Simulation Needs Analysis Guide – Training

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Abstract. There are numerous opportunities for Defence to exploit the benefits of simulation, particularly in training applications. However, training managers and developers, capability managers and capability development desk officers may lack sufficient expertise and experience of simulation to effectively and efficiently analyse simulation requirements. While there is much useful information in the various guides comprising the Defence Simulation Manual, there is scope for a simpler, structured and supportive guide for users analysing simulation needs and requirements for training applications, which include: a new capability with a new training need; an existing capability with a new training need; or an existing capability with an existing training need, seeking more efficient or effective training methods. The Australian Defence Simulation Office is developing a simulation needs analysis process, as an extension to the Defence Training Model, which has the potential to underpin an interactive computer-based guide to support users considering simulation to meet their training need. The process has been termed the Simulation Needs Analysis Guide – Training (SNAG-T). The paper describes the SNAG-T process, the intended user groups and future direction of Simulation Needs Analysis Guides.

1. INTRODUCTION

The Australian Defence Simulation Office's (ADSO's) principal roles are policy direction, collaboration, and coordination of simulation activities across Defence. ADSO staff promote the development of approaches to gaining and sustaining knowledge via simulation in order for Defence to make the best use of this technology wherever it can enhance capabilities, save resources and reduce risk. One of the main application areas of simulation in Defence is training, both individual, for example flight training devices, and collective, such as the use of Command Post simulations.

The use of simulation in Defence is still far short of the optimum level and there are numerous in-service training systems that make little, or insufficient, use of simulation. In-service training managers also need a process to guide them in the evaluation and selection of simulations to enable them to exploit the benefits simulation can bring to their training system.

The ADSO Simulation Manual (SIMMAN) contains useful and detailed information on the application of simulation across all phases (Needs, Requirements, Acquisition, Sustainment and Disposal) of the Capability Systems Life Cycle (CSLC). However, scope exists for a simpler, structured and supportive guide for users analysing simulation needs and requirements for training applications. These training applications include: a new capability with a new training need; an existing capability with a new training need; or an existing capability with an existing training need, seeking more efficient or effective training methods.

The guide should also better exploit current media technology, by using a more interactive, e-learning approach. This paper will present the simulation needs analysis process developed by ADSO, describing how it meets the perceived need, how the process works and its future direction.

2. THE PERCEIVED NEED

Ideally, the use of simulation should be considered from the earliest stages in the capability development process. Training requirements, and potential training solutions including simulation, should be based on a sound Training Needs Analysis (TNA). However, capability development desk officers and project staff usually have limited experience of simulation and have little time to spend acquiring a broad understanding of the simulation options available and how they can benefit the capability.

Methodologies to approach the requirements and development of training are well established; with Defence having its own Training Model and doctrine. However, processes for identifying where and how simulation can be applied to meet training needs are not so well established. This can present a challenge for training developers/managers or capability developers who are generally not simulation experts and may lack sufficient expertise and experience to effectively and efficiently analyse simulation requirements.

SIMMAN contains useful information and methodologies that can assist both capability developers and in-service training managers to acquire and exploit simulation, but they could be easier to follow and understand. The increased use of computer-based learning and presentation techniques could also be applied to improve accessibility and the effectiveness of the guidance.

Therefore, ADSO is developing a new simulation needs analysis process, termed the Simulation Needs Analysis...
Guide – Training (SNAG-T). The SNAG-T is linked to the well-established Defence Training Model (DTM), makes appropriate use of SIMMAN and other reference material, and is designed to underpin an interactive computer-based guide to support users who are considering the use of simulation to meet their training need.

### 2.1 Who is the SNAG-T user?

The SNAG-T user could be anyone in Defence who has been tasked to create business documentation for simulation in the training application area. However, the SNAG-T is specifically targeted to meet the need of three key groups:

- a) Capability Development Desk Officers at CAPT(E) to MAJ(E) level.
- b) Training Managers and Training Development Staff for Service HQ, Formations, and Training Establishments at SGT(E) to MAJ(E) level.
- c) DMO Project Managers, Systems Program Office Training Managers, and Weapon Systems subject matter experts at SGT(E) to MAJ(E) level.

