18th ICCRTS
"C2 in Underdeveloped, Degraded and Denied Operational Environments"

Enhanced Training by a Systemic Governance of Force Capabilities, Tasks, and Processes

Topics

Approaches and Organizations
Experimentation, Metrics, and Analysis
Architectures, Technologies, and Tools

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ABSTRACT

The Swedish Army has transformed from 31 brigades in to two in 20 years. At the same time the Swedish area of interest has increased from 60 km from the Swedish borders to 6000 km from Brussels. The type of missions for the armed forces has changed from invasion defending operations to international interoperable operations.

This overall change also has increased the necessity to become more interoperable with the partners in the Nordic, European Union, NATO and PfP countries. The NATO methods (OCC) and Core team Effectiveness (CTEF) together with the alignment of the Swedish MARTA provides the basis to assess, evaluate and accredit the Swedish forces.

This paper presents a Systemic Governance of Capabilities, Tasks, and Processes applied to the requirement specification for the core battalion in Nordic Battle Group 2015. The method consists of analyzing and compiling the battalion's capabilities, tasks, activities and processes in their context and in relation to each other down to platoon level. The paper then continues to describe the development of a system providing support for assessment, evaluation and accreditation which entail that the commander and staff better can govern the education and training efforts for the force.

Authors note:

This work is conducted with funding and support from the Swedish Armed Forces and Swedish Strategic Foundation (grant SM12-0052). The information in this publication is the one of the authors and is not the official voice of the Swedish Armed Forces, Combitech, SAAB, Swedish National Defence College, George Mason University and University of Skövde.

1 Introduction

The Swedish military challenge of today is that the forces are multinational composed and the mission space and operations have many facets. Training is conducted in a multinational interdisciplinary form and that there is a need to assess, evaluate and accredit forces of all participating nations to guarantee combat effectiveness. The NATO and EU modus operandi and methods for assessment and evaluation, are then not an option for Sweden, it is a requirement.

While looking back at the last 20 years changes in the Swedish Armed Forces the challenge is to increase the agility at all levels and in all functions. The most significant changes are the reduction from 31 brigades to two; the operational area have changed from 60 km from the Swedish borders to 6000 km from Brussels; from invasion preparedness to international interoperable operations; that a 100-year tradition of compulsory military service have been abolished in favor of a voluntary system. Add to that a reformation of Command and Control methods and procedures and increased usage of technology. Regardless of all changes the capability to deliver the desired effect at the right time and place and still protect the force assets is essential.

The ultimate goal is to produce Capability and Readiness by designing a force organization and task so that the personnel utilize the systems in the best possible way. To do so education and training is needed. Figure 1 gives a high level overview of the process.

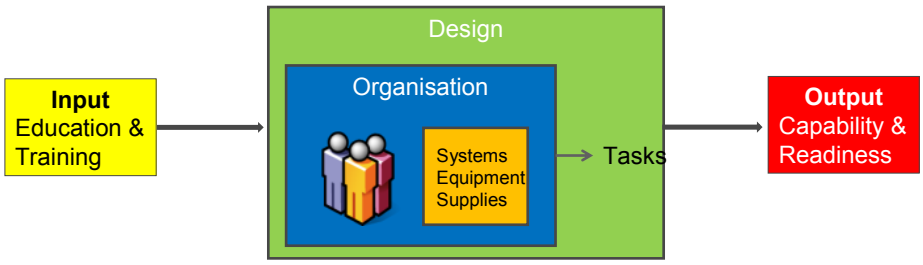

Figure 1- Capability and Readiness Development

For the commanders to actual know the readiness level of the troops, both own and collaboration partners, there is a need for a common and widely understood and agreed assessment, evaluation and accreditation method.

The systemic governance approach is a collection of methods that together provides for that the complex nature of military force structures and their tasks and processes span a large operational context. In the following sections the authors systemic approach is presented in the sections Scenario Based Training; Modeling of Force Requirements to Support Scenario Based Training by creating Mission Essential and Collective Tasks

lists; Current evaluation methods; computer aided tool to support training need analysis, monitoring and evaluation; a case study; ending with conclusions.

2 Scenario Based Training

The prerequisites for effective learning are 1) Agility by adapting to a new systems and environment; 2) Building on accumulated experience; and 3) Experience through rapid and correct feedback. Scenarios are here defined as the expectations on the organization and the operating procedures that are in place to support it.

