A Review of Team Collaboration Tools for Crisis Response in the Military and Government*

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Abstract

The military operates today both administratively and tactically using collaboration tools. The purpose of this report is to explore the recent past and current status of collaboration tools use in order to provide recommendations for the future with respect to crisis reaction. In other words, what are the "best" web-based tools to support small team interaction and work when team members cannot reside in the same physical workspace? Two methods, ad hoc research and systematic document search, were used to identify commercial and proprietary collaboration tools that deserve review and consideration for military and government crisis response. In this report we report on 64 collaboration technologies and tools, 37 in use by the United States (U.S.) Military and Government. The collaborative technologies and tools are grouped into three categories: (a) Modern collaboration technologies for the design, development, or enhancement of collaboration tools, (b) collaboration tools being used in the military or government, and (c) collaboration tools recommended for consideration by the military or government for crisis response. The identified tools or technologies are described in terms of capabilities and are analyzed for potential to improve collaboration for crisis actions teams.

Objective

The purpose of this report is to explore the previous and current use of commercial off-the-shelf (COTS) and Government off-the-shelf (GOTS) collaboration tools by government and military organizations. [1] This report seeks a current understanding and the wider perspective more than an in-depth analysis of specific tools because the tools and their usage change or evolve surprisingly quickly over time. Unlike just a few decades ago, the U.S. Government, including all branches of the military, operates today both administratively and tactically using the Internet. Not surprisingly, the public sector has greater computer and Internet user rates than the private sector (Bureau of Labor Statistics, 2005), and increasingly the Internet use involves commercial collaboration tools. Therefore, it will be beneficial to explore the recent past and current status of collaboration tool use in order to provide recommendations for the future. A reasoned objective might be to ask the question, what are the "best" web-based tools to support small team interaction and work when team members cannot reside in the same physical workspace? This quick review of a wide array of collaboration tools cannot address that question. Nor does this research address the benefits for using collaboration tools, although it is informative to note that Ford, Hogan, and Perry (2002) suggested that most complex work involves decisions, and that too often our decision space is limited by our bounded rationality (cf. Kahneman, 2003). Likewise, both the reliability and validation of collaborative tools are beyond the scope of this effort, although Powers (2004) and Noble and Letsky (2003) have addressed those fundamental topics. Finally, this report does not address prospective collaboration technology such as tele-immersion, [2] nor collaboration process tools like GroupSystems.

Here, we will report on our search for team collaboration tools used in the military and government. Moreover, Wroblewski & Warner (2005) have provided a list of collaborative capabilities on commercially available tools for team collaboration. For this report, two methods were used to identify collaboration tools being used either by the U.S. military or the Federal Government. Those two

[1] To facilitate the exploration and understanding of the various topics and tools presented in this document, the liberal use of hyperlinks and footnotes has been used.
[2] For tele-immersion see: http://www.advanced.org/tele-immersion/introduction.html

methods, ad hoc research and systematic document search, are described below. The culmination of this report will be the identification of collaboration tools that are currently "authorized" for use, as well as the identification of a handful of current COTS tools that deserve review and consideration for military crisis response.

It may seem as if we live in a world populated with sophisticated communications. Commercial cell phones and broadband Internet access are visible daily in developed nations, and ubiquitous wireless Internet access has become a reality. Traditionally, the U.S. military served as the vanguard for the specification and development of communication tools. One need only consider wideband radios, satellite communications, and the Internet itself. In sharp contrast, today's consumer-driven market has surpassed the military, with negligible exceptions, in its ability to invest and support the latest communication technology and tools.

The Critical Context: Military Crisis Planning

The U.S. military planning system traditionally falls into one of two categories, deliberate (detailed and systematic) or crisis action (immediate and spontaneous). The foundation for joint planning guidance is contained in JOPES (Joint Planning and Execution System).[3] "JOPES is much more than a manual. It is an elaborate system run by many people who use procedures, publications, and automatic data processing to integrate NCA policy decisions with military planning and execution at national, theater, and supporting organizational levels. JOPES supports this integration by facilitating actions during deliberate planning or crisis action planning" (Soucy, Shwendo, and Haven, 1995).

According to United States military joint publications crisis planning, as opposed to deliberate planning, requires rapid sharing of facts and knowledge, because there is an immediate threat against U.S. interests that may call for a military response. Commanders use options previously developed by deliberate planning if possible to solve crises quickly, but such plans sometimes have major shortcomings. JOPES points out that deliberate planning is done for hypothetical crises and relies "heavily on assumptions regarding the political and military circumstances [which] make it improbable that any contingency plan will be usable without modification." In a crisis, military staffs are faced with a serious, rapidly developing situation for which they must produce a plan that takes into account the realities of a particular problem, not a hypothetical incident. Moreover, they may not have a lot of time to consult the keystone doctrinal manuals" (Soucy, Shwendo, and Haven, 1995).

Although this system has been exceptionally functional and is well engrained across the US military services, it does not address the newer communication technologies and tools that are being used in the armed forces today. For that reason the military should explore and employ the more recent COTS tactical "unifying communications" technologies (i.e., web logs (Blogs), instant messaging (IM), mobile blogging (MoBlog), really simple syndication (RSS), etc.) because the current expectation for optimal crisis response changes the requirements (the preceding acronyms or terms will be explained in more detail later in this report).

Scientific Background: Cognitive Models of Team Collaboration

The cognitive mechanisms for effective team collaboration are not well understood and several models of team collaboration have been proposed (Orasanu & Salas, 1992; McNeese, Rentsch, Perusich, 2000; Cooke, 2005). Bolstad and Endsley (2005) provided a taxonomy of collaboration tools according to function: face to face, video, audio, telephone, net radio, chat/IM, whiteboard, file transfer, program sharing, e-mail, groupware, bulletin board, and geographic information systems. The value of that taxonomy reinforces our fundamental understanding that collaborative tasks are not generic and thus require different tools.

[3] JOPES see: http://www.fas.org/nuke/guide/usa/c3i/jopes.htm

Another collaboration model proposed by Warner, Letsky, and Cowen (2005) focuses on macro-cognition and provides a better context to evaluate collaboration tools, because there is empirical support for their collaboration stages: "Knowledge Construction", "Collaborative Team Problem Solving," "Team Consensus" and "Outcome, Evaluation and Revision." Teams will typically start in the Knowledge Construction stage and proceed into Collaborative Team Problem Solving, Team Consensus and finally to Outcome, Evaluation and Revision. The stages are not necessarily sequential. Because team communication is very dynamic, the flow of communication can follow virtually any path. The cognitive processes within each stage are represented at two levels: meta-cognitive, which guides the overall problem solving process, and macro-cognitive, which supports team member's activities within the respective collaboration stage. In addition, there are communication mechanisms (i.e. verbal and non-verbal) for developing the meta-cognitive and macro-cognitive processes.

APPROACH

Two methods, ad hoc research and systematic document search, were used to identify commercial and proprietary collaboration tools that deserve review and consideration for military and government crisis response. We identified 64 collaboration technologies and tools, 37 of which are being used by the U.S. Military or Federal Government agencies.

Ad Hoc Method

To assess the pulse of current military collaboration technology, a small number of domain experts were contacted during August 2005 and asked to discuss what they knew about COTS and GOTS collaboration tools being used in the U.S. military or Government today. In addition, the Internet was searched, in particular the military (.mil) domain, for tools and comment related to collaboration tools. The following review and analysis of collaboration technologies and tools in use by the U.S. military and or the U.S. Government is exploratory. While neither comprehensive nor systematic, our search can be considered representative.

Systematic Document Search

Two electronic searches were conducted during July and August 2005 in support of this effort. The first was at the Government Accountability Office (GAO) website where an advanced search for the term "collaboration tools" was made for anywhere in the document without time or other constraints. Six documents were identified (GAO, 2005), none of which identified any specific collaboration tool, yet all of which support the notion that the Government is interested in the functional utility associated with collaboration tools. For example, in 2004 the GAO looked across the Federal network landscape and identified nine agencies, which reported "34 major networks that support homeland security functions—32 that are operational and 2 that are being developed." A key finding in that report was that the U.S. Department of Homeland Security (DHS) "is in the process of developing the new Homeland Secure Data Network, which is expected to provide classified e-mail and Web sites, messaging, data analysis tools, collaboration tools, and other applications required to support DHS" (GAO-04-375, p. 25).

The second electronic search at the Defense Technical Information Center (DTIC) looked for any of these three terms, "collaborative software," "collaborative assistants," or "collaborative tools" during the most recent decade. The DTIC search tool called STINET (Scientific and Technical Informational Network), automatically performs a "wild card" truncation, and thus it searched for collaboration, collaborative, collaborated, and collaborates. The search was created as part of a brief newsletter report for the System Development Technical Group (Alley, 2005) of the Human Factors and Ergonomics Society. Eighteen documents were found that met the criteria, nine of which are cited elsewhere in this report.

Early Collaboration Research and Usage

A short decade ago, there were no commonly available multi-user internet-based digital collaboration tools (excluding e-mail) available anywhere. But the need for such tools was becoming visible. For example, in the early 1990s the Army selection board required a way to make distributed group decisions (e.g., brainstorming) easier. The Army also studied the implications for using collaboration tools in training (Bonk & Wisher, 2000), and in supporting the learning organization (Kingsbury, 1999). Likewise, the Navy has studied the use of web-based collaboration for peace operations (Spivey, 2002), during complex humanitarian emergencies (Ford, Hogan & Perry, 2002), in support of sea-based aircraft maintenance (Nasman, 2004), and to enhance group performance (Gallaher & O'Rourke, 2004). In the early 1990s, the local area network (LAN) was used mainly to share printers. As collaboration technology started to emerge networking became digital.[4]

After the World Wide Web expansion in 1995, collaboration topics developed relatively quickly. By 2001, there were at least four popular collaboration tools designed or enhanced by technology innovators in use by various Governmental and military organizations.[5] These four collaboration tools are identified below:

- Collaborative *Virtual Workstation* (CVW): This is a software prototype developed by MITRE [6] that supports a collaborative environment optimized for supporting persistent, geographically dispersed virtual rooms. CVW provides chat, audio/video conferencing, application sharing, electronic whiteboarding, and multi-point communications. At the time this paper was written, MITRE was looking for a vendor who would assume responsibility for managing and improving the software.

- Information *Workspace* (IWS): General Dynamics developed IWS as a Web-based, collaboration environment featuring virtual rooms, audio/video conferencing, chat, electronic whiteboarding, and application sharing with multipoint communications.

- Microsoft *NetMeeting:* A Microsoft product that supports point-to-point communications for its audio/video conferencing, chat, application sharing, and electronic whiteboarding.

- IBM *Lotus Sametime:* A Lotus product that interfaces with most Web browsers and provides audio/video conferencing, chat, application sharing, electronic whiteboarding, and awareness with multipoint communications.

Prior to that, however, Congress recognized the need for distributed coordination and in 1999 "instructed the Department of Defense (DOD) and the Intelligence Community (IC) to address the lack of interoperability between fielded collaborative tools. To respond to this Congressional direction, the Office of the Secretary for Defense (OSD) and the Joint Staff (JS) established a Collaboration Tiger Team (CTT) composed of members from the Commanders in Chief (CINC) (unified commands), Services, and Agencies (C/S/A), with a two-fold mission: (1) Develop a strategy for implementing the use of collaborative tools throughout DOD, and (2) Define and validate a prioritized list of functional

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[4] About LANs, interestingly, iGov recently was awarded a $300 million contract that "will provide acquisition, engineering, integration, testing, fielding and training services for [Southern Command] SOCOM's Tactical Local Area Network. SOCOM, one of the military's nine major commands, located in Tampa, Fla., coordinates Army, Navy and Air Force special forces' units that perform reconnaissance of enemy forces prior to a military conflict, trains foreign forces in warfighting tactics, and tracks terrorists."

[5] P. A. Dargan. (2001). The Ideal Collaborative Environment. The Journal of Defense Software Engineering: http://www.stsc.hill.af.mil/crosstalk/2001/04/dargan.html

[6] MITRE is a "not-for-profit organization [that] develops and protects information systems for the US Department of Defense, the Internal Revenue Service, and the Federal Aviation Administration."

requirements for DOD collaborative tools." [7] As of May 2005, applications were still being accepted for the test process, although the Defense Collaboration Tool Suite has remained their interim choice (see below).

Other organizations were pursuing parallel courses. For example, the review by Lindvall, Rus, Jammalamadaka, and Thakker (2001) exemplifies both the continuing growth of collaboration technology, and its wide usage. Likewise, by mid 2003, the National Institutes of Health had performed an internal survey and identified these collaboration tools as being used by NIH at that time: AMBIS, Conference Server, eRoom, Exchange 5.5, Groove, GroupWise, Key Flow, Place Ware, Plumtree, Project Server, Share Point, Shared Folders (Exchange 5.5), WebDAV, and WebX. Of these fourteen resources, eleven were identified as recommended for use in the next two years: Conference Server, eRoom, Exchange 2000, Groove, Key Flow, Place Ware, Plumtree, Project Server, Share Point, WebDAV, and WebX. [8]

Yet, the progress of COTS collaboration tools, driven by commercial interests, has continued unfettered by the lack of any comprehensive and systematic military analysis. At the Department of Defense Human Factors Engineering Technical Advisory Group (TAG-47) annual meeting, Seymour (2002) provided the most inclusive unofficial view of COTS collaboration tools to that date, and discussed some of the more than 700 COTS or GOTS collaboration tools that were available at that time. That call for a coordinated and joint military direction and oversight continues to remain officially unacknowledged, yet was independently revisited by Gallaher and O'Rourke (2004). They recommended a "Navy-wide scale to evaluate the 181 collaborative technology tools currently in use."

