Bridging the Joint Close Air Support Training Gap

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ABSTRACT

As enemy armored units threaten to overrun coalition forward lines, the Finnish Defence Forces Company Commander tries to contact the supporting Joint Air Ground Integration Center (JAGIC) to request fires. Enemy jamming has degraded voice radio communications. The supporting Joint Terminal Attack Controller (JTAC) requests immediate close air support (CAS) by sending a digital joint tactical air strike request to the JAGIC. The JAGIC, manned by U.S., Swedish and Finnish personnel, determines CAS is the best joint fires solution. The JAGIC digitally assigns two on-station Danish Air Force F-16C fighters to provide the required CAS while an airborne Royal Air Force MQ-9 shifts its orbit to provide follow-on CAS support. As the F-16s approach the target, the section leader informs the JTAC they are "digital capable" and the JTAC transmits his digital SITREP.

Digital systems in aircraft and Digitally-Aided Close Air Support (DACAS) ground kits provide significant benefits that improve CAS planning and execution. DACAS allows the use of digital messages to expedite communications, rapidly build shared situational awareness, reduce human error and shorten the kill-chain. DACAS is an increasingly important operational capability. However, with rare exceptions, current joint fires simulators do not support DACAS, leaving a gap between how joint fires personnel operate in the real world and how they maintain readiness.

How do we close this gap so warfighters can build and maintain the proficiency required to conduct effective joint and coalition DACAS missions? What role can simulation play in maintaining DACAS readiness? How do we make sure our traditional training strategies and methods are still relevant in an increasingly complex, digital world?

Building on our previous work (Reitz and Seavey, 2014), this paper discusses the challenges faced in developing DACAS capabilities in simulation to close this training gap across the Live, Virtual and Constructive (LVC) continuum.

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INTRODUCTION

Digitally-Aided Close Air Support (DACAS) is "the machine-to-machine exchange of required CAS mission data... between JTAC [Joint Terminal Attack Controller]... and CAS platform (or C2 node) for the purpose of attacking a surface target" (Joint Chiefs of Staff, 2014b). Digital systems in aircraft and DACAS ground kits provide significant benefits that improve Close Air Support (CAS) planning and execution. Although voice transmissions remain the principal means of communication during CAS operations, DACAS capabilities now allow use of digital messages to expedite communications, rapidly build shared situational awareness, reduce human error and accelerate the kill-chain. For example, a JTAC can now transmit digital target coordinates directly into an aircraft's systems before the aircraft even checks on station.

While DACAS is an increasingly important operational capability, current joint fires simulators (with rare exceptions) do not support DACAS. With nations, Services and program offices now beginning to develop their own DACAS capabilities in simulation, a common methodology is essential to ensure future fielded simulators are interoperable. This paper describes the early phase of a long-term effort to guide development of simulated DACAS capabilities to ensure future fielded systems are interoperable to support training, exercises and mission rehearsal.

BRIEF HISTORY OF DACAS

The development of a digital capability to control CAS operations began in earnest over the past decade and a half of war in Afghanistan, Iraq and Syria. With little guidance to ensure interoperability, nations, Services and program offices often fielded non-standard, non-interoperable, Service-specific digital data exchange capabilities (Mullins, 2009). These non-interoperable systems degraded mission performance in joint and coalition environments and increased the potential for human errors. Over the last two decades, multiple General Accounting Office reports have identified this as a recurring issue.

The creation of the Joint Fire Support Coordinated Implementation Change Control Board (JFS CI CCB) in 2013 codified joint digital fire support capability development across the participating nations, Services and program offices (Joint Chiefs of Staff, 2014a). The JFS CI CCB has an ongoing working group focused on DACAS interoperability. As a subordinate function of the Joint Fire Support Executive Steering Committee (JFS ESC), the JFS CI CCB DACAS Working Group provides nations, Services and program managers with a single body responsible for developing courses of action and delivering incremental improvements in DACAS capability in order to improve interoperability of fielded DACAS systems. As with other "coalition of the willing" efforts, the JFS CI CCB's success is a function of the participants' level of investment of time and resources to achieve the CCB's objectives (Mullins, 2014).

