

# Ontology in DoD



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# What Senior Leaders Want

“I’m certainly focused...on getting the absolute best value for the taxpayer, the most capability at the least cost.”

“We have to attack headquarters spending. And you all saw we just announced that we’re going to reduce 20 percent in one year, not five, so we’re aggressively going after that. We’re aggressively going to go after contract spending as well: spending on contractors.”

“Strategic agility is what we’re shooting for.”

Press Conference, July 30, 2014



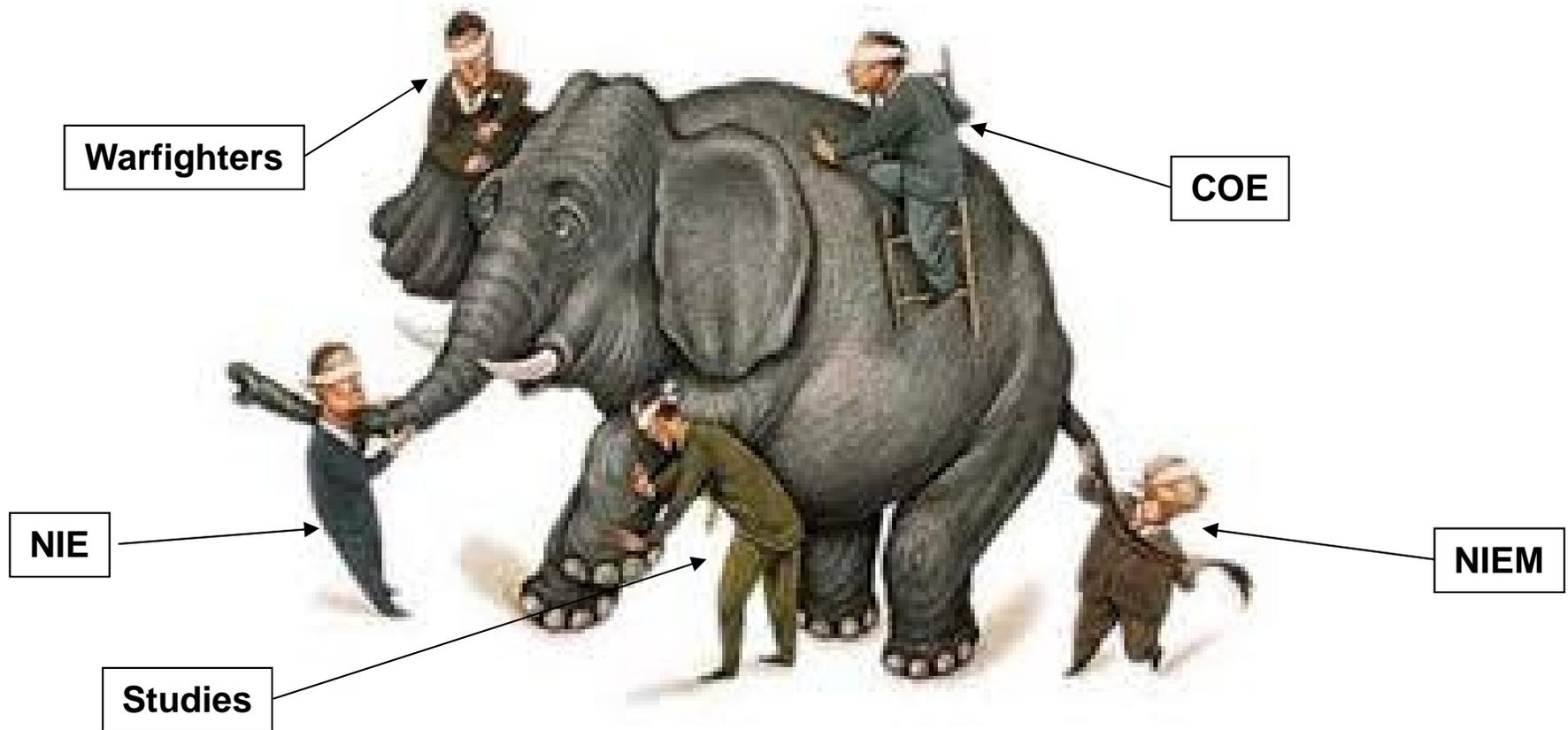
Deborah Lee James  
Secretary of the Air Force

We know that ontology, Big Data, cloud environments, etc., are enablers of getting best value, attacking headquarters staffs, and strategic agility. We need to (1) explain the connection between our services and the goals listed above and (2) facilitate the results desired by senior leaders.