It is important to note that collaboration progress is no better for the classified side of the military. Alexander (2005) reports that, "the intelligence community has not kept up with the Army. The 15 agencies of the community – ranging from the armed services to the National Geospatial-Intelligence Agency (NGA) – maintain separate portals, separate data, and separate people. The bad guys exploit the gaps, and your safety is on the line."

With practiced caution, the military is recognizing that gap. In December 2003, the Navy held its first Naval Information Technology (IT) Summit "designed to strengthen and align its Information Management/Information Technology" (IM/IT) (Pierce, 2004). The Department of the Navy (DON) IM/IT leadership team has recently published the DON IM/IT Strategic Plan for 2004-2005. [9] It specifies six goals, a few of which identify collaboration tools that are applicable here and are identified below. Finally, the 2005 International Symposium on Collaborative Technologies and Systems was held in St. Louis during May 15-19 with the support of the Air Force Research Laboratory. The principal technologies discussed included, "Human Collaboration, Jabber, Instant Messaging, Presence Awareness, Web-Services, Virtual Meetings (VMA), Video-Teleconferencing, Domain Tasking, KnowledgeKinetics™, Plug-in Architectures, and Java." [10]

Given the Defense Information Systems Agency's (DISA) long association with the digital collaboration concept, it may be constructive to discover what DISA considers useful for collaboration technology. "DISA says, it is using the COTS Tandberg systems, along with other COTS collaboration products (including IBM Lotus Instant Messaging, Bantu IM, and Wired Red conferencing products), to add new collaboration features to its expanding JWICS [Joint Worldwide Intelligence Communication System], the federal government's top-secret communications and collaboration system" (Mahowald, 2005). Moreover, "Air Force Lt. Gen. Charles Croom, the agency's new director, said in August that

[7] Source for 1999 Congressional initiative: http://jitc.fhu.disa.mil/washops/jtcd/dcts/index.html
[8] NIH Survey: http://enterprisearchitecture.nih.gov/brick_collaboration_tools.htm N.B. the new webpage is http://enterprisearchitecture.nih.gov/ArchLib/AT/TA/CollaborationToolsBrick.htm
[9] Which can be found here: http://www.doncio.navy.mil/fy05stratplan
[10] 2005 International Symposium on Collaboration: http://www.engr.udayton.edu/faculty/wsmari/cts05/DM3.htm

Net-Centric Enterprise Services (NCES) "is the only transformational program DISA has." General Croom also said that "the nine technologies in NCES need better explanations and the program may require more than nine" (Tiboni, 2005a). There is little doubt that DoD is moving toward the NCES and the start date was October 2005, however, the collaboration aspects are not widely known at this time. [11]

Collaboration Tools in Use Today

The identification and compilation in this report of thirty-seven collaboration technologies and tools in use by the U.S. military or the U.S. Government, while neither comprehensive nor systematic, serves as the base for exploring capabilities and functions considered necessary for military collaborative communication. These technologies and tools likely also serve as foundational for identifying the existing military collaboration state-of-the-art. With those caveats, the following collaboration tools and technologies have been grouped into three categories, and then listed alphabetically within each category. The three category groupings are: (a) modern collaboration technologies, in other words capabilities that permit the design, development, or enhancement of collaboration tools, (b) thirty-seven collaboration tools being used in the military or the U.S. Government, and (c) collaboration tools recommended for consideration by the military specifically for crisis response. To facilitate the objective of this report, identifying likely tools that can be used for military crisis intervention, only groups (a) and (c) are included in the report below, whereas group (b) can be found in Appendix A. In addition, one author (Seymour) is compiling a larger list that will address these topics which currently contains more than 100 collaboration technologies and tools.

RESULTS AND DISCUSSION

Modern Collaboration Technologies/Capabilities

The 14 most noteworthy technologies that deserve to be explored and exploited by every major U.S. military command for crisis collaboration are blogs, Bluetooth, chat, IM, pocket casting, podcasting, Radio Frequency Identification (RFID), RSS, video conferencing, [12] voice eXtensible Markup Language (voiceXML), voice over Internet protocol (VoIP), webcasts, and wikis. [13] Again, these are generally generic capabilities, not tools per se. They are technologies that support or can support collaboration, upon which tools are being created or enhanced at increasing faster rates. Each of these collaboration technologies is described briefly below.

[11] Rumor from the "deck plates" holds that, "DISA will provide NIPR and SIPR commercial collaboration services in early 2006 (RFP on the streets a/o December 9, 2005; expectation of an award will be made around mid February and two will be chosen) through the Network Centric Enterprise Services [program]."

[12] Although video conferencing has been available for about 30 years, until recently the technology precluded practically all but those willing to endure the small screens, large expense, jerky images, and other bandwidth issues. All of that is poised for change; see below.

[13] A Wiki is a writable web site, where the users have control over adding and deleting the content and pages

• **Blogs**: The explosion of blogs, represents but one capability that in its own right is exploding into variants each of which provides additional methods to collaborate. A brief background will be useful. "The term "weblog" may have been coined…in December 1997. The shorter version, "blog", was coined by Peter Merholz, who, in April or May of 1999, broke the word *weblog* into the phrase "we blog" in the sidebar of his weblog." [14] Originally blogging was a way to provide text to selected readers who would offer comment on the periodic postings. Today, however, we have audioblogs, moblogs (mobile blogs), photoblogs, etc. Thus this new blog technology continues to grow at extraordinary rates. Although in December of 2004 62% of Internet users reported that they did not know what a blog is, "8 million American adults say they have created blogs; blog readership jumped 58% in 2004 and now stands at 27% of internet users." Figure 1 below supports those data (Pew / Internet, 2005).

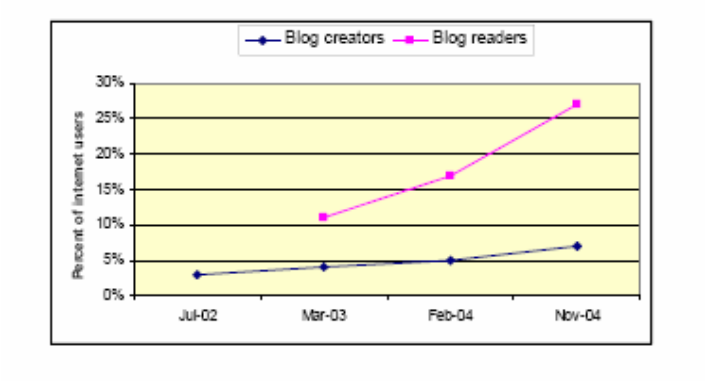

Figure 1. The growth of the blogoshere.

"A weblog (usually shortened to blog, but occasionally spelled web log) is a web-based publication consisting primarily of periodic articles (normally in reverse chronological order)" (Weblog, 2005). The Army Management Staff College uses blogs to support distributed learning. [15] Likewise, Federal government contracting uses a commercial blog host called BlogSpot.[16] Interestingly, the "Iraq war was the first "blog war:" Bloggers in Baghdad gained wider readership and one (Salam Pax) published a book of his blog. Soldiers serving in the Iraq war created "milblogs" [17] and provided readers a new perspective on the realities of war. Reading the thoughts of people who were "on the spot" provided a supplement to official news sources" (Weblog, 2005). The Mudville Gazette claims to serve as a resource for one of the largest collection of milblogs.[18] The power of blogs is exemplified by Kevin Sites who was honored by Wired Magazine in 2005 for "for rewriting the rules of war reporting." [19]

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[14] Source and introduction to weblogs: http://en.wikipedia.org/wiki/Weblog

[15] For the Army's educational use of blogs see page 10 of the January 2005 [Training & Doctrine Command] TRADOC Perspective: http://www.tradoc.army.mil/pao/TRADOC_Perspective/TP4.pdf

[16] Located at this site: http://profrex.blogspot.com/

[17] Milblogs were given focused attention by Hugh Hewitt in March 2004 at: http://www.weeklystandard.com/Content/Public/Articles/000/000/003/840fvgmo.asp Currently 284 participants contribute to the Milblog Ring, although many of them are not tactical. See: http://www.ringsurf.com/netring?ring=MiliBlogs;id=18;action=list

[18] http://www.mudvillegazette.com/ whereas the most famous military blog is called the Blogs of War: http://www.blogsofwar.com/ Interestingly, blogs quickly evolved into both photo blogs and video blogs: http://www.videoblogs.com/.

[19] That event last November when he was embedded with the 3rd Battalion, 1st Marine Regiment, can be read here: http://www.wired.com/wired/archive/13.03/rave.html?pg=8.

In another military domain, Alexander (2005) [20] is optimistic about using blogs on the classified side. He states that,

> "When I Google 'Afghanistan blog' on the public internet, I find 1.1 million entries and tons of useful information. But on Intelink there are no blogs….It's not far-fetched to picture a top-secret CIA [Central Intelligence Agency] blog about Al Qaeda, with postings from Navy Intelligence and the FBI [Federal Bureau of Investigation], among others."

On the other hand, in August 2005, the Army reported performing a "closer look at blogs and Web sites maintained by soldiers. Many such blogs and Web sites include photographs or other information that inadvertently exposes classified or sensitive information to anyone with access to the Internet. General Peter Schoomaker, the Army's chief of staff, noted that soldiers routinely post pictures online that include "tactics, techniques, and procedures" for weapons systems." According to Richard Cody, Army vice chief of staff, "The enemy is actively searching the unclassified networks for information, especially sensitive photos." (Federal Computer Week, August 30, 2005) [21]

• **Bluetooth**: "Bluetooth has become the most widely known short-range wireless communications standard. Defined by the Bluetooth Special Interest Group (SIG), the technology is quickly replacing various wired applications such as data cables for mobile phones and printer cables in office environments. Bluetooth has also found its way into several other applications in the automotive, industrial, medical and scientific sectors. Examples of such applications include remote metering and data collection, and wireless heart or blood pressure monitors….The Bluetooth SIG launched the Bluetooth 2.0 specification late last year. This was shortly followed by Bluetooth 2.0+EDR (Enhanced Data Rate). Bluetooth 2.0 is a refined version of previous standards and is fine-tuned to specific Bluetooth profiles. The EDR technology delivers 3Mbps transmission speed at minimal power." [22] The Air Force in particular has recognized the critical value of enabling digital technologies such as Bluetooth. [23]

- **Messaging Systems Overview**. The most common Internet and associated messaging systems include: e-mail, chat, IM, short message services (SMS) and multimedia message services (MMS). Discounting e-mail, the two most common, chat and IM, are discussed below.

• **Chat**: Chat is widely used tactically on Navy ships, and is a key communications tool for all the military services. Seymour (2001) discussed the use of chat rooms as they become recognized as useful for tactical missions. Recently, one Army organization professed this policy, "The use of chat software including American Online (AOL) Instant Messenger (IM) is prohibited on all Army systems. The only chat use authorized is that which is provided by Army Knowledge On-Line (AKO). ARL has attempted to remove AOL IM from ARL systems." Nevertheless, chat rooms can be found on every major ship in the Navy, as well as at many Air Force, Army, and Marine Corps commands. Chat, unlike IM (below) is typically accomplished at a workstation in a home or office.

• **Instant Messaging (IM)**: IM has been available for decades, but was used earlier mainly by computer professionals. In 1996 AOL pushed IM into the public eye with their buddy list, now copied

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[20] Kris Alexander is a Captain and military intelligence officer in the US Army Reserve.

