RECOMMENDATIONS FOR FRANCHISING AIRCREWS IN SYNTHETIC ENVIRONMENTS

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ABSTRACT

Synthetic environments will become increasingly important to the military in the future. The capability to optimally blend virtual, constructive and real environments will become crucial not just for aircrew training, but for other military uses (e.g, test and evaluation, research and development, prototyping, tactics validation). Technical advances in networking will theoretically allow any site in the world to be linked into world-wide synthetic environments. Individuals and components from the Joint Chiefs of Staff down to the individual warrior will be able to access these environments. Senior leaders will interact through synthetic environments in much the same way they currently interact with theater and battlefield level assets during war. Therefore, this paper does not focus on issues related to franchising upper echelon users of synthetic environments. This paper expresses recommendations and considerations about what will be required to franchise aircrews at the lower end of the hierarchy.

In the zeal to create and use synthetic environments, operating concepts, access tools and aircrew training requirements may be over-looked. Aircrews already voice the concern that they are merely "training aids" for senior leaders in large-scale exercises. The problem stems from aircrews not being allowed to function as they would in combat. This paper describes concerns, recommendations and access tools that should be considered to make sure that aircrews are properly franchised in the use of synthetic environments.

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INTRODUCTION

The Department of Defense has embarked upon a long-term program to make modeling and simulation (M&S) integral to future defense programs. It will be used in a wide range of roles from requirements definition, weapons systems development and acquisition, test and evaluation to training and education. The term for this initiative is "synthetic environments" (SE). This use of technology is deemed so important that the Department of Defense Office of the Director of Defense Research and Engineering has made SE one of only seven R&D "Thrusts" that it is pursuing.

Technology, real-world constraints and new age thinking about modeling and simulation have combined to significantly influence the creation and use of synthetic environments. SE will be used to provide and expand training opportunities that will complement and supplement future wargaming, exercises and operations tempo. When combined with live training, constructive (wargames and exercises) and virtual training simulations will provide a synergistic representation of what has heretofore only been available in battle.

Technical advances in networking will theoretically allow any site in the world to be linked into world-wide synthetic environments. Individuals and components from the Joint Chiefs of Staff down to the individual warrior will be able to utilize these new environments for their own purposes. Senior leaders will be able to interact through netted confederations of synthetic C4I environments in much the same way that they currently interact with theater and battlefield level assets during combat. Higher aggregate levels of constructive simulations with semi-automated forces and intelligent adversaries will meld with virtual and real weapons systems. This will provide decision-makers with the opportunities to apply and hone warfighting skills at the strategic, operational and tactical levels of war as well as supporting the decision-making process.

Invariably, man-in-the-loop simulation will be desired, if not required, to fully exploit realistic environments for decision-makers and warriors alike. As individuals and teams are transported into higher aggregate levels of simulation, concerns will arise regarding the relevance to those individuals' needs.

In the zeal to create and use SE for everything from requirements definition to manufacturing, it must be tempered by a requirement to do so. This creates a dilemma for leadership. Attempts to develop inclusive simulations that cut across various levels and types of simulations have been viewed as having limited utility, especially for the individual. Classic concerns of using individual warriors as "training aids" for those above them have created an aversion to participation in simulations and exercises alike. Serious problems can arise if lower-level SE users believe they are not allowed to function as they would in battle.

Incorporation of all levels of participants is not necessarily required or desired in every simulation. However, it may become extremely beneficial and cost-effective if a synthetic environment can support multiple opportunities to train while higher echelons practice the business of war at their levels. It

is imperative that the requirement to support higher levels of simulation with aircrews-in-the-loop accommodates the individual warrior's needs. It will be critical that the requirements of those above are transparent to those below.

Synthetic environments will offer the potential for increased training effectiveness, reduced training costs, accelerated mission readiness and ultimately improved combat effectiveness. Desert Storm showed that while the Services have dramatically improved their ability to fight individually and collectively as a joint/combined force, training opportunities still lag total combat requirements. Visions include linking ranges and thousands of weapon system platforms (both real and virtual) to provide more realistic training. While real platforms will continue to provide the operations tempo required to mature the force, virtual tools will provide those opportunities or alternatives unavailable due to cost, environmental, security and safety constraints and encroachment of airspace and ranges. This combination of training capabilities will provide a training synergy that is currently not available or readily accessible to the aircrew.

