Delivering Optimal Training for Future Systems

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Contents

1 Executive Summary

This research, conducted on behalf of the HFI DTC under acceleration funding, forms part of a scoping study for the project entitled Optimal Training for Future Systems. The work examines the fate of training needs in the procurement process particularly at the detailed level during the evolution of user and system requirements documents and more widely in the life of a project. By interviewing stakeholders, a picture is formed of the current state of training procurement in terms of organisation and methodology, focussing on the core Training Needs Analysis process. After considering a number of trends which may produce a demand for faster change in training provision, the report makes a number of recommendations aimed, in part, at improving the agility of the process. These include:

- The TNA process is found to be largely robust with the exception of an acknowledged deficiency in the area of collective training for which the guidance should be amended.

- Implementation of the TNA process within procurement is not always satisfactory. This is due to a large number of factors including the lack of training specialists in DPA and a lack of communication between industry and Customer 2. Perhaps the most important issue is a tendency for TNA work to be delayed in the CADMID cycle, this trend needs to be reversed to ensure that sufficient work is conducted during concept and assessment to ensure that realistic manpower and budget definition occurs before Main Gate. More detailed guidance on the conduct of early phase TNA work would be beneficial.

- A variety of software tools exist to assist the TNA practitioner to capture training requirements. Although these are not held in particularly high regard further development of an integrated tool does not seem warranted. Rather more emphasis should placed on guidance and tools to address specific areas such as the train/not train decision and Training Options Analysis, wherein the balance of live versus synthetic training remains a key question.

- The existing knowledge base of TNA case studies held within Customer 2 training organisations could usefully be developed and disseminated more widely e.g. within DPA.

- Training issues merit a higher priority in programmes of demonstration and experimentation. Failure to grasp aspects of training during such studies wastes an opportunity for the early identification of training solutions.

- Greater use of the MoDAF products during TNA is identified as a possible solution to the definition of training needs across a capability and their subsequent reconciliation with the steady state Training Enterprise.

2 Introduction

2.1 Study Definition

The work reported here was conducted on behalf of the Human Factors Integration Defence Technology Centre (HFI DTC) and was initiated by the Directorate of Analysis Experimentation and Simulation (DAES). The research task, supported by DTC Acceleration funding, forms part of a wider project studying *Optimal Training for Future Systems* scheduled for a three-year duration starting in 2006. It was therefore decided that this phase should take the form of a scoping study helping to define the research emphasis of later parts of the project. As the delivery of training for future systems is clearly a multi-faceted problem, it was further decided that this element should focus on the capture of training requirements by the procurement process. Other work, reported elsewhere, will address other aspects of the problem such as the actual means by which future training will be delivered to a target audience.

Before considering future systems it is essential to understand the existing training procurement process. The core of the work therefore concentrates on establishing a clear picture of the ways in which existing processes, of which Training Needs Analysis (TNA) is the dominant element, succeed or fail in supporting the delivery of appropriate training.

The report focuses on processes that occur at a crucial time in the acquisition process when user requirements are being captured, refined and then translated into detailed system requirements [1]. Beyond this however an attempt is made to form a view of the wider organisational and process issues which impact on training procurement.

Given that initial discussion with DAES emphasised that the project as a whole should address the robustness of the training procurement process in the face of a rapidly changing environment, the work attempts to consider the factors which it is believed are likely to have a significant impact on training in future systems.

The report is structured in the following way. It opens with a review of the current training procurement mechanism. Following a brief and necessarily speculative discussion of the trends which may influence future training procurement, we move on to a discussion of the views of a number of stakeholders on the fate of training requirements in the existing process. The report closes with a number of wide-ranging recommendations of ways in which training procurement may be improved. Where possible each report section is further divided into subsections dealing with issues of organisation, process, and methods and tools.

During this study every effort has been made to sample a wide range of stakeholder views but given the size of the community involved this is inevitably incomplete. Moreover, every acquisition programme is different. For these reasons general observations made in this report may appear contentious to the individual reader. It has also been the case during interviews that observations were made that lead to conclusions about MoD organisation and process. Such matters are outside the author's purview but the

observations are recorded here because they are of general importance and provide a useful background to the report's focus on those aspects which realistically may be influenced by HFI DTC activities.

3 The Current State

3.1 The Training Stakeholder Organisation

Even casual acquaintance with the UK military training community reveals it to be a very large and heterogeneous structure. At its core is Customer 2 (2C) not least for the obvious reason that, as far as operational training is concerned[1], the target population resides within it. Unsurprisingly then, 2C also contains a significant number of organisations charged with the specification, development, delivery and assessment of structured training ranging in stages from basic individual to multi-national collective where appropriate.

This steady state is delivered by numerous providers with agencies such Directorate Individual Training (Army) (DITrg (A)), Navy Training & Education Training Technology Division (NTE(TTD)), RAF Training Development Wing (TDW) and Director General Training and Education (DGT&E) acting as standards authorities applying the Defence Systems Approach to Training (DSAT) Quality Standard. The impetus for much of this training arises from the procurement of new systems. On the principle of "Platform Primacy" [2] it is the responsibility of the Integrated Project Teams (IPT) to deliver initial operational capability across all Lines of Development[2] (LOD) and as a consequence, identify training needs and requisite funding.