### 2.2 How does the SNAG-T support the user?

![SNAG-T context diagram](image)

Figure 1 shows pictorially how the SNAG-T supports the SNAG-T user. In the centre of the diagram is the SNAG-T user, the person who may have been tasked by their supervisor, to produce a specific business document relating to the use of simulation.

The range of business documents can be seen at the very bottom of the diagram and from left to right provides a continuum of the level of detail required of the analysis. The particular business document required depends on the task and when it is conducted in the CSLC.

The left of the diagram provides the policy, procedural, and doctrinal inputs that are applicable to the SNAG-T user’s work context. Combined with the task directions from the supervisor, these inputs provide the framework within which the SNAG-T user must operate.

The right hand side of the diagram can be considered the simulation specific guidance that the SNAG-T user can access for support to complete their task. To the far right is SIMMAN, a large collection of simulation specific advice; however, for the average user this is too detailed and the learning curve may be too steep to be of immediate assistance. Directly to the right of the SNAG-T user is the SNAG-T; this is the stand alone process which guides the user through the steps of the analysis required to achieve the task they have been given. The SNAG-T is linked to SIMMAN, as it will guide the user to SIMMAN for detailed analysis at specific steps.

Finally, directly below the SNAG-T user are the outputs of the SNAG-T. These are the body of analysis the user develops as they work through the SNAG-T process. The SNAG-T does not directly generate the analysis; it simply provides a process, appropriate questions, direction to reference material, and a location to store the analysis outputs. All of the outputs are user generated. Additionally the SNAG-T will not produce the specific business documentation that the SNAG-T user is required to create. Rather, the user will, after completing the process, have a body of analysis that they can then use to populate their business documentation.

### 3. THE SNAG-T PROCESS

The SNAG-T process was developed to be completed iteratively and has five main steps as follows:

- a) Context analysis;
- b) Identify possible options for training;
- c) Core simulation specific SNAG-T analysis;
- d) Comparison of training options; and
- e) Preparation of business documentation.

The SNAG-T begins with a context analysis and task scoping. This is followed by identifying possible option for training and assessment; these may include multiple simulation and non-simulation options. The user will then analyse each simulation option individually within the core of the SNAG-T process. Having analysed individual simulation options and derived a Value for Money (VFM) assessment for each, the user will now compare all the previously options, and make an overall determination on the preferred choice. The user has now completed the SNAG-T process and will use the determination and body of analysis generated through the SNAG-T to help develop their required business documentation.

#### 3.1 Establishing the analysis context

Initially, the process was intended to be flexible and widely applicable enough to context-independent, but a review of an early draft of the process indicated that the user’s requirements would affect how the user could best use the process. Consequently, a step was added to establish the context. Due to the wide scope of the business documentation that the SNAG-T user may be required to develop, it is critical to establish the context of the analysis prior to commencing the analytical tasks.
To establish the context, the SNAG-T user must clarify why the study is being conducted and then determine the level of the analysis to be conducted. This ensures that the appropriate amount of effort and resource is dedicated to the process. As the user progresses through the SNAG-T, they will frequently refer to their established context to ensure that their analysis remains at an appropriate level.

If the SNAG-T user is completing the process iteratively, they will establish the context at the start of every iteration. For each iteration, they will generate progressively more detailed analysis of the selected options from previous analysis runs.

3.2 Identify possible options for training
Having established the context for the analysis, the SNAG-T user then identifies possible training options to meet their training need. These include both simulation and non-simulation options.

Identifying training options (possible solutions) can only be done in relation to the training needs. Ideally the training needs are determined through the conduct of a TNA; the SNAG-T guides the user either to obtain these needs from a pre-existing TNA or to initiate a TNA or, if time and resources are short, to identify the critical elements of the training need that will influence the later steps of the SNAG-T. The TNA is a logical outcome of the ‘Analyse’ phase of the DTM, providing a linkage between the SNAG-T process and a wider training development process aligned with the DTM.