[21] The following five popular military blogs support the notion that technology will be used and that consequently it is better used when managed: A soldier's thoughts (misoldierthoughts.blogspot.com), Boots in Baghdad (bootsinbaghdad.blogspot.com), Life in this girl's Army (sgtlizzie.blogspot.com), 365 and a wake up (thunder6.typepad.com), and Ma Deuce Gunner (madeucegunners.blogspot.com). Source: Federal Computer Week: Chris Dorobek on September 21, 2005 http://www.fcw.com/blogs/archives/editor/2005/09/soldier_blogs.html

[22] Bluetooth: http://www.telecom.globalsources.com/gsol/I/Bluetooth-headset/a/9000000063869.htm

[23] Air Force enabling technologies: http://www.stsc.hill.af.mil/crosstalk/2002/08/alford.html

widely by competitors. Buddy lists are like an interactive address book -- names essentially light up on your computer screen when someone online is ready to chat. There is no mystery as to when they will get your message (Seymour, 2001). The IM popularity has grown almost exponentially. Recently, the Air Force initiated the "Friends and Family Instant Messenger" program, available through the Air Force Portal. Not only can Airmen communicate on work-related projects, but also they can chat online with non-Air Force friends or family members. "Air Force Instant Messaging is the hi-tech end of Combat Care," said Gretchen Shannon, 48th Mission Support Squadron (MSS) Family Support Center Flight chief. "It allows families to reach across the miles in real time and have that connectivity." [24] The prime issue with IM is that there are dozens of tools that provide IM capabilities, but few interact with each other. A notable exception is Trillian, which can connect to several other different instant messengers such as: Yahoo Messenger, Microsoft Network (MSN) Messenger, ICQ (I Seek You), mIRC (my Internet Relay Chat), AIM (AOL instant messaging), and IRC (Internet relay chat). Another exception is BuddySpace (see below). In August of 2005 Google raised the bar by offering free phone and IM services to subscribers of their free Gmail (Google e-mail) accounts. [25] Moreover, using short message service (SMS), IM can be accomplished while walking down the street. [26]

• **Pocket casting**: "ComVu has created the world's first live video broadcast solution from a mobile device to a global audience. With the push of a button on a camera phone bloggers, citizen reporters, family members, friends and corporate professionals can broadcast live events to their communities - simply and inexpensively." "This is a world where everyone will be able to carry around a mobile outside broadcast studio in their pocket. Just strikes muffin here that this could lead to all sorts of stuff. Imagine never knowing who's filming who, for what purpose or when? DIY [do it yourself] reality TV en masse. The beta is free, and there will be free and Pro versions eventually." [27]

• **Podcasting**: Podcasting is a way of publishing audio broadcasts using the Internet. It allows users to subscribe to a feed of new files, and became popular in late 2004.[28] Interestingly, during the day, "Aviation Technician Chief (SW/NAC) [Surface Warfare/Naval Air Crewman] Todd Cochrane can be found at Commander, Patrol and Reconnaissance Wing-Two, but by night he is a talk show host broadcast worldwide. Cochrane hosts a technical 'podcast' show where he talks about different technologies on the market from video games to the latest software, and technical news." [29] There is a military podcast site: http://www.militaryspot.com/military-podcast.htm and both the Air Force http://www.podcast.net/show/17153 and the Army http://www.army.mil/srtv/SoldiersRadio/SRN.html support podcasts. Moreover, on August 5, 2005 IBM began using podcasting to share its strategic vision with investors and businesses. "Companies have streamed audio at Web sites for years. The advantage of a podcast is that audio information (and in the future, perhaps other media) can be downloaded to a PC, iPod, or other MP3 player, and then played at the recipient's convenience." [30] A podcasting kit costs $20. In October 2005 Yahoo became the first major search service to support the search for podcasts. Yahoo

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[24] Source Air Force Instant Messaging: http://www.lakenheath.af.mil/jet48/2005Folders/020405/news_messaging.htm

[25] "Google has announced a free service called Google Talk that lets e-mail account holders talk to each other using a PC, microphone, and speakers and provides instant messaging capability. Google reportedly plans to make the service compatible with other companies' services, basing it on an open standard, which would allow users to talk to people on competing systems. Users will not be able to make calls to landlines or mobile phones, however. The new service does not carry advertising." Source: Edupage, August 24, 2005.

[26] Interestingly, IM and SMS have evolved an abbreviated "language." See: http://www.transl8it.com/cgi-win/index.pl

[27] Source: http://www.redferret.net/?p=5846 or to visit ComVu use this link: http://www.comvu.com/

[28] Podcasting defined: http://en.wikipedia.org/wiki/Podcast

[29] Hawaii Navy News, July 27, 2005: http://www.hawaii.navy.mil/NewsPAO/HNN_Archive/050527/052705NAVYNEWSB.pdf

[30] IBM podcasts. InformationWeek, August, 2005: http://informationweek.com/story/showArticle.jhtml?articleID=168600396

estimates that five million people listen to podcasts. Podcasting has obvious educational benefits [31] but also tactical and crisis response applications too. Podcast Alley has a useful directory, and an introduction can be found here (CNET.com).

• **RFID:** Radio Frequency Identification is being used in DOD for logistics, and likely will expand its use in the near future. "On July 30, 2004, the Acting Under Secretary of Defense for Acquisition, Technology, and Logistics signed a memorandum outlining policy for the use of RFID within the Department of Defense (DoD). The strategy calls for taking maximum advantage of the inherent life-cycle asset management efficiencies that can be realized with integration of RFID throughout DoD." http://www.acq.osd.mil/log/rfid/index.htm

• **RSS**: RSS stands for Really Simple Syndication. "RSS is a family of XML file formats for web syndication used by (amongst other things) news websites and weblogs." [32] The U.S. Army War College provides an explanation of RSS here: http://www.carlisle.army.mil/usacsl/whats_rss.asp as does the U.S. Joint Forces Command (USJFCOM): http://www.jfcom.mil/rss_fact.htm. The reason RSS is a critical technology for the military is that in the future commands will use it to customize their hourly information input. "Millions of people today are using RSS to get their news, customized to fit their tastes. Most don't know it--but anybody who uses My Yahoo's news feature is consuming data via RSS." [33] Within five years every major command center in the U.S. military will be using RSS, or some advanced version, to segment and process its intelligence and unclassified data and information input. The USJFCOM RSS site can be found here: http://www.jfcom.mil/rss_fact.htm. Another introduction to, and recommendations for using, RSS can be found here: http://www.askbobrankin.com/what_is_rss.html, which makes recommendations for aggregators that support Windows, Mac, and Linux platforms. Not only will the military have to use RSS aggregators to acquire information, but they also will be required to create reports that support the RSS format to support rapid collaboration among the many distributed crisis teams that evolve during any major National catastrophe. The DoD Newsreader Feed resource can be found here: http://www.defenselink.mil/news/rss/ .

• **Videoconferencing**: As mentioned above, although video conferencing has been available for about 30 years, the technology precluded practically all but those willing to endure the small screens, large expense, jerky images, or other bandwidth issues. All of that previous frustration is poised for change (Regenold, 2005). The current shift from Integrated Services Digital Network (ISDN)- to IP-focused videoconferencing reflects the newest technology advances. Moreover, Regenold (2005) offers seven cogent reasons why the promise of desktop webconferencing "at long last, may have arrived." Currently the Army is using video conferencing to connect families with warriors in Iraq. [34]

• **VoiceXML**: "VoiceXML, or VXML, is a markup language like HTML. The difference: HTML is rendered by your Web browser to format content and user-input forms; VoiceXML is rendered by a voice browser. Your application can speak to the user via synthesized speech or by prerecorded audio files. Your software can receive input from the user via speech or by the tones from their telephone keypad. If you've ever built a Web application, you're ready to get started with your phone application . . . . As in

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[31] "Purdue University has begun providing podcasts of lectures for certain courses. Purdue offers recordings for students who miss a class or who want to review specific lectures. Previously, recordings were available for about 100 courses but only on audio cassettes. Starting this fall, recordings for lectures from some courses are available as MP3 files, allowing students to download the recordings." Chronicle of Higher Education, 31 August 2005.

[32] RSS is explained here: http://en.wikipedia.org/wiki/RSS_%28file_format%29

[33] Needleman, R. (2005). Small Business Technology. CNET. http://reviews.cnet.com/4520-3000_7-6299586-1.html?tag=txt&tag=nl.e501

[34] See the report titled, "From Iraq, a smile for folks at home High-Tech Hello: Videoconferencing changes the way soldiers keep in touch" in the San Francisco Chronicle, July 24, 2004: http://sfgate.com/cgi-bin/article.cgi?file=/c/a/2004/07/24/MNGQC7SL491.DTL

the old days, you can still rent a telephone line and run commercial voice recognition software and text-to-speech (TTS) conversion software. However, the most interesting aspect of the VoiceXML revolution is that you need not actually do so. There are free VoiceXML gateways, such as Tellme, BeVocal, and VoiceGenie. These take VoiceXML pages from your Web server and read them to your user. If your application needs input from the user, the gateway will interpret the incoming response and pass that response to your server in a way that your software can understand. . . . You use a Web form to configure the gateway with the URL of your application, and it will associate a telephone number with it. In the case of Tellme, your users call 1-800-555-TELL, dial your 5-digit extension, and now they're talking to your application." [35]

• **VoIP:** Voice Over Internet Protocol has been evaluated by military commands for several years. "A part of its project management service offering, DTS-W [36] offers ongoing project management support and connectivity for Voice over Internet Protocol (VoIP) technology. Although DTS-W does not provide VoIP equipment, it assists its customers in: Obtaining connectivity (DSN and dial-tone), Selecting and procuring the necessary switches and equipment, and Managing the installation and support of VoIP implementations." Moreover, VoIP is being used over military networks under battle conditions, and the U.S. Marine Corps has been proactive in implementing this technology in the field, especially at its innovative Unit Operating Centers (UOC). [37]

• **VPOs:** A Virtual Program Office application is designed to enable geographically dispersed teams to work collaboratively via the web. It is based on the IBM / Lotus Domino technology, and is exceptionally robust and secure. Features include secure access from anywhere, calendar, member contact list, document view and revision capability depending on membership status, etc. See: https://vpo.spawar.navy.mil/

• **Webcasts**: Webcasts are a type of digital information pull system wherein personnel can obtain information (typically used for education and training) over the Internet. The Navy "Summex Health Management has sponsored a monthly Webcast since 2003 on a variety of health management topics. The Webcasts are designed for wellness program managers, human resource staff, medical directors, chief financial officers, health plan managers and administrators." [38]

[35] VoiceXML is defined here: http://philip.greenspun.com/seia/voice/

[36] The Defense Telecommunications Service—Washington organization (DTS-W) "acquires cost-effective, responsive and flexible telecommunications products and services for the DoD within the National Capital Region (NCR) in accordance with DoD Directive 4640-7, DoD Instruction 5335.1 and AR25-1, Army Information Management, Sections 2.7 and 6.3." https://secureapp2.hqda.pentagon.mil/dtsw_cms/index.cfm

[37] cf. Miller, 2005.

[38] Here is a list of webcasts available to Navy commands: http://www-nehc.med.navy.mil/hp/Summex.htm .

• **Wikis**: The general consensus is that, "Wikis Make Collaboration Easier" but they are not foolproof (Goodnoe, 2005). "Blogs and wikis are increasingly being used in collaborative educational settings…. Wiki is Hawaiian for "quick," and is a method for MANY users to create and edit web page content quickly and easily. A Wiki is . . . the simplest online database that could possibly work." [39] A recent report by, Wei, Maust, Barrick, Cuddihy, and Spyridakis (2005) reported that, "Wikis allow distributed teams to collaboratively write and edit documents through the Internet in a shared online workspace, without the need for special HTML knowledge or tools. The flexibility of wiki technology is a boon for increased cooperative work on large team projects." The author knows of no official military wikis in use, but noted that all branches of the military refer to, and provides links to, the Wikipedia, if not others. For example, Chips, [40] the Navy's premier information technology periodical provided a link to Wikipedia that described the 802.11i wireless Ethernet security standard. [41] The Space and Naval Warfare Systems Center in San Diego recently installed a wiki for internal use by young professionals to support new technology.

[39] Navy Human Performance Center: https://www.spider.hpc.navy.mil/index.cfm?RID=WEB_OT_1001257.
[40] http://www.chips.navy.mil/archives/04_fall/Web_pages/grid_computing.htm .
[41] http://en.wikipedia.org/wiki/IEEE_802.11b .

Specific Collaboration Tools for Crisis Collaboration

More than fifty collaboration tools, from Arel Anyware and Articulate [42] to World Crossing and Zeosoft having unknown usage patterns associated with official U.S. military organizations were identified as potentially useful for crisis collaboration. Given that at least a few U.S military organizations are (or have been) using these tools, the expectation is that military commanders or teams in a distributed collaborative environment would benefit from the use of these tools. Such tools not only indicate the explosion within the digital collaborative sphere and the need to find and share information at speeds unparallel in history, but they also signal the non-linear digital future. Although all of these collaboration tools deserve some consideration, that would not be possible in this report. Consequently, fourteen collaboration tools are identified below as likely collaboration resource options for most military organizations, especially those with crisis response missions. The decision process was not easy, but consideration was given to tools that were relatively mature, tools that exploited the newer technologies, tools that received good reviews, and open source tools. Not all of the following met all four criteria equally well, but this is the list that stands out in that regard. Also, open source is considered critical for the DoD which should create its own "tiger-teams" that would compare and contrast the various open source tools, choose the optimal tool(s), and then would modify the application's open source code with security features and task specific enhancements. All of the tools are discussed briefly below. Five of these tools however (indicated by a ☑) were selected for more detailed attention. Their analysis and review is emphasized because they are particularly representative of the newer collaboration technologies with potential for use during crisis collaboration. Thus, the following collaboration tools should be given serious consideration and analysis in terms of the collaboration models discussed herein, as well as their capability to support military crisis response.

