The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Enclosure to: NSAD-L-2010-050
JHS01

NSAD-R-2010-019

Live-Virtual-Constructive Architecture Roadmap Implementation, Common Capabilities - Reusable Tools Implementation Plan

Technical Report

March 2010

The Johns Hopkins University
APPLIED PHYSICS LABORATORY

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FOR:

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EXECUTIVE SUMMARY

The Live-Virtual-Constructive (LVC) Architecture Roadmap (LVCAR) Study (Comparative Analysis of the Architectures and Comparative Analysis of Business Models) identified two significant impediments to sharing and reuse of event development tools across programs and communities. The first is the existence of a wide range of tools utilizing a correspondingly wide range of business models. The second impediment is the current environment where different formats are used by the different architectures to store like event data. The purpose of the LVCAR Implementation Reusable Tools task is to identify the most beneficial approach that will facilitate tool sharing across architectures based on a structured analysis of the current state.

A key deliverable in the LVC Implementation task is plan for implementing a library of reusable LVC tools. The activities described in this, the Reusable Tools Implementation Plan, build the content for the planned library, and the activities described in the LVC Implementation Asset Reuse Implementation Plan will provide the mechanisms and form the basis of repository for tools access. The analyses found in this document inform the decisions for adoption of the best methodology for the acquisition and distribution of LVC tools that will be found in the repository defined and implemented in the LVC Implementation Asset Reuse task.

The study team began this analysis by concurrently establishing a set of candidate business models and developing an inventory of existing LVC tools. These business models were drawn from prior LVC Architecture Roadmap research and an assessment of current trends in software licensing:

1. Department of Defense (DoD) Wholly-owned and Centrally Distributed - A DoD organization owns the rights to the tool(s) and provides them to interested DoD organizations. This business model, also known as government-off-the-shelf (GOTS), is implemented by the organizations that support the Test and Training Enabling Architecture (TENA) and the Common Training Instrumentation Architecture (CTIA).
2. Laissez-faire - Each user organization or "buyer" decides what to adopt. Those adoption options can include purchasing commercial-off-the-shelf (COTS) software, adopting DoD wholly-owned tools, or adoption of an open source tool. Since DoD wholly-owned and open source are assessed as separate business models and described in subsequent subsections, the evaluation of the Laissez-faire business will focus on the purchase of COTS tools.
3. Open source - DoD fosters open source tools by contributing to their development and sustainment. This is the Open Technology Development approach recommended in the LVCAR Comparative Analysis of Business Models [Reference (a)][1].

[1] A list of References may be found in Appendix A.

4. Laissez-faire with Increased Visibility - This is essentially the same as Laissez-faire, but DoD puts an emphasis on making programs' choices, and more importantly, their experiences, more visible. The visibility mechanisms are addressed by the LVCAR
5. Standards-focused - In this approach, DoD does not take an active role to try to foster or force tool reuse but rather obtains the benefits of interoperability by focusing in on standards for tool data interchange. This is another variant on Laissez-faire, but tool compliance with the standards is used to "limit" the market.
6. Preferred Provider List - DoD publishes a list of preferred tools. Programs are "encouraged" to buy from this list or justify why not.
7. Central License Negotiation - DoD central purchasing organization receives tool requirements from users, makes selections on tools, and negotiates terms and licensing fee(s) for DoD users. Unlike the DoD wholly-owned, the individual organizations procure the tools with their own funds.
8. Software as a Service - Rather than purchasing licenses for installation, DoD negotiates with service providers. Delivery mechanisms vary across vendors. The software may be downloaded at run-time from the provider's server, may be provided via a services oriented architecture (SOA) interface, may be provided via a web client, or may be locally installed for a negotiated period of time.

A set of comparative factors was established by the study team to characterize business models.

In order to compare business models quantitatively, the study team identified a set of benefits and barriers by reviewing prior literature, as well as through the experience of the study team participating in previous LVC events. This analysis was performed using a quantitative method based on subject matter expertise from the study team's background and knowledge because observed data does not exist for an objective, quantitative analysis. In the absence of this subjective, but quantitative approach, the only recourse given the absence of observed data would be a purely subjective analysis.

The weights were developed by consensus of our expert team and reviewed by doing pair-wise comparisons of "is 'a' more important than 'b'?" As the study team did this consensus review of weights and likelihoods, some values change without dramatic change to the results; the top approach remained on top. Some of the lower rated approaches, where the ratings were close, shifted in order. For the purpose of this report, LVC tools include software used throughout the lifecycle of development and execution of an LVC event, with the exclusion of simulations, bridges and gateways, and middleware. The second and third items are addressed through other efforts. This inventory provided the analytic underpinnings key to understanding the market in which the development tools are developed and distributed. Currently, tools are developed and distributed through one of the first three of the business models listed above: laissez-fare, DoD wholly-owned, and open source, leading to the wide range of business models

noted in the LVCAR Study (Comparative Analysis of the Architectures and Comparative Analysis of Business Models) as an impediment to reuse.

In order to compare business models objectively, the study team identified a set of benefits and barriers by reviewing prior literature, as well as through the experience of the study team participating in previous LVC events. Benefits and barriers were included only if they had a positive or negative impact on the Department of Defense (DoD). These benefits and barriers have been assigned weights, reflecting their relative impact on DoD. Each business model was then assessed for the likelihood of encountering those benefits and barriers.

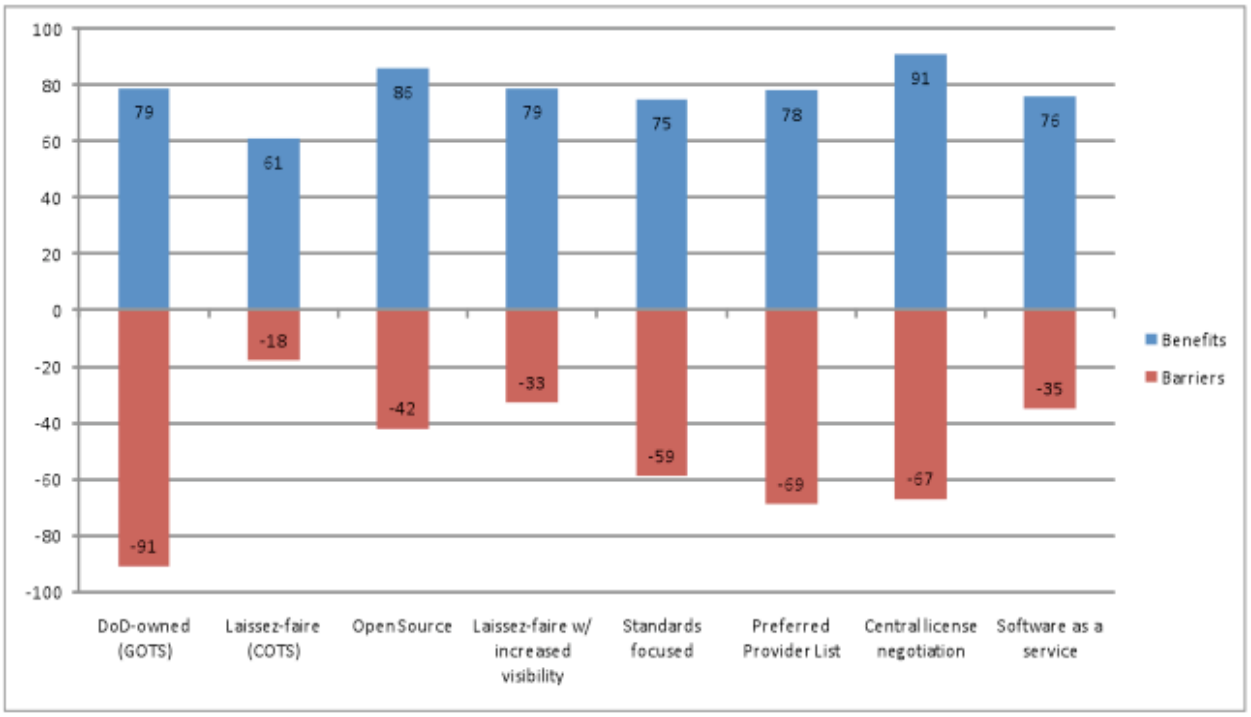

Figure ES-1: Relative Benefits and Barriers of All Business Models

The benefit and barrier scores for each of the business models found in Figure ES-1 are calculated by multiplying the weighted relative impact by the numerical value for the likelihood of encountering the benefit or barrier. Based on the magnitude of the relative benefits and barriers, as illustrated in Figure ES-1, combined with experience from participation in DoD LVC events, the following have been identified as key findings of this analysis:

1. A change to any of the other business models has more benefit to DoD when compared to staying with the current Laissez-faire model.
2. The DoD-owned business model compares well with other business models with respect to benefits but has significant barriers.
3. Central license negotiation appears to have the largest benefit but has significant barriers.

4. Open source appears to have the largest single benefit but does not have to be implemented in isolation.
5. Standards have a significant benefit and can be used in conjunction with other business models. Although there are a significant number of barriers, the barriers likely to be encountered are gauged to have low impact.
6. It is possible to reap the benefits of open source and standards-focused in concert, resulting in software available to DoD at little to no cost (providing the benefits of DoD-owned solutions).
7. On the surface, software as a service appears to be more beneficial to DoD than procuring software licenses. However, this technique has not been exploited in DoD and experiences are needed to validate this finding.
8. Central license negotiation appears to be clearly superior to preferred provider lists.
9. Increased visibility shows significant benefits that significantly outweigh barriers associated with implementing this business model.

Based on these findings, the study team developed both short- and long-term recommendations for implementation. The short-term recommendations are intended to provide risk reduction before making more broadly sweeping long-term changes. They consist of pilots and initiatives that will determine feasibility and provide lessons learned.

1. Execute a set of pilots to attempt to move some tool categories (especially DoD-owned) to business models with higher benefit to DoD.
2. Explore the barriers to central license negotiation to see if any can be ameliorated.
3. Conduct a pilot that transitions a currently DoD-owned tool to open source, while basing the effort on open standards.
4. In addition to the open source pilot effort, foster the establishment of open standards.
5. Gather information from industry to 1) inform industry that DoD is interested in the software as a service business model, and 2) determine if there are industry providers who would be interested in offering software as services.
6. Regardless of the business model selected for a tool category, take actions to increase visibility of tools in use, and gather user feedback. Improved visibility across the board will enable decision-makers under all business models to make more informed decisions, particularly using feedback from other users' experiences with tools under consideration. This recommendation is supported by the results of the LVCAR Implementation Asset Reuse task.

Implementation plans for the recommended pilots have been developed. Assuming the short-term pilots and explorations produce the desired outcomes, a set of long-term recommendations can be implemented. Figure ES-2 illustrates the relationship between the

recommended changes from current practices to a set of actions that both change business model focus for reusable tools and take other actions beneficial to DoD's reuse goals.

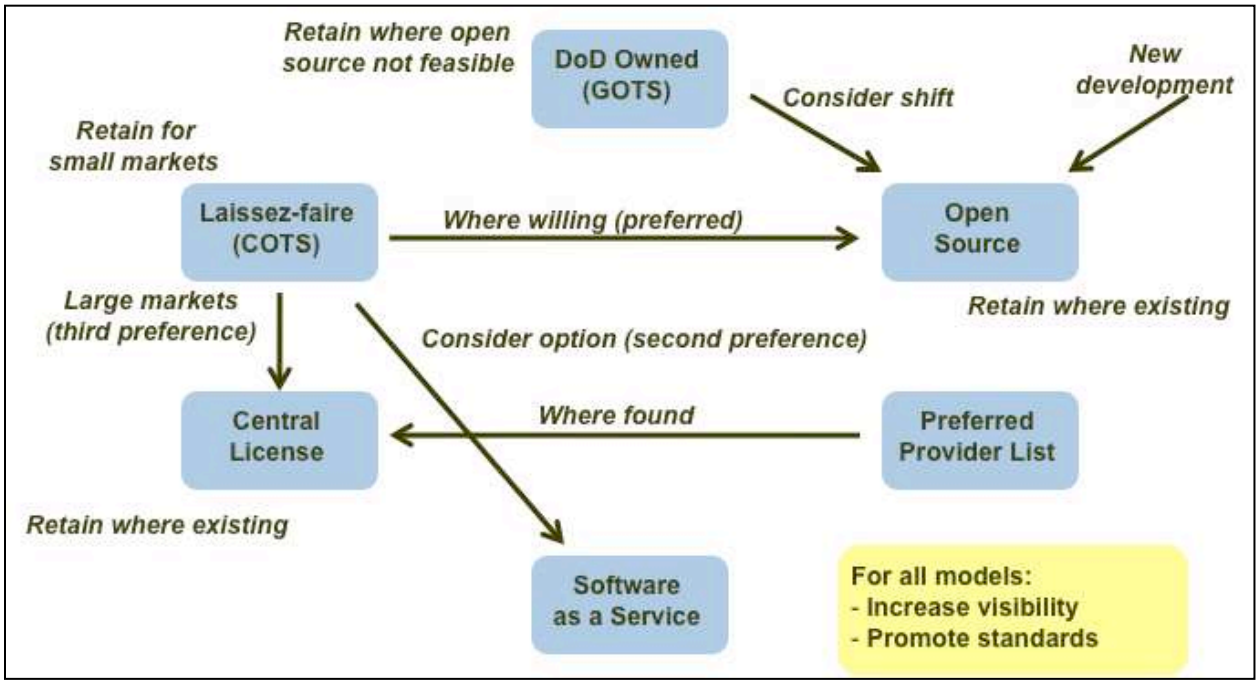

Figure ES-2: Relationship of Long Term Recommendations

Individual long-term recommendations based on the analysis represented in this table are as follows:

1. For legacy DoD-owned tools, consider a shift to open source, to reduce DoD costs and foster potential innovations. Use the experiences from the short-term recommendation #3 open source pilot to decide if this should be done, and if so, what considerations exist for LVC tools.
2. For new tools, where there is a desire to provide DoD influence but to defray ownership costs, use an open source model also informed by the open source pilot.
3. Where small numbers of licenses are purchased from industry, do not make a change.
4. Where a large number of licenses have been and continue to be procured from industry, take the following actions in the order presented until a viable option is identified:
   a. Shift to open source. This assumes that vendors are willing and the open source pilot experience described in short-term recommendation pilot #3 indicates there is benefit to DoD.
   b. Shift to software as a service. This assumes that vendors are willing and the experiences from the short-term recommendation #5, software as a service pilot, shows benefit to DoD exists.
   c. Attempt to negotiate DoD-wide discounted licenses.

5. For current open source efforts, make no changes.
6. If preferred provider lists have been established, attempt to establish DoD-wide discounted licenses, using the experiences gained from the short-term recommendation #2 pilot.
7. For existing centrally-negotiated licenses, do not make a shift.
8. The study team is unaware of any existing "software as a service" arrangement for LVC tools, so no recommendations in terms of a shift from current practices are made.
9. For all business models, increase the visibility of what tools are currently used, and take steps to increase the visibility of user experiences as indicated by the LVC Software/Asset Reuse Mechanism task.
10. Consistent with DoD policy, use open standards as a basis for tool procurements, and participate in standards development activities to ensure DoD's needs are met.

1 REUSABLE TOOLS IMPLEMENTATION DEFINITION

1.1 OBJECTIVES AND OUTCOMES

A key deliverable in the Live-Virtual-Constructive (LVC) Implementation task is plan for implementing a library of reusable LVC tools. The activities described in this, the Reusable Tools Implementation Plan, build the content for the planned library, and the activities described in the LVC Implementation Asset Reuse Implementation Plan will provide the mechanisms and form the basis of repository for tools access. The analyses found in this document informs the decisions for adoption of the best methodology for the acquisition and distribution of LVC tools that will be found in the repository defined and implemented in the LVC Implementation Asset Reuse task.