While identifying the training options, possibly through a market survey, it is likely that the SNAG-T user may identify a number of simulation options that may meet the training need. In this case the user would conduct an individual analysis of each specific simulation option. At the end of the process each option will have its own costing and (VFM) assessment and will be compared for the best option.

3.3 Core SNAG-T analysis of individual simulation options
Once the possible options for training are identified, the SNAG-T user must conduct an individual analysis of each simulation option. This will be conducted with the core of the SNAG-T, with the end result being a VFM assessment of each simulation option. The SNAG-T core covers all of the areas relevant to determining simulation VFM as follows:

a) Benefits and limitations of simulation;
b) Key cost drivers of fidelity, data, system performance, personnel, and facilities;
c) Confidence building and acceptance measures;
d) Interoperability issues;
e) Time for development and introduction into service;
f) Opportunity costs and procurement risks;
g) Rough Order of Magnitude (ROM) costs; and
h) The VFM assessment.

Each of these areas of analysis will be covered in section four.

3.4 Comparison of training options
Having completed the simulation specific core of the SNAG-T it is then time to compare all of the options, both simulation and non-simulation, as identified in the second step of the process. The SNAG-T does not provide the tools or guidance to analyse or make a VFM assessment on non-simulation options; the user is expected to source those tools from elsewhere. Having determined a VFM assessment for all the simulation and non-simulation options the SNAG-T user makes a final professional judgement decision on the best option for meeting the training need. The user now has a complete body of analysis, at the level scoped in the very first step, and is ready to use this information to further develop their required business documentation.

3.5 Prepare the directed business documentation
The SNAG-T user has now made a determination of the best option to meet the training need and they can use the body of analysis to populate their particular business documentation. In case the user does not have a prescribed documentation process or template to follow, the SNAG-T provides links to examples of simulation business documents which can be used for that purpose.

4. ANALYSIS PROCESSES OF THE SNAG-T CORE
The simulation specific elements of the SNAG-T are conducted within the SNAG-T core. All the steps of the SNAG-T core are completed for each of the individual simulation options identified in the preceding step ‘Identify possible options for training’. The function of each of the elements detailed earlier will be described in this section. It is important to note that each step of the core needs to be completed sequentially as subsequent steps use information derived from those previous.

4.1 Benefits and Limitations of simulation
With the context established and the simulation options identified, the user commences analysing each individual simulation option. This process starts by clearly identifying the specific benefits of simulation for this option. Benefits are identified upfront because, when compared to the limitations, this allows for an initial assessment of the likely value of the simulation option in meeting the training need. The three generic areas of simulation benefit are: enhanced capability; saved resources; and reduced risk. Within each of these areas there are benefits which will fall into one of four categories: direct quantifiable, indirect quantifiable, direct non-quantifiable, and indirect non-quantifiable.
Other than the initial assessment of simulation to meet the training need, the benefits identified at this early step will be used later to inform the VFM assessment towards the end of the process.

As well as the benefits, the user also indentifies the likely limitations of simulation in meeting their specific training requirement. The broad limitation categories are: physical, practical, financial/economic, environmental, performance, political, export, military, temporal and spatial. After identifying the likely limitations the user can then broadly compare the benefits against the limitations and make an initial assessment as to the ability of simulation to meet the training need. The limitations will also be used later in the process as they form part of the VFM assessment.

4.2 Key Cost Drivers

Having compared the benefits and limitations and deciding that a simulated option is worth assessing further the user will now begin the analysis of the key cost drivers for this option. The key cost drivers of a simulation are: fidelity, data, system performance, cost drivers for this option. The key cost drivers of a simulation are: fidelity, data, system performance, cost drivers for this option. The key cost drivers are dependant on the training requirement. The limitations will also be used later in the process as they form part of the VFM assessment.

