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The Impact of Synchronous Text-Based Chat on Military Command and Control

C2 Concepts and Organizations, C2 Architecture, Policy, Lessons Learned

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ABSTRACT

This research assesses the impact of synchronous (real-time), text-based chat on military command and control (C2) processes. Chat use among the services, particularly among joint forces, has evolved in ad hoc fashion to fill gaps in currently fielded C2 systems. This growth-by-improvisation inhibits clear definition of the underlying requirements: precisely what C2 deficiencies are being addressed by text-based chat tools? Or, from a bottom-up perspective: what capabilities do text-based chat tools bring to the war fighter? In this study we employ a broad set of use-cases to further refine why operators use chat based on how they apply chat to their specific combat problems. These use cases include ongoing combat operations in ENDURING FREEDOM, counter-insurgency operations in IRAQI FREEDOM, and disaster relief operations with Joint Task Force - Katrina. The focus of this study is on establishing operators' perceived requirements in light of the current capabilities delivered by the existing text-based chat tools. From these "reverse-engineered" requirements we propose future work to establish these communication capabilities in the next-generation C2 systems.

INTRODUCTION

Communication is the essence of C2, and the availability of real-time, text-based communications tools has led to a proliferation of ad hoc "solutions" for the warfighter. Currently within the services, every command appears to have its own preferred text-based chat client. While these solutions fill short term requirements, they usually miss the mark of joint interoperability. No standardized text chat tool for C2 has led to confusion and an inability to interoperate. No official text-based chat requirements document exists for any of the services nor is there an official joint chat requirements document. Further, there is no official support for text-based chat from the services' program offices. In effect, within the U.S military there is a tool used extensively for C2 with no official requirements, no official support, and no official sponsorship.

This paper first assesses the impact of synchronous (real-time), text-based chat on military command and control (C2) processes. Operational chat usage is documented across the warfighting functions and the full spectrum of military operations with a brief selection of use cases from Eovito (2006). The current trend in chat research focuses on the technical aspects of chat based off anecdotal evidence, both of which serve to obscure development of a coherent problem statement. This research consolidates specific cases of chat use to better develop insight into the problem, catalog capability gaps, and generate high-level requirements.

There is risk associated with various chat tools and protocols. Technical risks are the most documented by organizations like the Defense Information Systems Agency (DISA). In this paper, we assess not only technical risks, but other risks that are very difficult to assign metrics to, like those related to organization, human nature, situational awareness, and perhaps most interestingly, the impact of chat use on other C2 methods.

We finish with an explanation of the methodology used for documenting and developing the chat requirements. The quad-service chat requirements and select Combatant Command (COCOM) requirements from Eovito (2006) are listed as appendices. These high level requirements decompose the chat problem to a level that users, engineers, and managers alike can use, discuss, and understand. From this common understanding all stakeholders can work together to develop a set of combined and joint, text-based chat requirements for the next-generation C2 systems.

BACKGROUND

Modern chat tools allows multiple, concurrent users real-time participation in multiple chat channels (chat rooms). The conversations within these channels are referred to as threads. The use of client-server architecture provides the ability to scale a population of users from a few locally to thousands globally. Internet Relay Chat (IRC) is one of the most widely used chat protocol for military C2 (Boettcher 2005; Duffy 2005). This study considers chat usage regardless of type, whether chat specific tools like mIRC or Microsoft Chat (MS Chat) or embedded chat functionality found in many C2 systems and collaborative suites like InfoWorkSpace (IWS).

Chat use by the military grew rapidly during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Not only did chat usage grow on its own, we saw chat usage grow to supplement (or in some cases replace) other C2 systems. The experiences of the United State Navy and the United States Central Command (USCENTCOM) illustrate this.

Early during OEF there was one IRC server in the Navy's Fifth Fleet that averaged 300 concurrent chat users (Banerjee 2005). Chat use soon overcame capacity and a second IRC server was installed in Fifth Fleet supporting approximately 500 concurrent users (Banerjee 2005). Chat use grew drastically during OIF and two more IRC servers installed, bringing the totals to four servers supporting approximately 2500-3000 concurrent users in 350-400 chat channels (Banerjee 2005; Heacox 2004).

Prior to OIF, USCENTCOM used the Defense Collaborative Tool Suite (DCTS) chat programs during exercises in Saudi Arabia; however, DCTS provided inadequate chat capability (no multiple room support) and USCENTCOM J6 made the switch to IWS (Jara and Lisowski 2003). The bandwidth requirements of chat with IWS created latency problems and USCENTCOM switched to the US Naval Forces Central Command's (USNAVCENT) four IRC servers in Bahrain, which continue supporting all areas of operations (Banerjee 2005; Jara and Lisowski 2003). Currently servers at USNAVCENT, Al Udeid Airbase in Qatar, HQ USCENTCOM, and DISA support the following chat clients: mIRC, MS Chat, JABBER, and IE Web Browser clients (Moore 2005).