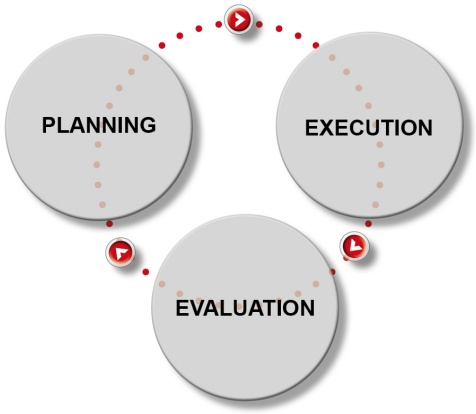

Figure 2 – Scenario Based Training components

Figure 2 presents Scenario Based Training and the three phases of Planning, Execution and Evaluation, which are derived from Battle Focused Training [4]. Before entering the process loop the capability requirements of the force that are to be trained needs to be defined. With the Misson Essential Tasks and Collective tasks defined a Training Need Analysis (TNA) is performed. Actually the TNA is an evaluation assessment of the current status of the force [4].

In **Scenario Planning** the TNA is used to select the Training Objectives (TO) and developed scenario vignettes based that focus on the mission essential task and collective tasks that are to be executed by the trained organization, supporting organizations, simulations, role players together with the operational plans and standard operating procedures (SOP). The result from the Planning is the exercise foundation and include: Defined scenario; Instructions for each role (e.g. trainees, trainers, players, evaluators, Exercise Director); Resources for a realistic execution; Planning for execution of a scenario, events; Objectives with the training/exercise – what to measure; "Lessons learned" from earlier exercises; and Actions/timing for role players.

Scenario Execution consists of the two elements of technical execution and human execution. From the technical view this is defined as the hub which allow for publish and subscribe of simulation models, creates interoperability between simulation and operational environment as well as for logging of actions taken in the training

environment. Connectivity is an enabling technology [1]. The human execution are the actual play of role players, response cells etc. conducting their business to support the trainees. The main functions regardless of degree of computer support are: Start of scenario; recording and logging of data; Stimuli to operational systems; stimuli to humans; Input from operational systems; Sensor emulation etc.; Role players acting; Event and objective tracking; Manage and supervise the exercise.

Scenario Evaluation enables that recordings and other data are restored so that the exercise/training events and observations in a systematic fashion can be examined. In this way the customers over time and in a controlled way builds up an extensive library of similar scenarios, but were task to measure varies all depending on who to training and purpose of the exercise. The main functions are: Analysis of data; Monitoring of events in real time; Dynamic evaluation; Mobil tracking; Mobil observations; Using evaluation methodology.

3 Modeling of Force Requirements to Support Scenario Based Training

The systemic governance approach is model based because of that the military force structures and their tasks and processes span a large operational context and is a complex system to describe. Model based approaches have an advantage over document based approaches, in that a Model Based approach describe the relations between operations, and that organization and systems can be described cohesively. A model base approach is better suited to handle changes (e.g. experience reports, changes in the operational environment, new materiel). And compliance is easier to describe using a model-based approach since the same abstraction level is used for the models. Information from a model can be extracted for various purposes and be exchanged with other systems [2].

The model framework of choice is the MoDAF (Minsitry of Defense Architectural Framework) [3], since it is simple to use and also mandated.

3.1 MoDAF (Minsitry of Defense Architectural Framework)

The MoDAF is an enterprise architecture framework that is developed to support activities of defence planning and change management. The MoDAF provides a rigorous, coherent and comprehensive way to capture and present information. The MoDAF then aids the understanding of complex issues.

The MoDAF consists of a set of views that are templates that provides a standard notation for the capture of information about the business in focus. The seven viewpoints in MoDAF offer different perspectives to be used, and are visualized in a graphical notation. The Views Viewpoints are [3]:

- Strategic Viewpoint (StV) defines the desired business outcome, and what capabilities are required to achieve it;

- Operational Viewpoint (OV) defines (in abstract rather than physical terms) the processes, information and entities needed to fulfill the capability requirements;
- Service Orientated Viewpoint (SOV) describes the services, (i.e. units of work supplied by providers to consumers), required to support the processes described in the operational Views;
- Systems Viewpoint (SV) describes the physical implementation of the Operational and Service Orientated Views and, thereby, define the solution;
- Acquisition Viewpoint (AcV) describes the dependencies and timelines of the projects that will of deliver the solution;
- Technical Viewpoint (TV) defines the standards that are to be applied to the solution;
- All Viewpoint (AV) provides a description and glossary of the contents of the architecture.

The relationships between the viewpoints are described in a meta-model called M3.

However a model based approach will still need to link the model to the actual source text documents and its containing data this because not everything can be modeled and that a source reference is needed to find the source and in cases to remodel parts of the model. The approach taken for this work is a combined tool-based approach [2].

