Assessing the needs of the warfighter in distributed collective training simulations

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ABSTRACT

The UK Ministry Of Defense (MOD) has a vision of providing Mission Training through Distributed Simulation (MTDS) for the air component of the joint battlespace. The MTDS Capability Concept Demonstrator (CCD) programme was funded to determine the key requirements for an MTDS capability and to understand the range of training which could be achieved within such a facility. To achieve this, a demonstrator facility was developed. This facility included fast jet and Airborne Warning and Control System (AWACS) simulators, and an extensive exercise management capability (including virtual role players and Computer Generated Forces). A synthetic air battlespace (air, land and maritime) was created for the exercises and the MTDS CCD facility was linked up to other UK and international facilities, all operating within a shared virtual world. This paper discusses how effectively warfighters' collective training needs can be met (when the trainees are collocated) with differing levels of simulator fidelities. The fast jet simulators used through MTDS CCD consisted of type representative mission simulators, representing four Tornado GR4 and four Typhoon aircraft. Each cockpit could be used within visual systems of three differing fidelity levels. A detailed human factors assessment was conducted to determine the requirements for these simulators and the impact of those requirements on training value. Clear themes supporting the need for a targeted fidelity approach emerged from the data analysis. For instance, it was clear that wraparound visuals would be needed to support Air to Air and Air to Ground training needs. It was also clear that to support a wide range of mission profiles, a sufficient range of weaponry models were needed. Collocation provided the audience with additional benefit of face to face training interactions. In consequence, enhancements to the facility to support future training exercises are being made as a result of these findings.

ABOUT THE AUTHORS

Dr Helen Dudfield is a QinetiQ Technical Manager with responsibility for human factors integration in training and simulation. Since 1986, she has been leading teams conducting human factors research in warfighter interface design, training and simulation. She has exploited defence technologies into civil programmes, including developing training for civil flightdeck situational awareness and for transition to glass flight decks. Recently, she led the Team ACTIVE human factors assessment team during the UK Mission Training Through Distributed Simulation Capability Demonstrator programme at RAF Waddington based at the Air Battlespace Training Centre.

James Kearse is a business development manager within the Simulation and Training group, Farnborough. He joined QinetiQ in 2004 as a training analyst supporting land collective training research for the UK MOD. In 2006 he joined the team tasked to deliver the MTDS CCD programme, and spent much of the next 3 years on this project, while continuing to support land training programmes. He was responsible for delivering large sections of the MTDS CCD research, focusing particularly on the training value, exercise management and operational utility areas. Following the successful completion of the programme in 2009 he assumed a new role as business development manager for QinetiQ's augmented reality technology.

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INTRODUCTION

The UK Mission Training through Distributed Simulation (MTDS) programme seeks to use synthetic training environments to deliver operational team and collective training for the air component of the Joint Battlespace.

"Collective training involves 2 or more 'teams', where each team fulfils different 'roles', training to interoperate in an environment defined by a common set of collective training objectives"
NATO Study Group SAS-013

The MTDS Capability Concept Demonstrator (MTDS CCD) was funded to de-risk UK MTDS by defining the user requirements. This demonstrator programme was managed by UK MOD and delivered by the QinetiQ led Team ACTIVE partnered with Boeing, CueSim, ATIL, HVR and Rockwell Collins from 2005 to 2008. The findings of the programme have been summarized in Dudfield et al (2008). The output of the programme was a series of reports based on studies and evidence obtained from a programme of nine exercises conducted using Team ACTIVE's facility located in the Air Battlespace Training Centre (ABTC) at RAF Waddington. The ABTC was linked to US, UK and Canadian distributed mission training centres as the programme progressed.

The purpose of the programme was to address a number of Key Investigative Areas (KIAs) and wider questions. In order to answer these KIAs, UK, US and Canadian forces, fast jet, rotary wing, Airborne Warning and Control System (AWACS), maritime and land military personnel, participated in MTDS CCD exercises during which their requirements for a MTDS capability were captured.