Users rapidly realized text chat was a mission essential C2 tool and discussion grew about the lack of official requirements, official support, and official sponsorship. The Navy's program office, Space and Naval Warfare Command (SPAWAR) reacted first. In response to

the Navy's text chat needs, Joint Distributed Command and Control Technologies SSC-SD, SPAWAR Systems Center San Diego (SSC-SD) hosted the 1st Annual Internet Relay Chat (IRC) Conference in 2004. All four services, numerous COCOMs, and Other Government Agencies (OGA) attended. This conference's purpose was to identify chat users and provide support to them throughout the Department of Defense (DoD). While focused on IRC protocol-based chat tools, this conference supported users of all chat tools, discussed emerging technologies, and the way forward within DoD. The 2nd Annual IRC Conference was held in June 2005 and was again attended by all four services, numerous COCOMs, and OGAs.

During the June 2005 conference, Joint Distributed Command and Control Technologies SSC-SD was tasked with developing the joint chat requirements for a Joint Resource Oversight Council (JROC) package by Joint Chiefs of Staff J-6 (JCS-J6) and Office of the Assistant Secretary of Defense for Networks and Information Integration (ASD(NII)). The research in this paper is part of that effort.

USE CASES

The warfighter has expanded the role of chat across the full spectrum of military operations. Commanders and innovative operators at all levels and units have grown their own chat solutions to complex C2 problems despite the many systems fielded to solve the same. Chat is used by the warfighter to put steel on target, or conversely, to build schools and repair mosques. These operational examples are intentionally broad to provide a brief yet substantive illustration of the far-reaching use of chat for military C2.

A. J-3 OPERATIONS

1. Multinational Operations

Her Majesty's Canadian Ship (HMCS) TORONTO (FFH-333) participated in OPERATION ALTAIR (Canadian OEF parallel) in 2004. She deployed as a fully integrated escort of the USS GEORGE WASHINGTON'S (CVN-73) Carrier Strike Group (CSG) to the Arabian Gulf.

The CSG exercised C2 with chat over SIPRNET (Secure Internet Protocol Routed Network), which HMCS TORONTO (the CSG's only foreign ship) could not access. Canadian Forces task by voice; however, the CSG used the coalition wide area network (COWAN) chat

for tasking HMCS TORONTO, with voice circuits as backup. United Kingdom and New Zealand vessels in the area of operations (AO) were also on COWAN chat.

TORONTO stood picket duty in sector screen for the CSG, tasked and coordinated over COWAN chat. Tasking orders for urgent maritime interdiction operations (MIO) were sent to HMCS TORONTO over the COWAN chat and she boarded 123 ships for the CSG.

The Combat Officer, HMCS TORONTO summed up chat issues from the Canadian point of view. The U.S. Navy did not rely on a single chat tool for C2. With HMCS TORONTO as the only non-U.S. warship it was easy for the CSG to overlook the need to use COWAN chat. Even with a liaison officer (LNO) aboard the George Washington and six months together, the U.S. never made the leap to using COWAN and continued using primarily SIPRNET chat. The recommendation was that coalition forces should use coalition networks.

2. Disaster Relief Operations/Civil Military Operations

Amphibious Squadron Four (PHIBRON4), embarked aboard the USS IWO JIMA (LHD-7), used chat for C2 during humanitarian operations with Joint Task Force-Katrina (JTF-Katrina). Chat was used extensively to plan, task, and coordinate pre-deployment and underway. Upon arrival in New Orleans, the movement of amphibious craft for transporting personnel, equipment, and supplies ashore was coordinated and tracked through chat. Situation Reports (SITREPs) from the ships and detachments ashore were sent to PHIBRON4 with chat and then sent from PHIBRON4 to Amphibious Group 2 (PHIBGRU2) by the same means. After Hurricane Rita, the USS TORTUGA (LSD-46), in Cameron, Louisiana, passed information on its amphibious craft operations and SITREPs over chat to PHIBRON4, still embarked on the USS IWO JIMA in New Orleans.

Canada executed Operation UNISON in response to Hurricane Katrina, sending its East Coast Task Group, including HMCS TORONTO (FFH-333), to Biloxi, Mississippi during September and October of 2005. Operations were reported to the USS Saipan using Maritime Command Operational Information Network (MCOIN) chat (MCOIN facilitates Canadian maritime C2 with U.S. Navy). The Canadian Task Group requested and coordinated landing support for its engineers, wood, generators, and other supplies over MCOIN chat.

United States Marine Forces Atlantic (USMARFORLANT) recognized a gap in its C2 capability during JTF-Katrina operations. The USMARFORLANT lessons learned from

JTF-Katrina included one entitled "Real Time Information Dissemination." Watch Officers had difficulty disseminating timely information with email. Citing successful chat usage in OIF for the conduct of fire [fire support] and unmanned aerial vehicle (UAV) operations, it was recommended that USMARFORLANT establish chat rooms to support real time information dissemination (Gray 2005).

The Area of Responsibility (AOR) for the U.S. Southern Command (USSOUTHCOM) is a huge geographic area where disaster relief efforts are not uncommon and civil military operations (CMOs) are the norm. Headquarters USSOUTHCOM uses the chat capabilities of DCTS to coordinate and support CMOs in its AOR. Chat was used to coordinate disaster relief efforts for the flooding in Guatemala caused by Hurricane Stan in 2005.