This document defines and provides details and results from a methodology for evaluation of potential business models to facilitate tools reuse in the LVC event environment. The three primary objectives of the LVC Architecture Roadmap (LVCAR) Implementation Reusable Tools task provide the context for developing this methodology:

- An investigation of business models supporting reusable tools including those currently implemented;
- Development of a taxonomy of benefits and barriers to the implementation of the identified business models; and
- A plan for implementing the most promising business model(s) based on the analysis of benefits and barriers.

Section 2 describes the business models associated with reusable tools. Section 3 defines the taxonomy of benefits and barriers, and presents the analysis of the business models using the taxonomy and findings of the analysis. Section 4 provides the short- and long-term recommendations based on the findings of the analysis. An implementation plan for the recommendations can be found in Section 5.

1.2 BACKGROUND

The LVCAR Study identified two significant impediments to sharing and reuse of development tools across programs and communities. The first is the existence of a wide range of tools utilizing a correspondingly wide range of business models. The second is the current environment where different formats are used by the different architectures to store like event data. The purpose of the LVCAR Implementation Reusable Tools task is to identify the most beneficial approach that will facilitate tool sharing across architectures based on a structured analysis of the current state. It was recognized in the study that a single approach may not be sufficient and that a reasonable methodology would be a hybrid implementation of different business models for classes of tools.

In order to identify the most beneficial approach - or approaches - to tools reuse, a review of existing approaches for tool sharing has been performed and a taxonomy of benefits and barriers to these developed for a systematic evaluation.

1.3 EVALUATION METHODOLOGY

The study team began this analysis by concurrently establishing a set of candidate business models and developing an inventory of existing LVC tools. The business models were drawn from prior LVC Architecture Roadmap research and an assessment of current trends in software licensing. A set of comparative factors was established to characterize business models.

The inventory of LVC tools was drawn from a variety of sources, including existing registries and repositories and interviews with LVC experts. For the purpose of this report, LVC tools include software used throughout the lifecycle of development and execution of an LVC event, with the exclusion of simulations, bridges and gateways and middleware. The second and third items are addressed through other efforts.

Next, the study team identified a set of benefits that could potentially be encountered by instituting business model changes, as well as a set of barriers that could be encountered. These benefits and barriers were assigned weights, reflecting their relative impact on the Department of Defense (DoD). Each business model was then assessed for the likelihood of encountering those benefits and barriers.

Based on the magnitude of the relative benefits and barriers, a set of findings was established, and both short-term and long-term recommendations were formulated. For the short-term actions, an implementation plan was established that identified key activities, outcomes, milestones, stakeholders, required resources, and risk mitigation measures.

2 IMPLEMENTATION APPROACH

2.1 BUSINESS MODELS

The LVCAR Final Report Comparative Analysis of Business Models defines a business model as "a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm" [Reference (a)].[2] This analysis of existing business models for LVC architectures addressed the following:

1. Principal Activities – the activities performed by the various proponents within the ecosystem.
2. Cost structure – specific costs and where costs are borne.
3. Revenue Stream – where the money comes from and how it's is executed.
4. Primary Elements of Influence – specific influential elements contributing to the relative success of the particular business model.
5. Implications – an analysis of the pros and cons, as function of the degree to which each model leads to the network effect for the business model product (i.e. interoperability architecture).

The LVCAR Study adopted the above parameters to examine LVC Architecture governance, but acknowledged that the first four: principal activities, cost structure, revenue stream, and primary elements of influence; are aggregations of more detailed taxonomies used for private sector business models. The fifth element, implications, is the heart of this analysis and is detailed separately in Section 3. For the purposes of this analysis, the study team found it to be advantageous to use the more detailed nine-element parameter set, found in Osterwalder (2004) [Reference (b)] and updated in Osterwalder and Pigneur (2009) [Reference (c)], to examine in more detail current and proposed business models for facilitating tools reuse. For the purposes of this task, the following parameters will be used:

1. The **value proposition** of what is offered to the market. For the purposes of this task, the value proposition is the primary benefit of the products and services delivered by each business model. It is the value that distinguishes the products or services to the buyer that compels the buyer to choose this offering.
2. The **target customer segments** addressed by the value proposition. There may be multiple, distinct segments within a given business model.
3. The **communication and distribution channels** to reach customers and offer the value proposition, later defined as having five phases: awareness; evaluation; purchase; delivery; and after sales (support).

[2] A list of References may be found in Appendix A.

4. The **customer relationships** that define how the organization chooses to interact on a regular basis with customers – a key element in understanding the mechanisms for feedback, requirements generation, etc.
5. The needed **key resources** to make the business model possible; the assets required to offer and deliver the previously described elements. These resources can include intellectual resources such as property rights and licenses; mechanisms, such as repositories, registries, and catalogs; as well as financial and physical resources.
6. The **key activities** to implement the business model; in the tools market, sellers would be focused on developing tools (production), or finding solutions to the buyers' challenges (problem solving). To facilitate reuse, visibility of the value proposition is critical. The buyers' knowledge and understanding of the availability and benefits determine the success of the business model.
7. The **key partnerships** to make a business model happen. Two of the primary reasons to form partnerships in the context of the reusable tools business models would be to reduce risk of the business model meeting the value proposition and to extend capabilities by accessing the strengths, resources, and activities of other organizations. Cost sharing is also a consideration for partnerships.
8. The **revenue streams** generated by implementing the business model. These can either be one time, as in purchase price, or recurring, as in support or licensing fees. For DoD organizations, how funding is obtained and executed are key factors.
9. The **cost structure** that describes the most important costs incurred by the business model. Factors such as cost sharing between both key partners and the buyers and sellers involved are important when looking at the business models for tool reuse and sharing.

To these nine elements, a tenth was added to address a factor found in the primary elements of influence not captured in the Osterwalder and Pigneur [Reference (c)] taxonomy. This element is ***enforcemen***t, a key element in evaluating government business models not usually considered in the private sector. In the description of business models that follow, enforcement will address who is responsible for ensuring that the key activities are performed to acceptable standards. Each of the identified business models will be described using the elements listed for purposes of comparison.

2.2 THE MODELING AND SIMULATION DEVELOPMENT TOOLS MARKET ANALYSIS

This task seeks to decompose the market into smaller components than did either the LCVAR study or the analyses, such as Shea and Graham (2009) [Reference (d)], which treat modeling and simulation (M&S) resources generically. Most work within this area has addressed the buyer side of the market, the consumers of the M&S products, as homogenous DoD organizations. For the purposes of examining and recommending business models, it is

more useful to examine the tool "marketplace" specifically – both buyers and sellers - to determine how best to define and decompose the market. The LVC community does not currently operate as a single market segment; the development of several specialized architectures attests to the fact that multiple markets exist.

In the current M&S environment, the Modeling and Simulation Coordination Office (M&S CO) "performs those key corporate-level coordination functions necessary to encourage cooperation, synergism, and cost-effectiveness among M&S activities of the DoD components" (M&S CO Mission Statement, www.msco.mil). Each architecture that is an accepted solution for its community [High Level Architecture (HLA), Distributed Interactive Simulation (DIS), Common Training Instrumentation Architecture (CTIA), and Test and Training Enabling Architecture (TENA)] has a separate governing organization with a different business model for operations. In Swenson (2008) [Reference (a)], the current LVC marketplace is described as "incoherent."

"Buyers" can be defined as consumers of development tools in each of the primary architectures that make up the LVC market. These buyers make decisions to purchase (or not), share, and reuse various development tools according to the requirements of their organization. This is not a homogenous group; the size, mission, and even funding levels vary greatly. Current business models for each of the architectures within the LVC market also vary in how these differences are considered.

The "sellers" are diverse as well. Government–off-the-shelf (GOTS), commercial-off-the-shelf (COTS), and open source are three of the ways in which the seller – or provider – offers development tools. Although COTS tools may be procured as single-node, site, or enterprise-wide licenses, the most frequently used licensing mechanism for open source software is the GNU[3] public license and similar derivatives. Each has unique reasons for entering the marketplace and may or may not be profit-oriented.

Examination of the LVC development tools market from a too macroscopic level prevents insight into more efficient and effective means of leveraging the differences in market structures. It can be argued that no single definition of market structure would apply with respect to the modeling and simulation development tools market as a single entity. Applying a single business model to the entire market will facilitate tools sharing and reuse only in those areas where the business model fits, potentially introducing issues into other markets where none exist now.

Development tools have evolved to meet the requirements of the LVC community, which, as noted previously, is broad and diverse. Breaking the development tools market down further into categories of tools offers an opportunity to distinguish individual markets and provide recommendations that are more suited to each market. Taking this approach also allows for "architecture-neutral" development of a business model that will include and encourage those

[3] A computer operating system composed entirely of free software.

tools that are not specific to a particular architecture. The categories, established at the LVCAR Common Capabilities Workshop 4-5 November 2009, are:

- LVC Event Development Tools
- Natural Environment Generators
- Scenario Generation Tools
- LVC Execution (Control and Feedback) Tools
- Visualization Tools
- After-Action Review Tools
- Verification and Validation (V&V), Testing Tools

As each category of tool was evaluated, an analysis was done to determine if implementation of a common data storage format would facilitate reuse of tools. The lack of common architecture-independent formats is noted as a key impediment to reuse especially for mixed architecture environments where event developers must use multiple tools and spend significant resources to reuse, transform, and post-process data generated in architecture-specific tools, particularly between data stored in different formats.

2.3 DEVELOPMENT TOOLS BUSINESS MODELS

During the LVCAR Common Capabilities Workshop, Reusable Tools session, there was a focused, round-table discussion of the current state of tools development and use and how reuse could be facilitated. In this discussion, three distinct approaches, or business models, were identified and discussed. These three are the first of the business models to be discussed. Subsequent sections describe business models that potentially meet requirements of the markets identified for each tool category. Each of these business models is described by the elements defined in Section 2.1.

2.3.1 DoD Wholly-owned and Centrally Distributed

A DoD organization owns the rights to the tool(s) and provides them to interested DoD organizations. This business model, also known as GOTS, is implemented by the organizations that support TENA and CTIA.

1. **Value proposition** – tools are free of charge to the non-originating organization.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – website and online repository maintained by sponsoring organization.
4. **Customer relationships** – regular user group meetings, online feedback.
5. **Key resources** – funding to develop and maintain software, distribution rights to software, development, and maintenance of repositories.

6. **Key activities** – managing requirements, assessing alternative solutions, developing and maintaining software in a structured program lifecycle, and managing the distribution of software.
7. **Key partnerships** – Communities of Interest (COIs) to include stakeholder representation from developing, maintaining, and end-user organizations;
8. **Revenue streams** – funding source(s) defined in the Program Objectives Memorandum (POM), use by organizations managing requirements, developing and maintaining software, and distributing the software.
9. **Cost structure** – dominant cost is for software development and maintenance and is incurred by the organization performing these activities, not the end-user. Additional costs are incurred by user organizations requiring special enhancements.
10. **Enforcement** – DoD sponsor organization defines terms of use and controls distribution.

2.3.2 Laissez-faire

Each user organization or "buyer" decides what to adopt. Those adoption options can include purchasing COTS, adopting DoD wholly-owned tools, or adopting an open source tool. Since DoD wholly-owned and open source are assessed as separate business models and described in subsequent subsections, the evaluation of the Laissez-faire business model will focus on the purchase of COTS tools. In Section 2.4, Laissez-faire business model statistics refer to COTS tools, and in Section 3, benefits and barriers characterizations for Laissez-faire apply to COTS choices.

1. **Value proposition –** Buyer is free to choose best-fit tools.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – Any such mechanisms are informal.
4. **Customer relationships** – Vary according to buyer-seller pair.
5. **Key resources** – Adequate funding for the user is a prerequisite.
6. **Key activities** – Sellers develop an understanding of buyer's requirements, provide tools, and structure a business plan to provide those tools.
7. **Key partnerships –** None beyond the typical relationships that exist in buyer-seller supply chain(s).
8. **Revenue streams –** Vary according to buyer-seller pair.
9. **Cost structure –** Buyer pays for seller's product.
10. **Enforcement** – Contractual/legal.

2.3.3 Open source

DoD fosters open source tools by contributing to their development and sustainment. This is the Open Technology Development approach recommended in the LVCAR Comparative Analysis of Business Models [Reference (a)].

1. **Value proposition** – Software source and executables are available at no cost, but developmental costs are shared.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – Open source distribution web site and collaboration capability.
4. **Customer relationships** – Primarily via a collaboration capability provided as part of the open source distribution mechanism; secondarily by other processes established by the COI.
5. **Key resources** – Adequate participation by co-developers and active management by a keystone organization.
6. **Key activities** – Maintaining visibility of users' requirements and integration of co-developer's contributions to the software baseline.
7. **Key partnerships –** Co-developers and open source initiative management.
8. **Revenue streams –** Baseline software is available at no cost, but sellers are free to add value and sell products and services.
9. **Cost structure –** Funding must be available to DoD sponsoring organization for initial investments.
10. **Enforcement** – Necessary controls for distribution.

2.3.4 Laissez-faire with Increased Visibility

This is essentially the same as Section 2.3.2, Laissez-faire, but DoD puts an emphasis on making programs' choices, and more importantly, their experiences, more visible. The visibility mechanisms are addressed by the LVCAR Implementation Asset Reuse task.

1. **Value proposition** – see Laissez-faire.
2. **Target customer segments** – see Laissez-faire.
3. **Communication and distribution channels** – Same as Laissez-faire plus the mechanism used to share user information.
4. **Customer relationships –** Regular user group meetings, with an increased emphasis on online feedback.
5. **Key resources –** Funding to develop and maintain software, distribution rights to software, development and maintenance of repositories as with Laissez-faire, plus the additional resources to keep discovery and assessment mechanisms operational and up to date.

6. **Key activities –** See Laissez-faire plus the solicitation and publication of user experiences.
7. **Key partnerships –** See Laissez-faire.
8. **Revenue streams –** See Laissez-faire.
9. **Cost structure –** See Laissez-faire.
10. **Enforcement** – See Laissez-faire.

2.3.5 Standards-focused

In this approach, DoD does not take an active role to try to foster or force tool reuse but rather obtains the benefits of interoperability by focusing on standards for tool data interchange. This is another variant on Laissez-faire, but tool compliance with the standards is used to "limit" the market.

1. **Value proposition** – Standardized or common storage or interchange formats for data that allow for architecture neutral tools.
2. **Target customer segment**s – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – Defense Information Technology Standards and Profile Registry (DISR) online and the DoD metadata registry provide authoritative mechanisms to identify applicable standards developed under the Simulation Interoperability Standards Organization (SISO), the Institute of Electrical and Electronics Engineers (IEEE), the International Organization for Standards (ISO), and other standards organizations. DoD engagement and leadership during the standards development and approval.
4. **Customer relationships** – Strong need for engagement and feedback.
5. **Key resources** – Funding for DoD organization for standards development activities.
6. **Key activities** – Standards development coordination and strategic engagement. Verification and benchmark testing to ensure that tools are compliant with the standard.
7. **Key partnerships –** Tool developer and user communities of interest.
8. **Revenue streams –** N/A.
9. **Cost structure –** Current cost is borne by organizations participating in the voluntary standardization efforts. DoD focused investment in new or ongoing efforts may potentially expedite the process.
10. **Enforcement** – Standardization and interoperability requirements must be levied on DoD programs of record as a matter of policy compliance. The DoD organization sponsoring organization must stay actively involved; monitoring use and requirements compliance across the M&S enterprise and relevant communities of interest.