• **Citadel**: "Citadel is a different kind of messaging and collaboration platform. While others focus on automating business processes, Citadel focuses on connecting communities of people together. Users love Citadel because its software that helps them work, play, stay in touch... without calling attention to itself. A Citadel system is made up of containers called "rooms." A room may be used as an email folder, a discussion forum, a real-time chat, a mailing list, a calendar, an address book, an RSS sink ... sometimes a combination of any of the above, and certainly any other uses which could be added in the future. Furthermore, you can replicate rooms between multiple Citadel nodes, allowing you to set up a federated, distributed messaging environment." [43]

• ☑ **FlashMeeting**: Remember NetMeeting? This is the high tech version. "FlashMeeting is a project of The Centre for New Media, which is a part of The Knowledge Media Institute, based at The Open University, Milton Keynes, UK. It is a simple but sophisticated web based 'meeting' tool, allowing a group of people to setup and have a meeting with each other using the internet. As long as you have an internet connection you can join a FlashMeeting anywhere in the world." Given that FlashMeeting was written in Macromedia Flash and is low-bandwidth friendly, it should be considered for Navy ships and other "field" uses in the military. [44] Given the military requirement for documentation, especially during any crisis, FlashMeeting has a complementary product called FlashMeeting Memo, which supports the direct reference of any part of a live session recording contributed by any one of the participants. According to Good (2005), [45] "This feature has much more important implications than, for example, the ability to reference any individual paragraph or section in a rich text-based document. While a text

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[42] Articulate can be considered a collaboration tool only in the sense that practically all of the typical collaboration tools use the Internet and the five Articulate tools significantly enhances the presentation of information that "rides" the Internet. See: http://www.articulate.com/

[43] See: http://www.citadel.org/ .

[44] http://www.flashmeeting.com/

[45] The entire Good comment can be read here: http://www.kolabora.com/news/2005/01/19/accessing_individual_bits_in_a.htm

document can be "scanned" easily, a rich media file, like an audio or a video recording, cannot be easily browsed yet. However, by allowing granular referencing down to the level of each individual voice intervention, while adding the ability to create a unique URL for each one, a vast number of opportunities for the effective use of live event recordings are opened up." Providing a hyperlink in a message to a document or a webpage is easy. Imagine being able to provide a hyperlink to one audio or video sentence by the Commander during a crisis.

• **Glance 2**: Glance is a real time desktop sharing tool that allows up to fifteen distributed participants to see exactly what you show them on your desktop. They do not need to download anything; they have no costs, and need only use any common browser. Although designed for sales, it can be used for sharing any information or data that needs to be shared within a small distributed group. [46]

• ☑ **Holocene Conversation Mode:** "Holocene Chat is a distinctively new (patent pending) approach to real-time online communications. Initial versions will quickly replace the 30-year old "chat" standard of interrupted, upward-scrolling lines with a graphical interface incorporating more than two dozen skills that people use in the real world, during spoken conversation." This new approach lets "people self-organize by distance, orientation, time, reputation - as in real life, and provide services that make conversation useful. . .cheap, easy, low bandwidth way for neighbors to self-organize in a crisis. More effective than any chat room. Faster than email." [47] [48] It can be used in any browser in real time, and provides much better situation awareness than any chat heretofore designed.

• **GoToMeeting**: "Citrix GoToMeeting is the most robust Web conferencing and collaboration offering available. Not only does Citrix GoToMeeting have all the necessary features to hold effective and successful online meetings, training sessions and collaboration gatherings, but it is the easiest and most cost-effective solution on the market. Citrix GoToMeeting is truly the most robust web conferencing and collaboration product available." [49]

• **Hexagon**: Hexagon is another "project of The Centre for New Media, which is a part of The Knowledge Media Institute, based at The Open University, Milton Keynes, UK. It is a simple but sophisticated web based 'presence' tool allowing a group of people to stay in touch with each other within a private, persistent, virtual 'room'. As long as you have an internet connection you can join 'your' Hexagon community anywhere in the world." [50]

• ☑ **JotSpot**: JotSpot identifies itself as an application wiki. In fact, Joe Kraus, co-founder and CEO, calls it "the first application-wiki company." It is likely one of the easiest to use collaboration enabled web page building tools available. One can create dynamic tables, and attach any type of file. The Application Gallery allows the installation of specific tools. [51] This tool deserves serious consideration. One reviewer wrote, "In a few minutes, I created a form using simple scripting. In about the same time, I built dynamic tables with drop-down menus for displaying and updating data. And, with JotSpot, you're not limited to using your own information. I had no trouble displaying a map from MapQuest, a Yahoo News search result, and even a view of Salesforce.com (Profile, Products, Articles) data in my pages.

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[46] See: http://beta.glance.net/site/home.asp

[47] "The invention, called Holocene Conversation Mode ("HCM"), takes advantage of the observation that human beings utilize a number of real world characteristics to participate in, perceive, control, and glean subtleties from conversations. These characteristics include proximity and orientation of a listener to other speakers, memory ageing, emphasis by a speaker, relative importance or reputation of a speaker, and the unique human ability to "filter" words of special interest to a listener from overheard conversations of many other speakers." See: http://www.holocenechat.com/

[48] A useful 1.2 MB PowerPoint presentation is available here: http://www.holocenechat.com/hcs.ppt. The subtitle of that presentation is "Meeting-ware, Real-time Conversation Spaces, Useful Virtual Worlds."

[49] See: http://www.citrix.com/English/PS2/products/product.asp?contentID=13976

[50] The URL is: http://hexagon.open.ac.uk/index.html .

[51] See: http://www.jot.com/index.php.

JotSpot's application gallery takes this process to the next level. Need a help-desk or CRM solution? Just browse the library, click the Install button, and it's loaded into your wiki — to be used as is or modified. Except for a few editing features that weren't yet operational, JotSpot looks to be a tough service to beat if you're creating applications around wikis." [52]

• **MERBoard**: Also known as the Blueboard, NASA (National Aeronautics and Space Administration) uses it to share information.53 "The MERBoard places information and images literally at the fingertips of the Mars Exploration Rover (MER) scientists and engineers. They can quickly and easily share, view, annotate, and store data and images with the touch of a finger, using drag and drop functionality." [54]

• **Ourmedia**: Ourmedia is an example of the democratizing of information that will require careful analysis and study to avoid its pitfalls and exploit its strengths. The concept behind Ourmedia is that it "is a project allowing any person with net access to publish their text, image, audio and/or video files for public consumption, for free, with the promise of permanent web presence as long as the host, the Internet Archive, exists." [55]

• ☑ **phpGroupWare** "formerly known as webdistro - is a multi-user groupware suite written in PHP. It provides about 50 web-based applications, as there are the Calendar, Address Book, an Advanced Projects Manager, Todo List, Notes, Email, Newsgroup- and Headlines Reader, a File Manager and many more Applications. The calendar supports repeating events and includes alarm functions. The email system supports inline graphics and file attachments. The system as a whole supports user preferences, themes, user permissions, multi-language support and user groups. It includes modules to setup and administrate the working environment. The groupware suite is based on an advanced Application Programming Interface (API)." [56]

• **R-CAST**: R-CAST is unique in that it supports collaborative activities among teammates comprised of both humans and software systems. R-CAST was designed at Penn State University, and recent experimental research has been described in a paper, "Extending the Recognition-Primed Decision Model to Support Human-Agent Collaboration," presented in July 2005 by John Yen at the Fourth International Joint Conference on Autonomous Agents and Multi-Agent Systems in Amsterdam. The U.S. Army Research Laboratory supported the research. [57] Given the recent interest in Augmented Cognition by DARPA, the R-CAST technology could be explored for tactical and operational utility.

• **smartMeeting**: "smartMeeting is designed to be feature rich but not over engineered. Users benefit from intuitive and easy to use functionality that addresses their every day key communication and collaboration needs." [58] It was highly rated by Kolabora.[59]

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[52] See: http://www.infoworld.com/article/05/03/28/13FEblogwiki-rev1_1.html .

[53] IBM created the MERBoard. "BlueBoard is an architecture for making information easily available to people no matter where they are. It is a 50-inch touch-sensitive plasma display that integrates easy-to-grasp interface functions to make it significantly easier for groups of users to access, share and annotate content from their desktop. It is intended for use as a collaboration tool within a corporate environment to support fast encounters and spontaneous meetings, but has also been the inspiration for NASA's customized version of this technology (referred to as MERboards)." See: http://www.almaden.ibm.com/software/user/BlueBoard/index.shtml

[54] See: http://www.cict.nasa.gov/assets/pdf/033_CICT_IS_MERBoard_A_web.pdf

[55] Ourmedia report: http://www.worldchanging.com/archives/003299.html

[56] See: http://www.phpgroupware.org/. Note: the PHP scripting language was cited as one of the five best open-source products favored by commercial companies and winning support in government IT shops (Joch, 2005).

[57] For R-CAST contact Margaret Hopkins mhopkins@ist.psu.edu or 814-865-7888.

[58] See: http://www.smartmeeting.com/

[59] Kolabora said, "This is the way you will meet in the future. A virtual immersive 3D office space in which you can gather, talk, present and discuss with your customers and peers. A secure, virtual office, which offers better than collaboration facilities than any videoconferencing solution while requiring only a 28.8 modem." Their evaluations are located here: http://www.kolabora.com/tools.htm

• **Socialtext**: “The Web isn't so much a place anymore, explains Ross Mayfield, CEO [Chief Executive Officer] of Palo Alto (Calif.)-based startup Socialtext Inc., which offers services to create collaborative Web sites called wikis. It's more of a doorway into services, from the user-written reference site Wikipedia to the community organizing service Meet up to the folksy classifieds site Craigslist” (Hof, 2005). One reviewer wrote, “It is as simple as working inside a normal text editor**.** Text can be formatted very easily, and making a change to an online document requires only a few seconds. Weblogs and RSS are integrated from day one. You can also create as many "workspaces" as you want and utilize each one of them to manage a different project or workgroup. Each workspace is in fact associated with the people you select and it is extremely easy to remove or invite new team members. SocialText wiki workspaces generate email notifications, RSS feeds and Update pages that allow any team member to easily monitor and track any progress and changes to the workspace without needing to access it directly. Everything that is composed, edited and written in the wiki maintains a full track record of the changes made, and the administrator(s) can easily revert any document /web page to any previous state it was in. Workspaces in the SocialText wiki can also receive emails from any of the team members, which are immediately organized and made available to all the other workspace members. For my own experience, this is indeed a great collaboration technology that can be extremely useful to virtual teams of non-technically oriented people. It bridges ease of use and access with all the advantages of being web-based and open to any operating system.” One of the few downsides was cost at $30 per month per user.

• ☑ **WiredRed Web**: “Two features distinguish the WiredRed collaboration server from its competition: First, it has extremely small server software requirements. Second, it almost exclusively focuses on deployment inside an organization's firewall…. The product's video and VOIP support is strong, and the solution provides a good collaborative workspace. We were also impressed with WiredRed's security options.” (Garza, 2005). According to their webpage (http://www.wiredred.com/), their e /pop web conferencing software is being used by 3,500 organizations including the U.S. Army and Air Force. According to Garza (2005), “WiredRed supports three types of conference attendees. First, the host is responsible for all aspects of the conference, including content and user privileges. Second, presenters can share documents and their desktops with other conference attendees. Third, participants can view only the presentation. As in Macromedia Breeze, a host can easily promote a participant to become a presenter. But all three attendee types can have video and VOIP inside a conference, a trick that Breeze did not achieve. This environment creates a user-friendly videoconference with collaborative document facilities. WiredRed users can record conferences in a variety of formats. Unlike Breeze, WiredRed allows users to share Word and Excel files without needing to convert to a Flash format. They also can view PowerPoint documents. WiredRed includes five default layouts, optimized for different presentation types and styles. Although WiredRed layouts are harder to manipulate than Breeze's pods, they work well. Hosts can also control the screen layout of participants by using the Apply My Layout function, which pushes the host's layout to all attendees. WiredRed also has a plethora of security offerings, including …Data Encryption Standard (DES), 3DES [Triple Data Encryption Standard (168 Bit)], Advanced Encryption Standard, RSA encryption algorithms and certificate support. Overall, we found WiredRed's e/pop straightforward, elegant and easy to use. WiredRed is more effective as a collaborative tool with multipoint video and VOIP than other products that are focused on one-to-many presentations.”

Implications: Crisis Planning and Collaboration 2010

Leveraging the Seymour (2002) appraisal, and subsequent to this 2005 review of the military collaboration technology landscape, the junior officers and senior enlisted tend to be reaching forward to explore the new technologies. Examples include blogs, chat, podcasting, RSS, and wikis. Moreover, the various services are using a wide set of collaboration tools, few if any of which interoperate, much less support each other. The primary implications for the current status of U.S. military collaboration technology usage are that: (a) inter-service coordination and collaboration are more limited than necessary, (b) security issues become too diffuse thereby increasing the risk at all levels of military operations, (c) training costs become unnecessarily large (cf. Softskills, 2004), (d) the current military

collaboration technology capability inevitably ranges from poor to exceptional, and (e) the likeliness of any effective coordinated response during a national catastrophe using the current set of collaboration tools is extremely low.

However, the U.S. military and Government collectively have moved forward in their use of digital collaboration tools, and yet the lack of coordination and interoperability has never been wider. Nevertheless, we should be optimistic. USJFCOM has already funded a task team to survey the administrative, tactical, and operational U.S. military collaboration requirements and has created a roadmap (Schneider, 2005). Military crisis and tactical response teams of tomorrow will incorporate collaboration and media technology unlike anything being used today or even under consideration. Imagine a distributed team whose job it is to keep track of certain topics or regions, and which use the functionality of Breeze, Crayon, Columbia Newsblaster, JetEye and Shadows collectively. The collective use of sets of modern collaborative tools represents the optimal empowerment of both standing crisis action teams, as well as any future ad hoc crisis collaborative teams.