It is the role of the IPTL, as with other IPT organisational matters, to resource the analysis, planning and costing of training provision which may draw on native 2C expertise but in many cases is contracted out to industrial partners such as primes, systems houses or consultants.

There exists a small number of specialist training IPTs namely Joint & Battlefield Trainers Simulators & Synthetic Environments (JBTSE), Flight Simulation & Synthetic Trainers (FsAST) and Maritime Training Systems (MTS) which deal exclusively with the procurement of training systems. Projects under these IPTs often involve large-scale standalone simulation systems many supporting collective training (e.g. Combined Arms Tactical Trainer (CATT)). These IPTs are seen as having an integrative and advisory role in training provision.

Figure 1 shows a snapshot of the stakeholder structure which, it is believed, has the most direct impact on the process of training procurement. Many other organisations have an indirect impact through research, concept and policy development, interacting with the key stakeholders in number of ways. This may involve 'top down' influence via the Equipment Capability Customer or 'laterally' through working groups such as the Collective Training Integration Working Group (CITWG) hosted by JBTSE.

[1] As distinct from other training such as that required by personnel deployed in DPA

[2] Training, Equipment, Personnel, Information, Doctrine, Organisation, Infrastructure, Logistics

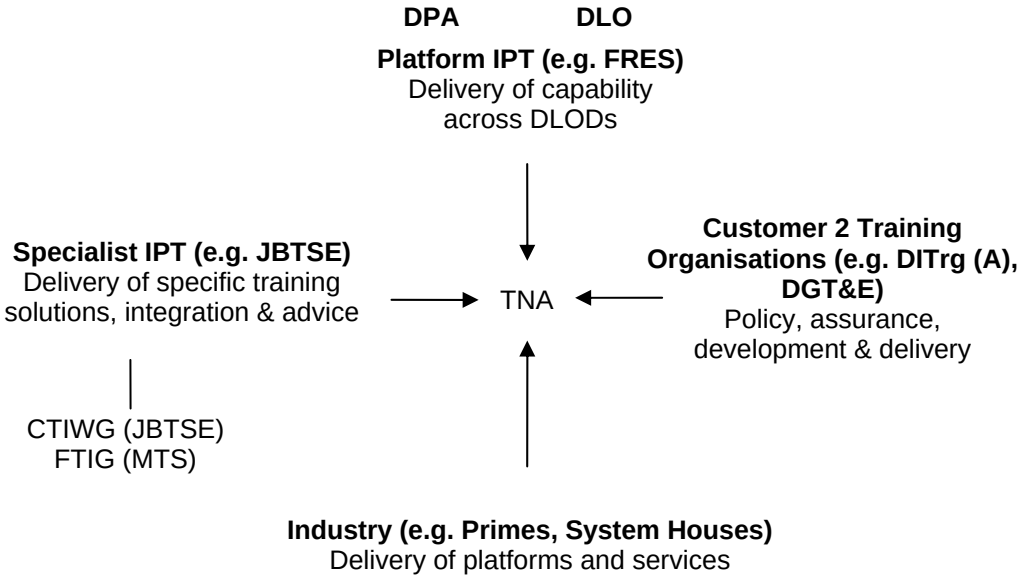

Figure 1 - Key Stakeholders in Training Procurement

3.2 Processes

For the purpose of this study the dominant activity is defence procurement of which the principal phases are defined by the familiar Concept Assessment Development Manufacture In-service Disposal (CADMID) cycle shown in Figure 2. For reasons which shall become clear later in the report, the Main Gate (MG) milestone is identified as a pivotal point in the project lifecycle. By the time of MG, assessment work should have translated User Requirements Document (URD) into Systems Requirement Document (SRD), the ITP should have in place a Through Life Management Plan (TLMP) and, by virtue of Whole Life Costing (WLC), should have identified the majority of the budget required to deliver the capability *including any associated training*. Although MG is typically identified with the transition from Assessment to Demonstration it is worth noting that budgetary considerations and current systems engineering practice involving the use of concept and technology demonstrators, can make this transition and the location of MG within it somewhat blurred. Being a generic process CADMID must be adapted to the type of project in hand. An interesting special case occurs when a specialist IPT is tasked to provide a training simulator a CAMID process then operates within the cycle of the parent project. It is clearly critical that processes used to capture training requirements successfully interlock with the wider systems engineering process implied by CADMID.