# Bottom Line Up Front

1. I have been asked to talk about ontology in DoD. Because of my career in the Marine Corps, I approach ontology with a users' and operational perspective.
2. Warfighters and other DoD users of IT are not interested in the IT as much as (a) the operational and other capabilities they need for mission accomplishment and (b) IT being used to improve these capabilities.
3. The DoD has found ontologies (i.e., formal representations of reality) essential. In DoD, these representations are often in the form of doctrinal manuals, operations orders, directives, and instructions. These are “people-friendly” – not “computer-friendly” ontologies.
4. DoD's challenge is to improve its efficiency and effectiveness with computer-friendly ontologies and other elements of IT. This is proving very challenging with a poorly shared understanding of the pieces (e.g., ontology, Big Data, and cloud) and how they fit together.

# The Operational Problem – IT Users, Managers, and Developers are Working with Disparate Information and Vision



# Technical Problem – We need bridges that connect the islands of ontology, Big Data, cloud, etc.



# User-Developer Gap Problem

About 2004, the gap between warfighters and developers of “warfighter IT” could be seen by the fact that references for IT interoperability did not include a single reference from Joint Doctrine instruction.

## CJCS I 5120.02A, Joint Doctrine

CJCS I 3140.01  
CJCS I 3500.01  
CJCSM 3500.04  
JP 1-02  
CJCS I 1800.01 Series  
CJCS I 1805.01 Series  
CJCS I 3170.01 Series  
CJCS I 5711.01  
CJCS I 3180.01  
CJCS I 5705.01  
CJCS I 2700.01  
DoD D 5100.3

## DoD I 4630.8, Interoperability of IT

DoD I 4630.8  
DoD D 4630.5  
DoD D 8100.1  
DoD I 4120.24  
DoD 4120.24-M  
DoD D 5000.1  
DoD I 5000.2  
DoD D 8500.1  
DoD I 8500.2  
DoD I 5200.40  
DoD D 5100.35  
DoD D 5105.21

It is often noted in the trenches that (1) warfighters and (2) programs of record claiming to support warfighters live in two different worlds, that there is a huge gap. This can be seen in the references listed in the CJCS instruction on the joint doctrine system and the references listed in the DOD instruction for IT interoperability. DoD is making large investment in IT interoperability with the objective of improving the information sharing warfighters achieve with or without computer-based IT. If DoD wants its IT development efforts to support warfighters, then the appropriate efforts need to be told to understand the needs of their intended customers.

**The first step towards achieving that is providing IT developers with a list of the relevant references.**

## Dennis Wisnosky



He is the former Chief Architect and Chief Technical Officer of the US DoD Business Mission Area within the Office of Business Transformation in the Office of the Deputy Chief Management Officer (DCMO) where he addressed improving DoD business operations.

He recognized that ontologies could facilitate sharing of data and information across DoD.

He also recognized that the biggest challenge was cultural change. He put considerable effort into giving senior DoD officials short classes on ontology and the potential to improve DoD's business operations. He also prepared several videos that explain the views on ontology.

He sought to apply ontology in the context of standard DoD end-to-end processes (e.g., hire to retire).

# ICODES' Value

The Integrated Computerized Deployment System (ICODES) is valuable to those explaining the value of ontology, big data, etc., for several reasons:

- Has been used to improve operational capabilities.
- Has been used to reduce staffs and contractors.
- Integrates and exploits ontology, user needs, “minor” Big Data, data quality, cloud, and other aspects of IT.
- Unclassified
- Is a pilot program of record (POR) for the application of ontology, Big Data, cloud computing, etc., to improve DoD effectiveness and efficiency, particularly strategic agility.
- Has documented and proven processes for producing and exploiting operational relevant ontologies, etc.
- Has been in operational use for 17 years.

# Warfighter “Application” Ontology

This map is an “application ontology” for a particular situation with (1) representations of units of different nations, types, and echelons; areas of operations; the terrain; objectives; control measures; and (2) relationships between entities.

The categories used in this map are based on the “reference ontologies” of doctrinal manuals.

These “ontologies” enable

- (1) information sharing,
- (2) inferencing, and
- (3) interoperability.