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[60] The hyperlinks in the footnotes and in this section and elsewhere are provided as a convenience and resource to support knowledge exchange. However, hyperlinks are commonly known to have brief "life spans" as web pages change frequently, and thus the hyperlinks cannot be guaranteed to function beyond the submission date (April, 2006) of this manuscript.

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Appendix A

Other Military or Government Collaboration Tools

The following 37 collaboration tools and services were identified as being used at large or smaller commands somewhere in the U.S. military or the Federal Government. Likely, this list is not comprehensive, yet it signals a presumably unrecognized generic requirement for collaboration capability, and each tool does serve some utility somewhere in the Federal Government. Moreover, one author, Seymour, is in the process of compiling a large list of current collaboration technologies and tools, which numbers more than one hundred.

• **Advanced Reality**: "Presence-AR is the first, real-time collaborative platform to deliver digital collaborative experiences spanning participants, applications, devices, and platforms. Far beyond screen or file sharing, Presence-AR enables existing and new applications to support multiple people working on one or more files or applications synchronously." [61] [62]

• **Army Knowledge Online (AKO):** "Launched in 2001, Army Knowledge Online is Yahoo! for grunts. All the things that make life on the Net interesting and useful are on AKO. Every soldier has an account, and each unit has its own virtual workspace. Soldiers in my reserve unit are scattered throughout Texas, and we're physically together only once a month. AKO lets us stay linked around the clock" (Alexander, 2005).[63]

• **Bantu**. Bantu Instant Messaging (IM) and Presence Platform provides organizations with an IM technology that -- from an information security perspective -- offers significant advantages over many IM alternatives, including: (a) The ability to integrate with enterprise authentication systems, (b) Encryption of message traffic between users, and (c) Lack of support for file transfers (which means the product cannot be used to introduce malicious mobile code into the Department of Defense (DoD) computing infrastructure, a threat intrinsic to many other IM solutions). GCCS personnel use it to communicate system upgrades and fleet problems.[64]

• **Basecamp**: "From small and big businesses managing their client and internal projects, to professors managing their classrooms, to individuals managing their home improvement projects (and weddings), everyone is using Basecamp to keep whatever it is they're working on organized and on track."[65]

• **Breeze 5:** Breeze, owned by Macromedia, "is a rich web communication system that lets you reach your audience anytime with engaging multimedia content. And, because Breeze is deployed using Macromedia Flash Player, already installed on more than 98% of browsers worldwide, your audience can join your Breeze online meetings, training courses and on-demand presentations instantly."[66] The "U.S. Naval Air Systems Command (NAVAIR) uses Breeze to provide on-demand, standardized computer-based training to 30,000 employees worldwide."

• **CD/DVD**: Although this is considered more of a capability as opposed to a tool, it serves as another compelling example of what can be called the "Insider Democratization" of information. For example, Army soldiers in Iraq created a music CD called "Live From Iraq." Much of the content of this CD is a sharp contrast to what is being published by official civilian and military news sources. An example is a

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[61] The Advanced Reality website is located here: http://www.advancedreality.com/ar/index.html
[62] The Army CIO/G6 lists this tool: http://www.army.mil/ciog6/links/links_home.html .
[63] The AKO can be found here: https://www.us.army.mil/suite/login/welcome.html .
[64] The 2002 DISA white paper on Bantu can be found here: http://iase.disa.mil/stigs/whitepaper/bantuwhitepaper12-13-02.doc .
[65] http://www.basecamphq.com/index.php .
[66] http://www.macromedia.com/software/breeze/ .

12-minute audio interview with Sergeant Neal Saunders, "who constructed his own studio and produced a brutally honest hip hop album while stationed in Sadr City, Baghdad."[67]

• **Collaboration at Sea** (CAS): Collaboration at Sea is based on the IBM / Lotus Sametime / Domino collaboration toolset, and is used currently by the planning (J5 and N5) community of interest (COI) because of their need to support multilevel secure operations with coalition partners. [68] Early uses of CAS included the "USS John C. Stennis and USS George Washington Battlegroup's use during 1999-2000, and following that, the USS Carl Vinson's success with Knowledge Web (K-Web) in 2001-2002" (Natter, 2002). The Commander, Joint Task Force (CJTF) 950 and the Second Fleet/NATO Striking Fleet Atlantic have used CAS. Since then the Navy has shared CAS with a large number of its coalition partners.[69] CAS is the first collaboration system being used by the Navy that is moving into a program of record (i.e., acquisition funded as opposed to using O&M funds) via the CENTRIX (Combined Enterprise Regional Information Exchange) program of record. Thus, it is coalition specific.

• **Collaborative Information Environment** (CIE): The USJFCOM J9 supports CIE. Beginning "in November 2003, CIE developers and engineers provided actual working prototypes of the CIE to U.S. Southern Command (SOUTHCOM) and U.S. Pacific Command (USPACOM)."[70] Recently, CIE "garnered the U.S. Joint Forces Command (USJFCOM) a prestigious award. The award from the E-Gov Institute was for 'best practice in a public sector organization for innovative knowledge management (KM).'" [71] CIE is funded by the Standing Deployed Joint Task Force (SDJTF) project.

• **CollabWorx**: "CollabWorx has taken a unique approach to providing collaborative solutions with its CollabWorx Platform. Building collaboration and communication solutions on this platform offers benefits over either of the two traditional approaches: implementing a packaged, "out of the box" solution, or implementing a custom-built solution." This tool is used by the Army Training Support Center in Fort Eustis, VA. In September 2005, the US Army DITSCAP ATO provided CollabWorx with certification for web-based audio/videoconferencing[72].

• **Composable FORCEnet** (CFn): According to a Navy message dated September 1, 2005, the Seventh Fleet Maritime Operations Center watch standers took CFn and turned it into a tool for expeditionary operations including amphibious assault planning and sustainment ashore of the follow-on and follow-up echelons. CFn is a product of the Space and Naval Warfare Systems Center, San Diego. [73]

• **Defense Collaboration Tool Suite** (DCTS): Supported by DISA, DCTS is a "flexible, integrated set of applications providing interoperable, synchronous and asynchronous collaboration capability to the Department of Defense's agencies, Combatant Commands and military services…. Initial fielding of DCTS V1.1.12 began in April 2002. By June 2003, DCTS V2.0 Phase I was installed at 101 sites

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[67] http://www.onthemedia.org/stream/ram.py?file=otm/otm081905g.mp3 .

[68] The JFCOM CAS website is located here: http://www.jfcom.mil/newslink/storyarchive/2004/no061604a.htm .

[69] Moreover, Admiral Natter says, "Their pioneering efforts have paid off during Operation Enduring Freedom, as the Enterprise, Theodore Roosevelt, and John F. Kennedy battlegroups have adopted and expanded collaborative planning to support strike missions into Afghanistan, MIO and amphibious operations, logistics, and command and control. Mission briefings and operational data posted to replicated Web sites, the use of various collaborative tools such as MS Chat, Sametime Chat, and Instant Messaging, and application sharing have dramatically increased information flow and situational awareness, facilitating better decisions by commanders at every level. Most importantly, it has helped the Navy rapidly and effectively carry the fight to the enemy, at and from the sea, for a sustained period of combat operations. We could not have done it as well without the benefit of globally networked collaborative planning tools." The overlap between CAS and the IBM Lotus Sametime <http://www.lotus.com/products/product3.nsf/wdocs/homepage> remains unclear.

[70] USJFCOM CIE: http://www.jfcom.mil/newslink/storyarchive/2003/pa121103.htm

[71] Source: Space and Naval Warfare Systems Center San Diego Outlook, August 26, 2005.

[72] See: http://www.collabworx.com/Products/whycollabworx.html .

[73] http://enterprise.spawar.navy.mil/getfile.cfm?contentId=912&type=R .

worldwide, with another 56 sites to be installed in 2003 at all combatant commands, their major components and all the services. Fielding of DCTS V2.0 Phase II, with several user enhancements, is scheduled to begin in 4th Qtr FY 03." [74] According to Powers (2004), as of "January 2004, DCTS V2 P1 is installed at 138 sites worldwide, at all combatant commands, major components and services, with another 218 planned for 2004. DCTS will remain in place until the Next Generation Collaboration Service (NGCS) is on-line in 2005 or 2006." This suite was "recommended as the interim standard DoD tool set by the OSD/Joint Staff Collaboration Tiger Team" (mentioned above). DCTS is the collaborative tool suite used for interoperability collaboration on the STRATCOM Command and Control LAN. It provides real-time and asynchronous collaboration using voice, video conferencing, document and application sharing, combined with instant messaging to assist in the planning and management of crisis situations. It is used by many military commands to support the mission planning process. DISA reports that, "As of February 2005, DCTS Version 2 is installed at 184 sites worldwide, including all combatant commands, major components, and services, with additional installations planned. DCTS will remain in place until an enterprise collaboration service takes over the operational load (in 2006 or later) under the Net-Centric Enterprise Services Program" (NCES). [75]

• **Digital Dashboard**: The Microsoft Digital Dashboard version 3.0, as part of the Collaboration Management Office (CMO), was approved by the Joint Interoperability Test Command (JITC) in 2002, at which time it was being used by the U.S. Marine Corps (McKenna, 2001). Owned by Macromedia, the Digital Dashboard was originally part of the DCTS (see above), and is being used by a unit of the California National Guard[76].

• **eKM** (Enterprise Knowledge Management): "eKM creates a shared environment for disparate organizations that have geographically dispersed locations. It is a web-based collaborative suite of knowledge management tools used to capture and manage documents, link command members through Communities of Practice (CoP), manage business processes, and provide ready access to command and enterprise information via search engines." It was used during JWID 2004, and currently is supported by the Air Force Research Laboratory, by PACFLT, and the submarine community. [77]

• **eRooms**: The Office of Foreign Disaster Assistance uses eRooms and Abacus[78]. In 2002, eRooms was offered as part of the NMCI COTS Catalogue Contract at the Space and Naval Warfare Systems Command. The monthly service cost was $32 per seat. [79]

• **Groove**: Groove, a subsidiary of Microsoft, is a collaboration tool allowing "users the ability to work collectively on a project. Multiple users can log on together or work individually within a shared space that contains the information (e.g., documents, etc.) that they are working on. Users will not have access to a shared space or associated information unless they have been invited to, and accept, the invitation to participate. If a user is uninvited, new keys are distributed by Groove to all remaining participants." The Department of Homeland Security uses Groove, primarily because of its encryption capability, and because the audio is also encrypted. The U.S. Department of State "used Groove to coordinate the establishment of the U.S. Embassy in Baghdad. Gallaher and O'Rourke (2004) reported that 27 percent of

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[74] DCTS Resource: http://www.disa.mil/main/prodsol/dcts.html

[75] Rumor "from the deck plates" has it that, "JITC [Joint Interoperability Test Command] collaboration [DCTS] certification stood down in 2005 (and DCTS will be sunsetted in 2006). You can continue to use JITC certified collaboration tools, even if they do not meet DoD IT Standards Registry guidelines until 2007, wherein they **must** meet DISR. By the way, there are few (if any) truly *interoperable* collaborative tools in the commercial market today."

[76] http://appserv.gcn.com/23_34/dodcomputing/28059-1.html .

[77] Submarine Group 10 comment can be found here: http://www.chips.navy.mil/archives/04_spring/web_pages/KM_training.htm

[78] See: http://tinyurl.com/9sn6g .

[79] NMCI COTS Catalogue: http://www.nmci.navy.mil/Primary_Areas/Contract/Content/Files/Contract_Artifacts/PMods-_1_thru_100/N00024-00-D-6000_P00042.pdf

their Naval Postgraduate School survey respondents reported using Groove. Additionally, the U.S. Army Corps of Engineers uses Groove as part of its common operating environment that promotes the sharing of knowledge and expertise among the organization's divisions and with partners." [80] [81]

• **Human Performance Center Spider**: HPC-Spider: is "the Navy's premier online resource for human performance and training technology for lifelong learning." Although primarily a resource tool, it does support 37 discussion links that include chat rooms, and 23 listservs links[82].

• **Hummingbird**: "Hummingbird Enterprise 2004 - Collaboration is a highly secure, Web-based collaborative workspace for dispersed teams across and beyond the enterprise. It enables businesses across the entire industry spectrum to streamline collaborative processes, enhance team productivity, and speed the delivery of targeted results in any collaborative activity." Apparently (based on their website), Hummingbird is either in use by or has been tried by the Air Force Personnel Center, Air National Guard, DoD Joint Strike Fighter Program Office, Headquarters Air Force, etc. [83] In terms of records management, Hummingbird is a strong contender because it goes "beyond the basic DoD 5015.2 standard in RM. . . . We support the more secure Chapter 4 level, which is used by highly sensitive agencies like the CIA (Smallwood, 2005)."

