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BATTLEFIELD SIMULATION— BUILDING VIRTUAL ENVIRONMENTS

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Abstract. The major shift in simulation to date has been in the orientation or role of the participant. In the past, analysts studied the world as an external reviewer using simulation to provide insight into the real-world system. Students trained on replications of systems to learn specific tasks and practice certain skills with respect to the replicated rea-world system. However, the domain of simulation has now spread to the digitised battlefield. As a result, through emulation techniques defined by interconnectivity and interoperability requirements and constraints, we can now climb into the simulation via the S*ynthetic Environment (SE)* and experience the 'realities' of the system we are studying or training with. While in the past, we used training systems to teach specific tasks, the use of simulation is just beginning to evolve to emulate an operationally valid, authoritative, real-world environment. This shift in focus, capability and the participant role has both great promise and great risk. The promise brings repeatable, safe, visually accurate, inclusive, seamless, training on demand capability. However, the risk is in direct correlation to the promise and is associated with the simulation training system's development process as engineers attempt to capture the actual real-world environment and create the artificial digital emulation. The associated risk is that current engineering practices in both Systems and Software Engineering do not provide sufficient process models, policies, standards or tools that can be leveraged in a simulation program. Furthermore, simulation as a body of science does not have a collective scientific paradigm that establishes development practices let alone the final "system" validation. Now more than ever, simulation development professionals need defined practices and standards and tools in order to produce the right environment for the right requirements at an appropriate cost.

INTRODUCTION

Somewhere ….

> Deep within the Combat information Centre (CIC) of a US Carrier is a Seaman watching his screen and monitoring the vital statistics of an Aircraft 200kms out. The aircraft has experienced an electrical failure and cannot use its onboard systems to locate the carrier. Communication has been affected as well, yet there is some voice contact. In support is an AWACS flying within the target area, the same target area that the troubled aircraft has just left. Both systems now show a rapidly descending blip into 'unfriendly' terrain on their respective screens, but both know that that blip represents real people that may not make it. As the tension mounts it becomes clear that the aircraft will run out of fuel before reaching the carrier. The Seaman on the carrier and the Airman on the AWACS as well as others who have now become spectators are beginning to exhibit the stress from watching helplessly as the lone aircraft comes dangerously close to the ground. Communication with the Aircraft is now intermittent but it becomes clear that the crew on the aircraft realise that they are not going to get to the carrier. Finally the ship and AWACS systems indicate that the crew have ejected and that the aircraft has gone down.

The ensuing silence in both command and control areas is totally encompassing. No one talks. Both the Airman and the Seaman did all they could yet they wonder if somehow they could have identified the problem earlier and somehow vectored the aircraft to a waiting tanker or to a 'friendly' area. They can only assume that the crew parachuted to safety but that 'safety' is well behind friendly lines. Search and Rescue are in route to the crash site. The Seaman and Airman in close cooperation across many platforms have done their 'best'. Yet, they wonder.

So does the training officer who finally steps forward and notifies all involved that the 'blip' was a computer generated aircraft and that debriefing on the exercise will be in 30 minutes.

In this particular situation the 'crew' were safe aboard the carrier in a training room from which they provided stimulus to the real systems in the AWACS and CIC. From a training perspective, the systems were real, the operators were real, the 'environment was real, the stress was certainly real, the situation plausible and believable, but the actual reality created within the virtual training world. This simulated exercise allowed for data to be collected on responses, timing, and situation awareness, which can be used to evaluate performance based on acceptable policy, procedures and doctrine in an after-actions environment. But at a higher level, data was also collected which would provide a measure of the ability of the different system platforms, data processors as well as personnel to *interoperate*[1] [1] in a joint service operation.

Embedded training on real equipment as depicted above as well as training on simulators (Figure 1) or replications of real equipment have been utilised in many areas of the training community for quite some time. The use of simulation to provide training has been essential in many cases where training must be conducted 'off-line' and in a comprehensive realistic setting. Studies [2] have shown that the use of simulation as a training tool is cost-effective and provides a valid training alternative to utilising the real equipment. While embedded training typically *stimulates* real-world sensors, system replication attempts to model the system, the sensors and the operational environment. Typical system replication is an extension of the basic natures of current simulation practices, which first captures the *descriptive* nature of the system in terms of functionality and then models the *predictive* nature of the system for interactive training.

[1] Italicised words are further defined as a standard reference point in [1].