In the past few years, as DACAS material solutions have matured, the DACAS community recognized a need to standardize Tactics, Techniques and Procedures (TTP) for DACAS as well. In response, Joint Staff J6 and the Joint Test and Evaluation (JT&E) Program began a collaborative DACAS Joint Test (JT) to address the problem that "JTAC, JFO [Joint Fires Observer] and CAS aircrew lack a standardized joint TTP to take advantage of DACAS capabilities, including shared situational awareness, to improve kill chain timeliness" (Office of the Director, Joint Test and Evaluation, 2016). Consisting of two field tests, the DACAS JT posed the following questions: To what extent does the DACAS TTP improve kill chain timeliness? To what extent does the DACAS TTP improve confidence? How useful is the DACAS TTP to planning and executing the CAS mission?

One of the primary observations during the DACAS JT is that current DACAS training is insufficient. Although most participating units had experience in DACAS, few participants were fully ready for the test on arrival. Throughout the test, participants with formal system training and familiarity with TTP performed better than those without. As the test progressed, JTAC/JFO and aircrew proficiency increased with use, thereby highlighting the gap: better DACAS training was required. As a result, the DACAS JT put forward a number of recommendations for improving DACAS training. Foremost among these recommendations was that Services implement DACAS TTP training in CAS schoolhouses and instructor courses, that DACAS be included in joint exercises and pre-deployment certification events, and that Services develop simulation capabilities to train operators in the use of DACAS.

As observed throughout the DACAS JT and during multiple Bold Quest events since 2013, joint and coalition warfighters have an immediate operational requirement for military simulations to support DACAS[1]. With nations, Services and program offices now beginning to develop DACAS capabilities in simulation, a standard approach is necessary to ensure future fielded simulators are interoperable. With the goal of long-term interoperability of emerging DACAS capabilities in simulation, Joint Staff began a multi-year effort to close this interoperability gap.

INTEROPERABILITY IN THE LVC DOMAIN

Interoperability in all areas is a primary requirement for building the future joint force. As the "Capstone Concept for Joint Operations: Joint Force 2020" states, the United States must:

"Become pervasively interoperable both internally and externally. Interoperability is the critical attribute that will allow commanders to achieve the synergy from integrated operations this concept imagines. Interoperability refers not only to materiel but also to doctrine, organization, training, and leader development. Within Joint Forces, interoperability should be widespread and should exist at all echelons. *It should exist among Services and extend across domains and to partners*" (Joint Chiefs of Staff, 2012 [italics added]).

There are many definitions of interoperability, even within the U.S. Department of Defense (DOD). Joint Pub 1-02 offers two interpretations of interoperability. The first is a conceptual definition of interoperability as "the ability to act together coherently, effectively, and efficiently to achieve tactical, operational, and strategic objectives." The second definition focuses on technical interoperability: "the condition achieved among communications-electronics systems or of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users" (DOD, 2018).

Discussions of interoperability in the LVC domain typically address technical interoperability between systems. There is, in fact, an extensive body of literature on LVC technical interoperability, with the Levels of Conceptual Interoperability Model (LCIM) being perhaps the authoritative source (Tolk, 2003). The LCIM model describes seven layers of interoperability between systems, ranging from no interoperability to interoperability at an advanced conceptual level, where "[i]nteroperating systems are completely aware of each other's information, processes, contexts, and modeling assumptions" (Wang, Tolk & Wang, 2009). In the context of simulated DACAS, our interpretation of interoperability is conceptual and includes operational as well as technical aspects of interoperability.

Because of the broad array of issues involved in standardizing DACAS in simulation – warfighter readiness, digital fires capabilities, modeling and simulation – our concerns with interoperability focus on creating higher levels of interoperability between people and processes, not just systems. In our joint and multinational environment, the NATO concept of *force interoperability* perhaps best captures our view that interoperability is "the ability of the forces of two or more nations to train, exercise and operate effectively together in the execution of assigned missions and tasks." (NATO, 2018) Force interoperability implies much more than just exchanging zeros and ones over a network; it implies a shared understanding of how mission partners operate together. To build this understanding we first needed to tell a story describing the problem to gain consensus among our multi-Service and multinational stakeholders on

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[1] Bold Quest is the U.S. Joint Staff-sponsored Coalition Capability Demonstration and Assessment series of events. Bold Quest is a collaborative joint and multinational enterprise in which Nations, Services and Programs (N/S/P) pool their resources in a recurring cycle of capability development, demonstrations and analysis.

how DACAS in simulation should work. Only afterwards could we propose any technical solutions. The next section of this paper describes the process.