2.3.6 Preferred Provider List

DoD publishes a list of preferred tools. Programs are "encouraged" to buy from this list, or justify why not.

1. **Value proposition** – Buyer is encouraged to buy from a list of preferred tools.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – Mechanism (website, etc) to advertise DoD maintained list of preferred tools.
4. **Customer relationships** – Varies according to provider.
5. **Key resources** – Adequate funding for the user.
6. **Key activities** – Maintaining visibility of users' requirements and tools' capabilities.
7. **Key partnerships –** None.
8. **Revenue streams –** Buyers must have adequate funding.
9. **Cost structure –** Buyer pays for seller product and innovation.
10. **Enforcement** – DoD organization must provide incentive for choosing preferred tools.

2.3.7 Central License Negotiation

DoD central purchasing organization receives tool requirements from users, makes selections on tools, and negotiates terms and licensing fee(s) for DoD users. Unlike the DoD wholly-owned in Section 2.3.1, the individual organizations procure the tools with their own funds.

1. **Value proposition** – Buyer gets negotiated price for subset of tools.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – DoD organization maintains mechanism for information.
4. **Customer relationships** – Varies according to seller.
5. **Key resources** – Central purchasing agent who negotiates price with vendors.
6. **Key activities** – Contract negotiations and maintenance.
7. **Key partnerships –** Tool developers with whom prices are negotiated. (May include alternate sources and second party vendors.)
8. **Revenue streams –** In this model, either the central procurement organization is funded separately to provide a centralized purchasing agent for LVC software, or buyer organizations may pool resources to be applied to one or more purchases.

9. **Cost structure –** Seller recovers cost of product research, development and testing through license fees and maintenance.
10. **Enforcement** – Contracts administration.

2.3.8 Software as a Service

Rather than purchasing licenses for installation, DoD negotiates with service providers. Delivery mechanisms vary across vendors. The software may be downloaded at run-time from the provider's server, may be provided via a service-oriented architecture (SOA) interface, may be provided via a web client, or may be locally installed for a negotiated period of time. [See References (e) and (f).]

1. **Value proposition** – Subset of tools easily accessible to organizations for free.
2. **Target customer segments** – Organizations enabled by M&S in support of DoD activities (to include government, industry, and academia).
3. **Communication and distribution channels** – DoD maintains information mechanisms.
4. **Customer relationships** – Negotiated with service/tool providers.
5. **Key resources** – Distribution mechanisms; centralized funding.
6. **Key activities** – Negotiating with providers.
7. **Key partnerships –** Service providers and users generally form distinct communities of interest.
8. **Revenue streams –** Buyers must have adequate funding to reimburse service suppliers.
9. **Cost structure –** Service provider amortizes research and development (R&D), operations, and maintenance cost over a continuously updated lifecycle. Specific capabilities may be brought on line through funded projects, whose return on investment (ROI) is assessed through usage metrics collected.
10. **Enforcement** – Centralized program office coordinates resource availability and usage with users.

2.4 CURRENT STATE OF THE MARKET BY TOOL CATEGORY

Preliminary data from collection efforts during the task execution provide insight into the market for each of the tool categories. This collection effort is ongoing but represents the tool information commonly accessible to potential users within the DoD. This data was collected through online Internet searches, inquiries to known tool vendors, and contacts with sponsoring organizations for architecture middleware products. The spreadsheet, in its entirety, can be found in Appendix B: LVC Development Tools Usage Tables, along with its references and sources.

Each of the tools categories has been evaluated to determine which business model defined in Section 2.3 currently applies. To date, the tools fall into only three of the eight business models addressed in this analysis. The term "mixed licensing" has been added in this analysis to address those DoD wholly-owned tools that have been developed with dependencies on commercial software products. These tools may have commercial license agreements involved with distribution and are a special case of DoD wholly-owned. To orient the reader to the LVC event stage during which each category of tool would be used, each of the following subsection includes a list of the steps of the Distributed Simulation Engineering and Execution Process (DSEEP) to which the tools apply [Reference (g)].

2.4.1 LVC Event Planning and Development Tools

The category of LVC Event Planning and Development Tools covers multiple types of tools that support the planning and development of any type or size of LVC event. Table 2-1 provides the breakout of tools in this category.

Table 2-1: LVC Event Planning and Development Tools

	All Tools	Laissez- faire	Open Source	DoD Wholly owned	Mixed Licensing
Requirements Definition Tools	6	5	0	1	0
Conceptual Modeling Tools	2	1	0	1	0
Data Exchange Modeling Tools	6	4	0	1	1
Execution Planning and Federation Agreement Tools	5	0	0	5	0
Network Modeling Tools	4	3	0	1	0
Performance Prediction Tools	1	1	0	0	0
Federation Planning and Development Tools Rollup	24	14	0	9	1

Table 2-1 illustrates that the market for these types of tools is almost evenly split between an organization(s) implementing the DoD Wholly owned business model and a Laissez-faire implementation where the users are free to choose among multiple commercial products. Notably:

- Requirements Definition Tools cover a broad spectrum, including an Integrated Development Environment (IDE), a content management system, a requirements management system, and Training Management and Readiness Assessment System. The toolsets are too diverse to form any insights into the market competition and requirements.
- The six Data Exchange Modeling Tools are architecture-specific; the Laissez-faire business model being implemented for the four HLA tools, and the DoD Wholly owned implementation for the two TENA tools, that includes one DoD owned mixed license tool.

- Of the five DoD Wholly owned Execution Planning and Federation Agreements tools, four are developed and owned by the CTIA program specifically for use with that architecture. The other planning tool was openly offered to all by the precursor organization to the M&S CO for use in HLA events but is no longer supported.

DSEEP steps supported:

- Define Simulation Environment Objectives
- Perform Conceptual Analysis
- Design Simulation Environment
- Develop Simulation Environment
- Integrate and Test Simulation Environment

2.4.2 Natural Environment Generation Tools

The breakout of the different business models applied to natural environment generation tools is found in Table 2-2.

Table 2-2: Natural Environment Generation Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
Environmental Database Tools	36	13	1	21	1
Natural Environment Generator Tools Rollup	36	13	1	21	1

The large number of tools found in this category is primarily due to the number of tools required to convert data among the various formats in which geospatial data is stored. Most of the conversion tools are supplied by the government under the DoD Wholly Owned business model. The tools within this category are not homogenous; the product market is characterized by products distinguished by capabilities and use.

DSEEP steps supported:

- Develop Simulation Environment

2.4.3 Scenario Generation Tools

The allocation of tools to business models for Scenario Generation Tools is in

Table 2-3.

Table 2-3: Scenario Generation Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
Scenario Development Tools	5	2	0	1	2
Force Structure Composition Tools	9	0	0	8	1
Logistics Data Composition Tools	0	0	0	0	0
Command, Control, Communication, Computer Systems, and Intelligence (C4I) Data Composition Tools	2	0	0	1	1
Behavior Composition Tools	2	2	0	0	0
Scenario Generation Tools Rollup	18	4	0	10	4

In the subcategory Force Structure Composition Tools, four of the eight DoD Wholly Owned tools are sponsored by the CTIA program for use with that architecture. The other four are joint level initiatives focused on providing and enhancing the development of simulation data from authoritative data sources – each addressing a unique part of the task. There is little redundant capability found in any of the subcategories to foster any type of competition in this market.

DSEEP Steps Supported:

- Perform Conceptual Analysis
- Develop Simulation Environment

2.4.4 LVC Event Execution (Control and Feedback) Tools

This category contains the largest number of tools; breakout is described in Table 2-4.

Table 2-4: LVC Event Execution (Control and Feedback) Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
Execution Control and Monitoring Tools	84	21	1	54	8
Federation Test and Network Monitoring Tools	28	13	3	10	2
Is used, or produces software or databases that are used, during LVC testing and execution	1	0	0	1	0
Collaborative Services Tools	1	0	0	1	0
C4I Traffic Simulator	1	0	0	1	0
LVC Event Execution (Control and Feedback) Tool Rollup	115	34	4	67	10

The Event Execution Tools category covers a broad spectrum of capabilities that include range control and monitoring. Most of these tools are architecture-specific.

DSEEP steps supported:

- Integrate and Test Simulation Environment
- Execute Simulation

Visualization ToolsTable 2-5 describes the market for Visualization Tools. This category includes all tools for the visualization of data as well as simulation execution in both 2D and 3D.

Table 2-5: Visualization Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
Visualization Tools	24	14	0	5	5
Visualization Tools Rollup	24	14	0	5	5

The market for these tools is fairly competitive with mostly commercial offerings using the Laissez-faire business model. Differentiation between tools is predominantly non-price, with added features and support being key factors in buying decisions.

DSEEP Steps Supported:

- Develop Simulation Environment
- Integrate and Test Simulation Environment
- Execute Simulation
- Analyze Data and Evaluate Results

2.4.5 After Action Review Tools

After Action Review (AAR) tools are divided into collection and analysis tools and are described in Table 2-6.

Table 2-6: After Action Review Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
Data collection tools	34	8	0	22	4
Data analysis tools	8	1	0	7	0
After Action Review Tools Rollup	42	9	0	29	4

The majority of the Data Collection tools are architecture-specific, since many are loggers that capture the architecture event traffic. Four have the capability to support multiple architectures – three are DoD Wholly Owned, and one is a commercial tool. The Data Analysis tools break out similarly, with all having been developed for specific types of events and architectures.

DSEEP steps supported:

- Integrate and Test Simulation Environment
- Execute Simulation
- Analyze Data and Evaluate Results

2.4.6 Verification, Validation, and Accreditation (VV&A) Tools

The category VV&A Tools includes the tools for supporting all phases of the VV&A process as summarized in Table 2-7.

Table 2-7: VV&A Tools

	All Tools	Laissez-Faire	Open Source	DoD Wholly Owned	Mixed Licensing
VV&A Tools	7	4	2	1	0
VV&A Tool Rollup	7	4	2	1	0

Two of the tools are open source and four are available commercially. The DoD Wholly owned tool is a software tool that automates the development of VV&A documentation and is available DoD – wide. All of these tools are architecture-neutral.

DSEEP steps supported:

- Define Simulation Environment Objectives
- Perform Conceptual Analysis
- Design Simulation Environment
- Develop Simulation Environment
- Integrate and Test Simulation Environment
- Execute Simulation
- Analyze Data and Evaluate Results

3 BENEFITS AND BARRIERS

In order to compare business models objectively, the study team identified a set of benefits and barriers by reviewing prior literature as well as through the experience of the team preparing this report. Benefits and barriers were included only if they had a positive or negative impact on the DoD. Items that would have a benefit to only industry, academia, other United States (US) government, or other nations have not been included. However, if there is a benefit to those other parties, and DoD would see some benefit as well, the item was included. Likewise, if the barrier exists for some key participant (whether inside DoD or outside DoD) in the business model, and this results in the effectiveness or practicality of the business model for DoD use, then the barrier was included.

3.1 BENEFITS

This section identifies the ways in which the adoption of a business model could provide a beneficial effect to the DoD. In some cases, these benefits are also received by non-DoD parties. To the extent that this creates a tenable reuse environment for LVC tools, those benefits have been included. The reader should also keep in mind that these are not the benefits of reuse. The benefits of reuse are well understood and include the potential for cost and risk reduction and increases in interoperability. This section addresses those factors that differentiate business models in how they foster the goal of reuse and effective management of DoD resources. To put each benefit in context, consider them in the following form: "If we adopt this business model, DoD will benefit because it *insert the benefit name."*

3.1.1 Reduces Overall Cost of Ownership to DoD

The goal of any manager is to keep costs to a minimum while meeting the stated requirements within the allotted time. The cost for LVC tools can be borne centrally, at the individual program level, or shared between these levels. The total cost of ownership includes the cost to develop requirements, purchase or build tools, sustain those tools, and train the end users.

3.1.2 Reduces Time to Procure/Obtain Tools

This benefit addresses the suitability of business models to meet the second prerogative of management—schedule. Although some business models may reduce the overall cost to DoD, they may take longer to execute. In DoD, having funds for a tool is often not sufficient. The difficulty of the procurement process and having the right type of money can also be factors.

3.1.3 Allows DoD to Influence Tool Requirements and Implementation Schedules

Some business models put DoD directly in the driver's seat on setting the requirements for tools and determining the schedule in which those requirements will be met. Other business models do not provide DoD that level of influence. Rather, a non-DoD tool provider takes into

consideration requirements from a variety of sources and is influenced by its own financial and schedule imperatives.

3.1.4 Provides Feedback on Usage to Inform Future Decisions

In an enterprise as large as DoD, it is often difficult if not impossible to determine where tool costs are being incurred and how effectively tools are meeting DoD needs. Some business models make that information more accessible to DoD.

3.1.5 Aligns Benefit Derived by Tool Ownership with Where the Cost is Incurred

If considered from the perspective of the individual project or program manager (PM), reuse of tools may not always be the most attractive decision. Only when looking at the larger DoD picture is the benefit evident. Some business models distribute this cost of reuse to the lowest level (where it is not well understood and often resisted).

3.1.6 Leads to "Survival of the Fittest" Tools

Some business models may lead to the sustainment of tools that may not be as efficient or cost effective as possible. Business models that include an element of competition can drive inefficient and overpriced tools from the marketplace, which results in lower cost to DoD. Likewise, tools that do not meet user requirements are weeded out.

3.1.7 Fosters Innovation

While highly related to the prior benefit of "survival of the fittest" (which will address innovations in the ways requirements are met), additional innovation benefits include the provision of capabilities that are useful but were not originally stated requirements.

3.1.8 Increases Interoperability Between Tools - Within a Single LVC Architecture and Across Multiple LVC Architectures

By converging on a restricted set of tools, or a set of tools that use common data exchange standards, a business model can increase the interoperability benefits within a single LVC architecture and also in multi-architecture environments.

3.2 BARRIERS

The set of barriers described in the following subsections allow a comparison of business models based on how likely they are to be successful and how difficult they may to be to implement. As with the benefits, consideration must be given as to whether a barrier, although it may primarily affect a non-DoD party in a business model, makes the overall business model viable for DoD participation. To put each barrier in context, consider them in the following form: "Adopting this business model will be difficult (in terms of time, cost, or risk of failure) because it *insert the barrier name."*

3.2.1 Requires Significant PPBES Changes to Fund (e.g., Requires Central Funding That Does Not Currently Exist)

Making changes in the DoD Planning, Programming, Budgeting, and Execution System (PPBES) is not an easy task. The DoD budget being a "zero sum game," finding additional funds outside the existing PPBES structure requires identifying where those funds can be offset from other program elements. Thus, business models that can work within the existing PPBES structure are viewed as less risky.

3.2.2 Usurps the Decision-Making Rights of Project/Program Managers

In DoD, PMs typically have wide latitude on the set of tools they use to execute their program. Business models that recognize the PM's decision power are more likely to succeed than those that mandate decisions to the PM.

3.2.3 Requires Gathering and Analysis of Usage Metrics, Which Will Require Effort

Earlier, a benefit that certain business models exhibit was identified that provides information upon which future decisions can be made. However, there is a cost associated with gathering and analyzing such data; thus, there is a risk associated with a business model that relies on such data.

3.2.4 Inconsistent with DoD Policy or Law (e.g., FAR)

Although no business model would be entertained that clearly breaks DoD directives or US regulations such as the Federal Acquisition Regulations (FAR), these directives and regulations are often open to interpretation. Thus, a business model's adherence to these may be a "gray scale" vice a clear-cut assessment.