3.2 Modelling Unit, Capability and Activities Using MoDAF

Figure 3 shows a simplified view of the MoDAF and is a reduced view of the M3 [3]. The core for modeling Units, Capabilities and Activities areis the logical model with the Unit and Activities, and the solution architecture comprising Capabilities. And a Capability has metrics attached to it. A Capability can be composed of Capabilities and depend on Capabilities. A Node is a Unit within this case is the Battalion. A unit has Capabilities and performs Operational Activities (OA). The Activities support a capability of a Unit. A Standard Operational Activity (SOA) is an OA. With this simple model a Battalion and its unit can be modeled. Capability is described in Strategic Viewpoint 2 (StV-2) and is here used to identifying capability requirements. The Operational Activity is described in Operational Viewpoint 5 (OV-5) and is here used to capture requirements, define roles and responsibilities and support task analysis to determine training needs. Node is described in Operational Viewpoint 2 (OV-2) and is here used to define operational concepts, elaborate capability requirements, and define collaboration needs.

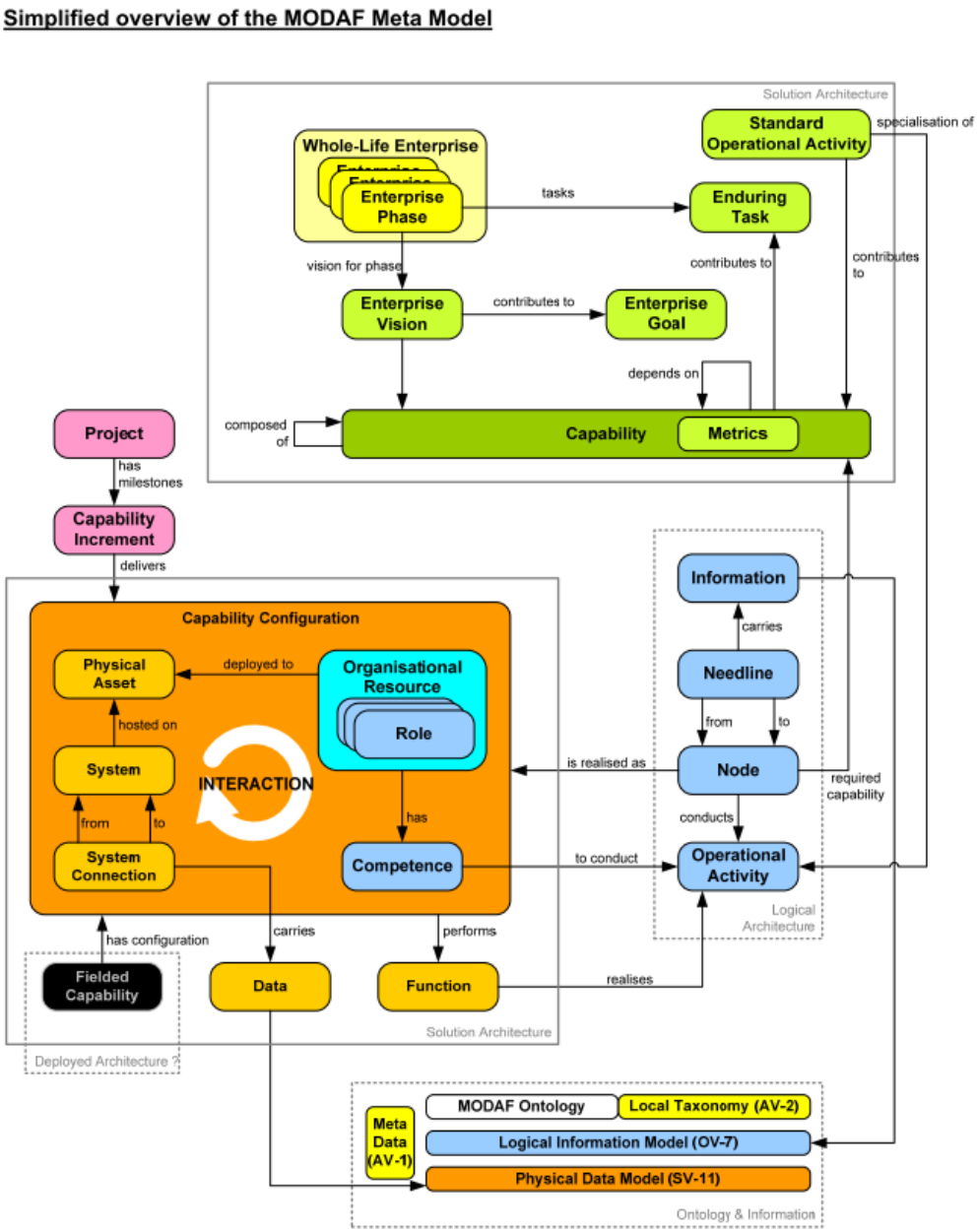

Figure 3 – Model of Unit (Node), Capability and Activity using MoDAF viewpoints

3.3 Modeling Unit, Capability and Collective Tasks Using MoDAF

A similar modeling is made for the Collective Tasks. The Collective tasks basically consist of the Mission Essential Task and Supporting and Implied tasks. The Scenario describes the whereabouts for units and range from simple scenarios that express organization structures and heir initial state and "positions", to express units' actions and plans. A Collective task is the tasks or activity conducted by an organization or unit that leads to that a mission or function is conducted. For a collective task to be accomplished it is important that the supporting individual and collective tasks are conducted. An individual task is a task or activity conducted by an individual with in