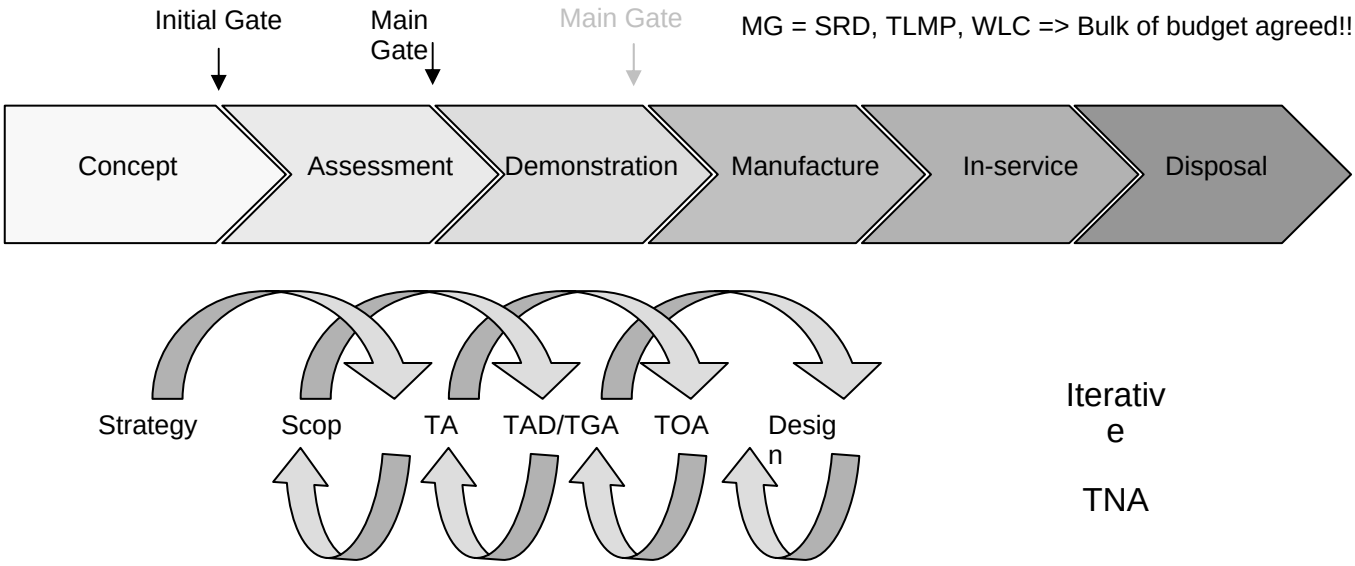

Figure 2 - The CADMID cycle and idealised interaction with TNA

The requirement to deliver new training arises from three principal sources:

1) Changes in equipment

2) Changes in manpower/personnel

3) Changes in doctrine

These drivers are conceived to act on training procurement through the familiar Training Needs Analysis process. This well-developed and longstanding methodology, illustrated in Figure 3, is supported by tri-service documentation [3], assured against the DSAT QS [4] and designed to be generic. TNA, although ideally conducted in several iterations (Figure 2), is considered to have two principal phases crucially straddling MG. Phase 1 comprises a scoping study which "*identifies the management of the TNA project, areas of risk, programming and resourcing issues, policies, assumptions and constraints, those personnel affected by the requirement, and highlights issues which could impact upon, or will need to be considered during Phase 2*" [3]. Phase 2 conducts the detailed work necessary to determine the who, what and how of training by undertaking a number of analyses with emphasis dictated by the nature of the training requirement. In summary, mission and task analyses reveal which activities must be undertaken by which personnel to provide the capability. Comparison with Target Audience Description (TAD) defines the training gap (or Δ). Training Options Analysis (TOA) then identifies the most effective combination of methods and media to bridge the gap. Much of the detailed development and of course, the delivery of training will take place outside the TNA but the final report should identify an evaluation strategy against Operational Performance Statement (OPS) and Competence Framework (CF). TNA may take many months but being generic can and should have a budgeted effort consistent with the size and complexity of the procurement.

For large complex projects TNA is often broken down into separate analyses for manageable components of the system.

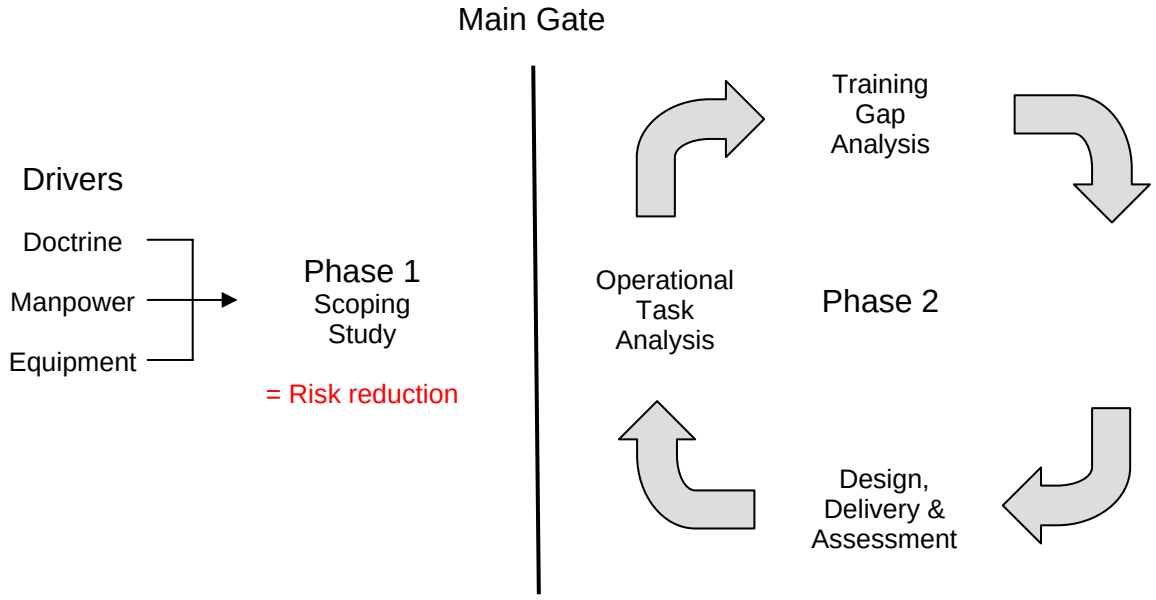

Figure 3 - Illustration of the components of the TNA process.