3.2.5 Requires the Project/Program Have Funding of the Specific Type for Tool Procurement

Often programs have sufficient funds to purchase tools if one considers their overall budget. However, funds may have not been earmarked specifically for tools purchases.

3.2.6 Requires DoD Policy Development and Enforcement

The development of DoD policy is not a simple matter. Recent experiences have shown that this can take over two years. More difficult than just development is enforcement of such policy.

3.2.7 Requires Realignment of DoD Organizational Structure/Responsibilities

Some business models may require the creation of new organizational structures or the assignment of responsibilities to organizations not currently tasked or budgeted with supporting those functions. Such changes can meet with resistance and, thus, are subject to some risk.

3.2.8 Requires Substantial Shift in Current Tool Procurement Practices (Overcoming Inertia)

Any radically new business model shift from current practices would take significant effort including gaining buy-in across the DoD and training procurement officials on how to take advantage of that business model. Business models that depart substantially from current tool procurement practices are subject to more risk.

3.2.9 There is an Insufficient Number of Tool Choices (in some Tool Areas)

Some business models presume that there is an established "marketplace" (not necessarily a commercial marketplace) of LVC tools. For some categories of tools, this assumption may prove invalid.

3.2.10 There is a Large Quantity of Tool Choices (in some tool area), Confusing the Decision Space

Having too few tools in the marketplace can complicate some business models. A plethora of tools, where it is hard to distinguish among them, can also create confusion in implementing some business models.

3.2.11 Limits Entrance of New Participants (Potential Innovators) into the Market

Just as some business models can encourage innovation in the marketplace (a benefit identified earlier), other business models can stifle the entry of new participants into the marketplace, thus removing some potential for innovation.

3.2.12 Requires Development and Conformance with New Standards

The development of a standard, especially one developed through open, consensus-based bodies, can take a substantial amount of time and effort. Many examples exist where this took over five years.

3.3 WEIGHTING OF BENEFITS AND BARRIERS

Not all benefits or barriers listed earlier would be expected to have the same impact on the DoD. Some benefits may be more substantial than others, while some barriers may be more of a "show stopper" than others. Table 3-1 and Table 3-2 provide a subjective assessment of the relative impact of the benefits and barriers. Weights were assigned a number 1 through 5, with 1 meaning there is little impact – either as a barrier or benefit, and 5 meaning there is significant impact. The reader should bear in mind that these weights do not reflect the likelihood the benefit or barrier will be encountered. Those assessments are presented in the next subsection, and as will be shown, vary based on the business model approach that is adopted. Rather, the weights assess the relative impact on DoD of the benefits and barriers. The weightings of benefits were developed by performing a pair-wise comparison of benefits and asking the question "is benefit *a* of more value to DoD in accomplishing reuse than benefit *b*, and if so, by how much?" Likewise, a pair-wise comparison of barriers was performed to develop weights.

Table 3-1: Relative Comparison of Benefits

Benefit	Relative Benefits
Reduces overall cost of ownership to DoD	5
Reduces time to procure/obtain tools	2
Provides feedback on usage to inform future decisions	2
Allows DoD to influence tool requirements and implementation schedules	4
Aligns benefit derived by tool ownership with where the cost is incurred	3
Leads to "survival of the fittest" tools	3
Fosters innovation	2
Increases interoperability between tools	4

Table 3-2: Relative Comparison of Barriers

Barrier	Relative Barriers
Requires PPBES changes to fund (e.g., requires central funding that doesn't currently exist)	4
Usurps the decision-making rights of project/program managers	4
Requires gathering and analysis of usage metrics, which will require effort	1
Inconsistent with DoD policy or law (e.g., FAR)	5
Requires the project/program have funding of the specific type for tool procurement	2
Requires DoD policy development and enforcement	4
Requires realignment of DoD organizational structure/responsibilities	3
Requires substantial shift in current tool procurement practices (overcoming inertia)	2
There is an insufficient number of tool choices (in some tool area)	1
There is a large quantity of tool choices (in some tool area), confusing the decision space	2
Limits entrance of new participants (potential innovators) into the market	2
Requires development and conformance with new standards	2

3.4 ASSESSMENT OF BUSINESS MODELS/APPROACHES AGAINST BENEFITS AND BARRIERS

To assess the business models against the benefits and barriers listed earlier, scales were established to address the likeliness of that benefit being obtained or barrier being encountered:

0 – not possible that the benefit/barrier will be encountered in this business model
1 – slight chance
2 – some chance
3 – moderate chance
4 – good chance
5 – certainty

Table 3-3 provides the study team's assessment of the benefits and barriers for each of the business models.

Table 3-3: Assessment of Business Model Benefits and Barriers

		DoD-owned		Laissez-faire		Open Source		Laissez-faire w/ increased visibility		Standards focused		Preferred Provider List		Central license negotiation		Software as a service	
Benefits	**Relative Benefit**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**
Reduces overall cost of ownership to DoD	5	3	15	2	10	4	20	3	15	3	15	3	15	4	20	4	20
Reduces time to procure/obtain tools	2	4	8	2	4	4	8	2	4	2	4	3	6	4	8	2	4
Provides feedback on usage to inform future decisions	2	3	6	1	2	3	6	4	8	1	2	2	4	4	8	2	4
Allows DoD to influence tool requirements and implementation schedules	4	5	20	2	8	3	12	2	8	3	12	4	16	4	16	2	8
Aligns benefit derived by tool ownership with where the cost is incurred	3	3	9	3	9	3	9	3	9	3	9	3	9	5	15	4	12
Leads to "survival of the fittest" tools	3	1	3	4	12	3	9	5	15	3	9	2	6	2	6	4	12
Fosters innovation	2	1	2	4	8	5	10	4	8	2	4	3	6	3	6	4	8
Increases interoperability between tools	4	4	16	2	8	3	12	3	12	5	20	4	16	3	12	2	8
			79		**61**		**86**		**79**		**75**		**78**		**91**		**76**

		DoD-owned		Laissez-faire		Open Source		Laissez-faire w/ increased visibility		Standards focused		Preferred Provider List		Central license negotiation		Software as a service	
Barriers	**Relative Barrier**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**	**Likelihood**	**Weighted Score**
Requires signficant PPBES changes to fund (e.g., requires central funding that doesn't currently exist)	4	5	20	0	0	4	16	2	8	1	4	0	0	0	0	0	0
Usurps the decision-making rights of project/program managers	4	5	20	0	0	2	8	0	0	2	8	4	16	4	16	2	8
Requires gathering and analysis of usage metrics, which will require effort	1	3	3	0	0	0	0	4	4	0	0	2	2	2	2	2	2
Inconsistent with DoD policy or law (e.g., FAR)	5	4	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Requires the project/program have funding of the specific type for tool procurement	2	0	0	5	10	0	0	5	10	5	10	5	10	5	10	5	10
Requires DoD policy development and enforcement	4	0	0	0	0	0	0	0	0	2	8	3	12	3	12	0	0
Requires realignment of DoD organizational structure/responsibilities	3	4	12	0	0	2	6	1	3	1	3	1	3	1	3	0	0
Requires substantial shift in current tool procurement practices	2	4	8	0	0	4	8	0	0	2	4	4	8	4	8	5	10
There is an insufficient number of tool choices (in some tool area)	1	0	0	2	2	2	2	2	2	4	4	2	2	2	2	5	5
There is a large quantity of tool choices (in some tool area), confusing the decision space	2	0	0	3	6	1	2	3	6	2	4	4	8	4	8	0	0
Limits entrance of new participants (potential innovators) into the market	2	4	8	0	0	0	0	0	0	2	4	4	8	3	6	0	0
Requires development and conformance with new standards	2	0	0	0	0	0	0	0	0	5	10	0	0	0	0	0	0
			91		**18**		**42**		**33**		**59**		**69**		**67**		**35**
Benefits - Barriers			**-12**		**43**		**44**		**46**		**16**		**9**		**24**		**41**

The relative balance of the benefit and barrier scores for each of the business models found in Table 3-3 are illustrated in Figure 3-1.

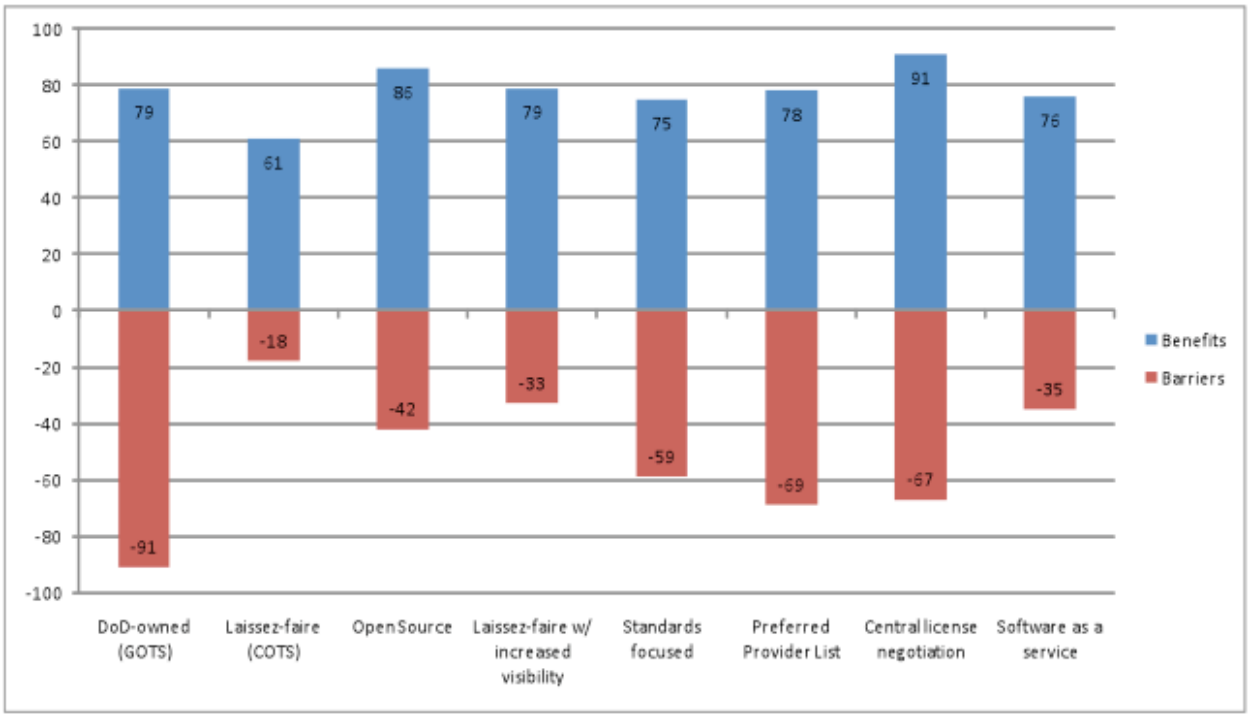

Figure 3-1: Relative Benefits and Barriers of All Business Models

The data in Table 3-3 and Figure 3-1 coupled with experiences in DoD support the following findings:

1. A change to any of the other business models has more benefit to DoD when compared to staying with the current Laissez-faire model.
2. The DoD-owned business model compares well with other business models with respect to benefits but has significant barriers.
3. Central license negotiation appears to have the largest benefit but has significant barriers.
4. Open source appears to have the largest single benefit but does not have to be implemented in isolation.
5. Standards have a significant benefit and can be used in conjunction with other business models. Although there are a significant number of barriers, the barriers likely to be encountered are gauged to have low impact.
6. It is possible to reap the benefits of open source and standards-focused in concert, resulting in software available to DoD at little to no cost (providing the benefits of DoD-owned solutions).

7. On the surface, software as a service appears to be more beneficial to DoD than procuring software licenses. However, this technique has not been exploited in DoD, and experiences are needed to validate this finding.
8. Central license negotiation appears to be clearly superior to preferred provider lists, so the preferred provider list option will not be further explored in this report.
9. Increased visibility shows significant benefits as compared with attendant barriers.

4 RECOMMENDATIONS

4.1 SHORT-TERM RECOMMENDATIONS

The recommendations in this subsection are based on the findings in the preceding section and are intended to assess the feasibility of achieving the long-term recommendations in the next subsection. These recommendations are executable in the short term, 1 – 2 years.

1. Execute a set of pilots to attempt to move some tool categories (especially DoD-owned) to business models with higher benefit to DoD. Some of the analysis in this report is based on the perceived benefits of approaches not currently used. Before engaging these approaches on a large scale, they should be validated on a small scale.
2. Explore the barriers to central license negotiation to see if any can be ameliorated. If successful, conduct a pilot to negotiate a DoD-wide central license informed by experiences from previous negotiations [e.g., Commercial Joint Mapping Toolkit (CJMTK)], where the broad license included some applications on a large acquisition program, but not all.
3. Conduct a pilot that transitions a currently DoD-owned tool to open source, while basing the effort on open standards. By definition, an open source project cannot be based on proprietary or closed standards because the source code would necessarily reveal the details of the standard. This pilot will be closely aligned with the results of the Common Data Storage Formats task.
4. In addition to the open source pilot effort, foster the establishment of open standards. Recommendations and prioritization of standards efforts will be identified in the Common Data Storage Formats report. Although the standards-focused business model did not rank high on the assessment of business models, this was primarily because its barrier rating offset its benefits. However, unlike some of the other business models, most of the barriers identified for the standards-focused model were low impact vs. high impact (e.g., it's not inconsistent with current DoD policy and law).
5. Gather information from industry to 1) inform industry that DoD is interested in the software as a service business model and 2) determine if there are industry providers who would be interested in offering software as services. This pilot should be closely aligned with the results of the Common Data Storage Formats task as the associated data format(s) have the potential to be standardized and may impact the future direction of other services.
6. Regardless of the business model selected for a tool category, take actions to increase visibility of tools in use, and gather user feedback. Improved visibility across the board will enable decision-makers under all business models to make more informed

decisions, particularly using feedback from other users' experiences with tools under consideration. This recommendation is supported by the results of the LVCAR Implementation Asset Reuse task.

4.2 LONG-TERM RECOMMENDATIONS

Many of the short-term recommendations provide risk reduction before making more broadly sweeping long-term changes. Assuming the short-term pilots and explorations produce the desired outcomes, a set of long-term recommendations can be implemented. Table 4-1 summarizes the recommended changes that apply a set of actions to current practices that both change business model focus for reusable tools and take other actions beneficial to DoD's reuse goals.

Table 4-1: Recommended Long-Term Actions

	Actions							
Current Practice	DoD owned	Individually purchased licenses	Open source	Increase visibility	Adopt & develop standards	Preferred provider list	Central license negotiation	Software as a service
DoD owned	Legacy (1)		New/ legacy (1)	Yes	Yes	N/A		
Individually purchased licenses (Laissez-faire)		Small markets	Where willing (1)	Yes	Yes	N/A	Large markets (2)	Yes (3)
Open source			Yes	Yes	Yes	N/A		
Preferred provider list						N/A	If found (2)	
Central license negotiation				Yes	Yes	N/A	Yes	
Software as a service	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	(1) Informed by open source pilot (2) Informed by the central license pilot (3) Informed by software as a service pilot information gathering							

Implementation plans for the recommended pilots have been developed. Figure 4-1 provides an illustration of the recommended actions to migrate from one business model to another in order to change business model focus for reusable tools and take other actions beneficial to DoD's reuse goals.