Fidelity Requirements For Meeting Warfighters Needs

When considering the design of a training environment a number of constituent parts must be considered which together deliver an overall training experience. These individual elements were examined in detail during the MTDS CCD programme and include the delivery of an exercise management model, the provision of planning and brief/debrief tools and Synthetic Training Equipment (STE).

Delivering the appropriate level of fidelity for each element is an important consideration as this is likely to be a significant cost driver during the 20-year UK MTDS programme. The fidelity of all elements of the training system should be considered, from planning tools through to the formation debriefing capabilities. In addition, the mission execution phase has been the focus of much attention. For fast jet training within the MTDS CCD, Team ACTIVE provided a mix of synthetic cockpits and visual fields of view allowing the appropriate level of fidelity for UK MTDS to be evaluated.

MOD funded research into air battlespace mission training prior to the MTDS CCD developed a series of STEs ranging from generic desktop PC-based solutions for role players to the type-representative two seater Tornado GR4 cockpits (Smith, 2003). Each increment in fidelity was based on analysis of aircrew feedback. These type-representative cockpits were the starting point for the research undertaken by Team ACTIVE.

While much of the work conducted before the MTDS CCD focused on the collective training domain, the MTDS CCD facility provided an environment to examine wider operational contexts, including joint

collective air land scenarios. For example, for the Tornado GR4 platform, investigation of fidelity levels focused initially on how different visual fields affected training benefit. As the programme evolved, attention widened to include how the Tornado GR4 crews might benefit from wider training with Forward Air Controllers (FACs), AWACS, rotary-wing aircraft and expanded coalition participation. The type representative level of fidelity of the cockpits was also reassessed as the range and complexity of the missions was expanded to include these other players and trainees.

The MTDS CCD programme included Typhoon (single seat) mission training simulators and a seven-seat AWACS simulator. These allowed Team ACTIVE to assess how modern counter-air fighter and air battle management training needs could be met in the MTDS context (Kearse et al, 2009).

Aligned with the analysis of STE fidelity for collocated training was an assessment of the impact of dispersion on training benefit, and the optimum balance between collocated and dispersed training. Following outputs from the preceding research (Smith, 2003), it was reported that, where practical, collocated training was more effective than distributed training. Since this research was conducted, there had been technological and conceptual developments related to MTDS which were likely to impact the previous findings. In addition, the current operational tempo and the predominance of coalition operations had increased the need for dispersed training and training across national borders with combined partners.

The MTDS CCD programme assessed the effect of dispersion on training benefit by comparing responses provided by collocated and dispersed players of each domain type (e.g. air-air, air-surface). This comparison was directly influenced by the level of fidelity experienced by each participant. Many of the coalition participants used high fidelity STEs which was expected to have improved their experiences. As reported in Dudfield et al (2009), where fidelity is matched to operational needs and exercise management controls and processes are in place to manage the exercise effectively across the sites, findings showed that dispersed and collocated trainees can both obtain similar levels of training benefit. This aspect, whilst not the focus of this paper, allows comparisons to be made between participants of similar roles at different sites to help confirm the collocated training requirements.

MTDS CCD Facility

The MTDS CCD facility, illustrated in Figure 1, consisted of eight fast jet simulators (four Typhoons and four Tornado GR4 aircraft), a seven seat E-3 AWACS capability, and a comprehensive exercise management and control suite.

Figure 1. MTDS CCD components

A 40-seat briefing and de-briefing room and a selection of smaller formation planning rooms were provided. These incorporated standard in-service planning aids and video conferencing, telephone and interactive whiteboard technology so that warfighters could undertake a condensed cycle of planning, briefing, execution and debriefing (PBED). A classified networking hub connected securely with training facilities in the UK, US and elsewhere in the world.

ASSESSMENT APPROACH

Participants

Twenty-four Tornado GR4 aircrew participated in the MTDS CCD across the course of four exercises. All, bar one, were combat ready with 738 average hours on type, with a very broad range of experience. The majority of aircrew had recent operational experience.