4.2.1 Fidelity

Fidelity is the first key cost driver to be considered by the user as the required fidelity is driven by the training need and provides requirements for the key cost drivers that follow. When considering fidelity, it is intuitive that a certain level of fidelity is required to meet the specifics of the training need in question, it is also clear that fidelity above this level is likely to be a waste of resources, as it provides no additional VFM. In determining the fidelity requirements, the SNAG-T user needs to complete two key steps: determine what needs to be represented, and determine the required fidelity of those representations.

After determining what needs to be represented to meet the training need, the user will consider fidelity across a number of areas: functional, visual, aural, vestibular, haptic, and proprioceptive. The level of detail that the

1 This judgement is likely to be made with further direction from the user’s superior or the task initiator.

2 Dependant on the business documentation the user is required to produce.

SNAG-T user will produce for each of these fidelity areas will depend on the level of analysis being conducted during this pass of the SNAG-T process.

4.2.2 Data

Having determined the fidelity requirements for the simulation option, the SNAG-T user is now able to consider the data requirements. The fidelity requirements drive the level and depth of the data. Firstly the user needs to consider the types of data that will be required; this will usually fit into four main categories: entity data, terrain data, environmental data, and output data. The user will then identify possible data sources and repositories; effectively they are considering where the data could be obtained from and where it will be recorded to and stored. Having identified the sources of data the user must determine if any modifications are required for the data to be fit for purpose. Finally, the SNAG-T user should identify how the data will be maintained and updated once the simulation is in service.

Of the five key cost drivers, data could be considered as the first significant constraint. Dependant on the entities and interactions that are required for the simulation, it is possible that the required data may not exist, take too long or be too expensive to produce, or be unable to be released by the data owner. It is important that the SNAG-T user investigates what data is already owned by Defence to ensure that repeat purchased of data does not occur unnecessarily.

4.2.3 System Performance

The system performance of the simulation option is analysed in two parts: the performance requirements to meet the fidelity and data requirements and the performance in terms of training rates, system availability, reliability and maintainability.

4.2.4 Personnel

When analysing the fourth key cost driver, the SNAG-T user considers the personnel required to allow the simulation option to function and also the required skill sets of those personnel. In determining the personnel requirements the user must consider the system performance requirements of training rates, availability, reliability, and maintainability. From these requirements they can determine the numbers of trainers, operators and maintainers required. Once this has been determined the user can then focus on the skills required of those personnel groups and any training that will need to occur to address any skill gap.

4.2.5 Facilities

The final key cost driver to be considered is facilities. When considering facilities the user will identify facility requirements and locations already established or planned to meet the training need, and whether an existing facility can be used, including any required
modifications, or whether a new facility must be established. Finally the user will determine if there is a requirement for supplementary facilities such as accommodation for trainees, storage facilities for spare parts, or other domestic facilities.

4.3 Acceptance

Having completed the analysis of the key cost drivers, the user now progresses to the confidence building and acceptance requirements of the simulation option. Confidence building can be considered as two elements, being formal and informal acceptance approaches. Within the SNAG-T process the user firstly determines who needs to be engaged with confidence building measures, and then determines the informal and formal approaches required to engage those groups.

The likely groups requiring engagement can vary but may include: trainees, training staff/instructors, the training authority, the organisation accepting the graduate, regulatory bodies and the simulator sponsor/approver. Having identified the groups requiring engagement the user then determines which groups can be engaged with informal acceptance approaches such as end-user engagement, transparent development processes and developing a sense of ownership in the project. For those groups requiring formal acceptance approaches the user must investigate the requirements for Verification, Validation and Acceptance (VV&A) processes.

4.4 Interoperability

During this step of the SNAG-T process the user is asked to consider and determine the interoperability requirements, if any, of the simulation option. At this point the user will be required to engage with Subject Matter Experts regarding the possibilities of interoperability options and the system requirements for those options. The user will then consider the higher level collective training needs and compare these against the requirements and costs of interoperability implementation.

4.5 Time

At this step the user calculates the time frame for simulator development and implementation. This schedule is then compared with the imposed time requirements of the training need/acquisition project. From this a determination is made as to the viability of the simulated option.