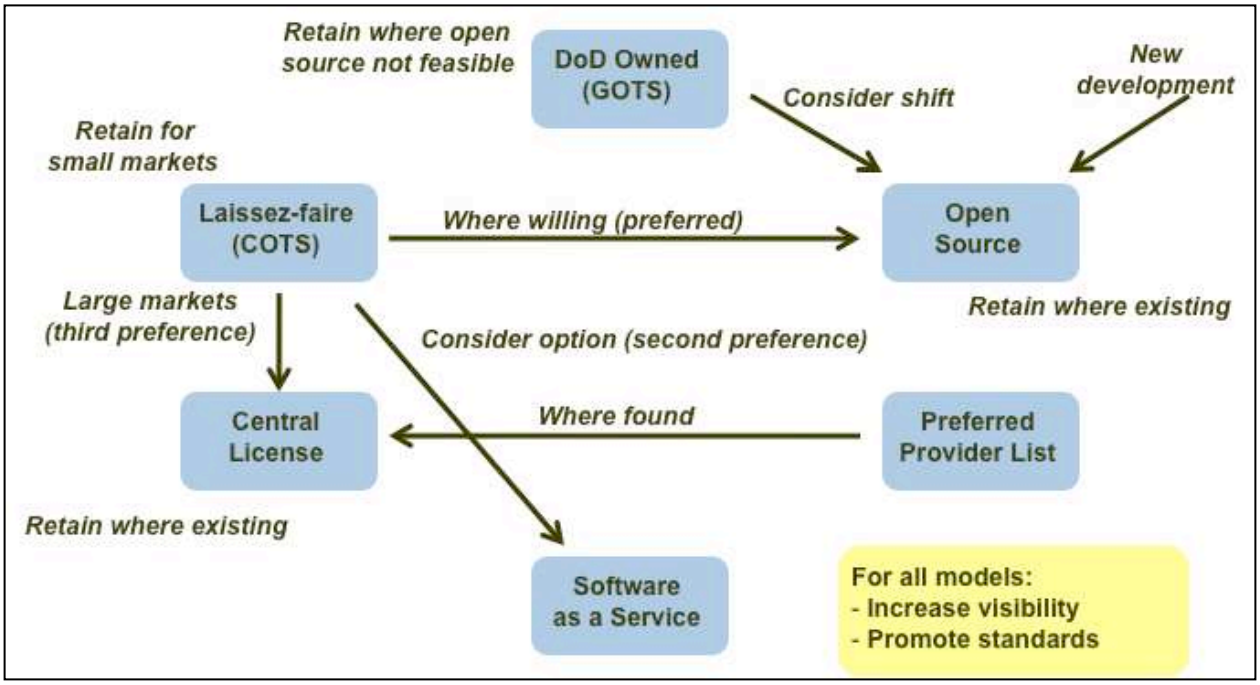

Figure 4-1: Relationship of Long Term Recommendations

Individual long-term recommendations based on the analysis represented in this table are as follows:

1. For legacy DoD-owned tools, consider a shift to open source to reduce DoD costs and foster potential innovations. Use the experiences from the short-term recommendation #3 open source pilot to decide if this should be done and, if so, what considerations exist for LVC tools.
2. For new tools, where there is a desire to provide DoD influence but to defray ownership costs, use an open source model, also informed by the open source pilot.
3. Where small numbers of licenses are purchased from industry, do not make a change.
4. Where a large number of licenses have been and continue to be procured from industry, take the following actions in the order presented until a viable option is identified:
   a. Shift to open source. This assumes that vendors are willing and the open source pilot experience described in short-term recommendation pilot #3 indicates there is benefit to DoD.
   b. Shift to software as a service. This assumes that vendors are willing and the experiences from the short-term recommendation #5, software as a service pilot, shows benefit to DoD exists.
   c. Attempt to negotiate DoD-wide discounted licenses.
5. For current open source efforts, make no changes.

6. If preferred provider lists have been established, attempt to establish DoD-wide discounted licenses, using the experiences gained from the short-term recommendation #2 pilot.
7. For existing centrally-negotiated licenses, do not make a shift.
8. The study team is unaware of any existing "software as a service" arrangement for LVC tools, so no recommendations in terms of a shift from current practices are made.
9. For all business models, increase the visibility of what tools are currently used, and take steps to increase the visibility of user experiences as indicated by the LVC Software/Asset Reuse Mechanism task.
10. Consistent with DoD policy, use open standards as a basis for tool procurements, and participate in standards development activities to ensure DoD's needs are met.

5 IMPLEMENTATION PLAN

5.1 IMPLEMENTATION OF SHORT-TERM RECOMMENDATIONS

Section 4.1 lists several short-term recommendations. The first of these recommendations was to perform some pilot projects to validate the feasibility of proposed long-term recommendations. Specifically, short-term recommendations 2, 3, and 5 recommended pilot projects. The following three subsections provide implementation plans for each of these three pilots including actions, outcomes and milestones, stakeholders, resources, and risk management.

5.1.1 Central License Negotiation Pilot

This pilot addresses short-term recommendation 2, exploring the barriers to central license negotiation and conducting a pilot to negotiate a DoD-wide central license informed by experiences from previous negotiations.

5.1.1.1 Actions

- Identify tool category and tool instance based on the following criteria:
  - Current use across multiple organizations, i.e., multiple organizations are currently negotiating licenses independently.
  - Potential for wider use, i.e., additional organizations would like to use the tool, but perceive they cannot afford to do so now.
  - Sufficient potential users to increase the overall value to the vendor while reducing the unit cost for the DoD.
- Identify organization that has the contractual authority to perform the negotiation, as well as being acceptable to current and potential users as the negotiator.
- Authorize contracting organization to negotiate central license.
- Establish mechanism for distributing licenses; this mechanism may be dependent upon the chosen tool's vendor's current license distribution mechanism, or may leverage the asset reuse mechanism also developed under the LVCAR Implementation Asset Reuse task.

5.1.1.2 Outcomes and Milestones

- Identified tool
- Identified contracting organization
- Negotiated license
- License distribution

5.1.1.3 Stakeholders

- Current license holders
- Potential new users
- Contracting organization
- Tool vendor

5.1.1.4 Resources

- Researcher to identify candidate tools and contracting organization

5.1.1.5 Risk Management

Table 5-1: Central License Negotiation Risk Management

Risk	Risk Mitigation Strategy
Unable to identify candidate tool	Terminate pilot because this indicates that this approach is not applicable currently
Unable to identify contracting organization	Establish suitable organization[4]
Vendor unwilling to negotiate central license	Select another tool based on tool identification research

5.1.2 Open Source / Open Standards Pilot

This pilot addresses short-term recommendation 3, transitioning a currently DoD-owned tool to open source while basing the effort on open standards.

5.1.2.1 Actions

- Identify tool category and tool instance based on the following criteria:
  - Potential for wide use / ability to establish potential user pool
  - Developer claims no proprietary/intellectual property rights (fully government owned)
  - Free of security restrictions
  - Willing current tool owner
- Select source code sharing mechanism (e.g., forge.mil) based on the following criteria:
  - Accessibility to intended distribution audience
  - Ability to support discovery
  - Low/no cost to DoD to use
  - Configuration management mechanisms

[4] Note that this aligns with the barrier of realigning DoD organizational structure/responsibilities.

- Reengineer existing tool to foster reusability
  - Identify and apply reuse engineering guidelines
- Manage the evolution of the tool baseline
  - Establish COI
    - Identify users and co-developers
    - Establish procedures for gathering and arbitrating requirements and managing and integrating code changes
  - Gather/arbitrate requirements
  - Manage and integrate code changes
- Socialize resulting baseline to potential (initially unanticipated) users.
- Collect metrics and lessons learned to inform implementation of long-term recommendations

5.1.2.2 Outcomes and Milestones

- Established code baseline
- Established COI membership and procedures
- Lessons learned with metrics

5.1.2.3 Stakeholders

- Current tool owner
- Pilot management lead
- COI members
- Unanticipated users

5.1.2.4 Resources

- Source code sharing mechanism
- Collaboration space (if not provided by code sharing mechanism)
- Source code
- Pilot manager
- Co-developers
- Software developers (reengineering for reuse)
- Software developers (baseline maintenance)
- Testers

5.1.2.5 Risk Management

Table 5-2: Open Source/Open Standards Risk Management

Risk	Risk Mitigation Strategy
Unable to identify candidate tool	Create a new baseline
Lack of co-developer participation	Offer to fund co-developers
Lack of resources to implement COI procedures	Offer to fund activities

5.1.3 Software as a service Pilot

This pilot addresses short-term recommendation 5, gathering information from industry to determine if there are industry providers who would be interested in offering software as services.

5.1.3.1 Actions

- Prepare request for information (RFI) identifying perceived benefits of software as services and requesting input on types of services, i.e. functionality, that industry could provide and their technical ability to deliver the functionality as a service
- Distribute RFI both broadly and targeted to current LVC software providers (see Appendix A)
- Collect and analyze industry feedback, identifying potential benefits in terms of:
  - Potential users
  - Technical feasibility
- Review analysis results with current users and recommend implementation of service with highest payoff
- Implement prototype of identified service

5.1.3.2 Outcomes and Milestones

- Consolidated analysis of industry feedback
- Recommendation for service to implement
- Implemented service

5.1.3.3 Stakeholders

- LVC industry software providers
- Current software users

5.1.3.4 Resources

- Staff to produce RFI and analyze results
- Web-based mechanism to collect results
- Resources to implement service to be determined once the service has been identified

5.1.3.5 Risk Management

Table 5-3: Software as a Service Risk Management

Risk	Risk Mitigation Strategy
Users fail to use the service once implemented	None; failure to use the service would indicate that this approach is not viable in the immediate future

5.1.4 Consolidated Schedule

The consolidated and phased notional schedule for implementing the pilot activities is found in Figure 5-1.

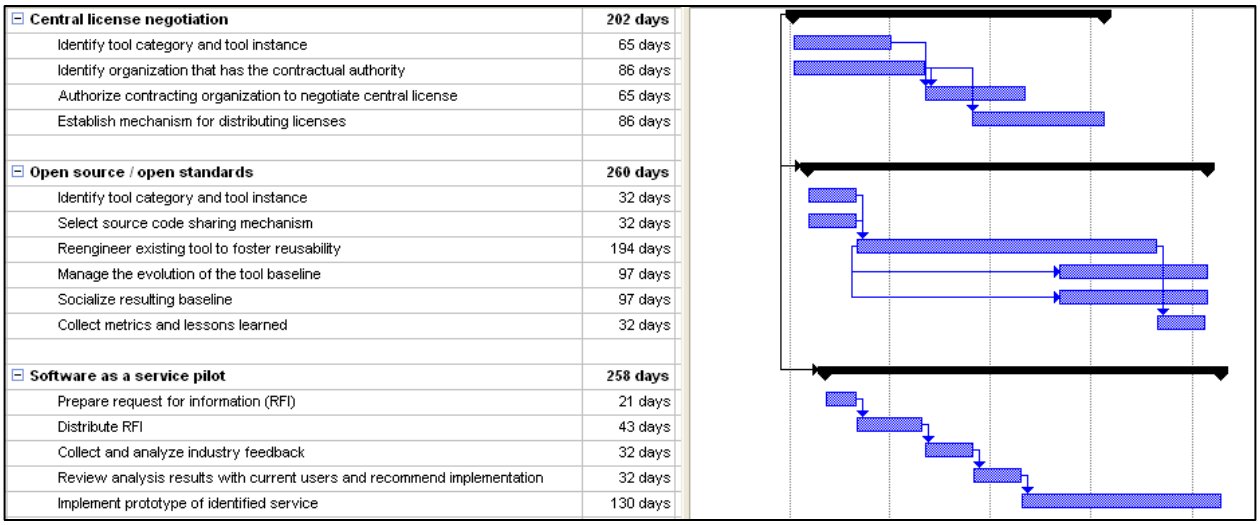

Figure 5-1: Consolidated Pilot Schedule

Estimates for the duration and level of effort are detailed below for each of the pilots:

Central license negotiation:

- Time duration: 9 months.
- Level of effort: 0.45 Full-time equivalent (FTE) + support from contracting organization

Open source/open standards:

- Time duration: 12.5 months.
- Level of effort: 0.75 FTE

Software as a service pilot:

- Time duration: 13 months.
- Level of effort: 0.2 FTE + government support for RFI distribution + prototype implementation from selected organization

Start dates for each of the pilots is staggered to provide for an orderly start.

5.2 IMPLEMENTATION OF LONG-TERM RECOMMENDATIONS

The purpose of this section is to identify the time and manpower resources necessary to implement the long-term recommended shift in business models to foster reuse of LVC tools. The specific tools and tool categories for which these recommended actions should be undertaken has yet to be determined. Rather than providing an overall level of effort for all possible tools, the estimates provided here are on a per-tool or per-tool-category basis as is appropriate. Where multiple efforts of the same type (e.g., open source initiatives) are to be undertaken, some reduction in the level of effort and time required may be possible if the same organization and individuals lead the efforts, based on experience gained. To allow that learning effect, and to spread the investment over time, it is unlikely that all efforts will begin simultaneously, but will be phased over time.

The exception to this phasing approach across tool categories is the effort to make existing tools, and usage information about those tools, visible. Immediate and continuous action is needed to increase the probability that tools will be reused. That effort should be conducted simultaneously for all types of LVC tools, and will eventually result in a virtual library describing reusable tools.

5.2.1 Utilization of Open Source

The level of effort is the same whether the shift is from a legacy DoD-owned (GOTS) tools or for a new development. This section identifies the tasks, timeframe, and level of effort associated with long term recommendations 1, 2, and 4a. Given that multiple open source efforts are likely to be undertaken, some reduction in the level of effort and time required may be possible if the same organization and individuals lead the efforts. This reduction would be based on the "learning effect" of experience gained. To allow that learning effect, and to spread the investment over time, it is unlikely that all efforts will begin simultaneously, but will be phased over time. This learning effect would begin with the open source pilot effort recommended in short term recommendation 3, and proceed only if that pilot proved successful.

For an open source activity, the following tasks need to be performed:

- Establish an open source consortium, with leadership and initial contributors identified. Establish open source collaboration mechanism working area (e.g., Sourceforge.net).
  - Time duration: 3 month.
  - Level of effort: 0.5 FTE open source lead and 0.25 FTE system administrator.

- Manage open source effort. Gather, validate, and arbitrate requirements. Establish development and release schedule.
  - Time duration: continuous through life of the effort.
  - Level of effort: 0.25 FTE open source lead + "voluntary" time contributions from consortium members (for DoD efforts, paid through project funds).

- Manage software baseline. Incorporate inputs from consortium members. Test integrated baselines. Release baselines.
  - Time duration: continuous through life of the effort.
  - Level of effort: 0.25 FTE system administrator. 0.5-2.0 FTE software engineering based on complexity of the software being maintained.

The level of effort for DoD contributions to the open source baseline is not included in this estimate. That level of effort is entirely dependent on the complexity of the software being maintained, and is much more variable than the integration cost. However, the level of effort is shared by the consortium members (DoD, industry, and academia) and in the case of DoD consortium members is not borne from central funding, but by project funding. Given non-DoD contributions, the overall cost should be less than if the tool was managed through the DoD wholly-owned business model.

For efforts transitioning from legacy DoD-owned efforts or from commercial products (long term recommendations 1 and 4a), where multiple potential tools exist to serve as the basis for the open source effort, and additional task will be needed:

- Select "best of breed". For competing tools in a tool category.
  - Time duration: 6 months
  - Level of effort: .5 FTE for manager + "voluntary" contributions from subject matter experts on existing tools.