3.3 Methods and Tools

The main software tools used in training procurement are those that assist in the conduct of TNA. There are a number available (e.g. Integreator [5], TRAP [6]) which attempt to encapsulate all phases of the TNA process. Some examples, such as Course Information Builder [7] and the US Automated Systems Approach to Training (ASAT) [8], appear to focus more on the development of instructional material.

These tools are essential structural devices which allow the user to step through the TNA process whilst providing placeholders for the information produced during the analysis (e.g. task hierarchies). In this respect they can act as a valuable aide-memoire particularly for the inexperienced TNA practitioner.

Given that TNA is conducted in parallel with other system engineering processes, it is common for requirements management tools (e.g. DOORS®) to be used to capture training issues during the development of SRD from URD. Such tools of course, have no TNA-specific functionality.

Hierarchical Task Analysis (HTA) is a methodology widely employed in systems engineering and is effectively called up in the operational/mission analysis element of the TNA process. Numerous tools are available to assist this activity including one developed by the HFI DTC. It is important to remember that various aspects of TNA, perhaps most importantly the mission and task analyses, are heavily dependent upon, indeed should be driven by, a Concept of Operations (CONOPS) and its derivatives Concept of

Employment (CONEMP) and Concept of Use (CONUSE), which must be viewed as vital 'tools' in the capture of training requirements.

In addition to specific software applications there are a number of informal tools that are brought to bear. Given that many TNAs have been conducted in the past (e.g. at the last count DITrg(A) had three hundred in process) there exists a significant documented knowledge base that can be used as sources of guidance and best practice.

Other sources of data contribute to particular phases of the TNA. Generic target audience descriptions can indicate the capabilities of various groups of serving personnel whilst Mission Essential Task Lists (METL) can give guidance on the perceived component tasks of aspects of a capability, perhaps reducing the need for task analysis

Perhaps the most significant method employed by those undertaking TNA is consultation with Subject Matter Experts (SME). These are personnel with substantial operational experience of various aspects of the capability under development. They will primarily be drawn from 2C but other organisations including industry will have relevant expertise.

4 Future Trends

4.1 Potential Factors in Future Procurement

Whilst consideration of the impact of future trends is necessarily speculative, especially when considering external factors, there seem to be a number of emerging themes which are not completely controversial.

- Continued downward pressure on cost and a drive to do more with less – the implications are too numerous to discuss, the increased drive for synthetic training being just one example.

- Rapid change in tasking – the variety of theatres, missions and operations has clear training impact not least in the decision whether or not to train to achieve the desired level flexibility in Knowledge Skills & Attitudes (KSA).

- Large elements of the force deployed for longer periods, at least in the current political environment - this restricts the time and location of training promoting more use of in-theatre and embedded solutions.

- More collective operation – the implied requirement for more collective training is obvious but there will also be an increased need for TNA expertise covering team, joint and perhaps coalition training.

- More options for collective action and connectivity at higher tempo – this implies a need for adequate training of skills needed for a greater burden of decision-making.

- More adaptability and interoperability in platforms and equipment – a highly desirable aspiration to make the most of a system of systems but the training needed to support it must be equally adaptable.

- More devolved authority and autonomy – this is implied by concepts such as mission command and 'power to the edge', if realised this will generate training gaps at the relevant command levels.

- More distributed operation – this lends itself to certain forms of synthetic training but raises new issues of communication and trust that have training implications.

- More emphasis on the role of information – the achievement of goals by information dominance and the use of novel forms of influence (Effects Based Operations) suggest a need for increased training to meet a demand for quantitative and arguably qualitative change in information processing.

What is not clear from the foregoing is:

a) The extent to which these changes will predominantly arise from the introduction of new equipment or doctrine? Inevitably both will be involved but the balance may be significant because changes in different LODs can place different demands on the training infrastructure.

b) Whether these ambitions imply a sustained increase in innovation demand? As somewhat crudely illustrated in Figure 4, the nature of tasks assigned to the military and the means at their disposal can arguably be seen as having placed increasing demand on the system to innovate. Such change drives training. Whilst this trend is hardly monotonic, roles and system elements are after all removed as well as added over time, the increasing complexity of modern operations suggests an upward tendency. Initiatives in place at the moment such as Network Enabled Capability (NEC), described as a revolution in military affairs, seem to imply a spike in demand for innovation and corresponding training. When such changes have had a chance to bed-in, will the innovative demand return to its pre-existing state or will it now increase at a faster rate having undergone a qualitative change?