the frame of his role or assignment. An individual task supports one or more collective tasks and can also support other individual tasks.

4 The process of a Model Based composition of METL,

The Method of decompose is the well known Mission Essential Task List (METL) is described in FM 7-1 [4] and the overall method is used in this work as well with the slight difference that a model based approach is used. The gain of using a model-based approach is that if Requirements, Units etc. are added or removed the changes are made immediately in the whole system. Let us reiterate that a Mission Essential Tasks (MET) are tasks that a unit must be able to perform on the basis of the assignment. A MET is performed in a dialogue with senior management to ensure that they support the higher managerial assignments (e.g. Platoon and troop / group performing Critical Tasks). A Collective Task (CT) and activities are those that a unit can perform based on the current organization and provided equipment. A CT is in relation to a MET is unspoken / implied or supportive.

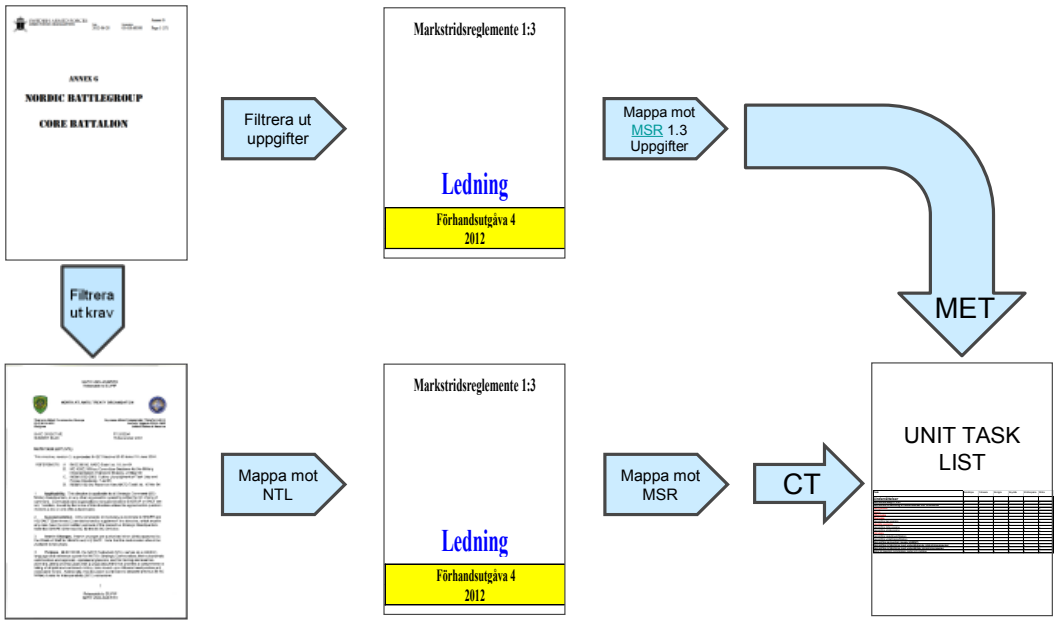

Figure 4 – Nordic Battle Group Requirement Specification to METL process

The MET and CT is used together with overarching requirements to form Mission Training Plan (MTP), Exercise Synchronization Matrix and a plan for which type of training support that are needed such as Command and Staff training and Combat Training Facilities.

In Figure 4 the process of transforming the Nordic Battle Group (NBG) Core Battalions Requirement Specification (RS) [5] to a METL representation is presented. The NBG-RS

[5] is filtered into two sets. The first describes Actions and the second describes Requirements. The Actions are mapped and aligned towards the Ground Combat Regulations (MSR) [6] producing the MET. The Requirements are mapped and aligned with NATO Task List (NTL) [7]. The result is mapped and aligned with the MSR and produces the Collective Tasks. This process is used for all units down to platoon level.

In Figure 5 a resulting MET / CT spreadsheet is showed for a unit. On the MET axis the tasks are defined according to Swedish doctrine (i.e. MSR). The CT is described using a mapping to NTL and MSR. For each MET the corresponding CT activities are marked with an "x" to indicate its included in that MET.