• **Hyperwave**: Each August the DTIC "Horizontal Fusion Portfolio conducts a demonstration of Net-Centricity, Interoperability, and Transformation capabilities that have been developed. . . . The Collaboration Service in the Horizontal Fusion environment is provided by a collaboration server based on the Commercial-Off-The-Shelf (COTS) product Hyperwave eConferencing Suite." [84]

• **InfoWorkSpace** (IWS): InfoWorkSpace[85] is the official collaboration tool via the JIVA [86] for Joint intelligence commands, including J2 and N2. It is used in the JBMC2 [87] project at JFCOM, and also at PACOM, EUCOM, TRANSCOM, and CENTCOM. According to Powers (2004), "IWS is comprised of several third-party products including Placeware/Microsoft, Oracle, IPlanet/Sun One Directory Server and Web Server, and the Tomcat Servlet Engine/Apache. IWS provides a secure virtual office organized into buildings, floors and rooms where users can build online meeting places to interact on projects in realtime. Accessed via a Web browser or Java client, it includes a number of features, including an instant-messaging client (LaunchPad), text chat (public and private), audio, Web video, application casting, desktop conferencing, Virtual File Cabinet, a bulletin board, Collaborative Whiteboard and shared Text Tool, threaded discussions (news groups), mail, and a calendar." [88]

• **Intelink: "**It's an open secret that the US intelligence community has its own classified, highly secure Internet. Called Intelink, it's got portals, chat rooms, message boards, search engines, webmail, and tons of servers. It's pretty damn cool … for four years ago….The scary truth is that most of the time analysts are flying half blind….There's no reason our nation's spy organizations can't leapfrog what the Army is already doing with Web technology and, at the same time what the public is doing with the blogosphere (Alexander, 2005)."

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[80] Source for Groove use at the State Department and the Army Corp of Engineers: http://government.ihs.com/news-05Q3/general-dynamics-business-workflow.jsp

[81] The 2002 DISA white paper can be found here: http://iase.disa.mil/stigs/whitepaper/Groove-Networks-WhitePaper-120402.doc .

[82] https://www.spider.hpc.navy.mil/ .

[83] Hummingbird website can be found here: http://www.hummingbird.com/

[84] The 2004 Horizontal Fusion Collaboration Service Specification report can be found here: http://horizontalfusion.dtic.mil/docs/specs/HF_20040916_Collaboration%20Specification.pdf

[85] http://www.infoworkspace.com/

[86] Joint Intelligence Virtual Architecture.

[87] Joint Battle Management Command and Control. See: http://www.jfcom.mil/about/fact_jbmc2.htm .

[88] IWS is owned by Ezenia: https://www.ezenia.com/default.asp and they cite quotes by military leaders here: https://www.ezenia.com/cases.asp

• **iUpload**: According to the company, "In most organizations, there is a huge gap between people empowered to use content management and others that need to communicate with smaller work groups. The latest release of iUpload's Application Suite brings tight integration between blogs and content management, allowing you to take full advantage of the blog phenomenon at a corporate level to connect and stay connected with employees, customers, partners or other key constituencies." Sandia National Laboratories, US Army Prescom, and Tinker Air Force Base are using this product[89].

• **meebo**: meebo is an example of the newer dotcom entrepreneurial technology tools being run out of an apartment and spread mainly by word of mouth. This tool provides IM capability across various IM services and, being web-based unlike most IM clients, can be accessed from any computer, not just one's office or home computer. Thus, soldiers in Iraq are using meebo. Web-access tools would seem to be critical to crisis response workers who may not be able to get to their work location early in any crisis. [90]

• **MERIT** "is a powerful, web-enabled tool that graphically depicts the current Marine Corps readiness posture and detailed supply and maintenance information using emerging data visualization techniques. MERIT transforms data into information that provides a dynamic and adaptable view of equipment readiness by commodity, functional area, and organization." [91]

• **mIRC**: mIRC is generally considered to be a friendly IRC chat client that is equipped with useful options and tools. Some Army tactical units in Iraq used it heavily, in particular to coordinate with the Air Force for air support. [92] Version 6.16 was released in July of 2004. [93]

• **Navy Knowledge Online (NKO):** "The NKO collaborative tools provide users different ways to communicate with each other and offer the ability to connect with others using: Chat sessions in real-time with other users having similar interests, Instant messenger to talk with other users one-on-one in real-time, Message Boards to read and participate in," etc. Phase II is called the Sea Warrior Portal[94]. NKO had achieved 72 percent active duty and 91 percent reserve force registration by the end of FY 2004.

• **Navy Marine Corps Intranet (NMCI)** "is a major transformational initiative for the DON. It consolidates hundreds of networks into a single integrated network. NMCI has helped the DON implement consistent and reliable security, better manage its applications and data, and provide more consistent and higher level of service to DON users." Although it could be argued that NMCI provides limited collaboration tools (it does provide e-mail and a collective calendar), they report a plan to introduce an EDS-based collaboration capability in the future. [95]

• **Raindance**: "How do you give one single sweeping presentation to multiple audiences dotted across the map? Start with Raindance Web Conferencing Pro[96]." The Navy Civil Engineer Corps Officer School for web conferencing is using it. [97]

• **Sametime** (IBM / Lotus): The "Sametime Instant Messaging and Web Conferencing System Version 3.0 (formerly Sametime V3.0)" has been certified for use on DoD SIPRNet Networks by the Joint Interoperability Test Command. [98]

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89 http://www.iupload.com/ .
90 meebo can be found here: http://www16.meebo.com/. Soldiers' use in Iraq: http://blog.meebo.com/
91 For MERIT see the Department of the Navy IM/IT Strategic Plan for 2004-2005.
92 mIRC also has been used by the Space and Naval Warfare System Center METOC Systems Knowledge Center: http://www.spawar.navy.mil/sti/publications/pubs/sd/530/sd530cond.pdf
93 Their homepage is: http://www.mirc.com/ .
94 https://wwwa.nko.navy.mil/portal/splash/index.jsp .
95 http://www.nmci.navy.mil/ .
96 See: http://www.raindance.com/rndc/wcp/wcpOverview.jsp.
97 http://cecos.navy.mil.raindance.com/iccdocs/index.shtml .
98 http://www-03.ibm.com/servers/eserver/iseries/sametime/ .

• **SKIWEB (Strategic Knowledge Integration Web):** This tool is used by USSTRATCOM to provide real-time command status, scrolling news, significant events and announcements, as well as, uniquely, a blog function. In other words, anyone in STRATCOM can get on SKI WEB and see what's going on and have a threaded discussion. The Commander will ask a question and anyone, regardless of rank, is encouraged to get on and add his or her input in a rolling discussion. Very high usage and the commander "loves it." He operates in a very short time frame, so doesn't like the old staffing of issues through formal taskers - generate discussions on line in a chat room, for lack of a better term, and get thoughts and ideas from the E-1 through O-10, civil servants, and contractors. [99]

• **Skype**: "Skype is a little program for making free calls over the internet to anyone else who also has Skype. It's free and easy to download and use, and works with most computers." Skype works with several platforms including Windows, "Mac OS X, Linux and PDAs" For a slight fee, you can call any number anywhere[100]. Note, however, their worthy new competition is called Wavigo.[101] "Since its launch in August 2003, its software has been downloaded more than 174 million times in 225 countries and territories. Around 56 million people are registered to use Skype's free services, with more than 3 million people using Skype simultaneously at any one time, according to the company." [102]

• **Sitescape:** Enterprise Forum, Version 7 has been given a "Statement of Non-Applicability for JITC Collaboration Interoperability Certification Testing. The Statement of Non-Applicability authorizes the use of the products listed on DoD Networks." [103] The Dockside Security group uses Sitescape extensively.

• **Stellent:** Stellent just released Version 7.5 of Stellent Site Studio, which they call the "Industry Leading Multi-Site Web Content Management Application." Apparently it is being used by the Air Force Medical Services.[104] The Air Force brochure states that, "U.S. military department gains efficiencies and ease-of-use by consolidating approximately 350 Web sites with Stellent multi-site Web content management." Given the growing recognition for the importance of records management (RM), Stellent "helps organizations control the creation, declaration, classification, retention, and destruction of business records. The Stellent solution manages records, along with documents (even non-records), digital assets, collaboration, and Web content, within one server via a common user interface, which simplifies use and minimizes total cost of ownership (Smallwood, 2005)."

• **Virtual Program Office (VPO):** A Virtual Program Office application is based on the IBM/Lotus Domino technology, and was designed to enable geographically dispersed teams to work collaboratively via the Internet in a secure environment. Both the Space and Naval Warfare System Center and Command have been leaders in providing this exceptionally useful resource to their work teams. The primary advantages of VPOs are that they are: exceptionally secure, accessible to anyone who has prior permission including contractors, supports membership access levels, organized to support distributed

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[99] Additionally, the Commander basically told senior leadership that nobody in the command should ever be restricted from blogging on SKI WEB and he better not hear you're the one behind discouraging a low ranking person from getting on there. He believes the system is self-correcting. If someone says something dumb, the community will let him know about it. On the flip side, leadership gets some very interesting insights from the trenches, as well as the head shed. SKIWEB resides on SIPRNet, so info is limited. Everyone in STRATCOM is on SIPRNet and generally uses that as primary web/e-mail interface, so it works for reaching the broadest community.

[100] Their URL is: http://www.skype.com/. See also: http://sscc.spawar.navy.mil/aboutus/pubs/chronicle.pdf.

[101] For Wavigo see: http://www.kolabora.com/news/2005/08/09/beyond_skype_wavigo_integrates_multiprotocol.htm

[102] Source: Educational CyberPlayGround, September 29, 2005. See also: http://business.timesonline.co.uk/article/0,,9076-1803303,00.html

[103] The complete Defense Collaboration Tool Suite CMO Product Exemption List can be found here: http://jitc.fhu.disa.mil/washops/jtcd/dcts/cmo.html

[104] Air Force Medical Services: http://www.stellent.com/stellent3/groups/mkt/documents/nativepage/airforce.pdf

work, and can support very large documents. Moreover, they are user-friendly. The lead author manages three VPO sites for various interests or projects.

• **Webbe:** The Special Forces warriors have preferred Webbe, and a related earlier tool called SWAMPS, because they were modified to support their unique focus, and can be used on portable computers. Moreover Webbe has great FTP and Falcon View support, and a very quick chat system. The military leaders who have seen it report asking for copies. Part of the development took place at China Lake, CA the rest at Amphibious Base in Coronado, CA. The Joint Interoperability Test Command has certified Webbe. According to Powers (2004), "The architecture is a peer-to-peer design that is distributed and modular with no single point of failure (see Figure 2). It provides presence awareness, intelligent routing, and guaranteed message delivery to member servers within a federation. A single federation can support up to 256 member servers. It uses the XML Distributed Architecture, which distributes realtime messages on the IP network…. A GSA contract was awarded in May 2004 to upgrade the Webbe Instant Messaging Tool Software Server/Client to support the Special Operations Mission Planning Environment (SOMPE) mission. Other commercially available instant messaging tools do not provide the voice instant messaging and highly compressed audio needed for this application."

• **WebEx**: Previously, DISA planned to "add 7,500 Tandberg desktop videoconferencing systems, in a broad shift away from its room-based video collaboration strategy. DISA says it is using the COTS Tandberg systems, along with other COTS collaboration products (including IBM Lotus Instant Messaging, Bantu IM, and Wired Red conferencing products), to add new collaboration features to its expanding JWICS, the federal government's top-secret communications and collaboration system. ….The terms of the deal are vague, but essentially WebEx has won a bake-off to provide on-demand conferencing services to improve communications and coordination between DoD's military, business, and intelligence organizations worldwide (Mahwold, 2005)." More recently, rumor has it that WebEx has been removed from DoD networks. There are no plans for it to show up on DoD networks again.

• **WEBSKED** (Web-Enabled Scheduling System; formerly known as VIPER). WEBSKED is an Internet-based "employment scheduling application designed to support current and long-range scheduling, force planning, fuel planning and budgeting, [and] was designated as the Fleet's primary scheduling tool."[105] This tool is required for all components of the Maritime Forces Protection Command. Likely WEBSKED will become part of the JESS (Joint Event Scheduling System).

• **WiredRed Web**: "Two features distinguish the WiredRed collaboration server from its competition: First, it has extremely small server software requirements. Second, it almost exclusively focuses on deployment inside an organization's firewall…. The product's video and VOIP support is strong, and the solution provides a good collaborative workspace. We were also impressed with WiredRed's security options (Garza, 2005)." According to their webpage, [106] their e /pop web conferencing software is being used by 3,500 organizations including the U.S. Army and Air Force.

[105] http://www.dodccrp.org/events/2004/CCRTS_San_Diego/CD/papers/115.pdf
[106] http://www.wiredred.com/ .

Review of Team Collaboration Tools for Crisis Response in the Military and Government

Command and Control Research and Technology Symposium

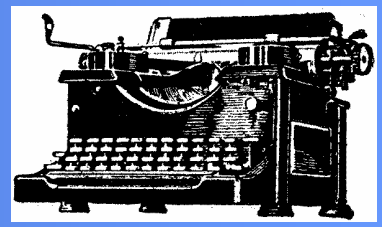
June 20-22, 2006

George Edw. Seymour
Michael B. Cowen

Space and Naval Warfare Systems Center, San Diego, CA

Program Sponsor: Dr. Michael Letsky, ONR

Remember these…



Collaboration Tools in the Military?

Digital Collaboration: DoD

"Collaboration technologies will be employed to assist users in making sense of the data that is pulled. For example, subject matter experts from diverse units or organizations are frequently called upon to come together to make sense out of special situations. The ability to pull expertise from both within a unit, as well as from across the Department is a value-added feature of a net-centric environment."