3. Antiterrorism/Homeland Defense

An antiterrorism vignette from Commander Coast Guard District 14 message 162008Z MAY 03, After Action Report: Terrorism Threat on Board Cruise Ship Legend of the Seas (LOS), 22-24 April 03:

> On 22 April 2003 Royal Caribbean Cruise lines cruise chip Legend of the Sea (LOS) was en route from Ensenada, Mexico to Hilo, Hawaii for a scheduled port call with 1668 passengers and 701 crewmembers. A cleaner found a written note in a restroom threatening the lives of American passengers onboard. LODS reported the note to Royal Caribbean Cruise Lines who informed the National Response Center (NRC) and the Federal Bureau of Investigation (FBI). Captain of the Port, Honolulu, ordered LOS to not enter port and divert to anchorage offshore. A 123 member multi-agency boarding was conducted to secure and clear LOS (D14 2003).

Coast Guard District 14 (D14) assumed Lead Federal Agency (LFA) for the boarding and operated in two SIPRNET chat rooms that included USCG Pacific Area, US Pacific Command (USPACOM), Commander U.S. Pacific Fleet, and 93rd Weapons of Mass Destruction Civil Support Team (93rd WMD-SCT).

A Marine Corps Visit, Board, Search and Seizure (VBSS) vignette from the 2003-2004 deployment of the 13th Marine Expeditionary Unit (MEU) Special Operations Capable (SOC) in the Arabian Gulf:

> The Maritime Special Purpose Force (MSPF) Commander is aboard the shouldering ship with laptop and chat connectivity. The Force Platoon Commander is on the boarded vessel. They were in contact over voice radio, but the MSPF Commander was in contact with the Landing Force Operations Center [LFOC] aboard a US Navy amphibious ship using chat. Prowords for mission segments, information requests, and the unfolding mission were passed and tracked in chat. The LFOC passed additional tasking to the

MSPF as the mission progressed. The VBSS resulted in the seizure of hashish with an estimated value in the millions.

4. Special Operations

In 2002 and 2003, during OEF in Afghanistan, units from Third Special Forces Group (Airborne) operated widely dispersed as part of the Combined Special Operations Task Force (CJSOTF). Third Group was equipped with AN/PSC-5 Satellite Radios, but assigned a single voice satellite communications (SATCOM) channel shared by the entire CJSOTF within the theater and reserved for command, emergencies, or units in contact. The SATCOM radios were data capable with ruggedized laptops allowing Special Forces teams to send free text messages. This is significant, because despite not having an actual chat tool, units used the free text messaging capability to provide an improvised chat (more specifically instant messaging) functionality to fill the C2 gap. Army Special Forces firebases always had SATCOM connectivity with the text messaging capability running and most business within the firebases was conducted by text conversations. While on the move during operations, teams were contacted over voice SATCOM and told to come up on the laptops for text messaging.

One Special Forces Operational Detachment A (ODA) Commander recounted how this text-based communications capability aided operations. His ODA team was operating in an area where another unit's mission fell through. His team received a voice call over SATCOM to come up on SATCOM data. With the text messaging capability he received a fragmentary order (FRAGO), acknowledged receipt, and discussed operational details. This improvised chat capability allowed the ODA team to execute the FRAGO much more rapidly than if a voice exchange had taken place. The ODA executed a cordon and search of a small village, resulting in two personnel under control (PUCs – enemy combatants; not prisoners of war) and capture of a weapons cache. The SITREP was sent to higher headquarters using the improvised chat capability, which would read it and start asking questions back.

In another case, after mission completion, an ODA team sent a SITREP to higher headquarters using the improvised chat. The CJSOTF replied immediately concerning the PUCs the ODA had in custody. The ODA Commander replied, telling the CJSOTF when and where the Afghan Militia Forces (AMF) captured the PUCs, passed their descriptions, what PUC1 and PUC2 said when debriefed, and that they had dual identification that did not check out. He also reported that they had weapons and were seen leaving a large cache with rifle propelled grenades

(RPGs), Soviet style mines, detonation cord, etc. Information continued to be passed and then the CJSOTF directed the ODA team to maintain positive control of the PUCs and document all information about them. The total, detailed exchange required only a couple of minutes with the improvised chat.

5. UAV Operations

Sixth Marine Regiment used chat for global collaboration during Direct Support (DS) UAV operations. Sixth Marines, in Afghanistan for OEF, used chat to communicate with the Air Force UAV pilot and payload operator at Nellis Air Force Base (AFB), Nevada. During the UAV mission, the regiment requested specific actions by the pilot and the payload operator in real time, while the Army Collection Manager for the CJTFs monitored the chat room and tracked the mission.

Second Battalion, Fifth Marines (2/5) used chat for UAV operations in OIF I and OIF II. Chat allowed 2/5 to direct the pilot and the payload operator during the mission and disseminate what the UAV was seeing.

Marine Unmanned Aerial Vehicle Squadron Two (VMU-2) used chat extensively during OIF II and OIF III. Chat was used for UAV support to targeting, strike execution, and close air support (CAS) for units supported by VMU-2 UAVs.