Typhoon aircrew participated in the execution phases in three exercises and demographic data was collected from 11 pilots across four exercises (this included their participation in PBD for one exercise). As Typhoon is a relatively new capability, the

average hours on type were relatively low (171 hours/pilot). However, 6 had prior experience on other frontline aircraft, and 5 of these had operational experience in those aircraft.

MTDS CCD Fixed Wing Simulators

Cockpits

The Tornado GR4 simulator was a type representative flight simulation system designed to represent the key elements of the Tornado cockpit relevant to mission training. These were developed for the research studies that preceded the MTDS CCD (Smith, 2003) and were supplied to the programme by the MOD. They were limited both in terms of the weapon models provided and in that their avionic fit had not been upgraded to reflect the current Tornado GR4 fit. The Tornado GR4 aircraft has been upgraded rapidly for use on current operations and many of the new avionic systems were not represented in the MTDS CCD simulators. This affected the warfighter's ability to participate in an increasing range of mission profiles. The fine balance between fidelity level and collective training benefit was a core assessment criterion of the research.

The Tornado GR4 simulator comprised a two-seat cockpit, equipped with conventional flight controls, mission systems and a limited range of guided and unguided weapons. The cockpits were fitted with head-down display screens, weapon, sensor and aircraft control panels and a representative communications system.

The Typhoon cockpit was fitted with three reconfigurable head-down display (HDD) screens, setup to replicate the standard Multi Function Displays (MFD) in the aircraft, weapon, sensor and aircraft control panels, and a representative communications system. There were two varieties of single seat Typhoon Cockpits - high and low fidelity. In the higher fidelity cockpits, the keys on the MFDs were real, whereas in the lower fidelity these were emulated as soft keys. The simulators had a limited range of guided and unguided weapons.

This was the first introduction of UK Typhoons into a synthetic collective training environment and much was expected to be learned in terms of the degree to which the fidelity levels provided met aircrew's training needs.

Visuals

Each of these simulators could be placed in one of three different levels of visual enclosures, offering nine different fidelity combinations to explore. The visual enclosures varied from two 'high fidelity' panoramic display (250h by 75v and 260h by 42v degrees) to a 'low fidelity' single-channel flat screen display (80h x60v degrees). Cockpits were switched between these visual environments over the course of multiple exercises to allow an investigation of the effect of visual fidelity on collocated training to take place.

The data collected allowed Team ACTIVE to compare performance and perceived training benefit in these differing environments to inform decisions over the field of view required for each role (air to air and air to surface) in UK MTDS.

Dispersed Simulators

In order to compare how much training benefit the collocated participants were experiencing in comparison to other participants, data were also collected at each dispersed training site. This allowed comparisons to be made between those that were collocated and dispersed, as reported in detail in Dudfield et al (2008) and Dudfield et al (2009).

In order to validate the warfighters experiences, the analysis team were able to compare the Tornado Air to Ground (A-G) and Typhoon Air to Air (A-A) team experiences with their role equivalents at dispersed locations:

- Two F15 variants; F15C four-ship full-mission trainers based at Langley; and F-15E Strike Eagle training systems;
- High fidelity F-16s based at AFRL Mesa;
- Deployable Tactics Trainer (DTT) F-16 lower-fidelity simulators;
- Medium fidelity A-10 simulators based at AFRL Mesa and Spangdahlem.

Procedure

Data were collected by UK and US research teams at each event using a range of objective and subjective data collection tools. At each training exercise Team ACTIVE human factors experts observed groups of the UK training audience and the exercise management team, i.e. the white force and role

players. Interviews and surveys with participants in the UK were conducted. These were supplemented by the AFRL Coalition Mission Training Research (CMTR) toolset (Gehr et al 2005, Bennett and Schreiber, 2005, Schreiber et al, 2006) including both UK and US collected data collected by the US CMTR research team at all sites. The focus of the CMTR was on Mission Effective Competencies (MECs) that are: "Higher-order individual, team, and inter-team competencies that a fully prepared pilot, crew or flight requires for successful mission completion under adverse conditions and in a non-permissive environment" (Colegrove et al, 2002 and 2005).