Map from Multinational C2 Demonstration  
Maneuver Control System (MCS)  
Linked to Canadian and Portuguese

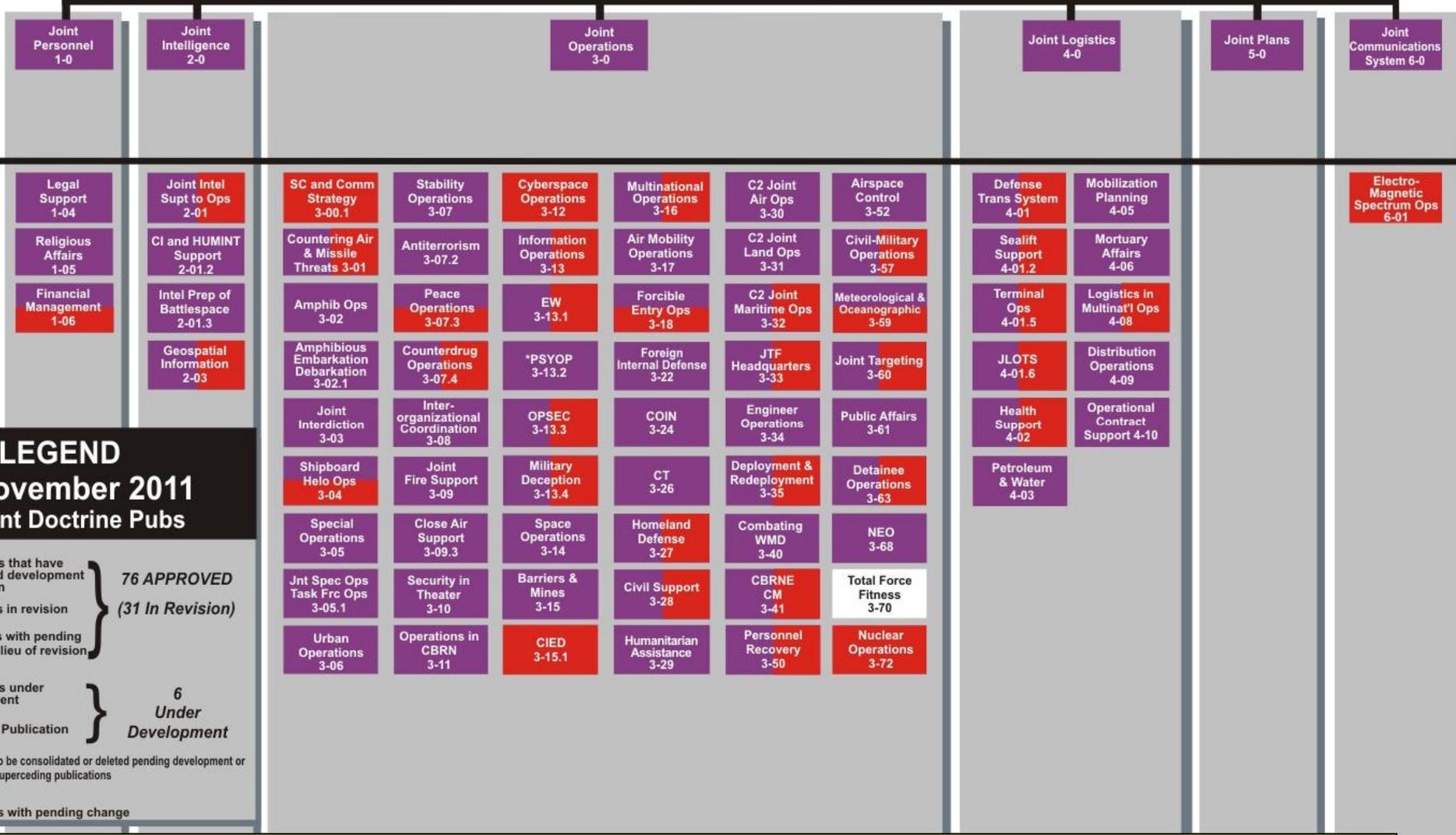
# JOINT DOCTRINE HIERARCHY

KEYSTONE PUBLS

DOCTRINE PUBLICATIONS

CONSOLIDATION

Joint Doctrine  
1



**LEGEND**  
02 November 2011  
82 Joint Doctrine Pubs

- Joint Pubs that have completed development or revision } **76 APPROVED**
- Joint Pubs in revision } **(31 In Revision)**
- Joint Pubs with pending change in lieu of revision }
- Joint Pubs under development } **6 Under Development**
- Joint Test Publication }
- Joint Pubs to be consolidated or deleted pending development or revision of superceding publications }
- \* Joint Pubs with pending change

80+ domain representations unified with a common structure and controlled vocabulary, JP 1-02, *DoD Dictionary of Military and Associated Terms*, and cross referenced.