6. Targeting

Third Infantry Division (3ID) OIF targeting vignette:

> "Baghdad...watched a BM-21 moved to outskirts of city S/SE; fires 3-5rounds, returns to city. 3ID following on UAV (in DS to DIV) and tracks launcher back into the city where launcher links with re-supply vehicle. 96D SGT HOLT, Paul is watching on GBS [Global Broadcast System] monitor and is in mIRC Chat talking to Air Force FAC [Forward Air Controller] while the Targeting Officer, 1LT Elizabeth Snyder is talking to CFACC [Combined Force Air Component Commander] in parallel. SGT Holt verifies grid and confirms target. Air force destroys target. Total time of sensing to shooter - 20 minutes...would have been earlier but he [BM-21] was driving in residential area...ACE did not see the re-supply vehicle in the field he drove into until the BM-21 stopped at its hide site" (Bell, Gainey, and McCoy 2003).

The US Air Force's 421st Fighter Squadron used SIPRNET-based chat for time sensitive targeting. This allowed collaboration with the Combined Air Operations Center (CAOC) at Al Udeid Airbase for questions on targets, the ATO, or strike-related questions and coordination with parallel agencies. Dynamic targeting and strikes were also facilitated by chat. For example, a ground unit calls in a troops in contact (TIC) report, the information flows to

squadron operations, which can then re-task aircraft to collect targeting intelligence or to execute CAS. This applied to situations beyond troops in contact like pipeline attacks or suspicious activity where jets from the 421st would be re-tasked to a specific target for surveillance. The squadron monitored the mission and watched the CAOC direct events. Monitoring the mission in chat aided in debrief preparation and expedited the debrief/mission report process once the pilots returned.

7. Close Air Support

During OIF the 4th Air Support Operations Group (4th ASOG) attached to the US Army V Corps used chat continuously for CAS execution among US Army V Corps, Coalition Land Forces Component Command (CFLCC), Combined Force Air Component Commander (CFACC), and Marine Expeditionary Forces (MEF). They provided C2 for all CAS V Corps CAS missions and considered chat absolutely critical to mission accomplishment because it was the most expedient method of communication and allowed real-time collaboration.

Chat was used by 4th ASOG to task UAVs (Predator, Hunter, Shadow, Global Hawk) and other assets to collect and disseminate intelligence to Tactical Air Control Parties (TACP), CAS aircraft, V Corps ACE (Analysis and Control Element), and any other units requiring the information for CAS execution. Chat was further used for de-confliction of CAS, joint fire support, and of CAS and UAV airspace, real-time, within V Corps, MEF, CFACC, UAV units, and Air Force Distributed Ground Stations (AF DGS) – the people exploiting UAV imagery.

The 22d MEU (SOC) in Afghanistan for OEF coordinated details of emergency CAS tasking over chat, mainly for the requesting, allocating, and tasking stages. The senior watch officer would post TIC reports in the main chat room and CAS details would be worked out in the same room or in private chat with liaison officers at CJTF-76 ACCE. Changes to chat were discussed in chat before and during the mission. Changes would be sent to coordinating agencies in chat and from there radioed to airborne aircraft. The Marine Direct Air Support Center (DASC) used chat to update what aircraft would execute CAS and their status (i.e. tanking, time remaining on station).

8. Combat Recovery

The 421st Fighter Squadron used chat extensively in every combat search and rescue (CSAR) mission during OIF (Eovito 2006). Chat was the primary tool used with

UHF/VHF voice circuits for airspace de-confliction and other supporting arms and coordination of close air support (CAS) for combat recovery missions. The 24th MEU (SOC) used chat during OIF I and OIF II to request aircraft for combat recovery missions and pass information.

Helicopter Anti-Submarine Squadron Three (HS-3 "TRIDENTS") embarked aboard the USS ENTERPRISE (CVN-65) for OEF, used chat for joint CSAR. The TRIDENTS supported joint maritime CSAR and CSAR for western Pakistan and southern Afghanistan.

Chat was also used for search and rescue missions (SAR) in the United States. Again, HS-3 used chat, this time to coordinate a joint Navy and Coast Guard maritime rescue off of North Carolina.

9. Medical Evacuation

Chat played a significant role in the medical evacuation (MEDEVAC) process around the world and across the spectrum of military operations. Chat was used in Afghanistan during OEF by CJTF-180 to coordinate MEDEVACS of combat and non-combat casualties. The CJTF also used chat to clear fires in the MEDEVAC airspace. The 22nd MEU (SOC) also used chat for MEDEVACS as part of CJTF-180 and later CJTF-76 in Afghanistan during OEF. Units posted MEDEVAC nine lines to the main chat room and the MEU would either task our organic air with the MEDEVAC over chat or use chat to request support from higher headquarters. When Third Battalion, Sixth Marines (3/6) received a unit in contact report they immediately monitored the MEDEVAC preparations in the aviation brigade's chat room and passed MEDEVAC information to the CJTF in chat.

During two deployments to Iraq, Helicopter Marine Heavy Squadron-465 (HMH-465) received tasking from higher to execute MEDEVACs. The 9-line (MEDEVAC) information was passed to the squadron over chat and then handed to the MEDEVAC pilot just prior to launch. This information included grid coordinates, radio frequencies, what to expect at the landing zone (LZ), etc.

Chat was also used to coordinate MEDEVACs during Disaster Relief Operations. The USS IWO JIMA used chat to coordinate MEDEVACs as part of JTF-Katrina

10. Meteorological and Oceanographic Support to Joint Operations

Meteorological and oceanographic (METOC) forecasting support affects joint and combined operations across the full military spectrum. Chat has proven a vital tool for coordinating weather forecasts for various theaters. Southern Command METOC (J332)

personnel used chat during Operation SECURE TOMORROW to coordinate weather support for Royal Canadian Air Force helicopters flying in-and-around Port-au-Prince, Haiti.