Nine events were conducted in the facility, five of which involved front line warfighters. These five exercises, plus one technical trial (FALCON FLIGHT) provided the data that allowed Team ACTIVE to answer the KIAs. These exercises were: BATTLE BUZZARD, CONDOR CAPTURE, NORTHERN GOSHAWK, ARCTIC OWL and AVENGING EAGLE. Each exercise typically lasted a week with a familiarisation day and then a build up in operational complexity over the next 3 or 4 days. Typically the fast jet warfighters were exposed to a range of mission types with their workload increasing over the exercise week, these included:

- Air-Air (Offensive and Defensive)
- Air-Surface (Close Air Support, Suppression/Destruction of Enemy Air Defences, Air Interdiction)

A day in the life of the MTDS CCD facility followed the cycle of PBED. The day began with mass briefings setting the context and overall intent for the day's mission. Led by a Mission Commander, the warfighters would then begin their formation planning, and co-ordinating between formations (including across national boundaries), as required. Following the completion of the mission execution phase, warfighters would lead a series of debriefings, beginning with a formation level debriefing. The final activity was a mass debriefing in which all participants ran through a facilitated After Action Review (AAR) including timed stamped mission replay, to capture the critical lessons identified.

It is worth noting that, in line with prior research, the warfighters gained benefit from far more than the mission execution phase alone and that ratings of training benefit will reflect the Planning, Briefing and Debriefing (PBD) cycle as well as the execution phase.

Measures

As the programme was driven to de-risk the appropriate levels of fidelity for collective training, a number of tools were applied to participants specifically relating to fidelity (Dudfield et al, 2008).

Each warfighter was asked to rate the simulator that they had flown on that day, typically on the penultimate exercise day, through the means of a survey. Finally during EXERCISE AVENGING EAGLE, there was a controlled comparison of tents with small domes over 4 exercise days.

Simulator component fidelity survey

The first of these was a likert scale survey asking crews to comment and rate elements of their cockpits. This survey focused on individual elements of the cockpits and visuals allowing for identification of their impact on immersion. Aircrew were asked to rate their agreement with a series of statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree), e.g.:

- The visual system provided sufficient fidelity to support my training
- I gained sufficient situational awareness from the out of the window cockpit view
- The cockpit provided sufficient fidelity to support my training

Essential vs. Desirable Survey

Following on from data obtained in the preceding survey over the course of the first four exercises, a system-focused survey was developed to distinguish between the range of requirements for Typhoon and Tornado GR4 platforms. This included a list of platform systems derived from Typhoon and Tornado GR4 aircrew manuals including in-cockpit systems, sensors, weapons and communications. Aircrew were asked to rate each requirement as essential, desirable, or not required. Ratings were captured separately for formation-level (i.e. team) and collective training.

MEC Fidelity Survey

A MEC based fidelity survey was used to analyse the degree to which MEC experiences were being met by the fidelity of the STE. These were collected for all platforms. Participants were asked to rate the extent

to which they could gain various experiences with the simulator. The ratings were from 0=the capability to experience does not exist to 5=the capability to experience exists to a very good extent.

Other sources of information

In support of the surveys focused on fidelity directly, other data tools were used to add detail and help explain their results. The first of these was the CMTR Top Three Bottom Three (T3B3) survey, distributed to the training audience, role players and white force every day. The aim was to obtain the top and bottom three outcomes of the day. Comments were also used to support the quantitative outputs from other data analysis.

A pre and post MEC survey allowed evaluation of the difference between what training participants expected to receive (CMTR expectations Survey 2a) and, after the exercise, what they actually experienced (CMTR experiences survey 2b). These CMTR MEC surveys were different in the UK and US to accommodate for differences in the type of aircraft and terminology used. In order for comparisons to be made common MECs by role were identified (Dudfield et al, 2009).

To determine if warfighters thought that the training had value, a CMTR Reactions survey was used to establish how the aircrew felt about the MTDS concept as compared to their current training.