However, the utility of these simulations will rest with the ability to franchise the aircrew both when the aircrew needs are being supported by SE, and, as importantly, when the aircrew is used to support higher level requirements. Concepts and access tools must be developed that will meet the needs of the aircrew while supporting a broader use of synthetic environments.

TECHNOLOGIES THAT MAKE SYNTHETIC ENVIRONMENTS POSSIBLE.

Enabling technologies are having the dual effects of making simulation more acceptable and credible, while at the same time significantly reducing the costs of simulation. Classic training constraints and encroachment of live training environments have accelerated the need to develop training alternatives.

New weapons systems and Global Reach-Global Power considerations are expanding training requirements. These enabling technologies are supporting an explosion in the application and utility of synthetic environments for all warfighters. Technology rollover is occurring more and more frequently as costs continue to drop significantly as computer speed and power increase dramatically. This relentless evolution has created opportunities for technology to reduce procurement and sustainment costs while dramatically increasing capability, realism and accessibility of training. The creation of realistic simulated environments, whether benign or full combat scenarios, will provide aircrews with new and expanding training opportunities. These realistic, simulated combat environments are becoming available and affordable.

Full visual systems supported by common, universal data bases can be networked locally or long-haul, secure, to bring all supporting elements together. Standardized, secure network protocols, high speed-high capacity nets and universal network interface units will allow aircrews to participate in any level or combination of simulation from live to virtual to constructive from their unit training device or while in their aircraft. Advanced image generation and display systems will make simulations realistic enough for full mission rehearsal or total combat immersion.

THE NEED TO FRANCHISE AIRCREWS IN SE

Despite their advantages, synthetic environments and simulation in general, do not enjoy universal support from aircrews and the current leadership. The reasons are varied, but focus on a lack of credibility, fidelity, cost and concurrency of simulation, especially for the fighter community. Also, concerns remain that simulation will again adversely impact operations tempo as in the 1970's when flying hours were reduced based on the potential for simulation to offset the cost reduction effort. Consequently, it is imperative that the aircrew be fully franchised

in new and expanding simulation applications.

The utility of synthetic environments rests with the ability to "franchise" the aircrew both when the aircrews' requirements are being specifically supported by SEs and, as importantly, when the aircrew is used to support higher level objectives.

Webster's New Collegiate Dictionary defines franchise as "freedom or immunity from some burden or restriction vested in a person or group." In the case of synthetic environments, the burden or restriction would be the concern that aircrews would be constrained in their ability to fully interact with a simulated battlefield compared to their wartime mission requirements. To be franchised, the aircrew must be "empowered to obtain value from their involvement in a training environment." This empowerment will come from establishing legitimate simulations and providing acceptable access tools based on aircrew training requirements.

Because of the nature of their positions in the chain of command, and because of the relative ease in representing the type of equipment, communications and data they would use in a theater-level battle, it should not be difficult for senior leaders to feel franchised in an SE.

However, a problem will occur if aircrews do not feel franchised (This problem may exist for all warriors at the lower end of the chain of command. However, this paper only addresses aircrew concerns). One primary concern is that the aircrews will serve only as "training aids" for leaders/decision-makers higher up in the chain. This concern is derived from experiences aircrews have had in large, live-fly, joint exercises in which participation was not conducive to good training. Loitering, flying designated ground tracks or acting as targets for ground-based systems in the simulated theater were not, and will not be seen as a desirable activity. Constraints that are necessary in the real arena need not be tolerated in simulation. Employing a "limited" weapon system may provide unrealistic and/or negative training. Aircrews are looking

for an unconstrained, all switches up combat environment. Anything less will be viewed as an accommodation to someone else's requirements. A self-centered, but legitimate concern.