5.2.2 Establishment of DoD-wide Discounted Licenses

The level of effort described here is the same whether the shift is from a legacy Laissez-faire model, or a preferred provider list, as described in long term recommendations 4c and 6. The following tasks need to be performed:

- Establish current user pool. Work through DoD M&S management organizations and program managers to determine who is currently using the tools in a given category.
  - Time duration: 3 months
  - Level of effort: .5 FTE for manager + "voluntary" contributions from user organizations.
- Select "best of breed". For competing tools in a tool category.
  - Time duration: 6 months
  - Level of effort: .5 FTE for manager + "voluntary" contributions from subject matter experts on existing tools.
- Negotiate DOD-side license
  - Time duration: 3 months
  - Level of effort: Not estimate; presumed within the scope of duties of existing procurement officials.

5.2.3 Increased Visibility

Regardless of business model employed, to foster reuse, visibility of which tools are being used and the ability to capture and inform on user experience is key to increasing reuse. The level of effort to create the optimal infrastructure for such sharing is not in the scope of this task. It will be addressed in the LVC Implementation Asset Reuse task. However, the history of M&S repositories, registries, and catalogs has shown that just providing infrastructure is insufficient. Actively engaged administrators who solicit usage information from the community of users are critical. Currently this function is understaffed in DoD, thus estimated here. The following task needs to be performed:

- Gather and maintain information of M&S tools usage. Populate (or encourage users to populate) registries, repositories, and catalogs with usage data. Monitor contents for currency and completeness. A starting point for the tools about which information should be populated is contained in Appendix B.
  - Time duration: 1 year to bring current registry, repository, and catalog contents up to date. After that, continuous maintenance of usage information and continue solicitation of new information
  - Level of effort: 4 [DoD, Army, Navy, United States Air Force (USAF)] x 1 FTE for first year. 4 x .5 FTE for subsequent years.

The best mechanism, in terms of existing and modified registries, repositories, and catalogs will be identified in the LVC Implementation Asset Reuse task. Presuming that the recommended solution will be a set of distributed asset discovery mechanisms, the result will be a virtual library of reusable tools.

5.2.4 Standards Development

DoD favors the use of open, consensus-based standards, and the study team recognizes that DoD participation in the standards development process is critical to ensure that DoD equities are addressed. The estimation and identification of which standards are needed to support tool reuse is outside the scope of this effort and will be addressed in the subsequent report on LVC Implementation Common Data Storage Formats.

APPENDIX A: REFERENCES

(a) Swenson, S. Live Virtual Constructive (LVC) Architecture Roadmap (AR) Comparative Analysis of Business Models (2008). LVCAR Final Report, USD(AT&L)/DDR&E/P&P/M&S CO.

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(d) Shea, D. P. and Graham, K. L. (2009). *Business Models to Advance the Reuse of Modeling and Simulation Resources*. Alexandria, VA: Center for Naval Analyses.

(e) Bennett, K; et al. (December 2000). "Service-based software: the future for flexible software" (PDF). Proceedings: Seventh Asia-Pacific Software Engineering Conference, 2000. pp. 214-221.

(f) Finch, Curt (2006-01-02). The Benefits of the Software-as-a-Service Model. Retrieved from http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=107276.

(g) Distributed Simulation Engineering and Execution Process (DSEEP), IEEE P1730, unpublished.

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APPENDIX B: LVC DEVELOPMENT TOOLS USAGE TABLES

B.1 TOOL SUMMARIES

The tables in Sections B.1.1 and B.1.2 show the relationship between the tools surveyed and the LVC architecture(s) they support and DSEEP process steps. While a total of 367 LVC tools were surveyed, 266 of these were applicable to the scope of this task. The remaining 101 tools, which are not reflected in these tables, include combat simulations, runtime infrastructure and middleware, bridges and gateways, catalogs/registries/repositories, systems and software engineering tools, and configuration management tools that lie outside the scope of this effort.

B.1.1 Architecture Support

Table B-1 summarizes the tools surveyed in relationship to the DIS, HLA, TENA and CTIA architectures. When a tool was found to support multiple architectures, it was counted for each. The "other" architectures category generally consists of tools that do not directly interface with the runtime simulation environment or in some cases do so indirectly (e.g., through bridges and gateways, which were not included in this survey). Although numerous software product lines managed by government programs and commercial vendors are optimized to support a given LVC architecture, some of these tools support multiple architectures directly. DIS, HLA, and TENA tools were the most likely to support multiple architecture environments; in all forty-seven (47) tools within the scope of this task were found to support multiple architectures: 17.7% of the total. Another 42.9% were found to be either not architecture-specific, or to support some architecture other than DIS, TENA, HLA, or CTIA.

Table B-1: Summary of Tools by Architecture

Architectures Supported	# DIS Capable Tools	# HLA Capable Tools	# TENA Capable Tools	# CTIA Capable Tools	# Other Tools
Tools by Architecture	49	75	47	75	114

Table B-2 shows the distribution of Federation Planning and Development tools by LVC architecture, including requirements definition, conceptual model, data exchange modeling, execution planning/agreements network modeling, and performance prediction tool.

Table B-2: Federation Planning/Development Tools by Architecture

Architectures Supported	# DIS Capable Tools	# HLA Capable Tools	# TENA Capable Tools	# CTIA Capable Tools	# Other Tools
Requirements Definition Tools	1	3	0	0	4
Conceptual Modeling Tools	0	2	0	0	0
Data Exchange Modeling Tools	0	3	3	0	0
Execution Planning and Federation Agreement Tools	0	1	0	4	0
Network Modeling Tools	0	0	0	0	3
Performance Prediction Tools	0	0	0	0	1
Federation Planning and Development Tools Rollup	***1***	***9***	***3***	***4***	***8***

Table B-3 shows the distribution of Scenario and Environment Generation tools by LVC architecture. Although many of these tools are not architecture-specific, with the exception of logistics data composition tools, the survey identified architecture-specific tools in each subcategory.

Table B-3: Scenario and Environment Generation Tools by Architecture

Architectures Supported	# DIS Capable Tools	# HLA Capable Tools	# TENA Capable Tools	# CTIA Capable Tools	# Other Tools
Environmental Database Tools	1	1	1	0	36
Natural Environment Generator Tools Rollup	***1***	***1***	***1***	***0***	***36***
Scenario Development Tools	3	2	0	1	3
Force Structure Composition Tools	1	1	2	4	4
Logistics Data Composition Tools	0	0	0	0	0
C4I Data Composition Tools	1	1	0	0	2
Behavior Composition Tools	1	1	0	0	1
Scenario Generation Tools Rollup	***6***	***5***	***2***	***5***	***10***

Table B-4 shows the distribution of Federation Execution (Control and Feedback) tools by LVC architecture. This category shows a diversity of architectures, since many tools in this category include architecture-specific tools developed primarily to support DIS, HLA, TENA or CTIA execution. For example, of the eighty-four (84) total tools in the scope of the Execution Control and Monitoring tools subcategory, twelve (12) or 14% are multiple-architecture tools, with the remaining seventy-two (72) tools specific to a single architecture or architecture-neutral. The federation test and network monitoring subcategory shows a similar distribution, and the other subcategories are characterized by low sample sizes.

Table B-4: LVC Event Execution Tools by Architecture

Architectures Supported	# DIS Capable Tools	# HLA Capable Tools	# TENA Capable Tools	# CTIA Capable Tools	# Other Tools
Execution Control and Monitoring Tools	13	29	17	36	15
Federation Test and Network Monitoring Tools	6	6	6	4	11
Is used, or produces software or databases that are used, during LVC testing and execution	0	0	1	0	0
Collaborative Services Tools	0	0	0	0	1
Number of C4I Traffic Simulators	0	0	0	1	1
LVC Event Execution (Control and Feedback) Tools	***19***	***35***	***24***	***41***	***28***

Table B-5 shows the distribution of Visualization, After Action Review, and Verification, Validation and Accreditation tools by LVC architecture. It is noteworthy that all VV&A tools identified are architecture nonspecific. The total number of surveyed tools for these categories is twenty-four (24) Visualization tools, forty-two AAR tools, and seven VV&A tools, respectively. Although none of the VV&A tools are architecture-specific, most of the AAR tools are specific to DIS, HLA, TENA and/or CTIA; twelve (12) of the latter tool category (28.5%) support multiple architectures.

Table B-5: Visualization, AAR, and VV&A Tools by Architecture

Architectures Supported	# DIS Capable Tools	# HLA Capable Tools	# TENA Capable Tools	# CTIA Capable Tools	# Other Tools
Visualization Tools	9	10	6	3	12
Visualization Tools Rollup	***9***	***10***	***6***	***3***	***12***
Data Collection Tools	11	11	7	15	6
Data Analysis Tools	2	3	3	2	0
After Action Review Tools Rollup	***13***	***14***	***10***	***17***	***6***
VV&A Tools	0	0	0	0	7
VV&A Tool Rollup	***0***	***0***	***0***	***0***	***7***

B.1.2 DSEEP Process Applicability

Table B-6 summarizes the tools surveyed in relationship to DSEEP process steps. The balance of these tools are used in the integration, test, and execution of the simulation environment, with some of the same tools reused after the simulation is executed to replay the recorded exercise and to visualize the results. Tools utilized to support earlier phases of event planning, preparation and execution tend to be generic off-the shelf tools for the most frequently repeated uses, or more specialized tools that may be used when specific input or output formats must be supported. In a few cases, commercial product lines offer enterprise-wide tools used throughout the DSEEP lifecycle in a common product line framework. Some government-developed tools, particularly VV&A tools, are also used through the end-to-end DSEEP process.

Table B-6: Summary of Tools by DSEEP Process Step

DSEEP Step	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results
# Tools surveyed	**16**	**31**	**26**	**80**	**196**	**191**	**69**

Table B-7 crosswalks the tool subcategories as surveyed for Federation Planning and Development tools with DSEEP process steps. As might be expected, these tools align with the first four DSEEP steps, with some carryover into integration, test, execution of the simulation and post-execution analysis. Requirements definition tools are specifically applicable to the definition of simulation objectives and performance of conceptual analysis. Conceptual models and data exchange models are utilized as the DSEEP model prescribes. Network modeling is primarily done in conjunction with simulation environment design. Planning and negotiation of execution agreements persists through the integration and test of the simulation environment.

Table B-7: Federation Planning/Development Tools by DSEEP Process Step

DSEEP Process Step	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results
Requirements Definition Tools	6	6	1	1	1	1	2
Conceptual Modeling Tools	0	2	2	2	0	0	0
Data Exchange Modeling Tools	0	6	0	6	0	0	0
Execution Planning and Federation Agreement Tools	0	0	5	5	5	0	0
Network Modeling Tools	0	0	4	0	0	0	0
Performance Prediction Tools	0	0	1	0	0	0	0
Federation Planning and Development Tools Rollup	***6***	***14***	***13***	***14***	***6***	***1***	***2***

Table B-8 crosswalks the tool subcategories as surveyed for Scenario and Environment Generation tools with DSEEP process steps. These tool categories and their associated subcategories are strongly coupled to DSEEP activities associated with development of the simulation environment.

Table B-8: Scenario and Environment Generation Tools by DSEEP Process Step

DSEEP Process Step	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results
Environmental Database Tools (BA)	0	0	0	36	0	0	0
Natural Environment Generator Tools Rollup	***0***	***0***	***0***	***36***	***0***	***0***	***0***
Scenario Development Tools	0	5	0	0	0	0	0
Force Structure Composition Tools	0	0	0	9	0	0	0
Logistics Data Composition Tools	0	0	0	0	0	0	0
C4I Data Composition Tools	0	0	0	2	2	2	0
Behavior Composition Tools	0	0	0	2	1	0	0
Scenario Generation Tools Rollup	***0***	***5***	***0***	***13***	***3***	***2***	***0***

Table B-9 crosswalks the tool subcategories as surveyed for Federation Execution (Control and Feedback) with DSEEP process steps; as expected, their primary utilization occurs during integration, test and execution of the simulation environment.

Table B-9: Federation Execution Tools by DSEEP Process Step

DSEEP Process Step	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results
Number of Execution Control and Monitoring Tools	0	0	0	0	84	84	0
Number of Federation Test and Network Monitoring Tools	0	0	1	0	27	27	0
Is used, or produces software or databases that are used, during LVC testing and execution	0	0	0	0	1	1	0
Collaborative Services Tools	0	0	0	0	1	1	0
Number of C4I Traffic Simulators	0	0	0	0	1	1	0
Federation Execution (Control and Feedback) Tools (In Scope)	***0***	***0***	***1***	***0***	***114***	***114***	***0***

Table B-10 crosswalks the tool subcategories as surveyed for Visualization, AAR, and VV&A tools with DSEEP process steps. These tools are less closely coupled to DSEEP process steps since they may be used to analyze and assess data generated by the simulation environment as it is being integrated and tested prior to execution as well as during and after the exercise is conducted.

Table B-10: Visualization, AAR, and VV&A Tools by DSEEP Process Step

DSEEP Process Step	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results
Visualization Tools	0	0	0	3	24	24	22
Visualization Tools Rollup	***0***	***0***	***0***	***3***	***24***	***24***	***22***
Data CollectionTools	0	0	0	0	33	34	25
Data Analysis Tools	0	0	0	0	0	2	8
After Action Review Tools Rollup	***0***	***0***	***0***	***0***	***33***	***36***	***33***
VV&A Tools	4	6	6	7	6	5	6
VV&A Tool Rollup	***4***	***6***	***6***	***7***	***6***	***5***	***6***

B.2 DETAILED INFORMATION ON TOOLS SURVEYED

Table B-11 provides a detailed list and summary information on the 266 tools included in the survey. These tools were extracted from those listed in the Live-Virtual-Constructive Architecture Roadmap: Legacy Architectures Reference Model (November 2009), the TENA Repository, and from surveys administered at the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2009. Publically available information about these tools was supplemented and verified by directly contacting the program and technical points of contact identified for these tools where appropriate. Marketing summaries were revised to reflect an objective, third-party perspective and to emphasize the tools' role and functions to the greatest extent possible. Listing of a tool in the table does not imply endorsement by the study team. The table consists of the following sections:

Tool Identification (ID) consists of an enumeration scheme that uniquely identifies each tool by tool category, applicable DSEEP process steps, applicable LVC architectures, and an arbitrary suffix to that ensures a unique enumeration value for each tool. These enumerators were utilized during cross tabulation and analysis of data in an Excel spreadsheet to generate the tables in Section 2.4 of the main body of this report, as well as Tables B-1 through B-10 of this appendix. The enumerator has the form XX-ABCDEFG-YYYY-ZZZ, with the following codes:

- The XX value represents the tool subcategory applicable to the tool. When multiple subcategories were applicable, every effort was made to break down the tool into identifiable components that correspond to a unique subcategory. Otherwise, the tools primary role was used. Enumeration codes are listed in section B.2.1 of this appendix.
- The ABCDEFG value encodes the DSEEP process steps for the tool. When a DSEEP process step was applicable, the respective integer is set to the numeric corresponding to that step, in the sequence. When not applicable, the value is set to zero (0).

- The YYYY value represents applicable LVC architecture tool enumerations corresponding to tool functions within the architecture. These enumeration codes are listed in section B.2.2 of this appendix.

Tool Description provides a textual summary describing the tool's role, function and distinguishing characteristics.

The Obsolete Tool cell is marked with a bullet "•" when the tool is no longer supported by its provider. In some cases, the tool may be available from the provider, but maintenance is not available. In other instance, the tool is no longer available from the provider at all.

Matured Release tools are available from the provider, placed under configuration management, and are supported under the terms of their license agreements.

DSEEP applicability is marked with a bullet "•" in the respective cell(s).

Support for LVC Architecture is marked with a bullet "•" in the respective cell(s).