The 28th Operational Weather Squadron (OWS) at Shaw Air Force Base (AFB), South Carolina used chat to support OEF/OIF. With chat they conducted forecast coordination, tailoring, and dissemination to in-theater units from one platform.

The lack of weather data in Iraq complicated forecasting efforts, but with chat METOC units at the CAOC, Al Udeid Airbase, Qatar and others spread throughout Iraq could collaborate with each other and with the regional forecasting center at Shaw AFB. The collaboration enabled by chat enabled them to develop one general forecast for the entire theater.

US Central Air Forces Command (USCENTAF) METOC used chat to provide weather support to all four services in both the OEF and OIF theaters. Chat was used to communicate with units in the field and discuss weather products. These units in the field were able to act as "eyes forward", feeding weather information back to USCENTAF that was integral to their product construction. They found chat use provided a more constant and reliable flow of information than other available methods (i.e. phone, email). With chat they were able to provide the best-tailored weather products to units because chat provided access to most units, enabling efficient, multi-person discussions that affected large groups of people. The time-sensitivity of some weather products was met with chat, which proved the fastest and most reliable method for their dissemination.

B. J-2 INTELLIGENCE

1. Counterintelligence

Members of the Air Force Office of Special Investigations (AFOSI) Detachment 105, Robins AFB, Georgia provide real time counterintelligence support in the Metro-Atlanta and middle Georgia AOR. They used chat for real-time discussion about intelligence and force protection information with the Clayton County Sheriff's Office, Georgia Intelligence Sharing Analysis Center (GISAC) and other local law enforcement agencies. Chat allowed AFOSI personnel to set up target areas to work sources and liaison with any nearby Air Force interests. Chat is used for planning and execution because of its ease of use.

2. National Intelligence Support to Joint Operations

The US Air Force's 55th Wing provided national intelligence support to OEF and OIF with their RC-135 Rivet Joint (intelligence, surveillance, reconnaissance platform) aircraft.

Chat was vital for real time re-tasking, target sharing, and indications and warning for ground elements. More efficient than voice, chat allowed real-time connectivity with everybody at once, including in joint and combined forces in theater and reachback to various stateside agencies. The most common use of chat was for coordination between on-station RC-135 Rivet Joints, the CAOC, and strike aircraft and similar coordination with ground elements

C. ASSESSMENT

There are many reasons warfighters choose to use chat. When answering the question of why chat, many attributes were used (48 total). Many of these attributes were synonymous, while others grouped well into subsets with each other. For productive discussion we wanted to refine the reasons given for chat use into common language, so we combine and reduce this list to the top five reasons for use.

1. Faster

Faster applies the chat users' ability to request, send, and receive large amounts of information in real-time. This is particularly useful for tasking. Tasks sent in email are immediately available for the recipient unit to read once you send it. Various members of the unit tasked can immediately read it and begin task clarification and refinement within their respective functional areas using chat. Subordinate and supporting units can also monitor these taskings and begin coordination and parallel planning, compressing the planning process and ultimately the time to prepare for mission execution. Tasking within chat happens so fast that some feel the chain of command is bypassed because very often when higher headquarters tasks the intermediate headquarters, the tactical units already see the tasking and begin working. However; many units leverage this speed to generate operational tempo, particularly in the dynamic counterinsurgent and disaster relief environments. Users report that chat aids in speeding up commanders' OODA Loops (Observe, Orient, Decide, Act).

Units are re-tasked fast with chat. The use cases demonstrated this: CAS aircraft in the air, UAVs, Special Forces teams – these can all be dynamically tasked during the mission because of the speed generated with chat.

Faster also applies to the transmission time and turn around times of other systems. There is no need to draft a radio message, hand it to the Radio Watch Supervisor, and wait for the operator to send it. Chat does not need to be read line by line like a radio message and copied down at the other end. You do not have to retransmit sections of the message or read

back sections to ensure understanding like you do with radio. Even if two actuals (commanders or staff officers) are talking to each other they (or somebody) need to take notes as grids, times, target numbers and the like are passed. This is unnecessary with chat, generating speed and making it faster.

Finding a phone number, dialing it, waiting for an answer, and then waiting for the person you actually want to talk too to get on the line can be long process. They may not be there requiring you to work with somebody else or even leave a message. If they are there you have to read grids, targets, etc back and forth and copy them down. Again, we see how chat generates speed.

Users point out that even email, file transfer, and web-based forms are too slow. They spend time looking up email addresses and websites. They do not have to wait on the distant end to read their requests and answer back. This is slower than chat. Now imagine you need to send the information to ten people in ten different units or agencies.

Chat is fast because it generates operational tempo. The increased flow of information across units, functions, operational boundaries, and services increase speed in planning and speed in execution.

2. Easy

Easy does include convenience, but easy helps make chat fast. With chat users have a list of who is in the room. All users in the room can read the chat thread (unless sent private) so users do not need to look up email addresses, phone numbers, or radio network ids.