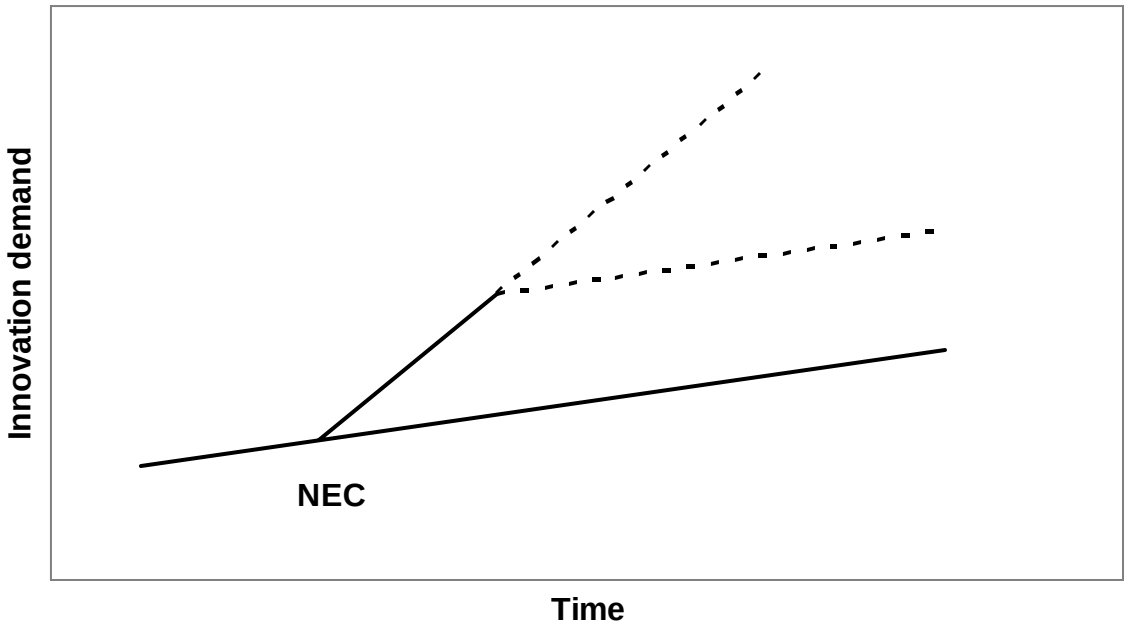

Figure 4 - Stylised representation of the impact of initiatives such as NEC on innovation demanded of military capability.

5 Observations on the Fate of Training Requirements

This section presents, in summary form, what are believed to be the key observations made by a sample of representatives of the main stakeholder organisations. These views were collated from interviews which started from a discussion of the capture of training requirements around URD/SRD transition and then ranged more widely over the issues facing the procurement process. The opinions are not attributed unless the interviewee has chosen to go into print on the subject and in many cases the points below are an amalgam of several opinions including the author's inferences.

5.1 Organisational Issues

As might be inferred from Figure 1, training is widely considered to be an orphan, responsibility being spread across (or perhaps falling between) a number of organisations or individuals at various times during a project [9]. Whilst division of responsibility is not unusual in the procurement organisation, the IPTs and industry tend, perhaps understandably, to focus on the physical engineering aspects of equipment delivery which coupled with the fact that the target of training activity resides in Customer 2 and perhaps is seen as less susceptible to immediate influence, can cause the Training LOD (TLOD) 'buck' to be passed. This is not helped by the fact that the TLOD appears to lack the managerial (rank) impetus consistent with its importance and that some IPTs and Working Groups have somewhat arbitrary membership in terms of training experience.

There is a reluctance to identify training costs which may lead to failure at MG. Despite significant integration initiatives there remains an opportunity and natural tendency for IPTs to behave in a stove-piped fashion. This militates against thinking about wider capability and in particular identifying costs that might 'belong' to someone else.

Closer inspection of the organisations involved in training procurement reveals a significant shortage[3] of expertise particularly in TNA. Customer 2 training organisations lack the resources to conduct the majority of TNAs in-house, DI Trg (A), for example, conducts only 20% of the three hundred that may be in hand. Perhaps partly as a consequence, there is a shortage of staff in the Defence Procurement Agency (DPA) with specific training experience. For example, there is currently only one or two specialist training advisors in DPA [9] and even in the specialist training IPTs (e.g. FsAST) few, if any, staff may have a training background.

Industry for its part, whilst no doubt appreciating the role of the TLOD in capability, has had a tendency to think of training as adding little value in terms of immediate return. As a consequence training questions have sometimes been passed to third parties detached from the main thrust of a project. More recent developments such as the procurement of

[3] In terms of capacity not depth

sophisticated networked simulators and the out-sourcing of training have modified this view.

Communication between stakeholders can be poor. For example there are cases of industry not talking to the appropriate parts of 2C and worryingly, IPTs have not routinely drawn on the expertise of the specialist training IPTs.

5.2 Process Issues

Before looking at the requirements capture processes in detail, it is important to acknowledge that for all but the simplest incremental acquisitions, TNA can be quite a difficult process particularly when conducted as an abstraction.

The TNA (and DSAT) processes as laid down are perfectly reasonable, perhaps having one significant weakness in failing to deal with collective training[4]. Having said that, being generic they are, in a sense, content free in that they tell the practitioner what to do without saying how it should be done.