Licensing Column codes are as follows:

- CF – Commercial Freeware
- CL – Commercial License
- CO – Obsolete Commercial License
- GA – US Government Rights License (Distribution A)
- GD – US Government Rights License (Distribution D)
- ML – Mixed License

B.2.1 Tool Subcategory Enumerators

LVC Event Development Tools	
Requirements Definition Tool	AA
Conceptual Modeling Tool	AB
Data Exchange Modeling Tools	AC
Execution Planning and Federation Agreement Tools	AD
Network Modeling Tools	AE
Performance Prediction Tool	AF
Natural Environment Generators	
Environmental Database Tool	BA
Scenario Generation Tools	
Scenario Development Tools	CA
Force Structure Composition Tools	CB
Logistics Data Composition Tools	CC
C4I Data Composition Tools	CD
Behavior Composition Tools	CE
LVC Execution (Control and Feedback) Tools	
Execution Control and Monitoring Tools	DA
Federation Test Tools	DB
Network Monitoring Tools	DB
Is used, or produces software or databases that are used, during LVC testing and execution	DC
Collaborative Services Tools	DD
C4I Traffic Simulators	DE
Viewers	
Visualization Tools	EA
After-Action Review Tools	
Data Collection Tools	FA
Data Analysis Tools	FB
LVC Event V&V Tools	
VV&A Tools	HA

B.2.2 LVC Architecture Classification Enumerators

Code	Classification	Code	Classification
CTIAP	CTIA Planning Tool	TNAA	TENA Analysis Tool
CTIAS	CTIA Systems Control Tool	TNAI	TENA Infrastructure Tool
CTIAX	CTIA Exercise Control Tool	TNAG	TENA Scenario and Terrain Generation Tool
CTIAD	CTIA Data Collection Tool	TNAV	TENA Visualization Tool
CTIAA	CTIA Analysis Tool	MIXP	Multiple Architecture Planning Tool
CTIAI	CTIA Infrastructure Tool	MIXS	Multiple Architecture Systems Control Tool
CTIAG	CTIA Scenario and Terrain Generation Tool	MIXX	Multiple Architecture Exercise Control Tool
CTIAV	CTIA Visualization Tool	MIXD	Multiple Architecture Data Collection Tool
DISP	DIS Planning Tool	MIXA	Multiple Architecture Analysis Tool
DISS	DIS Systems Control Tool	MIXI	Multiple Architecture Infrastructure Tool
DISX	DIS Exercise Control Tool	MIXG	Multiple Architecture Scenario and Terrain Generation Tool
DISD	DIS Data Collection Tool	MIXV	Multiple Architecture Visualization Tool
DISA	DIS Analysis Tool	NATP	NATO Planning Tool
DISI	DIS Infrastructure Tool	NATS	NATO Systems Control Tool
DISG	DIS Scenario and Terrain Generation Tool	NATX	NATO Exercise Control Tool
DISV	DIS Visualization Tool	NATD	NATO Data Collection Tool
HLAP	HLA Planning Tool	NATA	NATO Analysis Tool
HLAS	HLA Systems Control Tool	NATI	NATO Infrastructure Tool
HLAX	HLA Exercise Control Tool	NATG	NATO Scenario and Terrain Generation Tool
HLAD	HLA Data Collection Tool	OTHV	Other Visualization Tool
HLAA	HLA Analysis Tool	OTHP	Other Planning Tool
HLAI	HLA Infrastructure Tool	OTHS	Other Systems Control Tool
HLAG	HLA Scenario and Terrain Generation Tool	OTHX	Other Exercise Control Tool
HLAV	HLA Visualization Tool	OTHD	Other Data Collection Tool
TNAP	TENA Planning Tool	OTHA	Other Analysis Tool
TNAS	TENA Systems Control Tool	OTHI	Other Infrastructure Tool
TNAX	TENA Exercise Control Tool	OTHG	Other Scenario and Terrain Generation Tool
TNAD	TENA Data Collection Tool	OTHV	Other Visualization Tool

Table B-11: Detailed Information on Tools Surveyed

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
CB-0004000-CTIAP-001	CTIA Battle Roster	The Battle Roster is used during exercise planning to import battle roster data into the CTIA exercise database. A typical battle roster contains a list of participants that are being trained in an exercise.		•				•							•		GD
FA-0000567-CTIAP-001	Combat Training Center (CTC) Data Collection Plan Toolset	The Data Collection Plan (DCP) Toolset provides the ability for a database administrator to easily manage and manipulate data within a DCP database. The DCP database contains training manuals composed of data defined by complex relations. The goal of the DCP toolset is to take the rather complex process of managing/updating the data and turn it into a simple process for an end user.		•					•	•	•				•		GD
FA-0000560-CTIAP-002	Data Collection Plan Editor	The purpose of the DCP Editor is to create and edit the Training Database, thereby constructing the source for procedures, process, data and information by which the Training System appraises unit, leader, and soldier performance. This database provides all the necessary information to trainers and training analysts to achieve comprehensive and objective feedback to the training unit. Its primary purpose is to support the After Action Review (AAR), and its secondary purpose is to support the Take Home Package (THP).		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
CB-0004000-CTIAP-002	Embedded Battle Roster	The Embedded Battle Roster provides the functionality to manipulate a battle roster.		•				•							•		GD
CB-0004000-CTIAP-003	CTIA Force Structure Component	Force Structure is a CTIA-compliant component that is responsible for creating and editing Force Structures.		•				•							•		GD
AD-0034500-CTIAP-001	CTIA Range Data Editor Component	The Range Data Editor component can be used to manage the allocation of range assets (e.g., targets, target lifters, cameras, etc.) to a specific range and information associated with their use at that range.		•			•	•	•						•		GD
AD-0034500-CTIAP-002	CTIA Range Tracking Admin Tool Component	The Range Tracking Admin Tool is a component designed to create and manage Situational Awareness (SA) regions and Tracking Control (TC) regions for gunnery ranges.		•			•	•	•						•		GD
AD-0034500-CTIAP-003	CTIA Roles and Permissions Component	This collective function provides a Graphical User Interface (GUI) for editing user roles and data access permissions.		•			•	•	•						•		GD
EA-0000567-CTIAS-001	CTIA 2D Map Component	The 2D Map component provides map functionality in a standalone map component and as an interface to be used by other Live Training Transformation (LT2) components. The 2D Map Component provides an application programming interface (API) that allows other LT2 components to provide specialized views of the battle space.		•					•	•	•				•		GD
EA-0000567-CTIAS-002	CTIA 3D Map Component	The 3D Viewer component provides both a standalone component and an embeddable component to be used as part of a composite system.		•					•	•	•				•		ML

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DA-0000560-CTIAS-001	CTIA Asset Database Resource Manager (ADRM) Component	The Asset Database Resource Manager component is responsible for assisting the user with the allocation and management of training resources for instrumented, live collective training exercises. This component will typically be used during the planning phase of an exercise. The component will provide users with the capability for creation, import, and retrieval of equipment data into/from the asset database.		•					•	•					•		GD
DA-0000560-CTIAS-002	CTC System Control (SysCon)	SysCon provides the ability for the Tactical Control Officer (TCO) to define a rotation, prepare a rotation, run a rotation, and manage a rotation.		•					•	•					•		GD
DA-0000560-CTIAS-003	CTIA Explorer	The CTIA Explorer is a .Net application that dynamically queries instances of CTIA services for information on exercises, components, entities, and tracking control regions.		•					•	•					•	•	ML
DA-0000560-CTIAS-004	CTC Digital Tactical Monitoring Component	The CTC Digital Tactical Monitoring (DTM) component interfaces with the Tactical Message Database and Common Training Instrumentation Architecture Services, to provide a way to monitor tactical messages within CTIA Services. The CTC DTM component takes new tactical messages and sends them to CTIA Services as the appropriate event.		•					•	•					•		GD
DA-0000560-CTIAS-005	Event Generator Processor (EGP)	The EGP is a non-interactive processor that takes CTIA tracking events and performs analysis on them to determine if a derived event needs to be published. The processor will publish line-crossing, area-entry, and area-exit events based upon tracking data updates with respect to the tactical graphics in the system.		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
EA-0000567-CTIAS-003	CTIA GPS Support: Military Grid Reference System (MGRS) Display	CTIA Military Map Display. Uses Falcon View.		•					•	•					•		ML
DA-0000560-CTIAS-006	CTIA Instrumentation Status and Control (ISC) Tool	ISC provides the ability for the Tactical Control Officer to monitor the status of various instrumentation devices, such as Player Units (PU) and send them commands.		•					•	•					•		GD
DA-0000560-CTIAS-007	Pairing Processor	The Pairing Processor is a non-interactive component that captures and analyzes CTIA events to determine if a derived event needs to be published. The intention of the Pairing Processor is to pair related events based on a strictly defined criteria set. The Pairing Processor subscribes to the CTIA Services component to receive all Weapon Fire and Hit Detection Events. As these events are received from CTIA Services, the Pairing Processor adjudicates the events to determine if they are truly events that should be paired.		•					•	•					•		GD
DA-0000560-CTIAS-008	CTIA System Control (SYSCON) Component	The SYSCON, which is separate and different from the CTC SysCon component, is an interactive CTIA-compliant component that has two main purposes, monitoring ranges, managing and creating Training Events and runs. The SYSCON component provides a set of displays that allow the user to monitor the current status of all the range complex instrumentations that communicate with the Range Operations Center (ROC).		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	ObsoleteTool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DB-0000560-CTIAS-001	System Technical Monitoring (STM)	The STM System collects and presents status information about hardware and software executing in a distributed network. The information is gathered through a number of different mechanisms, including Simple Network Management Protocol (SNMP) and operating system calls.		•					•	•					•		ML
DA-0000560-CTIAS-009	Tracker Monitor	The Tracker Monitor application monitors the master exercise and instructs simple trackers and trackers to join a particular rotation exercise based on the configuration defined at its creation.		•					•	•					•		GD
FA-0000560-CTIAX-003	LT2 Ad Hoc Query Tool Component	The LT2 Ad-Hoc Query is a component designed for making LT2 GUI Framework widgets available in Microsoft Office applications for the purpose of creating custom CTIA Exercise Reports.		•					•	•					•		ML
DA-0000560-CTIAX-010	Alarms and Alerts Component	The Alarm and Alerts Component (AAC) is a component developed for analyzing, publishing, and detecting Alarm and Event Subscriptions. The user can specify when to be notified by specifying conditions within Rules, which will trigger an Alarm. Alarms are usually safety issues that are exercise-global and are received by all users. The user is capable of subscribing to events from any point in time during the exercise. As these events occur or are retrieved from the system, they are sent to the Inbox Component.		•					•	•					•		GD
CA-0200000-CTIAX-001	Close Air Support (CAS) Mission Editor	The Close Air Support Mission Editor Tool (CAST) is an interactive GUI application provided to support the creation, management, and execution of close air support missions.		•		•									•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
FA-0000560-CTIAX-004	CTC Reports Component	The CTC Reports component provides report templates for Observer Controllers to submit standardized reports electronically. Reports can be filed when an event occurs while others are filed on a daily basis, or on a mission basis.		•					•	•					•		GD
DA-0000560-CTIAX-011	Entity Commander Component	The Entity Commander component provides a set of commands available to update controlled entities.		•					•	•					•		GD
DA-0000560-CTIAX-012	LT2 Entity Property Grid Component	The Entity Property Grid (EPG) LT2 component was developed to display element properties and the values associated with those properties.		•					•	•					•		GD
DA-0000560-CTIAX-013	CTIA Exercise Controller (EXCON)	The EXCON orchestrates an aggregate of components for the execution of Tank and Bradley Gunnery Qualification for digital ranges. Runs are instances of scenarios composed of Steps based on Army doctrine.		•					•	•					•		GD
DA-0000560-CTIAX-014	Exercise Assistant	The Exercise Assistant component provides a configurable GUI used to guide the user through the steps involved for each state of an exercise.		•					•	•					•		GD
DA-0000560-CTIAX-015	Exercise Manager	The Exercise Manager provides configuration, control and views of the CTIA Exercise instantiations in the system.		•					•	•					•		GD
DA-0000560-CTIAX-016	Exercise Tree Component	The Exercise Tree is a component used for viewing and editing objects relevant to the training audience.		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DA-0000560-CTIAX-017	LT2 Inbox	The LT2 Inbox integrates Microsoft Outlook with a CTIA system, allowing users to view, manage, and interact with CTIA Observations, Reports, Alerts, and Battle Space Events as familiar email-like messages. Once these items are placed in the Inbox, they can be managed like any other Outlook email message using Outlook's searching, filtering, sorting, and grouping capabilities.		•					•	•					•		ML
DA-0000560-CTIAX-018	Participant Definition Tool	The purpose of the Participant Definition Tool (PDT) component is to allow the end user to create/edit participant entities as part of an exercise. Participants are entities such as personnel, weapons, equipment, and platforms that the user wishes to track during an exercise.		•					•	•					•		GD
FA-0000067-CTIAX-005	Playback Component	The Playback component enables users to replay activities that occurred in a training exercise. Its purpose is to create objective replays of the battlespace/environment surrounding a unit undergoing training. The result is suitable for use as an input to the production of formal After Action Reviews. The Playback component may also be used as a presentation tool by lower-echelon Observer/Controllers (OCs) to provide replays within less formal AAR settings in the field.		•						•	•				•		GD
DA-0000560-CTIAX-019	LT2 Player Cache	The LT2 Player Cache component provides a centralized cache for lifeform, platform, equipment and firing weapon entities within an exercise.		•					•	•					•		GD
DA-0000560-CTIAX-020	LT2 Player Status Component	The Player Status LT2 component was developed to display the status of all of the entities in the running exercise.		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
FA-0000567-CTIAX-006	Replay	The Replay LT2 component was developed to replay past tactical events in an exercise to LT2 visualization tools.		•					•	•	•				•		GD
FB-0000067-CTIAX-001	Rolling Combat Power (RCP) Component	The purpose of the RCP component is to allow the end user to evaluate the combat effectiveness of a unit based upon the status of participants in that unit and the unit's supplies.		•						•	•				•		GD
DA-0000560-CTIAX-021	Scenario Controller	The Scenario Controller is a CTIA-compliant component that is responsible for commanding and controlling physical range assets during an exercise and provides all of the logic involved in executing an exercise. These assets include, but are not limited to, targets, battlefield effect devices (BED) and field cameras.		•					•	•					•		GD
FA-0000560-CTIAX-007	Tactical Net Selector (TNS)	The TNS component provides the Training Analysis and Feedback (TAF) workstations the ability to monitor radio traffic, playback recorded radio traffic, and create tags that are stored in the CTIA Database (version 8B). TNS will also provide the TAF workstation the ability to search for recorded clips or tags that are stored in CTIA.		•					•	•					•		GD
DA-0000560-CTIAX-022	Training Range Exercise Command & Control Suite (T-RECCS)	The T-RECCS provides two executable applications that offer a core set of training functionality via multiple LT2 components. An Administration application is used for system configuration and range maintenance while a Training Operations Command and Control (TOC2) application is used for the planning, execution, and recovery of a training exercise.		•					•	•					•		CL