With many users in the room, no multiple radio calls, emails, phone calls need to be made. Collaboration is the norm in chat, no need to coordinate it like white boarding sessions, conference calls, or video teleconferences. The ability to monitor multiple rooms means that you can monitor multiple missions of various units. Users feel it is easy to build and maintain their situational awareness this way.

Chat uses plain language that is easier to converse in and understand than radio procedure for example. Chat automatically creates a record of the conversation in the room that you can refer back to for clarification or even review later for after action items. Some chat tools can log their conversations so there is a record beyond what is currently displayed in the room.

Users said that chat was easier than other communication systems like tactical radio networks, or secure telephones (STU-III/STE). Some noted that is easier to type in Mission Oriented Protective Posture (MOPP) gear with a gas mask than talk on a radio or phone.

One must be wary of the convenience factor, because chat may not be the best tool for all situations, but is used anyway. For instance, a request that a user needs filled in hours or days is probably better sent over email than in chat. Inundating chat with non-time sensitive information creates clutter, confusion, and makes chat slower and harder to use.

3. Availability

This attribute is a composite of attributes like connectivity, reliability, stability. Users found (and now expect) chat to be there when other C2 systems are not. Further, they expect the users they want in the room 24 hours a day, seven days a week.

When users enter a chatroom, they not only expect other users within their unit to be available, but "everybody else" worldwide. Users cite chat's ability to provide a collaborative C2 capability between multiple garrison (headquarters) units in the continental US and deployed units worldwide in a single tool. This global capability is the minimum C2 capability expected by many warfighters interviewed. Further, users expect chat to provide this capability over SIPRNET, high side (TOP SECRET networks), and even on Non-secure Internet Protocol Routed Network (NIPRNET) for coalition disaster relief operations like JTF-Katrina or Operation Unified ASSISTANCE.

Users find that chat is available when other C2 systems are not. They reported that chat was the only form of communications in many cases, where units were too far for voice, and the available transmission systems lacked the bandwidth for larger C2 systems. The geographic dispersion and topography of Afghanistan coupled with its lack of infrastructure is a perfect example. Users at Forward Operating Bases (FOBs) in Afghanistan during OEF reported having only a couple phone lines, which allowed only two concurrent phone conversations, but provided them the ability to dial in with chat and have several concurrent chat sessions.

Even when there is more robust transmission systems support, these systems lack the bandwidth for many workstations with larger C2 systems, so warfighters limit the number of these and use chat to fill this capability gap. Many chat tools use very little bandwidth allowing more users to use chat than other C2 systems; these tools avoid latency and timing hits on the network. When the network experiences issues and capabilities degrade (intentionally or not),

text-based chat is the minimum "gotta have" and generally available long after the other C2 systems have stopped functioning.

Users know chat will be available and reliable and work that into their C4 plans. When deployed, the first data system up in many cases is chat. Chat is then used to coordinate bringing up and establishing connectivity with the other C2 systems. Chat is the user's troubleshooting tool of choice, used for the global troubleshooting of SECRET and high side systems in theater, across theaters, and even with contractors stateside.

4. Efficient

Users like how chat allows them to send more data with far less expenditure of time and effort. For example, various reports can be sent in chat while the user continues to look at the Common Operating Picture (COP); map software, or other tools. They can monitor chat while working in these tools.

Stated before, chat's capability for users to access multiple rooms and have conversations with multiple people with no extra effort is a capability strongly embraced by the warfighter. Returning to sending reports, users send reports to large groups of people with the same effort it takes to send it to one. While reports can certainly be sent by email, chat allows other users who may not doctrinally need the report but are monitoring the chat room to receive it, increasing their SA at no additional cost in time or effort. Chat allows users to be proactive rather than reactive within and across organizations. One should note that this could lead to the dreaded overreact, or proactive action on bad information, and points to the need for good business rules. Some, organizations, like USCENTAF, have already developed chat business rules.

Users like how chat facilitates understanding with written text. Time and effort is saved from repeating questions because you have it written before you – if information is missing users can identify it faster. This persistence is not provided as efficiently with other C2 means that use paper logs or even digital methods like email where users waste time rifling through email chains.

Chat allows a division of labor between units throughout the world. Preparation of the forecasts by the METOC in the use cases is a perfect example. Deployed units drawing upon other units globally can experience economies of scale.

Technically, the operation of chat should breed efficiency. We already mentioned bandwidth and latency, but with chat there is no retransmission of radio traffic or stepping on

each, no repeated phone calls back and forth. This creates efficiency elsewhere; reduced radio traffic freeing voice nets for urgent tactical traffic, phones free for when needed, less load on email servers.

5. Required

This attribute is interesting and foreshadows some of the issues in the next section on chat risks. If most business is done in chat, then you need chat to do business. Users feel that without chat, their SA would be diminished and information dissemination and coordination would be a struggle. In cases where chat did become unavailable, users did find themselves behind power curve trying to use other methods (particularly voice) because their business practices had actually changed (note that the business rules did not change with the practices).

Requirement goes beyond capability when you consider combined operations. The HMCS Toronto's experience demonstrated that chat is required during coalition operations, but not everybody is always on the same chat. The Canadian ship's call for a single chat was echoed by Expeditionary Strike Group Six (ESG-6). The ESG noted that forces under tactical control of coalition forces should use a collation chat solution (in this case CENTRIX) where you would normally use SIPRNET-based chat (ESG-6 2005). The counterintelligence use case demonstrated how a military unit was required to use chat with civil authorities to prosecute their force protection mission.