# After-Action Report Extract Addressing Exploitation of Doctrinal Publication



## UNITED STATES MARINE CORPS

TASK FORCE 3/5  
REGIMENTAL COMBAT TEAM-1  
UNIT 73290  
FPO AE 09509-3290

### IN REPLY, REFER TO:

3000  
CO  
May 1 08

From: Commanding Officer, Task Force 3d Battalion, 5th Marines

To: Marine Corps Center for Lessons Learned

Subj: TASK FORCE 3D BATTALION, 5TH MARINES AFTER-ACTION REVIEW FOR  
OPERATION IRAQI FREEDOM 06-08.2

1. This after-action report is a compilation by the Marines of Task Force 3d Battalion, 5th Marines throughout the execution of combat operations in support of Operation Iraqi Freedom 06-08.
2. Task Force 3/5 arrived in country on 29 Sept 07, assuming responsibilities of AO Dark Horse, in the vicinity of Fallujah, from Task Force 2/6.

**Upon arriving in country TF 3/5 drafted a new battalion campaign plan using FM 3-24 Counterinsurgency as it's as azimuth. (emphasis added)**

C.S. DOWLING

Copy to:

Marine Corps Center for Lessons Learned (MCCLL)

This is an extract from an after-action report prepared by a battalion that deployed to Iraq.

Note that the battalion used Field Manual (FM) 3-24, Counterinsurgency, as generic domain representation when preparing its campaign plan after arriving in Iraq and thus having first-hand access to the situation.

Use of FM 3-24 and other doctrinal publications facilitated the battalion commander developing and promulgating his understanding of the situation and his plan to accomplish his mission in that situation.

# DoD IT Structure

Cornerstone Document. DoD Instruction 8320.02, “Sharing Data, Information, and Information Technology (IT) Services in the Department of Defense” of August 5, 2013, which:

States: “This instruction facilitates the shift from transportation media to a focus on content and guides the use of resources to implement sharing of data, information, and IT services....”

Directs use of DoD Data Services Environment (DSE) as repository and registry for ontologies and other entities needed for sharing data, information, and IT services.

DoD Architecture Framework (DoDAF) with its DoDAF Meta-Model (DM2) and IDEAS ontology.

IDEAS ontology does not support inferencing.

There is a “DoD Core Taxonomy.”

DoD has a significant number of documents (e.g., memorandums, directives, and issuances) intended to guide its IT efforts.. DoD Instruction (DoDI) 8320.02, “Sharing Data, Information, and Information Technology (IT) Services in the Department of Defense,” appears to be pivotal document because it provides a sparse framework focused on data, information, and shared services (e.g., software agents) that use and produce data and information. Ultimately, the value of data, information and IT services is determined by what is accomplished with them. DoDI 8320.02 provides a framework for integrating the DoD Architecture Framework, the DoD Information Enterprise Architecture, the DoD Data Services Environment (DSE) and other elements.

## **Backup Slides**

The slides which provide (1) observations of warfighters and (2) guidance in DoD and Army policy documents.

# General Chiarelli on His Selection of CPOF: Used a non-POR tool because it fit his CONOPS

- **CPOF facilitated information sharing across TOC and force**
- **CPOF facilitated use of doctrinal terminology and processes.**



*We have to make full use of collaboration. The greatest tool I've seen in almost 33 years in the Army, from a command and control standpoint, is the advent of the command post of the future [CPOF] that **allows headquarters located miles away to collaborate in real time** on the same problem within the current operational picture.*

*From my CPOF screen, I could **see the real-time operational picture with my brigade commanders and come up with a maneuver plan, fire support plan, an infrastructure plan, a whatever plan.** So while maneuver commanders talk about their plans, fire supporters, engineers, intel guys all listen, ask questions and simultaneously put together their support and collection plans for the scheme of maneuver.*

*We quickly can **move through the MDMP [military decision-making process] in a way that never has been possible before.***

GEN P. Chiarelli

Command Post of the Future (CPOF) is now a program of record (POR), but it was developed by a Defense Advanced Research Projects Agency (DARPA) project. General Chiarelli used it when he was a division commander because CPOF fit his concept of operations for Iraq while either (1) the existing Army PORs did not or (2) no one explained to him how the PORs could support his concept of operations.