STANDARDIZING SIMULATED DACAS – A PHASED APPROACH

In developing the initial project plans for this effort, we recognized early that we had a unique opportunity to package this project into three distinct phases which will be performed prior to and during Bold Quest 19.1. Bold Quest 19.1, which will be held at various sites and ranges during 2019, provides an opportune venue for testing, demonstrating and assessing simulated DACAS capabilities.

Phase One: The purpose of this phase is to develop shared understanding among stakeholders. This phase includes defining objectives, identifying high-level requirements, documenting use cases for how simulated DACAS will work and specifying technical standards.[2] Participants in this phase include all stakeholders.

Phase Two: The purpose of this phase is to conduct distributed systems integration and testing to verify basic functionality of emerging simulated DACAS capabilities. Participants in this phase include systems owners, engineering teams, data collectors, analysts and supporting network and test support personnel. The proposed schedule for this activity coincides with a large risk reduction event that the Bold Quest community will conduct between mid-October and early November 2018.

Phase Three: The purpose of this third phase is to conduct an operational demonstration of one or more of the simulated DACAS use cases. This phase will include data collection that will support follow-on assessments of the demonstrated DACAS capability. Participants in this phase include all those from the second phase plus joint and coalition warfighters. This phase will occur as part of Bold Quest 19.1 execution.

For the reasons stated previously, we spent significant time and effort building agreement between stakeholders about requirements, objectives, context and scope of DACAS in simulation. Accordingly, we used the development of a concept of operations (CONOPS) as the first, consensus-building step in our efforts to standardize DACAS in simulation.

CONOPS FOR DACAS IN SIMULATION

As a starting point for this effort, our primary requirements emerged from this problem statement:

Joint and coalition warfighters have an immediate operational requirement for military simulations to support DACAS.

Before defining these requirements, we first wanted to develop a better understanding of the problem and the potential solutions. To support this, we developed a CONOPS to document the community's thinking about how future implementations of simulated DACAS should work together to support training, exercises and mission rehearsal.

The stakeholders selected five initial use cases that span the range of Live, Virtual and Constructive (LVC) operations (live range operations, virtual simulators and constructive simulation systems). These use cases describe the primary ways that simulation can support DACAS.

The DACAS systems mentioned throughout this document are either actual fielded DACAS systems (e.g., JTAC kits, operational flight programs on aircraft) or emulated versions of those systems designed to be training devices. For the warfighter in the simulator, there should be no significant differences in form, fit or function between the actual DACAS capability and an emulated device. The capability represented and the "muscle memory" reinforced should be the same.

[2] Due to the scheduling of Bold Quest 19.1, Phase One is the primary focus of this paper; subsequent phases will be addressed in follow-on work.

To simplify the explanation of use cases, the descriptions below depict a simple scenario in which one JTAC controls a single CAS aircraft. In simplifying this complex process, we do not intend to downplay the role of other participants in DACAS operations, but simply to clarify the use case. As a general rule, any solutions for simulated DACAS should be interoperable across all systems involved in DACAS, to include simulators and simulations for JTACs, Joint Fires Observers (JFO), CAS aircrew, supported ground maneuver units and supporting C2 and ISR organizations (e.g., Air Support Operations Center (ASOC), JAGIC, etc.).

While the training value of each use case is not the focus of the CONOPS, we mention it here to explain the purpose of each use case. Clearly, the best training environment for DACAS is a live range with live aircraft. With live training opportunities becoming increasingly more scarce and expensive, simulators can help fill the gap to maintain warfighter readiness. Following are the five main use cases for distributed LVC interoperability for DACAS:

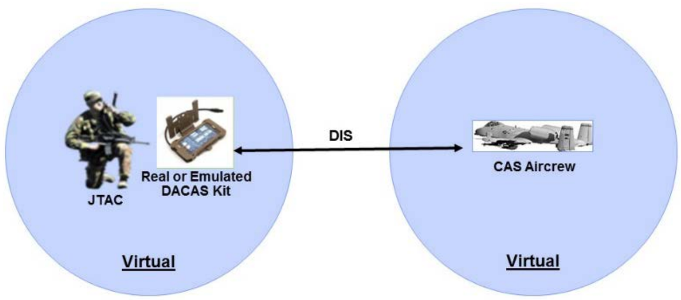

Figure 1. Use Case 1: Virtual JTAC with Virtual CAS Aircrew

Use Case 1: Virtual JTAC with Virtual CAS Aircrew (depicted in Figure 1).
(1) JTAC and CAS aircrew are both equipped with real or emulated DACAS systems located in virtual simulators.
(2) JTAC and CAS aircrew connect via network with simulated DACAS data transported between the two locations using Distributed Interactive Simulation (DIS) standard (IEEE, 1998).
(3) In this use case, despite not having the environmental stressors of live training (weather, terrain, etc.), training value is high for the JTAC and the CAS aircrew for Type 1, 2 and 3 controls[3]. Training value for both is also high for procedural employment of DACAS.

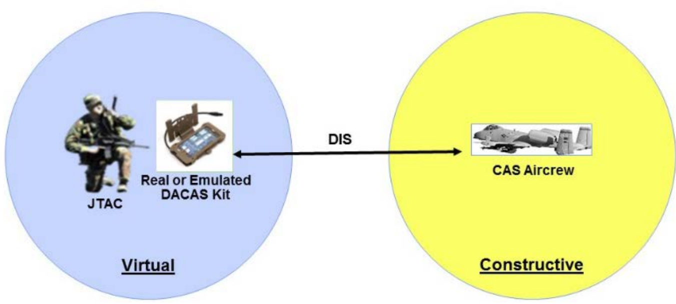

Figure 2. Use Case 2: Virtual JTAC with Constructive CAS Aircrew

Use Case 2: Virtual JTAC with Constructive CAS Aircrew (depicted in Figure 2).
(1) JTAC is equipped with real or emulated DACAS system located in a virtual simulator; CAS aircrew is a computer-generated simulation that responds to either manual input by a trainer or automated input from voice recognition software or other technologies that respond to tactical data link inputs.
(2) JTAC and CAS simulation connect via network with simulated DACAS data transported between the two locations using DIS standard.
(3) This is the default use case for training JTACs today in virtual simulators. The training value for the JTAC is generally higher than it would be without any constructive capability. This use case typically requires manual intervention from experienced simulation operators to "fly" the constructive aircraft. As constructive simulations become capable of more realistically interacting with the JTAC in a virtual simulator (via voice or digital communications), the training value of this use case will increase significantly.

[3] JTACs perform three main types of controls. Type 1 control is used when the JTAC must visually acquire the attacking aircraft and the target for each attack. Type 2 control is used when the JTAC is unable to visually acquire the attacking aircraft at weapons release, the JTAC is unable to visually acquire the mark/target, and/or the attacking aircraft is unable to acquire the mark/target prior to weapons release. Type 3 control is used when the JTAC must provide clearance for multiple attacks within a single engagement subject to specific attack restrictions and under the same conditions as Type 2 controls, (Joint Chiefs of Staff, 2014b).

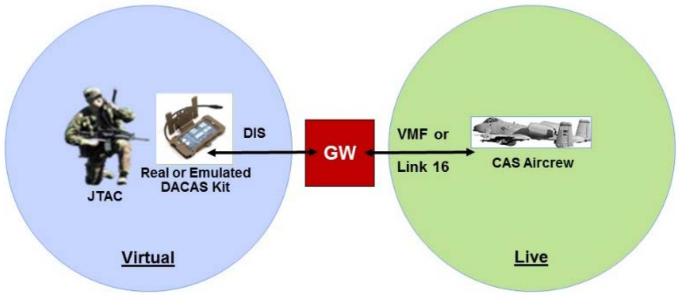

Figure 3. Use Case 3: Virtual JTAC with Live CAS Aircrew, through a gateway

Use Case 3: Virtual JTAC with Live CAS Aircrew (depicted in Figure 3).[4]

(1) JTAC is equipped with real or emulated DACAS system located in a virtual simulator; CAS aircrew is equipped with real DACAS system located in a live aircraft over a live range.