As well as the written surveys, a number of structured interviews were carried out to evaluate different aspects of MTDS, including formation experiences. Focus groups were held to establish warfighter opinion on the use of MTDS to increase e.g. understanding of operational doctrine, weapon systems, different platforms and Composite Air Operations (COMAOs), etc.

RESULTS

Where possible, the data from the exercises were analysed by parametric techniques. Analysis of the comments was carried out in conjunction with T3B3 data, quoted below, to allow points made to be further substantiated or clarified.

Visuals

As can be seen in Figure 2, results from the simulator component fidelity survey illustrated that satisfaction with the level of visual performance, fidelity and situational awareness was positively correlated with the increasing field of view. It was concluded that a larger wraparound field of view was essential for UK MTDS.

The requirements for air-air and air-ground visual systems were largely similar. An accurate and correlated visual representation of air and ground effects and objects were essential immersion factors, as was the ability to fly in formation via visual cues. A wide field of view was needed in both domains but for different reasons.

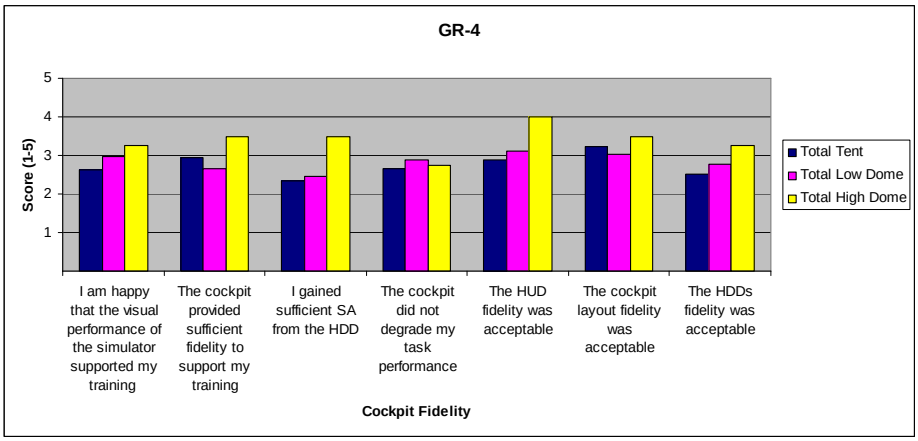

Figure 2. Results from the Tornado GR4 cockpit component survey by visual field of view (Score: 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree and 5=Strongly Agree)

In the air-air domain formation flying drove the need for a large out-the-window view. In the air-land domain the same applied but there was also a need to provide a wider view for Close Air Support (CAS) procedures and to immerse back seat aircrew.

Tornado GR4 simulator results

The more detailed ratings of simulator and wider fidelity components by Tornado GR4 aircrew illustrated that the Tornado GR4 cockpits were not sufficiently up-to-date to receive agreement with statements for the controls and comms systems (Figure 3). "Lack of realism between the sim and the GR4 cockpit. Unconventional processes." (Tornado GR4 in EXERCISE BATTLE BUZZARD) and on the performance of specifics "The mechanics of the simulator - the way the cockpit is laid out- lack of relevant fidelity means the simulator is extremely unrealistic....." (Tornado GR4 in EXERCISE NORTHERN GOSHAWK). Comments made in EXERCISE AVENGING EAGLE indicated that the cockpits were Tornado GR4 "almost adequate but not quite" and indicated that these cockpits needed to be enhanced. Clearly UK MTDS simulators should be representative of the operational equipment but in a targeted and upgradeable fashion such that "The difference between the jet and sim even just the basic functions wastes so much time during what could be great training". (Tornado GR4 comment in EXERCISE NORTHERN GOSHAWK) can be avoided. A number of aircrew comments across four events articulated the requirement for a greater number of weapon types and sensors than those provided within the MTDS CCD facility. This was in part due to the rapidly increasing operational context of the MTDS CCD during the programme as a result of its success and the need for the crew to be able to respond to this tempo. It is apparent that for flexibility in training, wider weaponry options are necessary

Further support for increased fidelity in specific areas was provided by the CMTR 2a and 2b surveys with expectations being higher than experiences on weapon related MECs. It was clear that as the MTDS CCD evolved over the course of the programme expanding the scope and range of training, the needs of the collocated Tornado GR4 crews increased in terms of cockpit fidelity. A further influence on ratings of training experience was due to the divergence between the MTDS CCD cockpits and updated systems on the actual aircraft, this was likely to have affected immersion.

