans – and interoperability is the prerequisite for this.

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	RAP	RCP	REP	REngP	RFP	RGP	RIP	(J)ISR	RLP	RMP	RMedP	(J)COP	Plans & orders	Chat
SHC SITA-WARE	Out	In/Out		In/Out	In/Out	In/Out	In/Out		In/Out	Out	In/Out	In/Out	In/Out	
STC SITA-WARE	Out	In/Out			In/Out	In/Out	In/Out		In/Out	Out	In/Out		Out	In/Out
ADatP-3 APP-11		In/Out			In/Out	In/Out	In/Out		In/Out	In/Out	In/Out	In/Out	In	
ADS-B ASTERIX	In													
AIS NMEA 0183										In				
KML OGC		Out	In		Out	Out	Out		Out	Out	Out	Out		
LINK 16 STANAG 5516	In/Out				In/Out	Out								
MIP	Out	In/Out		In/Out	In/Out	In/Out	In/Out		In/Out	Out	In/Out	In/Out	In/Out	
NFFI/FFI STANAG 5527	Out					In/Out								
NVG STANAG 4733					In/Out	In/Out	In/Out		In/Out	Out	In/Out	In/Out	In/Out	
OTH-GOLD ISR/CSD STANAG 4559					In/Out	Out		In/Out	Out	In/Out	Out			
VMF MIL-STD-6017					In/Out	In/Out	In/Out							
W-AIS STANAG 4668										In				
WMS OGC			In	In										
XMPP (Chat)														In/Out

Recommended interoperability matrix

The interoperability options are many, and choosing the right standard can be a challenge. The table above presents a recommended interoperability matrix from a land and Joint perspective.

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Multiple versions

Optional message sets

INTEROPERABILITY STANDARDS

Multiple protocols

Optional fields

The complexity in interoperability standards

Numerous elements must align to secure successful interoperability. When conducting information exchange, a coalition must choose common or compatible protocols and formats. It must also take into account that one standard may contain multiple versions – each with optional message sets and optional fields that may be incompatible with other versions of the same standard.

Moreover, the coalition must consider the individual standard. Some standards are designed to exchange comprehensive information, whereas others strictly focus on short and specific information. A standard such as AIS provides a simple language with little room for misunderstandings while MIP provides a much richer and nuanced language. If done incorrectly, translating a richer language into a simpler system will result in the loss of information – and vice versa.

Whenever you add an interoperability standard, you increase the level of complexity. As a result, you should aim at keeping conversions to a minimum.

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Comparing and contrasting interoperability standards

Interoperability standards support the exchange of Recognised Pictures at vastly different levels. While some only support the exchange of simple position location information, others are able to express much richer pictures that include military symbols, such as units, equipment, and control features.

Interoperability standards, such as KML and WMS, are able to render and convey military symbols. However, they do not possess the proper geometric representation, so they cannot convert the information to other standards – which the parentheses in the next table indicate.

Category	Name	Information complexity	Near-real-time tracks	Complex RP/COP	MIL-STD-2525 symbols	MIL-STD-2525 graphics	Messages
SitaWare	SHC	Medium	●	●	●	●	
	STC	Low	●		●	●	●
Two-way	ADATP-3 / APP11	Medium		●			●
	ISR / CSD	High		●			
	LINK11	Medium	●				
	LINK16	Medium	●				
	MIP	High		●	●	●	
	NFFI / FFI	Low	●		●		
	NVG	Low		●		(●)	
	OTH-GOLD	Medium	●	(●)	(●)		●
	VMF	High	●	●	●	●	●
One-way	WAIS	Low	●				
	AIS	Low	●				
	ADS-B	Low	●				
	ASTERIX CAT 048	Low	●				
	WMS	Low		●	(●)	(●)	
	KML	Medium		●	(●)	(●)	

Comparing and contrasting interoperability standards

With the vast amount of interoperability standards, it can be difficult to distinguish between the standards and their respective features and benefits. To get an overview and a solid foundation for decision making, it can, consequently, be beneficial to compare and contrast the standards. For that reason, the table above highlights differences and similarities between some of the dominant interoperability standards.

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2

EXCHANGE KNOWLEDGE WITH YOUR COALITION PARTNERS

Be sure to share enough with your coalition partners to find common ground. No details are too small. Create a positive list (what works) and then create a negative list (what is no-go).

1

KNOW YOUR SYSTEM AND YOUR OWN NEEDS

Start by creating the best possible solution for your own needs and then focus on securing interoperability with your coalition partners.

3

USE STRUCTURED BILATERAL TESTS

Work with your partners to adjust your positive and negative lists. Connect and do bilateral tests by sharing information and establishing common Standard Operating Procedures (SOP)/Tactics, Techniques, and Procedures (TTP).

5

USE STRUCTURED MULTILATERAL TESTS, E.G. CWIX, BOLD QUEST, AND JWA

Maintain and enhance SOP/TTP with and from lessons learned. As a member of a coalition mission network environment, conduct compliance and conformance tests.

4

EMBED COMMON SOP/TTP IN NATIONAL SOP/TTP

Establish documentation for information exchange. Create SitaWare symbol toolbox entries for workable symbols. Maintain and govern these entries nationally.

6

MAINTAIN YOUR INTEROPERABILITY

As new standards emerge and new partnerships are formed, continue to maintain your SOP/TTP and conduct multinational interoperability activities.

6 steps to interoperability

The challenge to ensure interoperability with partners and allies is both complex and continuous. However, following the 6 steps in the model above can help you break it down.

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Systematic delivers world-leading command-and-control, military messaging, and electronic warfare solutions – providing commanders at all levels of the battlespace with comprehensive situational awareness and advanced mission management tools. Operating across domains, our reliable, user-friendly, and operationally proven C4I software has been delivered to more than 45 customers worldwide.

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