(2) Live aircraft's instrumentation provides spatial position data that is visible in the virtual JTAC trainer.

(3) JTAC and CAS aircrew connect via network with live and simulated data translated between the live and virtual environments.

(4) In this use case, training value for the CAS aircrew is improved by having access to an actual JTAC when live JTACs are not available at the range. There are a number of LVC interoperability challenges to make this use case effective for both JTAC and aircrew. For example, since the aircrew will not see the virtual JTAC or other simulated units on the ground, training value is low for the aircrew in discriminating between friendly and enemy units. For this reason, this scenario may be more applicable to Type 2 or Type 3 controls with no friendly units on the ground. Nevertheless, this use case can provide good training on procedural employment of DACAS.

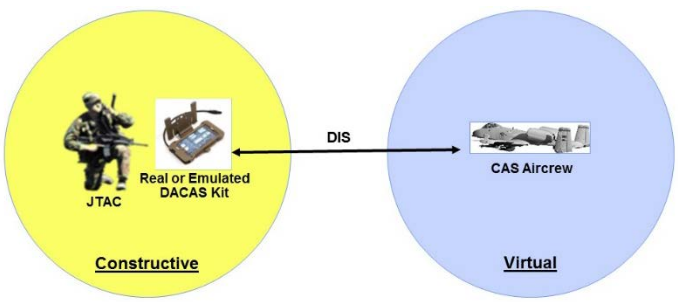

Figure 4. Use Case 4: Constructive JTAC with Virtual CAS Aircrew

Use Case 4: Constructive JTAC with Virtual CAS Aircrew (depicted in Figure 4).

(1) CAS Aircrew is equipped with real or emulated DACAS system located in a virtual simulator; JTAC is computer generated and responds to either manual input by a trainer or automated input from voice recognition software or other technologies that respond to tactical data link inputs.

(2) JTAC and CAS simulation connect via network with simulated DACAS data transported between the two locations using DIS standard.

(3) As in Use Case 2 above, this is the default use case for training CAS aircrew today in virtual simulators. The training value for the aircrew is generally higher than it would be without any constructive capability. As in Use Case 2, this use case typically requires manual intervention from experienced simulation operators to play the role of the constructive JTAC. As constructive simulations become capable of more realistically interacting with the aircrew in a virtual simulator (via voice or digital communications), the training value of this use case will increase significantly.

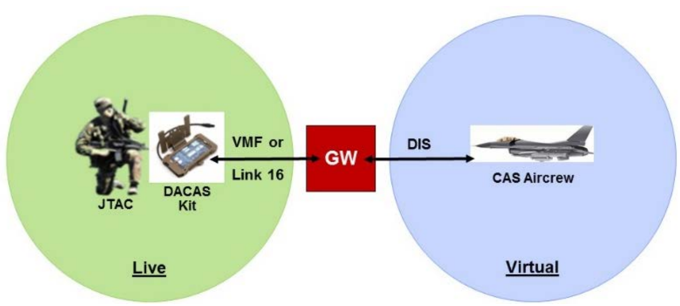

Figure 5. Use Case 5: Live JTAC with Virtual CAS Aircrew, through a gateway

Use Case 5: Live JTAC with Virtual CAS Aircrew (depicted in Figure 5).

(1) JTAC is equipped with real DACAS system located at live range; CAS aircrew is equipped with real or emulated DACAS system located in virtual simulator.

(2) Live JTAC is instrumented so that own position data can be seen in the virtual cockpit.

(3) JTAC and CAS aircrew connect via network with live and simulated data translated

[4] Use Cases 3 and 5, which blend live and virtual environments, require the use of specialized LVC systems and technologies (i.e., gateways (labeled "GW" in Figure 3) to bridge positional data, voice radio communications, data links and, in some cases, weapons effects across the live and virtual worlds.