4.6 Opportunity Costs and Procurement Risks

During this step the user is asked to identify the opportunity costs and procurement risks to the simulation project. When considering the opportunity costs the user is asked to determine the opportunities that will be missed if the simulator is not brought into service. Effectively this assessment forms part of the user’s ‘hurt statement’ in their business documentation and is used during the VFM assessment. It is also a good time in the process to refocus on the benefits of simulation after so far predominantly considering the costs and issues involved in introducing a simulator into service. Having considered the opportunity costs the user must then consider the procurement risks.

The risks considered in this step are only procurement risks and not the risks associated with the in-service simulation. The in-service risks will be considered in detail later in the process. The purpose of considering the procurement risk is two-fold; firstly, awareness of the procurement risks and secondly, developing and costing risk mitigation strategies. In order to identify and mitigate procurement risks the SNAG-T user will use their business area endorsed risk tool; this output will then form part of their body of analysis.

4.7 Rough Order of Magnitude Costs

The next step involves a final determination of the ROM life cycle costs for the simulation project. It stands to reason that the accuracy of the ROM cost is based on the depth of analysis and costing that has been conducted in the previous steps. The process of life cycle costing effectively involves summing the acquisition cost and the post acquisition costs.

The SNAG-T user has already determined the acquisition costs through the process so far. Post acquisition costs comprise the annual operating costs, the simulator upgrade costs and the simulator disposal costs. The SNAG-T user determines each of these three cost types individually and then sums them to achieve the post acquisition costing.

4.8 Value for Money Assessment

The VFM assessment is the final step in the simulation specific core of the SNAG-T process. This is based on a professional judgement that balances the following three main elements: the value of the simulator investment, the cost of the simulator investment, and the risk of the simulator investment. The SNAG-T user determines the value of the simulator investment by considering the direct and in-direct benefits as well as the opportunity costs, both determined earlier in the process.

The cost of the simulation investment is determined in two parts. Firstly the SNAG-T user determines the accrued savings from the simulator investment, in other words the accrued savings that will be realised when the simulator is in service. Sources of accrued savings may be reduced maintenance of live assets, reduced resource usage, or reduced training time. Secondly, the accrued savings are subtracted from the life cycle costs calculated earlier. Subtracting the accrued savings from the life cycle costs gives the true cost of the simulator investment.

In order to determine the total risk of the simulator investment the SNAG-T user needs to consider both the procurement and in-service risks. The procurement risks
have been determined earlier in the SNAG-T process. To assist in identifying the in-service risks, the user considers the limitations that were identified towards the start of the process and the risks that they pose to meeting the training need.

As stated previously, once the value, cost and risk of the simulator investment have been determined, the VFM assessment is based on a professional judgement and the relative balance between the three elements.

5. WHERE TO FOR THE SNAG-T?

The SNAG-T process has been developed in the form of flowcharts and supporting documents and references. Amendments following a comprehensive review are being incorporated and the process is being prepared for the next stage of development. The intention is to produce an interactive, computer-based tool and, following testing and initial feedback, make it available to users across Defence. The final form of the tool is yet to be confirmed, but will be influenced by existing e-learning and other computer-based tools in use with Defence. It is hoped to release the SNAG-T before the end of 2012.

Training is only one of the simulation application areas for Defence and it is envisaged that the SNAG-T will become the basis for the development of guides for the other application areas. The SNAG-T could form part of a suite of Simulation Needs Analysis Guides, such as for Research and Development, Operational Planning, etc. These could become SNAG-R&D, and SNAG-OP respectively.

6. CONCLUSION

The recognition that increased use of simulation can be of great benefit to Defence is growing and the development of a readily accessible, easy to use simulation needs analysis tool is a positive response to this greater awareness and demand. Initial interest in the SNAG-T development has been positive and an independent review of the draft process has validated the approach. Development of the process into an interactive, computer-based tool should encourage its widespread use and applicability across Defence.