(Stenbit, 2003)

Digital Collaboration: DoD

“Leaders need to reevaluate their approach to defense spending because the character of warfare is changing. The military is finding that small numbers of large, expensive systems are not appropriate for irregular types of warfare, which are seen more and more, . …Rather, we are moving into the age of the small, fast and the many. To do that, we need an entirely different approach to what things cost,” he said. “We need to change the way we shop.” (Cebrowski , 2005)

Digital Collaboration: DoD

"Communication!"

The Honorable Thomas F. Hall's single word reply when he was asked for his opinion about our lessons learned from Katrina.

(Mr. Hall is the Assistant Secretary of Defense for Reserve Affairs, and provided the kickoff address at West 2006 in San Diego, CA January 10, 2006).

Defining Collaboration

“Defining ‘groupware’ is nearly impossible; various groupware packages from Lotus Notes to Microsoft Sharepoint to Novell Groupwise provide a wide range of functionality and capabilities. Typical functionality includes:

- Shared contact lists usually with some auditing capability.
- Task lists and projects management.
- Facilitation of shared document maintenance.
- Document version control.
- Scheduling and resource management.
- Facilitation of meeting scheduling.”

Agenda:

- **Objective:** Update Seymour (2002); It's all About…
- **Not That Long Ago:** 1899 and 1919
- **Disruptive Innovation**: Exponential growth
- **Background Research**: Two document searches
- **The Interim**: What's been happening?
- **Current U.S. Military Tools**: "Officially"
- **Now Imagine . . . .**
- **Behind the Curve**: High Tech Unofficially

Objective

- At the DoD Human Factors Engineering Technical Advisory Group annual meeting in San Diego on April 29, 2002 Dr. Seymour briefed the then current status of digital collaboration tools. His list numbered more than 700.
- That brief URL: http://tinyurl.com/64hqo
- What is the status of military collaboration?
- What's new in collaboration technology and tools today?

It's all About…

- People:

  Mostly stay the same over time (cognitive and physical abilities and liabilities).

- Information:

  Has exploded. We have too much information and not enough task-specific situational knowledge.

- Collaboration Tools:

  Have exploded. Collaboration tools evolved slowly until the last few years.

Not That Long Ago: - 1899 -

"U.S. Navy's Manual for the Care and Training of Homing Pigeons was published. This manual required that a flying book be kept on each pigeon and recorded such information as number of flights, length, and rate of miles per hour. According to a Bureau of Navigation enlisted code book of 1919, pigeon trainers (or Pigeoneers as they were known) were a part of the Quartermaster rating and were identified as Quartermaster (Pigeon), Q.M.(P)."

Cher Ami was an American carrier pigeon, "one of 600 birds owned and flown by the U.S. Army Signal Corps" which carried messages during World War I in Europe. Today we take telephones and satellite communications for granted, but communication has always been critical…."

Sources: http://www.linking.to/Navy/ and http://www.2-sir.com/customers/Bustl.html

Not That Long Ago: - 1994 -

Early InterNet use was mostly a color-free, mono-font, silent, text based experience:

- MSG, SNDMSG, RD, RDMAIL, etc 1971 (Unix based)
- ftp: 1972 ftp://ftp.usask.ca/pub/hytelnet/README
- BBS: CBBS was first in 1978: <link>
- Usenet: 1979 ftp://rtfm.mit.edu/pub/usenet/news.announce.newusers/
- IRC: 1988 http://daniel.haxx.se/irchistory.html
- ELM / PINE: 1989 UW (remember control-V for “page down”?)
- Gopher: 1992 gopher://gopher.floodgap.com/
- WWW: 1993-4 http://www.livinginternet.com/w/wi_mosaic.htm
- PowWow: 1994 http://powwow.jazy.net/

How Much Information?

Storage Medium	Terabytes Upper Estimate	Terabytes Lower Estimate	Upper Estimate	Lower Estimate	% Change Upper Estimates
	2002		1999-2000		
Paper	1,634	327	1,200	240	36%
Film	420,254	76,69	431,690	58,209	-3%
Magnetic	4,999,230	3,416,230	2,779,760	2,073,760	80%
Optical	103	51	81	29	28%
TOTAL:	**5,421,221**	**3,416,281**	**3,212,731**	**2,132,238**	**69%**

"Worldwide production of original information, if stored digitally, in terabytes circa 2002. Upper estimates assume information is digitally scanned, lower estimates assume digital content has been compressed" (Lyman & Varian, 2003)

How Much Information II

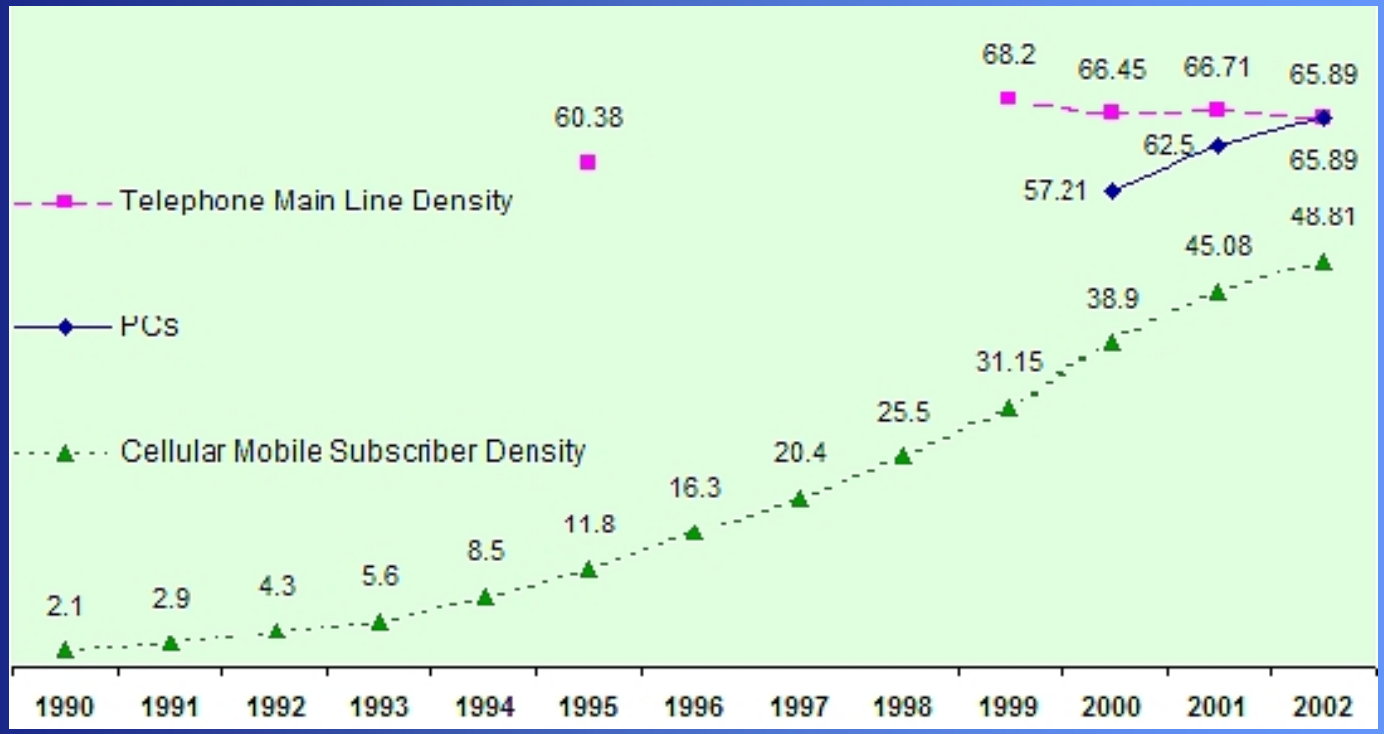
- **"Print, film, magnetic, and optical storage media produced about 5 exabytes of new information in 2002. Ninety-two percent of the new information was stored on magnetic media, mostly in hard disks."**
- **"How big is five exabytes? If digitized, the nineteen million books and other print collections in the Library of Congress would contain about ten terabytes of information; five exabytes of information is equivalent in size to the information contained in half a million new libraries the size of the Library of Congress print collections."**
- **"Information explosion? We estimate that new stored information grew about 30% a year between 1999 and 2002."**

LOC: Shelves in miles?

Terabytes Today—Tomorrow?

- Wal-Mart “operates a data warehouse with, at last count, 583 terabytes of sales and inventory data built on a massively parallel 1,000-processor system.”
- “With real-time or near-real-time data, the value of those insights increases exponentially. "We know how many 2.4-ounce tubes of toothpaste sold yesterday, and what was sold with them," says Dan Phillips, Wal-Mart's VP of information systems.”

A Decade of Technology



Computer, Telephone, and Cellular densities in the USA / 100 inhabitants.

Information < One Decade Ago

In 1997 this was incredible; Windows 95 / 3.1 / NT 3.51 SVGA, 256-color monitor supporting 640 x 480 provided 2 CD Encyclopedia that features over 31,000 entries, 14,000 photos, etc.

In 2006 Information Week described the $135 billion market showcase at the annual Consumer Electronics Show in Las Vegas. NB:

- Google (9/98) = 8 billion web pages + +
- Wikipedia (1/01) = 922,900 English articles

Value of the Internet: 2005

How is the Internet being Used Today:

1. e-mail,
2. general Web surfing,
3. reading news,
4. shopping,
5. entertainment news (searching and reading),
6. seeking information about hobbies,
7. online banking,
8. medical information (searching and reading),
9. instant messaging, and
10. seeking travel arrangements and travel info….

Disruptive Innovation

- "Disruptive Technology" was coined by Clayton M. Christensen in his 1997 book *The Innovator's Dilemma*.
- The term "Disruptive Innovation" was used in a later book because he recognized that "few technologies are intrinsically disruptive or sustaining in character. It is strategy that creates the disruptive impact."
- COTS collaborative technologies are disruptive.

Background Research

- **Ad Hoc Research**
- **Systematic Document Research:**
  - ✓ Government Accountability Office (GAO) advanced search for the term “collaboration tools” anywhere in the document. Six documents were identified.
  - ✓ Defense Technical Information Center (DTIC) for any of these three terms, “collaborative software,” “collaborative assistants,” or “collaborative tools” during the most recent decade. Eighteen documents were found that met the criteria, nine of which were used.

The Interim

For example, in 2003 the National Institutes of Health performed an internal survey to identify collaboration tools being used by NIH at that time. Of the fourteen tools identified, eleven were recommended for use in the next two years: Conference Server, eRoom, Exchange 2000, Groove, Key Flow, Place Ware, Plumtree, Project Server, Share Point, WebDA, and WebX.

Current U.S. Military Tools

- Air Force Portal, Army Knowledge Online, Navy Knowledge Online……..(themes)
- Collaboration at Sea (CAS)
- Collaborative Information Environment (CIE)
- Defense Collaboration Tool Suite (DCTS)

  * Evoke and Groove *
- InfoWorkSpace (IWS)
- Strategic Knowledge Integration Web (SKIWEB)

AKO = 97K to 1.8 m users; 3/6: new login record = 754,943/ day.

N@VY
KNOWLEDGE ONLINE

Welcome to the Sea Warrior Portal

NKO User Name
all lowercase
NKO Password
case sensitive
LOG IN TO NKO

I forgot my User Name I forgot my Password

USS BOXER (LHD 4) well deck and deck department personnel help boat crews from 1st Battalion, 3rd Marines, practice small boat departures and arrivals.

:: New Users

If you have never registered on NKO:

- View the Registration Tutorial
- Register as a new user
- Register as a guest user

:: NKO Login Help

- I need to change my User Name
- I need to change my Password
- Download Security certificate
- Help & FAQ's

:: Help Desk Contact

COMM: (850) 452-1001, Option 1

DSN: 922-1001, Option 1

Toll Free: (877) 253-7122, Option 2

nln.helpdesk@netc.navy.mil

Freedom of Information Act (FOIA) This is an Official U.S. Navy Website U.S. Navy Recruiting

Naval Education and Training Command 250 Dallas Street - Pensacola, FL 32508-5220

Read the Privacy and Security Notice

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Collaboration at Sea

Collaboration at Sea (CAS): Collaboration at Sea is based on the popular IBM / Lotus collaboration toolset, and is used today mostly by the planning (J5 and N5) groups because of their need to support operations with coalition partners. Early uses of CAS included the "USS John C. Stennis and USS George Washington Battlegroup's use during 1999-2000, and following that, the USS Carl Vinson's success with Knowledge Web (K-Web) in 2001-2002" (Natter, 2002). The Commander, Joint Task Force (CJTF) 950 and the Second Fleet/ NATO Striking Fleet Atlantic have used CAS. Since then the Navy has shared CAS with a large number of its coalition partners. CAS is the first collaboration system being used by the Navy that is moving into a program of record (i.e., acquisition funded as opposed to using O&M funds).

Collaborative Information Environment (CIE)

Collaborative Information Environment (CIE): The JFCOM J9 supports CIE. Beginning "in November 2003, CIE developers and engineers provided actual working prototypes of the CIE to U.S. Southern Command (SOUTHCOM) and U.S. Pacific Command (USPACOM)." Recently, CIE "garnered the U.S. Joint Forces Command (USJFCOM) a prestigious award. The award from the E-Gov Institute was for 'best practice in a public sector organization for innovative knowledge management (KM).'"