Despite having a largely satisfactory process in place, there have been too many examples of inadequate TNA practice. These arise from several causes:

- The TNA process is often neglected or delayed until late in the CADMID cycle suggesting that message of WLC and the importance of training within it, has not fully permeated. The reasons for this procrastination are varied, many of them resulting from organisational and financial factors. Perhaps the easiest to understand is that it is much simpler to identify training requirements when a system is physically realised.

- Parts of the TNA cycle are conducted by the wrong people or more importantly with inadequate consultation, the particular issue being insufficient 2C involvement (by industry) most importantly during early phase TNA work. There is an associated view, acknowledged to be a generalisation, that industry has insufficient understanding of how a system will be 'fought'.

- Training requirements have been considered from a platform rather than capability-centric viewpoint and have focussed on the operation and maintenance of the system rather than its wider role and use. This has a particular impact on the capture of collective training requirements.

- The TNA process can be poorly iterated, this may arise from a tick in the box syndrome where it is mistakenly believed that a process is complete simply because some form of deliverable has been produced, because of budgetary reluctance to 'repeat' work or because of genuine human performance issues associated with iterative tasks.

[4] It is estimated the 60% of training costs are in collective.

- There is little to suggest that the virtuous circle between training requirements and system design is being exploited. Delays to the TNA process (waiting for the system to be realised) reduce the opportunity for training issues (cost, difficulty) to be addressed by changes to the design and vice versa. This is similar story to that found with respect to Human Factors Engineering (HFE) and Integrated Logistic Support (ILS).

- Early phase TNA work is heavily dependent on CONOPS and CONEMP. These can be poorly developed at this stage of the project and indeed may present a moving target as they evolve on the back of the system design. There is an obvious impact on TAD and hence the definition of the training gap.

- The TNA process can be neglected due to complacency as, for example, in the mistaken belief that already having a platform variant in service means that that the training requirements for a new variant are trivial, when in fact the system differences are significant not least because we may have to train for two variants 'in parallel'.

More subtly, there can exist a lack of understanding of the link between human factors analysis and training issues and the fact that close scheduling of these activities can greatly assist early capture of training requirements. This perhaps reflects a wider issue raised some time ago [10], that training, ILS and more recent Human Factors Integration (HFI) initiatives have not been satisfactorily integrated.

Ironically, TNA training is considered to have weaknesses in terms of course content and selection of attendees.

5.3 Methods and Tools

Although only a limited sample of potential users were polled, software tools for conducting TNA do not seem to be held in high regard and considered by some to be unwieldy. Whilst the tools are useful in bringing structure to the process they lack 'intelligence' and provide less functionality in the area of decision support (e.g. in the selection of training options) since these involve data (such as cost) not resident in the applications. Import of data from external sources can be problematic.

Often these tools are not available off-the-shelf but form part of a consultancy service offered by the developers.

The knowledge base of previous TNA studies is dispersed among the various training organisations each maintaining and consulting records of their own projects but not developing or disseminating them.

Without doubt the most important 'method or tool' used in the TNA process is the subject matter expert. Only the most capable practitioner with directly relevant career experience can successfully execute a TNA without consulting SMEs with significant knowledge of the operational tasks or equipment under development.

Training issues do not appear to be a high priority in programmes of demonstration and experimentation be they general concept development or specific IPT studies. Training questions emerge and may be addressed in these exercises but it is not clear how efficiently these are captured and fed back into the training enterprise.

5.4 Consequences

Whilst we must guard against being misled by this litany of potential pitfalls, it has to be admitted that they have contributed to a number of failures in training procurement, amongst them, high profile examples which have drawn the attention of the National Audit Office. Without identifying individual projects we can identify some general outcomes. It is not unknown for projects to pass MG with TLOD issues 'at red' and worse, with no line of funding identified for training provision. Lack of feedback from training into system design can lead to unnecessary variation between equipments which multiplies the training burden. Most famously, platforms enter service with training provision for only part of the capability or worse no provision at all. The cost and time implications of recovering these situations are obvious.

6 Recommendations

6.1 Organisation

Whilst MoD organisational issues are clearly outside the author's purview, a number of recommendations were identified during the study and are recorded here partly for completeness, but also because no amount of process and method development will compensate for inappropriate organisation.

Perhaps the most important message received from those at the sharp end in DPA is to have people with the right experience engaged in the project at the right time. This expertise can come from many sources but certainly should draw on 2C training organisations. To this end Customer 2 needs to grow more TNA expertise, particularly of the more difficult Phase 1 variety. Such expertise then needs to be fed across into DPA at least in the form of a quality assurance capability. Part of the solution to the expertise shortage is to send a sufficient number of the right people on the right TNA course.

It may therefore be desirable to change the focus of training development teams from detailed low level work to higher level TNA issues. Perhaps the more concrete aspects of TNA should increasingly be sub-contracted.

Those concerned with training policy in DPA have made recommendations for specific organisational changes including the establishment of a small TNA QA cell. This might sensibly interface with the HFI support such as that formerly provided by the HFI DTC Process Improvement Cell (PIC) and now being developed in Technical Enabling Services (TES), to help align these two closely related activities. It has also been suggested that Phase 1 TNA work be predominantly conducted on a 'contracted in' basis wherein it is either carried out by a Training Branch or by an independent contractor (not prime) with close Customer 2 oversight. The applicability of this model to different forms of procurement project is still open to debate.