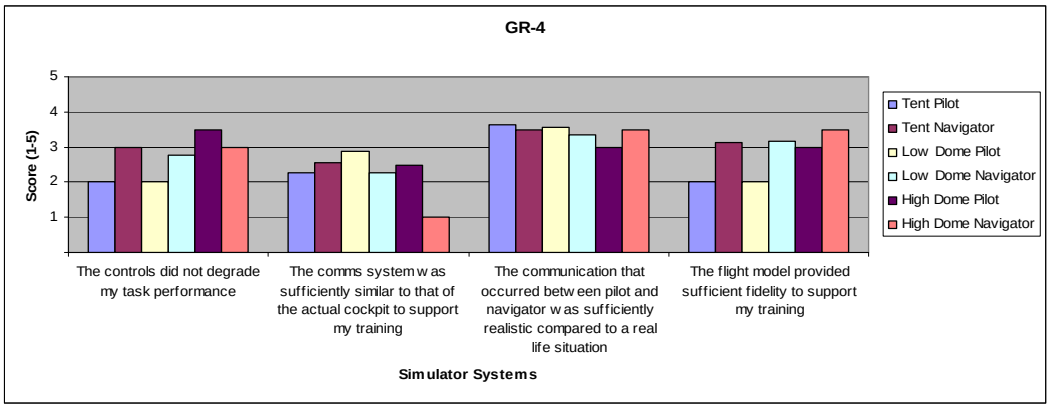

Figure 3. KAT fidelity ratings for Tornado GR4 cockpit, comms and flight model (Score: 1= Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree and 5=Strongly Agree)

Immersion Through The Total MTDS Mission Cycle

Both members of the training audience and the white force commented on the value of PBD in responses from exercises. As reported in the preceding work, Top three comments from Tornado GR4 aircrew in EXERCISE AVENGING EAGLE highlighted "being involved in the brainstorm, planning and debriefing". Typhoon participants also commented on the advantage of seeing the whole planning cycle and that the experience supported operational planning. Further comments from T3B3 data reflect the importance of the PBD process and technologies on enhancing training benefit. In EXERCISE AVENGING EAGLE Typhoon operators said "The planning co-ordination with US forces and multiple platforms was good and it increased my knowledge of how they operate and terms they use" and "Good planning process for COMAO". Further in EXERCISE CONDOR CAPTURE Tornado GR4 operators: "the mission planning was enjoyable, challenging and useful" and "Mass debrief was very [informative] with many tactical lessons being identified".

Communications as an enabler of collective training

One of the fundamental requirements identified by prior research that created the immersive environment within the MTDS CCD was the communications, both in terms of voice and data. Previous research has indicated the significance of the communications as the enabler of collaborative working both within and between players at each site. The MTDS CCD programme reinforced this: radio 'chat' is "awesome" and "top training" (EXERCISE BATTLE BUZZARD). Further, often the realism of the radio traffic provided individual and collective training benefit for the training audience as well as internal training from a crew perspective.

Communications with other US players, AWACS and FACs were seen as significant contributors to training; "Good comms w/JTAC - critical to hitting correct tgt". When comms were unclear, overloaded with chatter/frequencies - "Single flow, if used again, needs revision to the plan. The radios were way too busy…" (F15 EXERCISE AVENGING EAGLE), or failing, "Comms problems with tinker AFB AWACS – negated pretty much all training value" (EXERCISE AVENGING EAGLE comment). Unintentional comms failure had an immediate impact on immersion, especially between dispersed sites and was stated as causing loss of training value. Poor communications within events were troublesome and yet paradoxically reflected real life and met training requirements. It was recommended that the quality of communications in a robust system should also have the ability to be controlled by exercise management team, such as the ability to control the communications content and capability to meet training objectives.