The attribute required goes back to the problem statement of this paper. There are numerous chat tools in use that do not interoperate. There are major issues during combined operations. If we believe, as users claim, chat is a required tool for warfighting, we need representation and program support to facilitate standardization and interoperability.

CHAT RISKS

Chat, like all military C2 systems, has associated internal and external risks that must be mitigated to an acceptable level. The factors creating risk are technical, organizational, and related to Human Systems Integration (HSI). These risks affect the baseline Information Assurance (IA) requirements of confidentiality, availability, and integrity set forth in DoD Directive 8500.1: IA (2002) and DoD Instruction 8500.2: IA Implementation (2003).

1. External Risks

The external risks are those to critical infrastructure and parallel to the generalized threats to the Global Information Grid (GIG) and other national (coalition partners) networks (JCS and DISA 2005). The peer to peer aspect (P2P) of chat includes risk, and was banned initially before being authorized conditional to adherence with the appropriate IA practices and Designated Approving Authority (DAA) approval (Wells 2004a and Wells 2004b). This does not mean the risks were mitigated, but only accepted.

2. Internal Risks

a. Integrity

Internal risks are the greatest, with 75 – 80 percent of all network attacks and loss of proprietary or classified information attributed to internal, authorized users (JCS and DISA 2005). Research has shown chat use can lead to a group phenomenon termed *false sense of security*, where things happen to quickly in virtual collaboration and lead to premature decisions (Wainfan, Lynne and Davis 2004). This impacts the integrity of information in chat. The MEF Tactical Air Control Center (TACC) experienced information integrity issues within chat rooms during OIF ranging from erroneous grid coordinates, transposed numbers for times, and even an incorrect order to execute a Tactical Recovery of Aircraft and Personnel mission (TRAP) (Glasgow 2003).

b. Confidentiality

With most chat residing on the SIPRNET, confidentiality is less at risk by external disclosure than by disclosure to or lack of disclosure from internal users. Many user ids used in chat are functional, making it difficult to know who is really in the chat room. Some consider that human nature creates risk, with users lying about their identity, sharing accounts, failing to log out, account compromise, and somebody looking over your shoulder or even "sniffing" your conversation (JCS and DISA 2005). Malicious software may be received and activated by users if coming from a "person" they are comfortable with in chat (JCS and DISA 2005).

c. Availability

Availability is impacted by several factors, with bandwidth the major factor affecting units' ability to use chat, particularly the chat capabilities of larger collaboration suites. During Operation UNIFIED ASSISTANCE, initial use of IWS chat by deployed METOC teams failed due to insufficient bandwidth, forcing all units supporting the Joint

Operations Area Forecast (JOAF) and switched to a smaller, less bandwidth intensive chat tool (Hey 2005; Symes 2005). A similar instance happened to CJTF-Haiti METOC personnel from USSOUTHCOM using the DCTS chat software, which failed due to bandwidth and latency shortfalls (Kampmeyer 2004). The Stryker Combat Teams of 3rd Brigade, 2ID used chat in Iraq to great effect; however, they too, suffered bandwidth-related availability issues (3rd Brigade, 2ID 2004).

3. Tactical Information Exchange and Situational Awareness

Finally, chat can actually affect the units' tactical operations and situational awareness. The Combined Anti-Armor Teams (CAAT) of Weapons Company, Third Battalion, Fourth Marines struggled to receive important information in Iraq. Important tactical information, TICs, be on the lookout (BOLO) reports, friendly troop movements, and more was sent in chat, not tactical radio networks leaving those units without chat out of the loop (Butler 2005a; 2005b). Recent research into human performance issues for supervisory control of the Navy's new Tactical Tomahawk missile, reported by Cummings (2005) made the unexpected discovery that many subjects fixated on the chat interface and ignored the task of retargeting missiles in urgent situations. The experiment subjects were repeatedly instructed that retargeting was their primary mission; however, they continued to fixate on chat answering all queries before the retargeting problems (Cummings 2005). The Command, Control, Communications, Computers, and Combat Officer (C5O) of the USS IWO JIMA, while standing watch noted that the volume of chat traffic inundated users with information. This information deluge consisted of legitimate traffic and spurious requests from users requesting information in the names of higher headquarters units. When the C5O started calling these users based off their profile information, he discovered they were lower ranking personnel collecting information for briefs and reports. In most cases the information had already been passed and chat was being used because it proved easier to ask for the information directly than look it up.

Significant research opportunity exists looking into managing the risk of chat use. Technical solutions abound, but standardization and the ability to integrate cross-domain within our own forces, let alone with coalition partners, remain problems of policy and organizational behavior. Organizational change must be coupled with HSI research to ensure success. Only by addressing risk as a dependency of technical, organizational, and HSI issues will we reach an acceptable level of risk for the DAA.

