IS LVC A PANDORA FOR ALL TRAINING NEEDS ...?

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ABSTRACT

The military have been encouraging the development of training assets, particularly platform simulators that can be linked to create large scale virtual training exercises. Interoperability standards such as DIS and HLA have been created and a number of exercises conducted, realising considerable savings against the large scale deployment of live assets. Appended training systems have also advanced over the years enable live assets to train together realistically and safely in monitored environments improving training effectiveness. However, there has until recently been little demand for the integration of the Live, Virtual and Constructive domains, despite the advantages of force multiplication, tempo and realism (especially in communications). With even more emphasis on costs saving, coupled with the continued advance in technology, the military are now turning to industry to improve interoperability still further to make maximum use of all available assets.

Keywords: workstation design, work measurement, ergonomics, decision support system

1. ROTARY WING INTEGRATION

Rotary wing offers an interesting example in the LVC domain. Helicopters operate across the land, sea and air environments, are operated by all services and in many case by one service on behalf of another (e.g., the Air Force providing tactical lift in a battlefield environment).

However, they are rarely truly integrated into any combined force training other than as occasional role players – largely down to cost. Role playing without training benefit is not cost effective and deployment costs are also high.

Therefore, LVC offers a considerable training advantage that the military may now be prepared to adopt on a larger scale.

AgustaWestland has conducted a number of studies and self funded demonstrations into the technology necessary to delivery truly integrated rotary wing training environments :

- Apache Live-Virtual Integration: A successful demonstration has been conducted by Agust aWestland with Aviation Training International Limited (ATIL) and The Boeing Company, integrating the live training and virtual training environments, using Apache AH Mk1 Collective Training System (CTS) & the ATIL Attack Helicopter simulator network. This highlighted benefits in force multiplication and tempo, along with reducing environmental demands and the pressure on the training fleet by lessening the impact of live aircraft. Other applications include the integration of UAV's into the live training domain, via their ground stations.
- Ship borne Helicopter: AgustaWestland has also conducted technical feasibility studies into the stimulation of helicopter sonar systems, on the ship and airborne, to enable training with constructive targets or with submarine simulations, classroom trainers or embedded trainers. The data is passed to the aircraft via off board stimulators when on the deck or the ships Data Links when airborne.
- Air/Land Integration: Study activity has taken place with UK MoD and Industry to integrate t he Apache AH Mk1 CTS with training ranges and the UK's fxed wing Rangeless Airborne In strumented Debriefing System (RAIDS). This would enable AH and the strike aircraft to train together, including the helicopter designating t argets for fixed wing attack.

2. LVC - A ROTARY WING CASE STUDY

In addition to rotary specific applications, AgustaWestland has also assisted the UK MoD in demonstrating linked virtual training exercises (the Combined Arms Tactics Trainer) with the live domain (Salisbury Plain Training Area), using the UK's tactical communication Bowman network.

This paper takes the Apache Live-Virtual integration study and looks at some of the lessons learned.

2.1. The Exercise

In 2004 AW, Boeing and ATIL developed a training scenario to demonstrate the practicalities of LVC, based on a 4 ship exercise. The demo had 3 simulators on a wide area network, linked to an instrumented live aircraft, which had a training mod to allow for simulated weapons effects.

The demo was a Sal missile engagement with both live and virtual entities targeting 3 live vehicles at Middle Wallop airfield. The networked simulators (at Dishforth, Wattisham and Middle Wallop) were stationed on HMS Ocean in Southampton water and the live aircraft based at Middle Wallop.

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All the aircraft departed their bases, approach march and flight into a holding area just south of the target area, before moving to the battle position, at which point a series of engagements started.

The first engagement (Sal missile engagement - handoff) had a virtual aircraft (FMS) designating for a live aircraft, targeting the furthest of the instrumented targets (now a virtual entity within the simulated environment). The FMS selected the target, confirmed and passed the designation data to the Live aircraft so the live aircraft could run through a remote Sal engagement, once the live aircraft had confirmed the designation code, a virtual simulated missile was fired against the Live target. During the engagement the FMS had to ensure it achieved the critical illumination period to ensure the missile found its target and on impacts the Live target registered a hit and flashed its instrumentation to indicate to the live aircraft the targeting was successful destroyed. At the same time all the simulators could see a constructed vehicle on fire following a successful engagement.