Comparison To Dispersed Simulators

A strong theme running through the data collected was that both UK participants and their combined equivalents benefited mutually from the ability to undertake multinational PBED processes.

A comparison was made of collective CMTR Mission Essential Competencies (MECs) between the collocated and dispersed players. This analysis demonstrated that, if the exercise was managed effectively across the dispersed sites and the infrastructure was in place to support collaborative planning, briefing and debriefing, then dispersed trainees benefited equally from the training.

In terms of air to ground (A-G) experiences, differences between the collocated Tornado GR4s and dispersed US A-10 assets found that for the Suppression of Enemy Air Defence (SEAD) MEC, in spite of dispersion, A-10s were reporting higher experiences; this is likely to be due to the need to improve the fidelity of the Tornado GR4 STE, so that they represented the (changed) operational aircraft. The different levels of flight simulator fidelity were having an impact on specific training experiences, indicating certain aspects were immersion breakers. For other collective MECs, there were no significant effects of dispersion compared to collocation.

Operational Relevance

The operational utility (or overall training value provided by the MTDS CCD experience, relevant to operations) reported by Tornado GR4 participants varied between exercises. In general terms as the exercise model was refined throughout the course of the programme, experiences provided by the MTDS CCD improved, e.g.:

- "Another good insight into COMAOs - especially air land integration" (EXERCISE ARCTIC OWL)
- "Good coordination work between Air Support Operations Centre/ Unmanned Air Vehicle/Combined Air Operations Centre/ Forward Air Controller provides good effects in scenario" (EXERCISE ARCTIC OWL)

Ratings from aircrew for operationally relevant MECs varied according to the platform in question. They were affected by the performance of simulators and visuals, especially for the new Typhoon capability.

A comparison of Tornado GR4 crew experiences with their expectations over the course of the programme found a number of significant differences between exercises based on specific MEC experiences. In particular, the experience 'Operations with other formation/packages' was rated higher than recorded expectations providing evidence of the utility of the MTDS CCD for this purpose.

In spite of their limited exposure to representative mission execution phases, the Typhoon crews debrief in EXERCISE AVENGING EAGLE included comments on the benefits of exposure to multinational sorties and the opportunity for more regular exposure to collective training. Specific comments included: Seeing the whole planning cycle and preparation for war; "strength is in getting lots of things together". It was commented that the strongest points were the interaction with blue with experiences being gained in the different usages of language, deconflicting the position of flight paths: "language was huge, flights, deconfliction, airspace – sorting out huge concepts".

Detailed analyses (Table 1) over the course of several exercises according to role permitted a picture to develop of the warfighter's subjective view on their ability to gain sufficient experiences from their STE and within the context of the operational environment. As has emerged from other analyses, tactical and procedural MECs were being rated lower than those MECs associated with collective training. Broadly, this implies that the MTDS CCD was successful in its original intent to provide sufficient fidelity for collective training. However, as its scope widened and mission profiles increased in their difficulty, training needs required higher levels of targeted fidelity.

DISCUSSION

The key requirements for fast jet simulators that emerged from the MTDS CCD programme were as follows: that wraparound visuals are needed to immerse fast-jet warfighters in a widened scope of mission profiles; and that a sufficient range of weaponry is required to produce representative effects.

Table 1. Examples of MECs ratings

Platform	RATING of capability to experience exists to…			
	1 = a very poor extent	2= a poor extent	3= a moderate extent	4 = a good extent
Typhoon	Operating having suffered battle damage	A variety of unfamiliar terrain Live weapons employment Dynamic retasking/ scramble ops	Operating against threat with a superior force ratio Tackling a full range and mixture of adversary ground threat type and doctrine Decision making under pressure	Operating with degraded comms Operating under constrained ROE
Tornado GR4	Combat ID Joint personnel recovery training Actions if you get shot down	Defence against surface threats High stress level Large packages in poor weather	Challenge discrepancies in tasking Airborne re-tasking Have broad experience leading formation Working with other nations' Sqns and SOPs	Air Battle Management/ Air C2 Operations with other formation/ packages