Defense Collaboration Tool Suite

Supported by DISA, DCTS is a "flexible, integrated set of applications providing interoperable, synchronous and asynchronous collaboration capability to the Department of Defense's agencies, Combatant Commands and military services…. Initial fielding of DCTS V1.1.12 began in April 2002." According to Powers (2004), as of "January 2004, DCTS V2 P1 is installed at 138 sites worldwide, at all combatant commands, major components and services, with another 218 planned for 2004. DCTS will remain in place until the Next Generation Collaboration Service (NGCS) is on-line in 2005 or 2006." This suite was "recommended as the interim standard DoD tool set by the OSD/Joint Staff Collaboration Tiger Team." "It provides real-time and asynchronous collaboration using voice, video conferencing, document and application sharing, combined with instant messaging to assist in the planning and management of crisis situations. It is used by many military commands to support the mission planning process."

InfoWorkSpace (IWS)

IWS is the official collaboration tool for Joint intelligence commands, including J2 and N2. It is used in the JBMC2 project at JFCOM, and also at PACOM, EUCOM, TRANSCOM, and CENTCOM. According to Powers (2004), "IWS is comprised of several third-party products including Placeware/Microsoft, Oracle, IPlanet/Sun One Directory Server and Web Server, and the Tomcat Servlet Engine/Apache. IWS provides a secure virtual office organized into buildings, floors and rooms where users can build online meeting places to interact on projects in realtime. Accessed via a Web browser or Java client, it includes a number of features, including an instant-messaging client (LaunchPad), text chat (public and private), audio, Web video, application casting, desktop conferencing, Virtual File Cabinet, a bulletin board, Collaborative Whiteboard and shared Text Tool, threaded discussions (news groups), mail, and a calendar." IWS is owned by Ezenia.

Strategic Knowledge Integration Web

SKIWEB is used by USSTRATCOM to provide real-time command status, scrolling news, significant events and announcements, as well as, uniquely, a blog function. In other words, anyone in STRATCOM can get on SKI WEB and see what's going on and have a threaded discussion. The Commander will ask a question and anyone, regardless of rank, is encouraged to get on and add his or her input in a rolling discussion. Very high usage and the commander "loves it". He operates in a very short time frame, so doesn't like the old staffing of issues through formal taskers - generate discussions on line in a chat room, for lack of a better term, and get thoughts and ideas from the E-1 through O-10, civil servants, and contractors.

Groove

- Ray Ozzie founded Groove Networks in October 1997. They shipped the first beta version of Groove in October 2000. Microsoft acquired Groove in April 2005.
- In four years Grove had become one of the most frequently used military COTS collaboration tools.
- The U.S. Department of State “used Groove to coordinate the establishment of the U.S. Embassy in Baghdad. Gallaher and O’Rourke (2004) reported that 27 percent of their Naval Postgraduate School survey respondents reported using Groove.

The Rise of Wise Groups

- Howard Rheingold publishes *Smart Mobs: The Next Social Revolution*,
- James Surowiecki publishes *The Wisdom of Crowds.*
- Ever hear of "collective online brain trusts?"
- The "architecture of participation"
- The tactical role of social behavior is increasing only for those who know it.

Groups + Technology =

- Hamachi = free software that lets you create a quick, simple, and secure virtual network between any two or more computers with a connection to the Internet.
- iMediaPOLL = "integrates the smartest features of a dynamic online poll, and allows you set the look of your poll. And what about having it for free?"
- Jot Spot Live = allows you & others to take notes on the same web page at the same time. You can see changes other are making, drag to rearrange, edit in real-time.
- netomat = keeps you connected to friends at home on your computer or on the go with your cell phone. It works through the creation of netomat "hubs." It's free.
- Skype = A proprietary protocol VoIP system built using Peer-to-peer (P2P) techniques. Free for non commercial use . "It's over." FCC Chairman.
- Vlog It = the world's first video blogging software.
- Zoho Writer = online word processor that edits, stores and shares your documents from anywhere.

Recent “Disruptive” Technologies

- Cell phone
- Digital camera
- E-learning
- Internet
- Mini steel mills
- Open source
- Transistor
- Blogs
- Bridge Blogging
- Chat / IM
- Podcasting
- RSS
- VoiceXML
- Webcasts
- Wikis

Now Consider:

- Disruptive Technologies (1997) becomes Disruptive Innovations in 2003.
- Military Transformation: Drivers = Asymmetric war & Budgets & Democratization * of Communication.
- Seymour (2002) identified >700 COTS / GOTS collaboration tools available to, or in use by, the U.S. Military.
- Since then, hundreds and hundreds of world-wide collaboration technology companies each hired dozens and dozens of young "geeks" who work overtime striving to create the next greatest application, service, or tool. Can anyone keep up to date?
- Seymour (today) identifies 14 "disruptive" collaboration technologies (not tools).

Collaboration: 2006

- For thousands of years, information creation has been structured, institutionally based, and flowed one-way (Scribes, Books, Dictionaries Newspapers,, Encyclopedias).
- Today all that has changed. We're web enabled.
- These 14 digital-based technologies (not tools) are driving innovation/change everywhere:
  - Blogs
  - Bluetooth
  - Chat / IM
  - Pocketcasting
  - Podcasting
  - RFID
  - RSS
  - Videoconferencing
  - VoiceXML
  - VoIP
  - VPOs
  - Webcasts
  - Wikis

BLOGS

- Word “blog” coined by Peter Merholz in 1999.
- On July 30 2005, Technorati tracked >14.2 million weblogs, twice the number found 5 mos. previously.
- Warwick University gives all their students and staff the opportunity to develop a blog http://blogs.warwick.ac.uk/
- Oxford University Press: http://oupblog.typepad.com/oupblog/
- Soldiers serving in the Iraq war created "milblogs" and provided readers a new perspective on the realities of war. Currently 284 participants contribute to the Milblog Ring.
- Today, however, we have audioblogs, moblogs (mobile blogs), photoblogs, etc.

33.7 million / double @ six months / L

CHAT / IM

Chat and IM are not the same:

- **IRC** allows you to connect to any channel and **talk in real-time** to people with the same interests. Jarkko Oikarinen (Finland) developed Internet Relay Chat (IRC) in 1988.
- In March, 1991, there were more US-based IRC servers (69) than non-US. based ones (66) for the first time.
- **IM** was popularized by AOL starting in 1992.
- As of August, 2005, AIM had 53 million active users.
- Interoperability is a big issue. The major players are AOL, Google, ICQ, MSN, PSI, Skype, Windows, and Yahoo.
- In December Google & AOL agreed to combine IM usage.

IM 50-70%

Milblogs

The following five popular military blogs support the notion that technology will be used, and that consequently it is better used when managed:

- A soldier's thoughts (misoldierthoughts.blogspot.com)
- Boots in Baghdad (bootsinbaghdad.blogspot.com)
- Life in this girl's Army (sgtlizzie.blogspot.com)
- 365 and a wake up (thunder6.typepad.com) and
- Ma Deuce Gunner (madeucegunners.blogspot.com)

Milblogging.com currently has 1,125 military blogs in 23 countries with 1,119 registered members.

1,378 / 27/1,521

RSS

2005: The year of RSS

- Feb 23: "The Associated Press begins to deliver content via RSS feeds. Can you say mainstream?"
- May 2: Business Week says that RSS aggregators "could turn the web on its head" by eliminating the need for web surfing.
- June 24: "Microsoft announces that it will support RSS in Longhorn (now Vista) and Internet Explorer 7."
- Oct. 10: Yahoo releases whitepaper: *RSS – Crossing Into the Mainstream*. Key findings include:
  > 12% of users are aware of RSS and 4% knowingly use it.
  > 27% of internet users use RSS without knowing it.

25,226

Videoconferencing

- Remember the decade-old VTC promise?
- Today VC is alive and being used:

From an Army camp in Iraq

“You look very beautiful today, hon," Capt. Jason Hughes told his wife, Chrissy, who bought a new dress for the teleconference. Sons Christian, 3, and Patryk, 15 months, also were on hand in Clayton.”

Wikis

- “Wiki is Hawaiian for "quick," and is a method for many users to create and edit web page content quickly and easily. A Wiki is . . . the simplest online database that could possibly work.”
- The author knows of no official military wikis in use, but noted that all branches of the military refer to, and provide links to, the Wikipedia, if not others:

http://en.wikipedia.org/wiki/Main_Page

Innovation Squared

December `05: Macromedia partners with Jabber. The plan: Integrate Macromedia's Breeze Meeting and Jabber's Extensible Communications Platform (Jabber XCP).

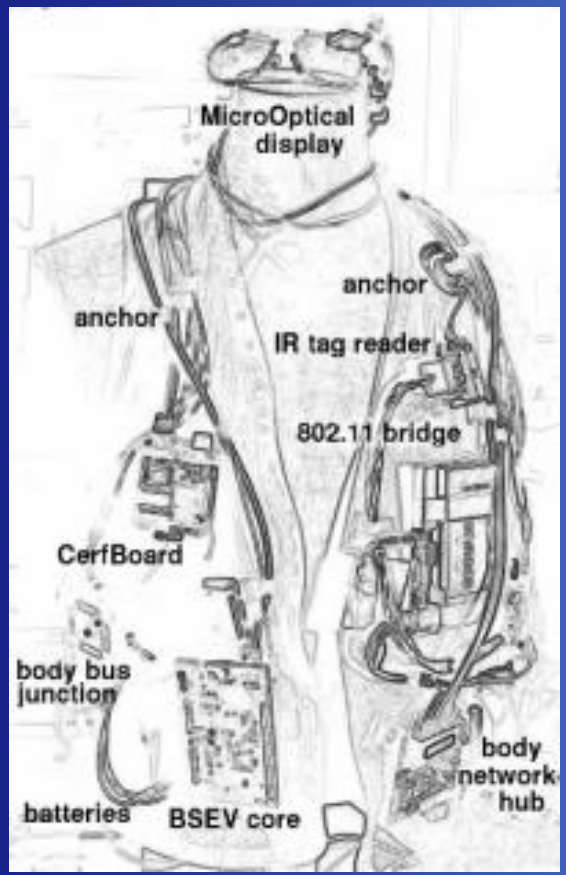
"The joint offerings are intended to allow DoD and other federal agencies to deploy a Web conferencing, instant messaging, chat, presence, and awareness solution that meets the standards requirements of the federal government."

Think VoIP + XML

Collaboration Innovation Drivers:

- The number one blog site (Blogspot.com), draws more web-based traffic than the NYTimes.com, USAToday.com, or WashingtonPost.com
- Podcasting, a way to publishing audio broadcasts using the Internet , is being used by every branch of the military.
- ComVu is first to offer mobile users the ability to transmit live video broadcasts.
- instaColl ... a free program that allows for 1:1 online document editing.
- MIThril is a next-generation wearables research platform developed by researchers at the MIT Media Lab
- MySyndicaat: First true RSS news mastering engine (it's free for now).
- P-ISM: Network gadget packages enhance mobile collaboration.
- Podzinger & Podscope: two tools to convert podcasts (audio) to text.

MIThril



The MIThril hardware platform combines body-worn computation, sensing, and networking in a clothing-integrated design. The MIThril software platform is a combination of user interface elements and machine learning tools built on the Linux operating system.

http://www.media.mit.edu/wearables/mithril/index.html

P-ISM: The Future Now

A Pen-style Personal Networking Gadget Package: P-ISM is a five function pen set of virtual keyboard, handwriting, camera scanner, projector, and personal ID using short-range wireless and cell phone internet technology.

Conferences:

- Beyond Blogs & Social Networks (2005) <link>
- C2: Connect & Collaborate (2005) <link>
- Collaborative Communications Summit (Feb 2006) <link>
- Collaborative Technologies Conference (June 2006) <link> <loop>
- Convergence Conference (2005) <link> <blog>
- Emerging Technology (Mar 2006) <link>
- Emerging Telephony (Jan 2006) <link>
- VON (Voice on the Net: Mar 2006) <link>
- Web 2.0 (2005) <link> <speakers>

Selected Resources:

- Lyman, P. & Varian, H. (2003). How Much Information. Retrieved from http://www.sims.berkeley.edu/how-much-info-2003
- Schneiderman, R. (2005). Preparing for the Disruptive Technologies of Tomorrow. http://forum.ecoustics.com/bbs/messages/34579/129798.html
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- Seymour, G. E. (2002). "Enabling the Information Dominance Transformation Via COTS Collaboration Tools" Presented at the Department of Defense Human Factors Engineering Technical Advisory Group annual meeting in San Diego, April 29.
- Warner, N., Letsky, M. & Cowen, M. (2005). Cognitive model of team collaboration: macro-cognitive focus. Paper presented at the 49th Annual Meeting of the Human Factors and Ergonomics Society. Orlando, September.
- Warner, N. & Wroblewski, E. (2004). The Cognitive Processes used in Team Collaboration during Asynchronous, Distributed Decision Making. http://www.dodccrp.org/events/2004/CCRTS_San_Diego/CD/papers/092.pdf
- Web Conferencing Guide: http://thinkofit.com/webconf/
- Web Conferencing Picks: http://www.conferencevillage.com/softdirect.html

Thank You.

Questions are Welcome