The potential consequences of disenfranchised aircrews will be manifested in several ways.

- Over-tasking of aircrews. The proliferation of SE may inundate the down-sized force structure. Single-seat aircraft in eighteen unit equipped squadrons may lack the manning to cover new additional taskings to participate in SE even if it is beneficial.

- Lack of relevance. Boredom or lack of attention may result if the simulation is not realistic enough or the aircrew perceives a training aid status. Scenarios must be stimulating and challenging and provide the aircrew training opportunities that are unavailable or readily accessible in his current regimen.

- Poor desired outcomes. If aircrews are not properly franchised, training benefits will not be achieved by the aircrews or by the higher echelon participants. If the aircrew is supporting a higher level simulation, those objectives may be skewed due to the poor performance by the aircrew and represented weapon system. Poor performance may produce bad data which may negatively impact decision-making by higher echelon leaders.

- Dislike of SE. Disenfranchised aircrews could feel some resentment that they are "forced" to spend time in SE. This may be true even if their access to an SE is via their actual aircraft. This resentment could carry over from training applications of SE to other applications such as: test and evaluation, weapons systems design, and tactics development where M&S credibility is already a problem.

- General negative attitude towards simulators. Disenfranchisement will be most

probable for aircrews accessing an SE with a marginal access tool (simulator). They will be frustrated by being asked to accommodate "sim-isms" and limited fidelity that constrain their ability to employ their weapon system as they would in combat. Classic negative training. Less apparent will be the reticence of aircrews who view current simulators as somehow threatening. The windowless building with meatlocker temperatures. Cipher locks controlling access to nonconcurrent devices with, at best, a window to the battlefield. Canned scenarios from someone else's database. Grade sheets made out by contracted instructors. The dreaded cry from the ops counter, "We need somebody for the sim" as if it were time to feed the beast as opposed to an opportunity to hone combat skills.

- Paranoia concerning flying hour tradeoffs. Until aircrews are effectively franchised in SE or any simulation, inordinate concern will exist regarding potential loss of flying hours to simulation. The concern is real, it happened in the 1970s. The solution is to provide training opportunities that do not overlap or compete with flying time by pursuing low-cost, high fidelity access tools and realistic synthetic combat environments.

RECOMMENDATIONS FOR INCREASING THE LIKELIHOOD THAT AIRCREWS WILL BE FRANCHISED IN SE

In order to provide adequate synthetic combat environments and access tools that have the proper functional and physical fidelity, we believe it will be necessary to implement the following recommendations that are aimed at franchising aircrews. We believe that the consideration of the following recommendations would be very beneficial.

1. Provide realistic, accessible simulated combat environments that provide training opportunities that are currently unavailable to the aircrew. (e.g, full mission training, force-on-force engagements, kill removal, electronic warfare)

2. Provide multi-use, affordable, high fidelity training devices in the unit that can stand alone, net with others or access SE.

3. Use aircrews in SE only when they are productively engaged in a specific mission. We are concerned that aircrews may become disenfranchised if they are participating in an SE where they are only used to support the objectives of the exercise.

4. Design SE and SE access tools based on the needs of the aircrew in order to fully franchise the aircrew and ensure support of the SE objectives.

5. Franchise aircrews in the "Big Picture" through briefing and debriefing sessions at all levels. SE should provide the technology to make briefings/debriefings easily available for all levels. Long haul, secure networking of simulators, constructive wargames, and range instrumentation debriefing centers will ultimately allow warriors at all levels to be linked. Aircrew distance from the primary SE exercise areas before and after the exercise will not be a problem for briefings/debriefs. Quality video teleconferencing will go far toward allowing the aircrews to feel that have been franchised in the entire process.

6. Ensure senior-level users address the concerns of the aircrew.

PROVIDING ADEQUATE ACCESS TOOLS FOR THE AIRCREW

The capability will soon exist to effectively and affordably immerse aircrews in the synthetic combat environment as opposed to merely a view of the battlefield. This immersion will require that legitimate access tools be made available to transport the aircrew into the simulation to fully leverage this expanding training capability. Training devices must evolve to become the access tools to these environments. As such, they will be required to fully replicate the capabilities of the weapon system they represent while porting the aircrew into the simulated combat environment. The

simulation also must provide for mission requirements such as multiship employment while including combat support assets such as AWACS and EW platforms to ensure realism.