6.2 Process

The way in which TNA interacts with CADMID is widely seen to be critical. An emerging conclusion seems to be that as much of the TNA process as possible needs to be conducted before MG particularly in relation to manpower and costs which should be tractable at this stage [9, 11]. It is considered that the emphasis on early scoping work should even apply before Initial Gate (IG) by the development of a training CONUSE before URD [12].

One important implication of the sensible desire to de-risk at the earliest opportunity is that personnel involved at this point need to be sufficiently experienced to manage the task at a more abstract stage.

The exact scheduling of Phase 2 TNA has also received attention [12] with the suggested extension of TNA activities across design freeze, with interim TOA recommendations, to help alleviate the difficulty of working with immature designs.

Clearly a consensus within the tri-service training community will be required to promote a view of the ideal way to deploy TNA within procurement. This will have to acknowledge the variability of CADMID implementation and the nature of capability being procured. If they are to wholeheartedly 'sign-up', IPTs will require specific guidance as to how the process can be tailored to their project.

Broadly speaking the TNA process *per se* is now tried and tested, we 'fix it' at our peril. The guidance should be amended to reflect the greater emphasis on collective training, the absence of which is an identified weakness. Consideration should also be given to expanding the coverage of the Scoping Study to reflect the desire to bring more of the effort into Phase 1 of the TNA.

As already stated, training for those undertaking TNA is not entirely adequate in that course content is not matched to the future roles of attendees. It has been proposed that three tailored types of TNA course should be available:

1) Detailed courses for those who will be concerned with early scoping work including collective and joint training

2) Abridged courses for those such as Warrant Officers who will work in specific areas

3) IPT specific training for those who manage the process during procurement.

Such courses could usefully be extended to industrial personnel.

6.3 Methods and Tools

With regard to implementation, at the risk of over-generalising, it may be said that many aspects of TNA cannot be conducted from first principles, i.e. there is often no fundamental theory that can inform decisions about who should be trained, what they need to learn and how they should be taught. The process therefore effectively proceeds by case-based reasoning from past experience of the, frequently incremental, procurement process. Where this is true and the availability of experienced personnel is an issue, it is obvious to consider improvements to knowledge management as a major part of the solution. This might include:

- The development of the body of existing TNA work held by the various training establishments into a single searchable knowledge base widely available to DPA and perhaps, IPR and commercial sensitivities notwithstanding, to industry.

- Better use could be made of TADs and METLs if these were maintained and disseminated more widely. Perhaps this could be linked to recent efforts in the development of competency frameworks for NEC for example.

In addition to specific sources of data, non-specialists have a need for more guidance on the TNA process. In common with the reaction to HFI guidelines, it is felt that there is never enough detail in the documentation to actually answer the specific questions arising in a project. Access to a pool of experts would clearly be the most flexible solution but if this is not possible it would be worth considering the production of more detailed documentation at least on certain topics.

The production of a new integrated TNA tool does not appear warranted unless it can provide much greater functionality; such development is likely to lead to even more unwieldy applications. There may be an argument for a tool which is specifically designed to support Phase 1 of the TNA but this would need careful specification to prevent it from turning into 'just another TNA tool'.

Specific adjuncts to the TNA process to assist in decision making on specific topics is a more attractive option. For Phase 2 the following topics spring to mind:

- In the more abstract world of digitisation (NEC, EBO etc) the train / not train decision becomes more difficult. New ways of working, which to some extent are perceived to rely on generic skills in the target audience, always present the opportunity to neglect training in the hope that human ingenuity will be sufficient to achieve some unspecified level of performance. TNA practitioners need guidance on how to make evidence based decisions to deliver training.

- The Training Options Analysis process would also benefit from support. It would be useful to revisit earlier work [13] on the development of expert systems to compensate for the limited pool of expertise. More specifically the question of the balance of live versus synthetic training or at least aspects of it still demand to be addressed. General answers to this question have been the Holy Grail (or perhaps thorn in the side) of training researchers for years and may well be an unrealistic goal. Nevertheless the tendency for training to move towards synthetic solutions as a default on cost considerations demands that aspects of the question be addressed, one important topic now being the minimum acceptable level of live training needed to achieve a capability.

- Training evaluation is easily neglected but its outcomes should justify training expenditure and inform future training design. TNA practitioners need guidance in the specification of efficient and sensitive training assessment mechanisms and metrics.

Synthetic environment research could usefully address the question of whether simulators and demonstrators can be developed through the life of a project evolving into prototype Computer Based Training (CBT) equipment satisfying at least part of the training requirement.

Training issues must be given higher priority in experimentation and demonstration programmes. Experimentation is increasingly seen as a means to understand capability and to facilitate the introduction of new concepts into procurement. The approach is being used both at the generic (e.g. NITEworks, DXC) and IPT specific levels. These studies are an excellent opportunity to capture training requirements not least because

training issues arise spontaneously in the design of controlled experiments where a subject population should be sufficiently experienced with a new capability to act as the 'treatments group'. Lessons learned in this way need to be fed forward into training procurement and it is not clear that this happens. Beyond their role in the design of rigorous experiments training issues should be on the agenda for study in their own right.