MET

CT

Task	Bekämpa	Försvara	Skingra	Skydda	Stridsspana	Störa
Underrättelser						
Genomföra steg 2 i PUT	x	x	x	x	x	x
Genomföra inhämtning av underrättelser och information						
Rekognosera		x		x		x
Spana		x		x	x	x
Ytövervaka						
Övervaka						
Genomföra fast spaning		x		x		x
Upprätta postering		x		x		
Genomföra rörlig spaning		x		x	x	x
Genomföra stridsspaning	x	x		x	x	x
Patrullera				x		x
Genomföra innästling/infiltration						
Genomföra utnästling/exfiltration						
Genomföra samverkan (passiv HUMINT)						
Genomföra inhämtning med understödjande inhämtningsresurser		x		x	x	x
Genomföra inhämtning med underställda inhämtningresurser		x		x	x	x
Bidra till lägesbild motståndare, parter och civilläge	x	x	x	x	x	x

Figure 5 - An Example MET CT spreadsheet

From the requirements in NBG-RS mission are selected that cover the collective tasks needed to be trained. In Figure 6 a Mission Training Plan example is presented with the selected missions for training (Deploy, Early Entry, APOD/SPOD, Seize key Terrain). These mission vignettes are then planned to an exercise event (FBÖ 1-4). For each exercise event a synchronization matrix is developed (Figure 7). In the synchronization matrix the highlighted unit VK (i.e. call sign) is the battalion staff and for each exercise day the main activity is described. For each of the company (the rest of the list) their tasks are described. For KK (i.e. call sign) their main training will be to recognize (spana in Swedish).

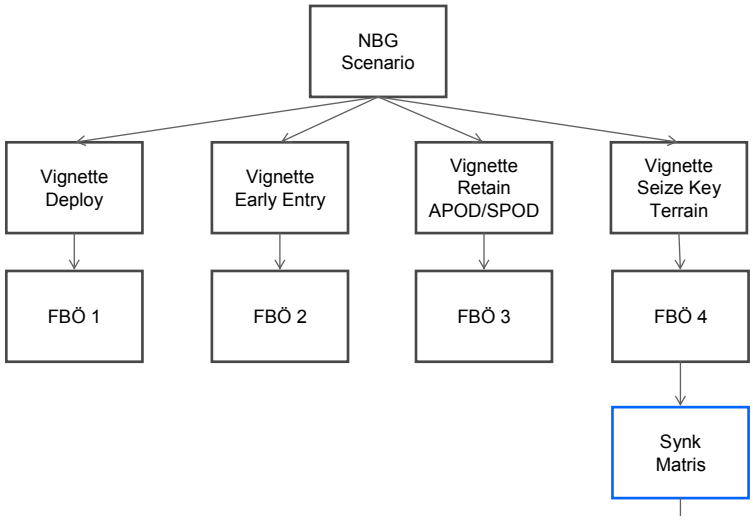

Figure 6 - Mission Training plan

	Måndag	Tisdag	Onsdag	Torsdag	Fredag
VK	Marsch	Ta	Fsv	Öppna väg	Skydda
PK	Marsch	Ust	Ust	Ust	Ust
KK	Spana	Luftlandsätt	Spana	Spana	Spana
AK	Marschund erställ	Ust	Ust	Ust	Ust
QK	Marsch	Ta	Ta	Reserv	Skydda
RK	Marsch	Stridsspana	Ust	Minspana	Undsätta
QO	Marsch	Ta	Fsv	Ta	Försvara
XK	Marsch	Ust	Ust	Ust	Ust

Figure 7 - Synchronization Matrix FBÖ 4

5 Assessment, Evaluation and Accreditation Methods

During the exercise collecting and recording of data together with real-time evaluation is conducted. The evaluation methods used are primarily the NATO methods Operational Capabilities Concept Evaluation and Feedback (OCC E&F) method and Core Team Effectiveness (CTEF) together with the Swedish Military Analysis method for Reliable Tactical Assessment (MARTA). Generally these methods have the process of evaluators that collects data from training and education units. This data are then used in the evaluation to answer to which degree the units meet the criteria, and if it sufficient or if there is a need for more training in a particular activity.

OCC E&F – Operational Capabilities Concept Evaluation and Feedback [8-9] is an assessment method developed by NATO. The OCC is used to measure the interoperability between nation's military forces. The method has two levels. The first level is to evaluate the unit and individual soldiers towards Military Tasks for Interoperability and can range from templates for orders and reports, individual soldiers capability of using English in radio communication, type of gasoline used in trucks etc. The second level is a Combat Readiness Evaluation (CREVAL) that measures the capability on a higher level. The CREVAL consist of two levels where the first is a self-assessment by the own nation. NATO conducts level two.