Three types of fidelity must be addressed to ensure appropriate support to the aircrew. Functional fidelity is based on the faithful representation and operation of the simulated system and subsystems at the model and integration level. Physical fidelity requires that the interface between man and machine provides adequate familiarity to preclude "sim-isms". Both of these relate to concurrency with the weapon system. Psychological or perceptual fidelity, while less precise, requires that the aircrew "feels" right in the simulation. Shortcomings in any of these could result in negative training, lack of confidence or credibility in the simulation or poor results that could skew decision-making. Reduced or selective fidelity also may require a validation of training effectiveness for which adequate studies are time-consuming and difficult at best.

Rather than pursue the question of "How much fidelity is enough?" We must pursue technology, methods and applications that will make full fidelity affordable and available. While full fidelity may not be required for all applications, operating in a full combat scenario makes it imperative.

However, some have suggested that the aircrew need only be provided with a minimalist solution primarily to reduce costs. The "60% solution" may allow the aircrew to believe they are in the synthetic environment because it "generally looks right", and it properly represents the data base. However, if it doesn't allow the aircrews to adequately perform their combat duties and tactics, their frustration may be similar to that caused by lack of concurrency in their current genre of training devices.

While the SE community is investing large amounts of resources in developing and demonstrating the M&S and networking infrastructure necessary to create SE,

aircrews are offered "60% solutions" for their simulated weapon system. This is akin to building an Indianapolis speedway, then providing the race car drivers with go-carts to simulate the Indy 500. Aircrews want to conduct effective training that cannot be provided elsewhere, whether it be in the aircraft or the ground-based training system. They want to enter combat, real or simulated, with a full-up system, and not be constrained by lack of fidelity.

In order to "train the way we intend to fight", the synthetic training environment must represent the combat environment without peacetime constraints and with minimal concessions to reduced fidelity. The simulated weapon system must be able to conduct the specific mission without accommodations. Therefore, the access tool must fully support the warfighters requirement to enter the simulated combat environment with his total weapon system and that of his wingman or total force package. If the requirement for aircrew-in-the-loop is to operate in a simulated combat environment, then the aircrew must be provided with a full-up simulation of his weapon system. The corollary is that if higher levels of simulation require a weapon system be involved, then aircrew-in-the-loop is required since the aircrew is an integral part of the weapon system. Anything less will not fully franchise the aircrew and will require arbitrary extrapolation to determine value and utility to training and decision-making objectives alike. Aircrew requirements must be used to determine the capabilities of the training device or access tool, not the objectives of the supporting SE. Therefore, in order to fully franchise the aircrew, the requirements of the aircrew must be met before the objectives of the synthetic environment can be achieved.

CONCLUSION

Franchising the aircrew, if not properly understood and addressed, could greatly reduce the effectiveness of synthetic environments. The SE development community may be able to make huge strides in the technological challenges related to SE

(e.g., networking, data base development, instrumentation). However, if aircrews and other warriors at the bottom of the chain are not accommodated, they may discount the training value of the SEs in which they participate.

SE proponents must avoid the following attitude about franchising the aircrew: "The folks at the bottom will just have to get used to the idea that in a theater-level SE their needs and concerns are not of paramount importance. They will get something out of their participation regardless of how they feel about it. They are paid professionals and they will just have to do what they're told."

Such an attitude will not help SE attain their full measure of utility. In this paper we have made recommendations that we believe will allow the full enfranchisement and empowerment of the aircrews that will be such important parts of future synthetic environments.

An aircrew should not be expected to enter combat, real or simulated, with less than a full-up weapon system and the full complement of combat support. If synthetic environments have anything to offer aircrews, it is an unconstrained opportunity to "train the way they will fight." If they are constrained, then the simulation has failed and we have failed to support the aircrew.