# Warfighter Problem – From a Warfighter



“This is my HQ plt after returning from a patrol in the city”



Afghans observing quietly

The insurgents undoubtedly work our seams. They do it in a couple ways. First is the obvious - figure out what point our patrols turn around or don't seem to have firm control and conduct or stage for attacks there. The extra time it takes us to deconflict cross-boundary for fires and maneuver buys the insurgents the extra minutes they need to egress.

Second, and more problematic, is the method of living in one AO and conducting attacks in another. The insurgents have a clear understanding of our battalion AOs. Cells that operate in one battalions AO will conduct the majority of their operations in the neighboring ones. "

– Infantry Company Commander, March 2007 email to SES in OSD

The email quoted above was prompted by a DoD SES wondering if the enemy exploited gaps in our IT systems data and information-sharing capabilities. The answer was absolutely yes.

# Lesson Learned from Operation Iraqi Freedom – 2007

Stove-pipe functionality continues to function within the technical battlefield functional areas

“Business Process” analysis is required.

We continue to relearn the lesson that technology absent an operational concept is not a solution.

Unit LNOs to the Corps are tasked to cut event data contained in CPOF and paste the information into CIDNE.

The “storyboard” (PowerPoint slides that use map backgrounds and the common terminology and graphics standardized and codified in doctrinal publications) has become the defacto tool-of-choice for backbriefs at all echelons.

Units often default to the use of MS Office rather than the Systems of Record.

COL Harry Greene, PM-BC, and COL Roger McDonald, TRADOC Capabilities Manager, BC, after trip to Iraq

This situation continues to this day. As these quotations show, our adversaries understand how to exploit our lack of TTPs and the training that would be possible if the TTPs existed.

# Focus IT Intended for C2 on Commanders' Needs and Human Interface



DoD's Principal Maxim of C2: Technology enables the human interface and supports "command" and the decision-maker, rather than forcing the decision-maker to operate within the constraints of the "control" technology. The force development community will remain cognizant of this to ensure C2 technical solutions meet commanders' needs.