MARTA – Military Analysis method for Reliable Tactical Assessment [8] is a Swedish assessment method to measure the capability of units. The core parts are a method to systemic gather observations from training and exercises. The method basically consists of data collecting templates and a computer-based model to connect collected data for analysis. The method uses concrete evaluation criteria that are used by independent observers in assessment.

The results of the evaluation are shown in documented form containing the percentage fulfillment of the tasks.

CTEF – Core Team Effectiveness [10] is an assessment method of the Command and Control functions. The CTEF model represents the scientific, empirical and theoretical consensus that effective teamwork is the result of conditions, processes, outcomes and feedback factors. The model comprises eleven components, such as mission context or team focused behaviors, each characterized by a set of features, which sums to 32 in total. Based on the CTEF model, an assessment instrument for commander and staff teams was constructed in the form of a questionnaire. Using this questionnaire, the status of the team's effectiveness can be reviewed, which can then be used for improvement during team evaluations.

MARTA can give an indication that a function is not working, if it is due to the team Effectiveness then, if the team has been measured according to CTEF, it can be pinpointed to what degree the teams collective effort was an issue or not.

6. Putting it all together

In section 2, Scenario Based Training is presented which base is the TNA and the selection of TO. With the modeling of the MET and CT it is possible to determine which CT that are associated with the MET. The trainee (in this case the battalion) has a set of MET that it needs to be able to handle. With the modeling each participating unit is in turn modeled with its specific MET and CT (see Figure 9). The MET and CT for each Unit then together form a collective view of all parts that needs to be educated, trained, assessed and evaluated. One could look at it as a hierarchical network model where a particular MET on battalion level unfolds to the subordinates MET and CT. For each CT there exists a method and procedure that are to be trained and assessed. In some cases there exists scenario vignettes, in other cases scenarios need to be developed. A scenario

could then be defined as the manual input and stimuli to the trainee or could be defined in scripts to be executed in a simulation. Both approaches require the trainer or simulator to be skilled to adjust the prototype scenario into the current situation in the exercise. Simply put, there is no silver bullet but for each new training event the repository of training sets groves larger and enables for more automated selection of scenario and instruction sets for each role, and evaluation questions and scales.

5. System Architecture for a Support System for Evaluation

So long is everything fine, however to provide a robust assessment, evaluation and accreditation there is a need for support system that helps in the process of administrating what to monitor for evaluators (external or self evaluation) or by automatic means, i.e. collecting and automatic fuse data. The system shall also support in presenting results that together provides an agile After Action Review capability.

Figure 8 present the core architecture the support system consists of sensors inform of observers, live, systems and simulators that collects different measurements. These measurements are defined in accordance with the task they are meant to measure. The tasks are provided through the model-based approach to produce MET and CT for the force. With the data stored in the database a variety of reports can be generated whenever the evaluator wants to. Further a unit's progress can easily be reviewed and the information from the reports helps in planning for the next training events. The collected data also provides that during exercises that the next event can be provided to the role players as well as exercise trends can be provided to further adjust the training.

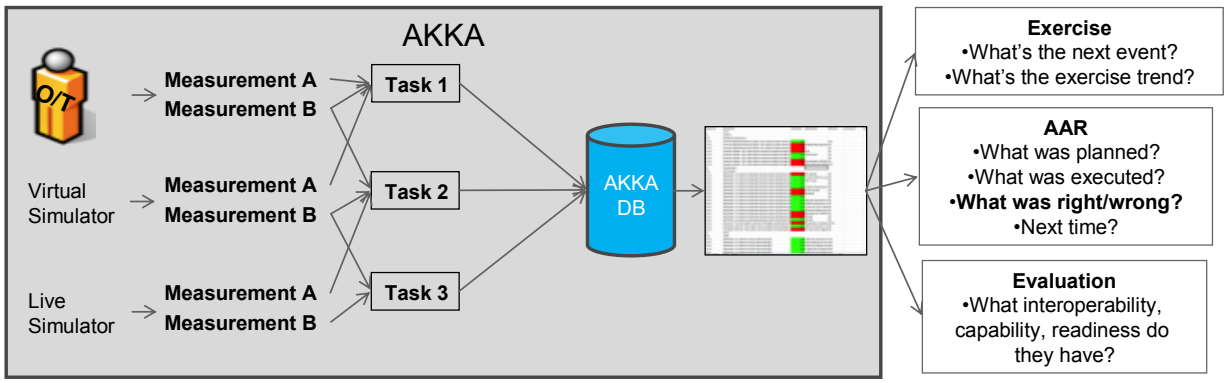

Figure 8 - Support System Overview

In the Planning phase the system import the defined Task-list or the tool can be used directly to insert tasks. The measurements and checklist is centered around tasks, units, roles or individuals providing for various level of granularity depending on the evaluation need and method used. The type of observation mechanism, i.e. subjective and objective observations, is defined.