between the live and virtual environments via some type of gateway (GW).
(4) In this use case, training value for the JTAC is improved by having access to actual CAS aircrew instead of role player-controlled constructive aircraft. Due to the projected paucity of live aircraft for JTACs to train with and the fact that DACAS makes up only a small portion of aircrew training requirements, this use case may have the highest utility. As in Use Case 3, there are a number of LVC interoperability challenges to make this use case effective for both JTAC and aircrew. For example, training value in this use case is negligible for the live JTAC for Type 1 controls, since the live JTAC will not be able to see the virtual CAS platform or any weapons effects on the target; it is better suited to Type 2 or Type 3 controls or for training procedural employment of DACAS.
(5) As a special case of Use Case 5, the live JTAC could be equipped with Augmented Reality (AR) systems that overlay the virtual environment onto the JTAC's actual field of view of the live environment. In the AR version of this use case, training effectiveness for the JTAC using AR optics can be high for both Type 1 controls and weapons effects (Reitz & Seavey, 2014).

Use Case 1 is the traditional use case for employing distributed simulators; Use Cases 2 and 4 are the default method used today in stand-alone virtual simulators for JTACs and aircrew with contract instructors often playing the constructive role. As artificial intelligence and agent-based constructive simulations become more capable of interacting directly with people (e.g., via voice recognition software), Use Cases 2 and 4 will become more common in distributed simulation too. The requirements for Use Case 3 and especially Use Case 5 are growing as LVC technologies – especially AR – mature and fill some of the gaps identified above. While Use Cases 1, 2 and 4 are the way we use simulation to train today, Use Cases 3 and 5 will play an increasing role in how future joint fires personnel train. Therefore, to ensure that a solution for simulated DACAS works now and in the future, a standard approach must support all five use cases.

The discussion above about use cases and high-level requirements for simulated DACAS primarily involve virtual simulators and live systems in which the operator is an actual Soldier, Sailor, Airman or Marine. Most training and exercises, also involve trainers as part of a white cell. The white cell plays a critical role in tailoring training to the needs of the trainees. Each of the five use cases must also enable white cell players to participate in DACAS events involving simulation. White cell players do not require the same level of realistic form, fit and function for their DACAS systems, but do require similar capability. In this way, all of the use cases described above could employ a white cell player as a surrogate or adjunct for any other participants. For white cell players, the simulated DACAS capability is an integral part of their training capabilities.

DACAS Messaging Standards

Since the use cases outlined above represent participation by both live and simulated DACAS systems, the standard approach for simulated DACAS must focus on interoperability of DACAS messaging.

Operational DACAS systems use a mix of messaging protocols today in the live environment, with the Variable Message Format (VMF) standard being the most widely in use today (MIL-STD, 2012). A growing number of systems also use Link 16 and Situation Awareness Data Link (SADL) standards (MIL-STD, 2008). In the simulation environment, DIS is generally the baseline standard for joint fires simulators, with a small number of systems using various implementations of the High Level Architecture (HLA) standard (IEEE, 2010). Where VMF is predominant today in the live environment, Link 16 is better developed and more widely implemented in simulation than VMF.

There is no one-to-one correlation between VMF (K-series) and Link 16 (J-series) messages. As one example, the Routing/Safety of Flight (RSOF) phase is done entirely in voice when using VMF; in Link 16, it includes a mix of voice and J-message exchanges. Additionally, K-series messages (e.g., K02.33 CAS Aircrew Briefing) are generally more tailored to CAS operations than J-messages. Many Link 16 exchanges use the J.28.2 (Free Text Message) to transport information, such as the JTAC's 9-line brief.

These differing techniques create a notable difference in DACAS message flow between VMF and Link 16. DACAS solutions in simulation must be able to support whatever type of messages their user base employs in the real world. That is, for simulators supporting JTACs who normally use VMF-based DACAS kits, the DACAS solution should handle VMF K-series messages. Similarly, for those supporting an aircrew virtual trainer whose actual aircraft normally uses Link 16 to exchange DACAS data, the DACAS solution in simulation should also handle Link 16 J-series messages. For simulators supporting users with DACAS kits using both VMF and Link 16, the DACAS solution should support both. Do simulators need to represent these differences in message flow? We argue that they do.

First, Link 16 and SADL are well supported in simulation and there is a growing capability to support VMF (SISO, 2006 and SISO, 2015). The DIS standard provides a flexible, interoperable way to handle tactical data links in simulation. Established DIS TRANSMITTER and SIGNAL Protocol Data Units (PDUs) transport data link messages in the same way that DIS handles any radio transmission. The TRANSMITTER PDU indicates location and activity state of the radio transmitter; the SIGNAL PDU carries the message payload. The standard specifies the type of data link used and supports multiple data link types, including Link 16, SADL and VMF, among many others (SISO, 2017).