Second engagement, the roles were now reversed with the Live aircraft designating for the FMS and the next target selected. This created a new set of issues, with the Live aircraft now having responsibility for achieving the critical illumination period so the FMS could conduct a successful engagement of the target.

Following the successful completion of both engagements the live aircraft returned to base, prior to a full after action review for the 4 aircraft (3 sim's and 1 live). During debrief the following issues were identified: tempo, data bases / entities, simulation within the cockpit and aircraft qualification.

2.2. The Results

Exploring these issues in detail:

- Tempo the exercise had been run using the simulators the day prior to the demo to establish the schedule for the main event and to esure that critical events took place when advertise. However during the live demonstration that schedule was significantly impacted by the effects of the LIVE aircraft and the diferences between simulated flying and live aircraft manoeuvring, which created a significant delay to the overall event. So if time critical events are a key part of the training requirement, then care must be taken to ensure a realistic duration is achieved .. Adding a live entity into the exercise may enhance the training fidelity and ultimately the effect
- Data bases / Entities – The resolution of the terrain data base and the location of imported entities coursed a few issues .. we had vehicles appearing semi submerged or hovering above the ground, but this was easily resolved by tagging the entity to ground. More significant were the impacts of visibility, with the live aircraft having its view of the targets obscured and a revised fire position required prior to the engagement, even though the simulators had clear line of site at all times.
- Simulation within the cockpit – The crew of the live aircraft committed that the exercise would have been more realistic had they been able to see the simulatd aircraft alongside them during the engagement, even though the 4 aircraft could communicate clearly they still felt the training lacked a level of realism from not having tht capability.
- Aircraft qualification – Simulated training systems on board Live helicopters is still not widely available, its more common in fixed wing and for land forces, but to gain the full potential out of systems available today, a base line configuration should be established which provides the building block for training systems development. How do we partition onboard software, yet still display realistic systems / effects. How do we manage growth, without the massive expense of aircraft requalification?

3. SIMULATION INTEGRATION

We have learned much from the work completed to date, and the technology to achieve integration has been available for some time, but very little live-virtual integration has actually been achieved. There have been many reasons for this temporary stagnation, but this is starting to change. Some of the key issues listed below, focused on the UK, but with similar observations across geographies:

- A focus on the more immediate training need for operations, with some limited success in integrating virtual assets for specific tactical training needs such as the Military Training thrugh Distributed Simulation (MTDS) programme in the UK which has matured from an experimental into and operational programme (Distributed Synthetic Air Land Training – DSALT) with plans to develop further through the new Defence Operational Training Capability (DOTC). This has a stated objective to lay foundations for full LVC post 2020, paving the way for new and innovative solutions to be realised.
- A lack of budget to integrate training assets. The budgets for training have traditionally been associated with and individual platform or groups of platforms. The integration of these assets has required the individual programmes to effectively give up part of their training budgets which they have been reluctant to do. Interestingly it is the current lack of budget for costly all live training that is causing the military to look again at simulation, instrumentation of live assets and integration of training assets to deliver a collective training benefit. It is

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recognised now that to achieve this, budgets need to be allocated for integrated collective training as well as individual. By illustration, the UK MoD has recently conducted an Industry consultation on this issues and international military presenters at the recent TEC event sited networked training as something we have talked about for a long time and now need to do.

- Maturity of Technology, especially in the live domain where the integration of laser and radio based training systems with the aircraft has often beenfinancially prohibitive, especially where such instrumentation would primarily benefit the land forces training with the airborne platform rather than he aircrew specifically. However, this too is changing, with new systems available, such as cards to incorporate into on board processors (as opposed to bespoke Line Replaceable Units-LRUs) and light weight sensors using radio wave networks to replace hard wiring.
- Industrial Inertia. The incumbent defence simulation providers have stagnated in terms of the level of technology and innovation they can provide o the Military. The commoditisation strategy must be pursued even harder to deliver true value for money. Part of this solution must include the wholesale adoption of gaming technologies which can provide a level of fidelity unmatched by the traditional options – gaming technologies that are a result of tens of billions of revenues each year globally and themselves drive the adoption of common standards and tools. In order to achieve the savings, investments must be made in the correct areas to allow adoption of the technology. In parallel, military procurement organisations should pursue a "Small & Medium Enterprise" policy that ensures a certain proportion of overall funding is spent with agile, innovative organisations, unhindered by bureaucracy, who can raise the bar to the larger organisations.