In the execution phase the system provides the observer with a tool so that reports in accordance with the defined checklist are made via a mobile device or a pc. Simulator reports in accordance with the checklist via an integration interface, and the exercise manager can summarize the result of performances at any time.

In the evaluation phase the system provides support for the exercise manager to filter, summarize and export the result at any time. The replay in AAR activities can be determined from the export. The exported result always represents the capability at that time.

The measuring by observers (human or machine) are made by questions that answers to questions such as: a) Has unit X conducted A before B - with the choice of Yes or No; b) To which degree have X developed A – with the choices Not at All / Little / Sufficient / Very Well; c) Do X use the C2 method – 1-5 (where 1 is low and 5 is highly, (Linkert scale)); d) How long time has it taken for X to develop an initial WARNO – hours and minutes. The answers are then judgements by the observer and also by the trainee or absolute measurements by observers or systems. The resulting measurement can then depending on what is measured be the average of the observation, be the sum of all observations, be the latest observation, be negative if there is at least one that is negative etc. Mostly an average of the observations is made. The measurements are grouped together (if needed/wanted) to map to specific tasks that are to be observed. Also depending if MARTA, CREVAL or other systems is used the specific measurements and mathematics for those evaluation systems is implemented into the computer system. Making it possible that from one measurement support several evaluation systems.

6. A case study

The case study exemplifies the support systems function and efficiency in the appliance to evaluate a training event with the scenario of a Traffic accident with injured personnel. The training audience consisted of an Ambulance service (2-4 ambulances) and Fire Department. The training event was conducted 4-6 times a day with slight differences in scenario and injuries. Each event had duration about 20 minutes, a 2-5 minutes preparation of AAR and a 20 minutes AAR session. During the exercise the exercise manager developed the evaluation template in harmony with exercise. Each of the observers carried a tablet with the system where they mainly reported with text, video and pictures the events and answered to the defined measurements. The AAR reports where extracted by a system manager in 1-2 minutes after each training event.

Figure 9 shows a spreadsheet extract to visualize the result from a series of observations made. The red fields address areas and observations that didn't follow the standard. These areas are of extra interest during AAR since no observations where made and there is a potential of improvement. The 1.2.1 reads 0,78 which is the average of the observations (i.e. 7 / 9).

Reference	Description	Estimation	Observation	Observer	Conclusion	Recommendation
1.	PAPS :	0,78				
1.1	Sjukvårdsledning :	0,83				
1.1.1	Generellt :	0,83				
1.1.1.02	Fordonsuppställning avstånd : Sker fordonsuppställning utanför varn	0,00		johan		
1.1.1.02	Fordonsuppställning avstånd : Sker fordonsuppställning utanför varn	1,00		thomas		
1.1.1.02	Fordonsuppställning avstånd : Sker fordonsuppställning utanför varn	1,00		thomas		
1.1.1.05	Klädsel : Bärs klädsel enligt riktlinjer?	1,00		thomas		
1.1.1.06	Tidtagning vindruterapport : Tryck här när vindruterapport skickas	1,00	10:57	thomas		
1.1.1.07	Vindruterapport RAKEL : Genomförs genom vindrutan rapport på Ra	1,00		thomas		
1.1.1.08	Vindruterapport utformning : Är genom vindruterapporten korrekt	1,00		thomas		
1.1.1.09	Rekvarv : Genomförs rekvarv omfattande hela skadeplatsen även ur	1,00		thomas		
1.1.1.09	Rekvarv : Genomförs rekvarv omfattande hela skadeplatsen även ur	0,00		johan		
1.1.1.10	Inriktningsbeslut : Ger sjukvårdsledaren inriktningsbeslut?	1,00		thomas		
1.1.1.11	Tidtagning samverkan : Tryck här för att ange när samverkan påbörja	1,00	11:05	thomas		
1.1.1.15	Ankommande sjvpersonal : Får ankommande sjvpersonal snabbt up	1,00		thomas		
1.2	Ambulans 2 på plats :	0,79				
1.2.1	Generellt :	0,78				
1.2.1.01	Rakel : Använder de rätt Raps-grupp och sjvinsatsgrupp?	1,00		tore		
1.2.1.02	Fordonsuppställning avstånd : Sker fordonsuppställning utanför varn	0,00		tore		
1.2.1.03	Tidtagning på plats : Tryck här när ambulanser är på plats	1,00	11:02	tore		
1.2.1.05	Klädsel : Bärs skyddskläder enligt sjvledarens direktiv?	1,00		tore		
1.2.1.06	Söker sjvledare : Söker personalen direkt upp sjvledaren?	1,00		tore		
1.2.1.07	Rätt utrustning med fram : Bår, filtar, syrgas, utr för helkroppsimmob	1,00		tore		
1.2.1.13	Tidtagning hos patient : Tryck här när sjvpersonal är hos patient	1,00	11:02	tore		
1.2.1.14	Primär undersökning A-E : Primär undersökning enligt A-E genomför	0,00		tore		
1.2.1.19	Tidtagning kritisk/icke kritisk : Tryck här när beslut tas kritisk/icke-kr	1,00	11:05	tore		
1.2.2	Icke kritisk :	0,80				
1.2.2.01	Beslutsdelgivning : Delges beslut om icke kritisk tydligt till berörd p	1,00		tore		
1.2.2.02	Sekundär undersökning A-E : Sekundär undersökning enligt A-E gen	0,00		tore		