Paper page 5, *DoD C2 Implementation Plan*  
October 1, 2009

Paper page 3, *DoD C2 Strategic Plan*  
January 12, 2009

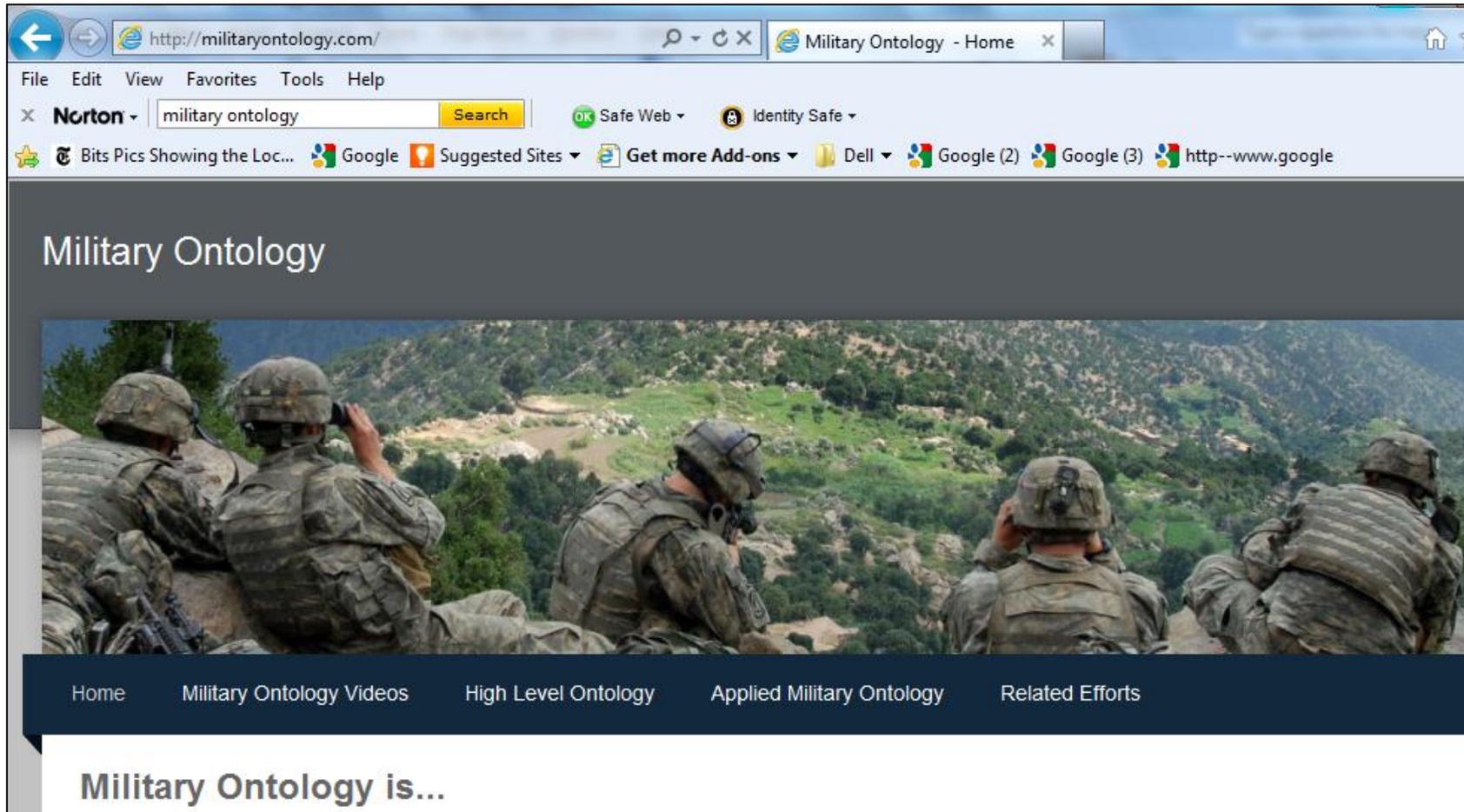
# Army Guidance

b. Customer-focused information technology management. The IT community professionals will maintain customer focus in their support of system users and the Warfighter.

(1) The Army IT community provides information capabilities and services for the benefit of Army, DOD, non-Defense Federal agencies, coalition partners, and the general public. The IT capabilities and services are not ends in themselves. Ultimately, they have value only when they support the Warfighter and the Army's mission. Because of the strategic and tactical roles of IT in support of the Army's missions, the IT community must maintain focus on the needs of its customers.

Paragraph 1-7, Army Regulation (AR) 25-1,  
*Army Information Technology*

# Military Ontology Web Site



[www.militaryontology.org](http://www.militaryontology.org)

This web site, which is maintained by a colonel in the US Army reserve who holds a PhD in ontology, has information on ontology for military operations.

## Commander, US Pacific Command – July 2001

### After observing C2 supported by IT that uses ontology and software agents

FM USCINCPAC HONOLULU HI  
TO RUEKJCS/CJCS WASHINGTON DC

...

UNCLAS PERSONAL FOR GENERAL SHELTON AND GENERAL KERNAN FROM  
BLAIR//N00000//  
SUBJ/JTF IMPROVEMENTS IN PACOM//

RMKS/1. HUGH AND BUCK, WE JUST COMPLETED KERNEL BLITZ  
(EXPERIMENTAL) (KB(X)). I SPENT A DAY LAST WEEKEND LOOKING AT IT MYSELF.  
KB(X) IS A JTF-LEVEL FTX FOCUSED ON EXPERIMENTING  
WITH AND ASSESSING IN A REALISTIC SCENARIO MATURING TECHNOLOGIES  
THAT POTENTIALLY WILL ENHANCE NEAR TERM JOINT TASK FORCE (JTF)  
EFFECTIVENESS.

WE ATTACKED ALL THE JOINT INTEROPERABILITY LINKS WITHIN THE JTF. FLEXIBLE  
WIRELESS COMMUNICATIONS DOWN TO THE LOWEST TACTICAL LEVELS  
PROVIDED COMMON REAL TIME SITUATIONAL AWARENESS AT ALL LEVELS OF  
COMMAND. ARMY ELEMENTS INTERCONNECTED WITH MARINES ON THEIR LEFT  
AND RIGHT DIGITALLY, KNOWING EACH OTHER'S LOCATION, AND LEVERAGING  
EACH OTHER'S FIRES DIGITALLY. ADDITIONALLY, THESE FORCES AND THE JTF  
USED THE WARNET TO COLLABORATIVELY PLAN, AND DECONFLICT FOLLOW ON  
MISSIONS. FINALLY, THE BATTLEFIELD BECAME NEARLY SEAMLESS ..., SAW  
ENOUGH TO KNOW WE HAVE GLIMPSED THE FUTURE OF JTF-LEVEL OPERATIONS.