REQUIREMENTS

The requirements documentation and development of by Eovito (2006) used the capabilities-based approach called for in current joint doctrine and joint acquisition. The Capstone Concept for Joint Operations (2005) and its Joint Operating Concepts (JOCs) build the bridge between the National Security Strategy and the National Military Strategy and future joint capabilities through transformational change in Doctrine, Organization, Training, Material, Leadership and Education, Personnel and Facilities (DOTMLPF). The Joint Capabilities Integration and Development System (JCIDS) process is a capabilities-based assessment (CBA) composed of a structured, four-step methodology to define capability gaps, capability needs, and approaches to provide functional or operational capabilities defined in the JOCs to the future joint force (CJCSI 2005; CJCSM 2005).

This research concentrated on the definition of C2 capability gaps filled by chat and identification of capability needs to develop a set of warfighter requirements. This top down, systems engineering approach focuses on interoperability when decomposing the chat capability needs of DoD, federal and local agencies, and our coalition partners into requirements. This is crucial because while many organizations listed the same gaps and requirements, they had very different ideas of what those requirements meant to them (i.e. a bandwidth austere environment to the Navy is very different from that of the Air Force). The explicitly stated quad-service requirements and selected COCOM and OGA requirements are summarized in appendices one and two of this paper. Development of a single set of joint and coalition chat requirements continues.

CONCLUSION

Chat use has permeated all aspects of military operations. While considered an ad hoc "solution" for the warfighter filling short term requirements, chat is actually changing units' business practices, while the business rules regarding chat are not necessarily keeping up. This poses the question, "does chat support doctrine making warfighters more lethal, or does chat supplant doctrine, allowing corners to be cut?" We must establish an official set of requirements, official support, and official sponsorship for chat.

Appendix 1

TEXT-BASED CHAT REQUIREMENT COMPARISON				
Requirement	**USN**	**USMC**	**USA**	**USAF**
FUNCTIONALITY				
Participate in Multiple Concurrent Chat Sessions	X	X	X	X
Display Each Chat Session as Separate Window				
Persistent Rooms & Transitory Rooms	X	X		X
Room Access Configurable by Users	X	X		X
Automatic Reconnect & Rejoin Rooms	X			
Thread Population/Repopulation	X		X	
Private Chat "Whisper"	X			
One-to-One IM (P2P)				X
User Configured System Alerts	X			
Suppress System Event Messages	X	X		
Text Copying				
Text Entering				
Text Display				
Text Retention in Workspace				
Interrupt Sessions				
Foreign Language Text Translation				
Naming Conventions Identify Functional Position	X	X	X	
Multiple Naming Conventions	X			
Multiple User Types				X
Distribution Group Mgmt System for Users				
Date/Time Stamp	X		X	X
Chat Logging	X	X	X	X
User Access to Chat Logs	X	D		X
INFORMATION ASSURANCE				
Access Control				X
PKI Enabled (DoD CAC)				X
User authentication via Active Directory and LDAP ver3				X
Unique ID for all users worldwide				X
Provide Encryption				X
Multi-Level Security Operation		D		
SCALABILITY				
Austere Network Operation	X	D	X	X
Low Overhead Login Process	X			
Use Client Without Server	X			
Distributed Architecture	X			X
# Concurrent Chat Sessions	X			
# Concurrent Users	X		X	X
Specified Quality of Service	X			
INTEROPERABILITY				
DoD Standards	X			X
Multi-Platform Clients	X			X
Interoperate with Existing Collaboration Systems		X		X
Interoperate With Office Automation Tools		X		

Appendix 1

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Appendix 2

SELECT COCOM & DISA TEXT-BASED CHAT REQUIREMENT COMPARISON				
Requirement	**JFCOM**	**CENTCOM**	**NORTHCOM**	**DISA**
FUNCTIONALITY				
Participate in Multiple Concurrent Chat Sessions	X	X		X
Display Each Chat Session as Separate Window	X			X
Persistent Rooms & Transitory Rooms				X
Room Access Configurable by Users	X			
Automatic Reconnect & Rejoin Rooms				X
Thread Population/Repopulation		X		X
Private Chat "Whisper"				
One-to-One IM (P2P)			X	X
Off-line Messaging				X
User Configured System Alerts			X	
Suppress System Event Messages				
Text Copying	X			
Text Entering	X			
Text Display	X			
Text Retention in Workspace	X			
Interrupt Sessions	X			
Foreign Language Text Translation	X			X
File Transfer		X		
Portal Capable		X		
Web Client		X		X
Presence Awareness			X	X
Naming Conventions Identify Functional Position	X			
Multiple Naming Conventions	X			
Multiple User Types				
Distribution Group Mgmt System for Users	X			
Date/Time Stamp	X	X		X
Chat Logging	X		X	X
User Access to Chat Logs	X		X	
INFORMATION ASSURANCE				
Access control		X	X	X
PKI Enabled (DoD CAC)				
User authentication via Active Directory and LDAP ver3				
Unique ID for all users worldwide				
Provide Encryption			X	X
Network Security Tools		X	X	
Cross Security Domain Functionality		X		
SCALABILITY				
Austere Network Operation		X		X
Low Overhead Login Process				
Use Client Without Server				
Distributed Architecture				
# Concurrent Chat Sessions				
# Concurrent Users				
Specified Quality of Service				
INTEROPERABILITY				
DoD Standards			X	
Open Standard				X
Multi-Platform Clients			X	
Interoperate with Existing Collaboration Systems		X	X	X
Interoperate With Office Automation Tools				

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