Figure 9 - AAR from Civil Exercise

In Figure 10 the overall performance of a series of events are presented. In the figure the units of C2 function and two ambulances are presented. Noteworthy is that the increase of performance from Event one to Event two. Bothe the C2 function and Ambulance crews reached the desired goal. In event 3 something had happened in the C2 function. This indication helps the evaluator to drill down and examine why this loss of performance occurred. In this exercise the reason was that the C2 team made a shift in commanders and that they missed in the procedures during the change. It is also noteworthy to see that the ambulance crews performance just slightly decreased meaning that they are self attend and not needing a fully functional C2 to deliver required effect.

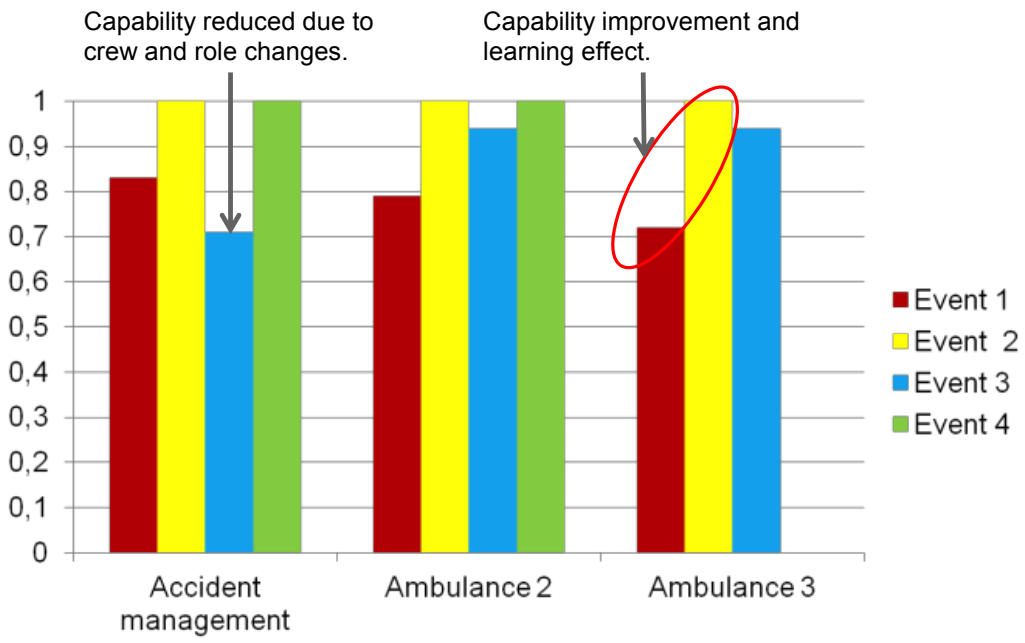

Figure 10 - Overall Performance

6 Conclusion

With a Model Based Approach to derive the MET and CT for the NBG a step towards a Systemic Governance of Force Capabilities, Tasks, and Processes to support training a robust and agile system can be built. With the MET and CT a comprehensive set of Training Objectives are identified. Depending on the commanders training need a more precise design of scenarios aiming on what to actual train can be made.

The structure of the data in the system makes it possible to assign different measurements to tasks and that a specific measurement can affect several tasks. Thus supporting evaluation systems such as Marta and CREVAL. Depending on how the questions are designed the mathematical calculations could be the average, the sum, the latest value etc. At the design of the questions it is of course essential to know what evaluation method is to be used. But since the raw-data is captured and stored digitally it allows exploring different approaches to evaluation and also comparing results amongst evaluation methodologies.

The approach then is an aid to the commander and staff to plan, execute, and evaluate training. The next step is to practically use the system in the force development of the Core Battalion in Nordic Battle Group 2015.

References

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