4. OPEN STANDARDS AND COMMON DATA BASES

LVC integration will depend upon the cost-effective application of common standards and common databases. These are maturing and being used more widely as more implementation tools are becoming available moving away from the traditional domain of the large primes.

For LVC applications the most significant development has been in the production of simulator databases from real-world data, using satellite imagery. This has a number of advantages to Live – Virtual integration:

- Ability to align the real and simulated world so that all players have the same view of the world and other players position init.
- Real world Maps can be used by all players, as opposed to maps derived from databases that all take a slightly different view of the same world.
- Rapid Database development of detailed terrain areas for specific training purposes which should be the same for all players.

Figure 1

The continued improvement in graphics processing power will also help by enabling the processing of detailed databases for all players. Such detail may not be required at the individual training level, just for collective training end especially live-virtual integration emphasising the need to budget at the Macro level to ensure that each platform system is properly equipped.

5. AIRCRAFT INTEGRATION

The integration of the necessary embedded and appended simulation equipment is the most costly aspect of LVC and therefore the most difficult to justify on a cost basis. However, without it, collective training exercises lose significant value with aircraft being invulnerable to ground fire and unable to engage targets in a realistic and meaningful way. As helicopters in particular are increasingly becoming an essential integrated component for most operations it is time to review this situation as we call more and more to 'train as you fight and fight as you train'.

Fortunately technology has moved on, enabling a lower cost approach to be taken to integration with more effective solutions. Some examples are given below:

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- Lightweight laser sensors: It is now becoming possible to move away from large pods hardwired into the aircraft systems and to use lighter laser sensorsthat communicate using radio based systems.
- DAS stimulation: Card based solutions are available to stimulate the aircraft DAS from simulated threats either produced from within the systemor from externally simulated entities
- Helmet projector systems: The quality and capability of these systems has also improved to the point now where simulated targets can be practically preented to the aircrew flying in the live assets, overcoming many of the limitations experienced during our previous demonstration.
- Radar and Sonar stimulation: Technical feasibility studies completed by AgustaWestland and Lockheed Martin have shown that on-board systems may be stimulated to provide training in the live environment whilst on the ground or airborne. These systems can in turn be networked to virtual and constructive entities. This could be of particular benefits in the Naval environment and operators have been interested for some time in helicopter integration, but requirements have yet to emerge.

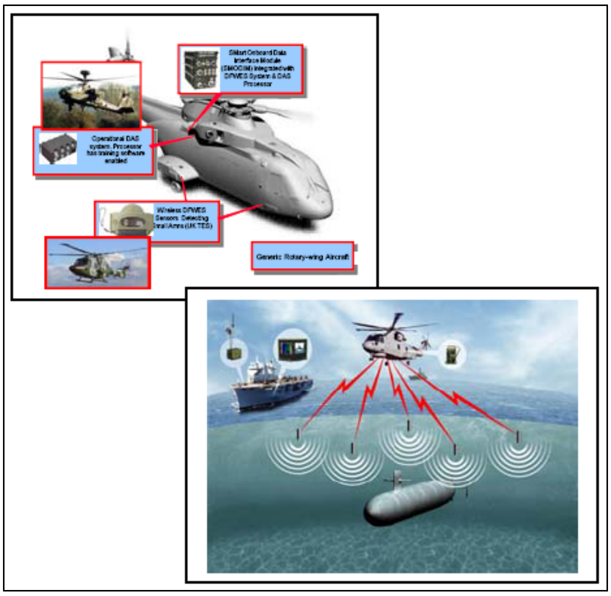

Figure 2

These systems can all communicate to ground stations that can link into networks using DIS and HLA.

6. CONCLUSION

The technology exists and has been proven to work, creating the opportunity to link in Live, Virtual and Constructive training assets to meet the needs of all types and levels of collective training as required by individual nations or at the multi-national level. However there are some barriers that must be overcome:

- Military stove pipes: Inevitably individual services and units will have to give up some live training budget to fund better synthetic and integratd training which has proved difficult if not impossible. Unless forced (increasingly more likely) they make take some convincing, but if we can demonstrate real training value rather than inert role playing then this may help.
- Procurement stove pipes: Individual programmes are still cutting costs by droving out interoperability with bespoke solutions, especially in visual databases with several versions of the same area
- Industry stove pipes: Preservation of IPR has lead to incompatible systems and databases with proprietary interfaces. Real common standards must be the way ahead.

Clearly we all need to work together if we are to get the full benefit of LVC.

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