Problems in the capture of training requirements across a capability and their integration with the training 'pipeline' could, at least in part, be addressed by use of the MoD Architecture Framework (MODAF) [14]. This framework has been developed to provide the means to comprehend complex systems by the use of a number of defined views. For example Operational View 3 (OV-3) defines the information exchange requirements of a capability. Using such a view during TNA would ensure that the full scope of training required to support the capability can be visualised and captured. Other views might be used to capture and sanity-check the phasing of training delivery.

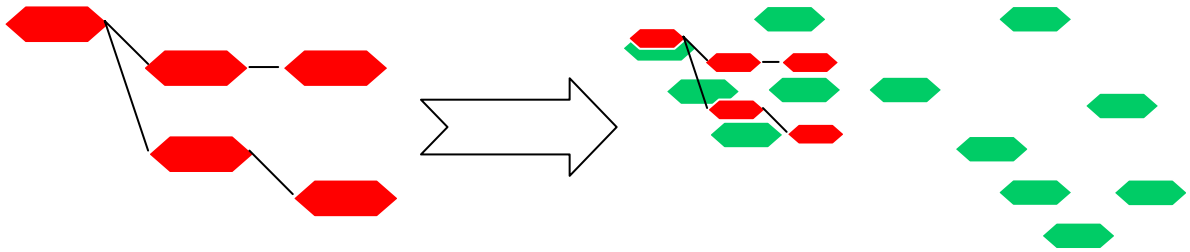

Figure 5 - Stylised representation of a hypothetical capability training view being aligned with the training enterprise view.

If found useful, this idea could be developed further to visualise parts of the existing steady state Training Enterprise i.e. the large scale system which delivers current training. Comparison between views for emerging capability and the Enterprise would reveal likely difficulties in accommodating new training delivery within the existing system. The introduction of a new initiative such as NEC, which MODAF is designed to support, might be an ideal opportunity to test this idea. It may further be the case that the development of specific training views might be beneficial but this would need to be done in consultation with the Integration Authority (IA).

As with all new process its success depends on willing uptake by practitioners. MODAF is a relatively new initiative whose potential benefits are certainly not yet perceived by all in DPA. Those undertaking TNA cannot be expected to be in the vanguard and the use of MODAF in capturing training requirements may have to wait for wider DPA deployment.

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8 Abbreviations

2C	Second Customer
AMS	Acquisition Management System
CADMID	Concept, Assessment, Development, Manufacture, In-service, Disposal
CADMIT	Concept, Assessment, Development, Migration, In-service, Termination
CATT	Combined Arms Tactical Trainer
CF	Competence Framework
COIEA	Combined Operational Effectiveness & Investment Appraisal
CONEMP	Concept of Employment
CONOPS	Concept of Operations
CONUSE	Concept of Use
CTIWG	Collective Training Integration Working Group
DAES	Directorate of Analysis, Experimentation and Simulation
DCDC	Development, Doctrine & Concepts Centre (formerly JDCC)
DEC	Directorate of Equipment Capability
DGT&E	Director General Training & Education
DIF	Difficulty, Importance, Frequency
DITrg (A)	Directorate of Individual Training (Army)
D Jt Cap	Directorate of Joint Capabilities
DLO	Defence Logistics Agency
DPA	Defence Procurement Agency
DSAT	Defence Systems Approach to Training
DXC	Defence Experimentation Centre
EBO	Effects Based Operations
FRES	Future Rapid Effects System
FsAST	Flight Simulation and Synthetic Trainers
FTIG	Future Training Interest Group
HFI	Human Factors Integration
HFE	Human Factors Engineering
HFI DTC	HFI Defence Technology Centre
HTA	Hierarchical Task Analysis
IA	Integration Authority
IG	Initial Gate
ILS	Integrated Logistic Support
IPR	Intellectual Property Rights
IPT	Integrated Project Team
IPTL	IPT Leader
JBTSE	Joint & Battlefield Trainers Simulations & Synthetic Environments
JDCC	Joint Doctrine and Concepts Centre
JSENS	Joint Sensor & Engagement Networks
KSA	Knowledge, Skills, Attitudes
LOD	Lines of Development
METL	Mission Essential Task List
MG	Main Gate
MOD	Ministry of Defence
MODAF	MOD Architectural Framework

MOTS	Military off the Shelf
MTS	Maritime Training Systems
NEC	Network Enabled Capability
NITEworks	Network Integration Test and Experimentation Works
NTE TTD	Navy Training & Education Training Technology Division
OPS	Operational Performance Statement
PIC	Process Improvement Cell
SME	Subject Matter Expert
SRD	System Requirements Document
TEPIDOIL	Training, Equipment, Personnel, Information, Doctrine & Concepts, Organisation, Infrastructure, Logistics
TA	Task Analysis
TAD	Target Audience Description
TDW	Training Development Wing
TES	Technical Enabling Services
TGA	Training Gap Analysis
TLMP	Through Life Management Plan
TLOD	Training Line Of Development
TNA	Training Needs Analysis
TOA	Training Options Analysis
TRAP	Training Requirements Analysis Program
QA	Quality Assurance
URD	User Requirements Document

- End of Document -