The inherent flexibility provided by varying visual enclosures and mobile STEs allowed different configurations to be examined in each exercise. Feedback from fast jet aircrew indicated that wraparound visuals were required. Specifically the horizontal FoV had to be sufficient to immerse each participant (pilot and navigator) in the exercise. Further, a significant vertical field of view was required for air-air engagements and to gain the level of immersion necessary for combined training.
A clear requirement for air-ground participants is the weapon to target matching process in which the most appropriate weapon is selected to prosecute a pre-planned target. This calls for wider breadth in the range of weapons available to the air-ground operator.

Another consideration for UK MTDS is the fidelity of the weapon models provided. For air-air operations, the performance of weapon relative to an aircraft is a key determinant of tactical outcomes and non-representative weapon performance can be a huge immersion breaker.

Overall, it is critical that cockpit systems provide an adequate representation of current fielded equipment as it is upgraded. A planned upgrade process is required to keep STEs current as platforms evolve.

In the air-air domain, situational awareness (SA) is of critical importance and hence the faithful representation of the air picture is critical. Voice communications are also critical in transmitting this information. For the air-ground operator, it is critical that sensor feeds and air-ground weapons capability are represented.

It was evident that the provision of common visual models and databases for both collocated and dispersed trainees further mitigated the risk of dispersion reducing training benefit. This was demonstrated through the successful provision of aircrew-FAC training at distributed sites several times during the programme.

Robust, reliable and representative communications are essential. Communications were reported as essential to build the air picture and created immersion. Interviews established that the radio 'chat' was "awesome" and "top training" – it is this realistic radio traffic that provides individual and collective training benefit for the training audience.

A further issue for fidelity was the range of training required. While focused on the use of UK MTDS for collective training, support for the use of UK MTDS for fast jet team level training was captured. Typhoon aircrew in EXERCISE AVENGING EAGLE suggested that a robust UK MTDS simulator could be used for elements of pairs and 4-ship lead work up training in a controlled environment, to provide a progression towards more complex COMAO-type scenarios. The pairs and 4-ship training requires more robust, repeatable weapon and platform models than is needed for combined training. A solution to meeting these fidelity requirements, whilst maintaining their currency with operational aircraft systems, is needed within UK MTDS if it is to be used for fast jet team training.

Synthetic environments can only provide effective training if they are sufficiently immersive. MTDS training should represent the relevant mission, plan – brief – execute – debrief, processes to instil in warfighters the related operational competencies.

CONCLUSIONS

The MTDS CCD programme highlighted the need for immersive, targeted fidelity STEs, maintained to the same operational state as the aircraft. In order to achieve and retain the ability to train realistically, for current conflicts and the next, the fidelity and layout of equipment and the capabilities of simulated platforms and weapons systems must be maintained and modified appropriately in line with current operational capability.

The CCD reinforced the previous findings that collocation of the trainees provided the training audience with significant benefit. In contradiction to the previous findings, the CCD showed that dispersed trainees, with an existing training needs gap, could have their needs met if they were supported by robust technologies, high end simulation at dispersed sites and effective exercise management and control across the sites (Dudfield et al, 2009). Collocation provides a wider exposure to operational roles and activities that in itself provided high value. Individual training needs can also be met through rotation during MTDS exercises, e.g. to experience being a Mission Commander, or to develop specific competencies (such as Limited Combat Ready (LCR) intelligence staff). Skill fade can also be remedied by more frequent exposure of participants to novel, irregular and/or multi-national scenarios, increasing preparedness for ever-changing operational theatres.

In conclusion, the MTDS CCD programme demonstrated the potential of a combination of collocated and dispersed training within the UK MTDS concept.

ACKNOWLEDGEMENTS

Grateful thanks for all military UK, US and Canadian training participants, role players and operators. To Team ACTIVE members, AFRL Mesa, and the UK MOD.

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