Using IEEE Standards to Support *America's Army* Gaming Development

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***America's Army* gaming uses IEEE software and systems engineering standards to define process baselines.**

IEEE software and systems engineering (SS&E) standards support basic software production control processes. When practically applied, these standards helped resolve the real-world problems that occurred when researchers combined a classically structured Department of Defense (DoD) approach to basic skills trainer (BST) development with the more agile environment of gaming systems development. These IEEE standards directly aided the development of sound software engineering practices and processes. They provided the flexible support necessary for this dynamic and fast-paced integration environment while promoting the practical process application that helped to develop the *America's Army* products.

A computer game produced by the US Army, *AA* promotes Army recruiting and the seven core values of loyalty, duty, respect, selfless service, honor, integrity, and personal courage. The game's PC version currently boasts more than 7.5 million registered players worldwide.

In addition to the public game, more than 20 DoD basic skills trainer (BST) applications using the same gaming engine are currently in development (www.americasarmy.com and http://info.americasarmy.com). The AA Project Office—part of the Aviation and Missile Research, Development, and Engineering Center Software Engineering Directorate (SED) at Redstone Arsenal, Alabama—manages these applications.

The *AA* public game has been around since 2002; however, things started to get interesting when the Army began to transition the lessons learned from the public arena to its training. The training programs saw success with their first fielded common remotely operated weapon station BSTs in late 2004, as Figure 1 on the next page shows.

DEVELOPMENTAL CHALLENGES

As the *AA* program grew, fundamental software engineering challenges started to crop up.

The project began to experience classic software engineering issues associated with requirements management, configuration management, and verification and validation. These problems were multiplied by the integration issues that geographically isolated development teams often experience, which were then additionally divided by corporate boundaries. Add the market pressures associated with commercial game production to the mix, and these challenges only intensified.

The AA Project Office began looking for help.

Paring CMMI with IEEE CS SS&E standards

The IEEE Computer Society currently provides more than 40 standards that support software and systems engineering life-cycle activities and methodologies. Many of these standards specifically support the Capability Maturity Model Integration Level 2 process areas and map directly to CMMI goals and practices. The SED is a Level 4 organization, and the goal was to have AA projects fully support CMMI-SW Level 2 process areas and practices.

It was important for *AA* to learn how to apply the CMMI model and to use tools to help describe the required software engineering methodology to the development team members. SS&E standards support a variety of CMMI compliance activities, but, more importantly, developers used the standards to train staff and to establish and help improve existing software engineering practices.

Each IEEE CS SS&E standard contains the vetted industry best practice for the topic of standardization. Each standard provides the detailed guidance and procedural explanation needed to support the CMMI docu-

Figure 1. Common remotely operated weapon station basic skills trainer. The BST integrates fielded hardware with the AA *gaming engine software.*

mentation requirements. These standards offer the best practice as defined by industry and academic experts. The benefit of pairing the CMMI and IEEE SWE standards is that CMMI served as the motivator, and IEEE standards provided the sound foundation on which to build our software engineering processes and practices.

The CMMI *process* and the IEEE CS Standards *product* compliment each other; the IEEE standards are more *prescriptive* in nature, whereas the CMMI model is more *descriptive*. This pairing proved to be effective for reaching our process improvement goals. The *AA* team examined each IEEE SS&E standard to determine how to best apply it to support its software processes and identify the best practices to extract to yield the greatest immediate return.

Table 1 shows the correlation between the CMMI Level 2 process area and the IEEE SS&E standards that most specifically support them.

Institutionalization

Several framework definition standards support the CMMI institutional notion. Simply the organization's routine way of conducting business as part of its corporate culture, institutionalization is critical to the effective implementation of organizational process improvement. Researchers developed these standards to establish an internationally recognized model of common software life-cycle processes that the software industry could reference to promote an understanding among business parties by applying commonly recognized processes, activities, and tasks.

IEEE 12207 Standards

The IEEE 12207 standards—adopted as IEEE CS SS&E standards—provide a wealth of information to support software and systems life-cycle processes that tie together the organizational-level, supporting, and primary processes. The *AA* team considered these as a standards framework, prior to documenting the detailed software process.

AA used the IEEE CS SS&E standards to help define and document the initial baseline of recommended processes and practices and to train its development staff. The IEEE's expert advice was leveraged to help define each initial process baseline.

In addition to the public game, a few of the initial BST rollout projects

Table 1. CMMI-software process areas and IEEE SS&E standard cross-reference.

Level 2 CMMI-SW PA	IEEE standard(s)*
Requirements management	IEEE Std 830
	IEEE Recommended Practice for Software Requirements Specifications
Project planning	IEEE Std 1058
	IEEE Standard for Software Project Management Plans
	IEEE Std 1490
	Project Management Body of Knowledge—adopted from the Project Management Institute PMBOK Standard
Project monitoring and control	IEEE Std 1058
	IEEE Standard for Software Project Management Plans
Process and product quality assurance	IEEE Std 730
	IEEE Standard for Software Configuration Management Plans
Supplier agreement management	IEEE Std 1062
	IEEE Recommended Practice for Software Acquisition
Measurement and analysis	IEEE Std 1045
	IEEE Standard for Software Productivity Metrics

* This is not a complete list by any means—there are more than 40 standards in the collection, and many support each of the CMMI process areas.

included the bunker defeat munitions on the future soldier trainer applying the *AA*, as Figure 2 shows; the javelin BST; the tube-launched optically tracked, wire-guided, missile-improved target acquisition system BST; and a nuclear, chemical/biological BST.

It was imperative that all documentation requirements remained flexible and that key development team members remained involved and contributed to defining the development processes. Using the IEEE SS&E standards was ideal for this approach.

ORGANIZATIONAL LESSONS

Each organization striving for software process improvement should leverage existing IEEE software and systems expertise. Set timelines and firm goals, define processes, use IEEE standards to perform gap analyses, and develop your baseline process documentation or refine existing documentation. Gauging your development environment—listening to your customer, your management team, and development staff—is critical. Push, but move at a comfortable pace for them; all team members must be participants in the change process.

One size does not fit all, and the method that works for one situation will fail in another. Both the standards and the CMMI must be applied practically. However, when the development staff is empowered with these two key enablers, they have the tools they need to define successful and controlled processes. Motivation is key: Individuals must want to manage their product baselines and learn how to be effective software engineers.

With *America's Army* as a benchmark, if your staff uses IEEE SS&E standards and builds its own processes—unique to its own environment—it will never return to the chaotic environment of an ad hoc development process.

Figure 2. Bunker defeat munitions on the future soldier trainer, a BST application of America's Army.

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The views expressed herein are those of the authors and do not purport to reflect the position of the United States Military Academy, the Department of the Army, or the Department of Defense.

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