Second, since Use Case 1 is currently the most common for distributed operations, it may appear safe to assume that a solution for simulated DACAS can create its own unique message types and message flow, thereby requiring no association to real world messages and data flow. This erroneous assumption would mean that program offices and vendors could choose their own method of relaying simulated DACAS messages. Often such choices are based on Service or system-specific requirements only and do not contribute to broader joint and coalition interoperability. As an example, instead of using Transmitter and Signal PDUs, simulated DACAS messaging could potentially use DIS DATA or SET DATA PDUs to pass DACAS information, such as 9-lines. Application, program or vendor-specific solutions are usually difficult to translate to other systems and software. Therefore, they are generally non-interoperable solutions that detract from, rather than contribute to, improving systems interoperability.

Finally, we are working with five use cases that span live, virtual and constructive environments. Use Cases 3 and 5 have one foot in the live domain and require real world message flow to support the live DACAS system. Translation devices can bridge simulation-specific solutions and real world DACAS systems. However, a standard that represents a one-to-one correspondence between real world messages and simulation messages is a more general and ultimately a more interoperable solution. Gateways that support non-standard implementations are generally not interoperable solutions and may end up being stove-piped, proprietary solutions.

With the use cases and description of message flow outlined above as background, we derived the following high-level requirements for standardizing DACAS in simulation:

1. The standard approach to simulated DACAS must define a technical standard (or set of standards) that supports all five use cases identified above.
2. The standard approach to simulated DACAS must support interoperability across all systems involved in DACAS, to include simulators and simulations for JTACs, JFOs, CAS aircrew, supported ground maneuver units and supporting C2 and ISR organizations and other related systems.
3. For JTACs and JFOs, the simulated DACAS kit must provide a realistic DACAS device (i.e., an actual DACAS kit or an emulated device) with requisite form, fit and function for the type of DACAS kit that the JTAC operates.[5]
4. For CAS aircrew or C2 organizations, the simulated DACAS system must provide a realistic DACAS capability with accurate form, fit and function for the type of systems that the aircrew or C2 organization operates.
5. The simulated DACAS system should employ the same messaging protocol that the simulator's user community employs (i.e., VMF or Link 16).
6. Joint fires simulators should support the ability to process real-world DACAS messaging (i.e., VMF, Link 16 and/or SADL) from live systems natively or via gateway solutions.
7. Data translation gateways must be able to support the translation of messages between live DACAS protocols (i.e., VMF, Link 16 and/or SADL) and simulation protocols (i.e., DIS, HLA, etc.).
8. The sequence of data flow for simulated DACAS messages should correlate with live DACAS message data flow.
9. DACAS capability in simulation solutions should be vendor-agnostic and not depend on proprietary software or hardware.
10. The technical standards defined in the CONOPS should be used for all simulated DACAS efforts throughout the LVC community.

[5] Similar form, fit and function are not a requirement for white force players.

NEXT STEPS

The primary work so far has been on developing and gaining consensus on the CONOPS, which outlines high-level requirements as a first step toward defining a standard approach for implementing simulated DACAS. As we reach consensus on the CONOPS, we are simultaneously beginning detailed planning for test and integration activities during the Bold Quest 19.1 risk reduction event in the fall. This event will include distributed sites in North America and Europe. At the same time, we are now in early planning for a live demonstration next spring of Use Case 3 with a virtual JTAC in the U.S. or France digitally controlling a live aircraft.

For this effort to be successful in the long term, it is crucial that within the joint fires simulator community we develop a standard methodology for doing DACAS in simulation. Once the standard gains community buy in, we will need to ensure that current policy and guidance for simulators, such as the JTAC Memorandum of Agreement (MOA) that governs the accreditation of JTAC simulators, reflects this methodology (Joint Chiefs of Staff, 2017). Establishing a new implementation process in the modeling and simulation community, leveraging a coalition of willing stakeholders will be a challenge, but as already demonstrated in operational DACAS development, it is an achievable challenge.

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