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
FA-0000560-CTIAD-008	Bookmark Tool	The Bookmark Tool component is a non-interactive processor developed for recording situational awareness data from a live exercise to disk.		•					•	•					•		GD
DA-0000560-CTIAD-023	Common Player Unit Controller	The Common Player Unit Controller provides translation services between CTIA events and XML messages defined by the PU-CTIA Common Messages Set ICD (see Asset Browser-ICD).		•					•	•					•	•	GD
FA-0000560-CTIAD-009	Contact Report Component	The Contact Report component allows a user to create or edit a report that marks the time, state, personnel, and equipment involved in an engagement. The report also identifies the initiator of the engagement and the missions related to the engagement.		•					•	•					•		GD
DA-0000560-CTIAD-024	Event Log	The Event Log is a GUI CTIA-compliant component that displays CTIA events in real-time. The events that are displayed are configurable via a real-time filtering mechanism within the event log. The filtering mechanism allows a user to pick which events the user wishes to see and which events the user does not wish to see.		•					•	•					•		GD
FA-0000560-CTIAD-010	Observation Lite	The LT2 Observation Lite component is developed for creating, viewing, editing and deleting observations.		•					•	•					•		GD
FA-0000560-CTIAD-011	Observation Recording Tool (ORT)	The ORT component is developed for creating, viewing, and editing observations based on doctrine defined within the DCP Editor.		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DB-0000560-CTIAD-002	Player Unit Check Out Tool	The PU Checkout Tool is a CTIA-compliant component that uses CTIA Services to gather information for Player Units so that personnel at the Vehicle Install Pad can checkout a PU's data as received by and distributed by CTIA Services. The Vehicle Install Pad is where users physically install PU hardware onto Vehicles.		•					•	•					•		GD
DA-0000560-CTIAD-025	Target Event Processor	The Target Event Processor (TEP) acts as a gateway between the Universal Target Controller (UTC) and CTIA Services. When commanded, the TEP publishes CTIA Participant Events for the commanded targets into the other instances of CTIA Services. These Participant Events represent the current state of the targets as related to the CTIA Exercise.		•					•	•					•		GD
DA-0000560-CTIAD-026	Weather Station Lite (WSL)	The Weather Station Lite is a CTIA-compliant component that acts as a gateway between the WMR968 weather station hardware and CTIA. It reads messages from the WMR968 and converts the messages into CTIA state messages that are dispatched into CTIA Services.		•					•	•					•	•	ML
DA-0000560-CTIAB-028	Common Player Unit Gateway	The Common Player Unit Gateway provides an abstraction layer to facilitate Common Gateway-Controller (GC) Messages to and from a gateway. The abstraction layer provides a simple API that gateways can use to send the most common GC Messages. The functionality provided by the Common Player Unit Gateway includes the initial client connection, status requests, receiving reports from player units, and sending request to player units.		•					•	•					•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DA-0000560-CTIAB-029	Common Player Unit GC Message Service	The Common Player Unit GC Message Service Component is defined by the Common Message Set Interface Control Document (ICD). This ICD describes in detail the requirements needed to standardize a communications mechanism between instrumented player units and CTIA. Data exchanged between gateways and controllers is done via XML.		•					•	•					•		GD
DA-0000560-CTIAB-030	Common Player Unit Multiplexer (MUX)	The MUX facilitates the bidirectional messaging of data between gateways and controllers. The MUX does not perform any operations on the data, it simply routes the traffic to the correct client.		•					•	•					•		GD
DA-0000560-CTIAB-031	CTIA Joint Live Virtual Constructive Data Tool (JLVCDT) Adapter	The JLVCDT is an application intended to reduce the number and complexity of translators used in LVC training environments through the development and employment of an extensible translator framework. The framework provides a system and software architecture capable of rapidly integrating, configuring, controlling, and monitoring the execution of new and existing modules.		•					•	•					•		ML
FA-0000567-CTIAA-012	After Action Review	The AAR Tool enables streamlined creation of AAR materials, including choreography for presentations that may occur on a variable number of output devices, and to enable more versatile presentation capabilities for use in different AAR venues.		•					•	•	•				•		ML

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
FB-0000007-CTIAA-002	CTC Queries	CTC Queries and views will be stored in the Database, as will any supporting procedures.		•							•				•		GD
DA-0000560-CTIAA-036	Field Camera Control	The Field Camera Controller is a CTIA-compliant component that provides the capability to command Camera Mounts to point to specified locations via presets that have been programmed into the Camera Mounts via a Pelco Keyboard or optional GUI. This component also allows the switching between Color and forward looking infrared (FLIR) cameras that are mounted on the Camera Mount, the powering up and down of the FLIR camera, commanding of a camera to zoom in or out, commanding of the Camera Mount to tilt up and down, pan left and right, and to open and close the aperture.		•					•	•					•		ML
DB-0000560-CTIAA-003	Miniature Networked Spectrum Monitoring and Engineering Control System (Mini-SMECS)	The Miniature Networked Spectrum Monitoring and Engineering Control System system is a versatile radio frequency (RF) spectrum monitoring and recording system. The Mini-SMECS system supports a network of ruggedized broadband monitoring points that provide continuous monitoring and recording of RF spectrum usage over a wide geographical area.		•					•	•					•	•	ML
FA-0000567-CTIAA-013	Report Generator Tool	The Report Generator Tool allows any application that runs within the LT2 GUI Framework to generate PowerPoint reports based on events that have occurred in the past.		•					•	•	•				•		GD

Tool ID	Tool Nomenclature	Tool Description	Obsolete Tool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DA-0000560-CTIAA-037	Vehicle Video Control	The Vehicle Video Controller is a CTIA-compliant component that provides the capability for a user to assign a player unit's video cameras to one of the available channels.		•					•	•					•		GD
FA-0000567-CTIAA-014	Video System Suite (VSS)	The Video System Suite is a LT2 component that enables users to view, record, and replay video and audio feeds from range and vehicle video cameras on instrumented, live training ranges.		•					•	•	•				•		ML
DA-0000560-CTIAI-038	CTC Commercial-off-the-Shelf (COTS) Support	COTS Support allows the COTS products to easily integrate into the overall system and uses the functionality of the COTS product to meet system requirements.		•					•	•					•		GD
FA-0000560-CTIAI-015	Data Access Layer	The Data Access Layer is a CTIA-compliant component that provides a uniform framework for accessing range assets and scenario data from the Asset and DCP databases respectively.		•					•	•					•		GD
AD-0034500-CTIAI-004	DRTS Parametric Database (DB)	Live fire range training requires the use of parametric data to store target characteristics, target exposure times, weapon characteristics, ammunition characteristics, and platform configurations and characteristics. This component defines Oracle DB tables that should be used by components needing this type of data and that intended to be compatible with the Digital Range Training Systems (DRTS) product (a.k.a. Instrumented Ranges program).		•			•	•	•						•		GD
CB-0004000-CTIAI-004	Entity Type Editor	The Entity Type Editor provides a user interface to view, create and update entity types for use in CTIA.		•				•							•		GD

Tool ID	Tool Nomenclature	Tool Description	ObsoleteTool	Matured Release	Define Simulation Environment Objectives	Perform Conceptual Analysis	Design Simulation Environment	Develop Simulation Environment	Integrate and Test Simulation Environment	Execute Simulation	Analyze Data and Evaluate Results	DIS	HLA	TENA	CTIA	Other	Licensing
DA-0000560-CTIAI-039	Exercise Builder	The Exercise Builder component provides a GUI interface that allows users to perform the CTIA setup tasks prior to running an exercise. The setup tasks include: establish a new exercise name, create a new training exercise, create an instance of the exercise database, start JBoss, and create the Situational Awareness region.		•					•	•					•		GD
DE-0000560-CTIAI-001	Force Battle Command, Brigade-and-Below (FBCB2)	The FBCB2 component is a CTIA-compliant component that provides the capability to create, edit, manage, send, and receive a subset of the Joint Variable Message Format (JVMF) message set.		•					•	•					•	•	GD
DA-0000560-CTIAI-040	JBus Adapter	The Joint BUS (JBus) is an application intended to reduce the number and complexity of translators used in LVC training environments through the development and employment of an extensible translator framework.		•					•	•					•		ML
DA-0000560-CTIAI-041	LT2 GUI Framework	The purpose of the GUI Framework is to establish a library to assist the developer in the implementation of LT2 components while retaining a common look and feel to the user. An integrated GUI is achieved by using features such as a common desktop to house the tools, drag and drop between tools, menu options within one tool that trigger actions in another tool, and a common preferences storage system, to name a few.		•					•	•					•		GD
DA-0000560-MIXI-042	MÄK VR-Exchange®	VR-Exchange® is a translator for distributed simulations. It performs Federation Object Model (FOM)-to-FOM translation, Run-Time Infrasructure (RTI)-to-RTI bridging, DIS or HLA-to-TENA translation, and can support simulation-to-C4I interoperability.		•					•	•		•	•	•			CL

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EA-0000567-MIXV-004	MÄK VR-Vantage™	VR-Vantage™ is the MÄK 3D visualization package and consists of three components: VR-Vantage Toolkit, Vantage Image Generator (IG) and the MÄK Stealth		•					•	•	•	•	•	•			CL
EA-0000567-MIXV-005	MÄK VR-Vantage Toolkit	The VR-Vantage Toolkit is a software development toolkit for the MÄK Stealth and Vantage IG. It is designed to extend or embed MÄK Stealth or Vantage IG functionality into a simulation application. VR-Vantage Toolkit is based on Open Scene Graph (OSG) enabling OSG architecture compliant plug-ins to be used as well.		•					•	•	•					•	CL
EA-0000567-MIXV-006	MÄK Vantage Image Generator	The Vantage IG is a configurable desktop image generator within the MÄK product line.		•					•	•	•	•	•	•			CL
EA-0000567-MIXX-007	MÄK Stealth	MÄK Stealth is a 3D information station used for situational awareness, exercise monitoring, simulation debugging, and after action review/exercise playback.		•					•	•	•	•	•	•			CL
EA-0000567-MIXX-008	MÄK Plan View Display	MÄK Plan View Display provides a 2D view of the virtual battlefield. HLA or DIS entities and information may be overlaid onto 2D views of tactical, strategic, and visual databases to gain insight into the simulated battle.		•					•	•	•	•	•	•			CL

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FA-0000567-MIXD-016	MÄK Data Logger	MÄK Data Logger captures and replays simulation data; it records HLA or DIS messages to a file and replays them to review and critique simulation exercises through a GUI. The Data Logger provides standard digital video recording (DVR)-like features including pause, fast forward, and slow motion (both forward and reverse). Velocities and accelerations are scaled during non-real-time playback, to facilitate a smooth display in the MaK Stealth, MaK Plan View Display, or other visualization tools. Simulation data can be exported to an SQL database for data mining and analysis.		•					•	•	•	•	•	•			CL
DB-0000560-HLAX-004	MÄK RTIspy®	RTIspy® is a web-based diagnostic GUI and API that gathers diagnostic information from the RTI, and makes it accessible to the user. Functionality includes a federation's network topology graph, object scanning, list of interactions sent and received, status browsing of current state of FOM subscriptions and publications and log trace of federate-ambassador-invoked and RTI-ambassador-invoked method calls, and Network and CPU monitoring tools [not Management Object Model (MOM)-based] to identify performance bottlenecks.		•					•	•			•				CL
DB-0000560-HLAX-005	MÄK RTIspy Plug-in API	MÄK RTIspy Plug-in API builds plug-ins to alter, extend, and query MÄK RTI functionality.		•					•	•			•				CL

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FA-0000567-DISD-017	Redsim DIS Protocol Data Unit (PDU) Logger	The Redsim PDU Logger is a Windows application for off-line processing of PDU capture files generated by DIS Link Monitor. It provides the capability to generate human readable text files, export PDU data in csv format for import into other database applications, and the ability to select individual PDUs for inspection, editing and/or replay.		•					•	•	•	•					CL
FA-0000567-DISD-018	Redsim DIS PDU Recorder	DIS PDU Recorder for Windows records and plays back DIS exercises at a PDU level.		•					•	•	•	•					CL
DB-0000560-DISX-006	Redsim DIS Link Monitor	The DIS Link Monitor for Windows is an engineering tool to be used in a DIS environment for network monitoring and exercise management. It is suitable for the development and/or testing of DIS based applications, as well as personnel involved in planning, coordination and execution of DIS based exercises.		•					•	•		•					CL
DB-0000560-DISX-007	Redsim DIS PDU Generator	Redsim DIS PDU Generator for Windows generates DIS PDUs using PDU Templates using the Custom PDU Definition capability of the DIS Link Monitor. Options are provided for immediate transmission of the defined PDU as well as the capability to save defined PDUs to a file for subsequent replay.		•					•	•		•					CL
DB-0000560-DISX-008	Redsim DIS Radio Receiver for Windows	Redsim DIS Radio Receiver for Windows This application is a diagnostic tool that emulates DIS radio functionality. It enables listening to any selected frequency, a single radio or in fact all frequencies simultaneously.		•					•	•		•					CL

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DA-0000560-DISI-044	Redsim DIS PDU Router	DIS PDU Router for Windows provides DIS filtering capabilities in a LAN to WAN connection environment to reduce bandwidth requirements.		•					•	•		•					CL
DA-0000560-DISI-045	Redsim Cyclops for Windows	Cyclops is a PC Windows based application that provides DIS routing, filtering and parameter transformation capabilities in a LAN to WAN connection environment.		•					•	•		•					CL
CA-0200000-DISG-002	Redsim Redwind for Windows	Redwind is a PC Windows based application that provides a DIS compatible Scenario Generator.		•		•						•					CL
DA-0000560-HLAX-046	HLAControl	The HLAControl tool assists the management and control of the federation. It provides a single point of monitoring and control of distributed HLA federation status and performance metrics; allows for the monitoring of complex multi-platform distributed environments; supports the HLA Federation Development and Execution Process (FEDEP) for Life Cycle Planning; and provides a graphical display that indicates problems and status during federation executions.		•					•	•			•				CL
FA-0000567-HLAA-019	HLAResults	hlaResults provides data collection, playback, and analysis. hlaResults can collect and analyze data during execution, then play back all or selected portions of a simulation event. Its features support runtime and post-run data analysis and provide a tab-based user interface to guide the user through the data collection, playback planning and execution processes. Collected data can be saved to Microsoft Access, MySQL or Oracle.		•					•	•	•		•				CL

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DA-0000560-HLAX-047	Virtual Control™	Virtual Control™ monitors, controls, and analyzes distributed modeling and simulation and live training environments. It provides a floating user interface for flexibility of exercise control; presents the topology and component status of the enterprise; indicates problem spots; overlays devices on a floor plan; and analyzes system-to-system throughput (TCP, UDP and Multicast). Virtual Control™ can remotely interact with hlaResults, providing access to the console commands and MOM data of RTI NG Pro. Virtual Control™ also provides Multicast analysis and an Infrastructure Wizard.		•					•	•			•				CL
DA-0000560-HLAI-050	Pitch Booster™	Pitch Booster™ enables the user to run HLA-compliant simulations with Pitch pRTI™ running on top of the Pitch Booster™ network, connecting simulations from different sites into one federation, and run multiple federates and federations at the same time across the Pitch Booster™ network. This provides a way to combine and reuse simulation resources from many different locations. The full set of services according to the HLA standard is available, using the standard C++ and Java APIs with adapters for HLA 1.3 and DIS support.		•					•	•			•				CL

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DA-0000560-HLAX-051	Pitch Commander™	Pitch Commander™ provides a process for planning and running a federation execution. The tool describes sites and host locations together with simulators, supporting databases, visualization systems and other important applications to enable the federation can to be described and mapped to the corresponding hosts and applications. Pitch Commander™ also allows the user to auto-discover what hosts and federates are available.		•					•	•			•				CL
FA-0000567-HLAA-020	Pitch Recorder™	Pitch Recorder™ provides the ability to record, analyze and playback information exchanged in an HLA federation.		•					•	•	•		•				CL
AC-0204000-HLAP-001	Pitch Visual Object Model Template (OMT)™	Pitch VisualOMT™ provides the capability to create and maintain HLA 1516 Object models. This tool allows the developer to develop, maintain, and quality-assure these object models. Pitch Visual OMT™ can be used by federation developers during early federation modeling phases as well a later in the development lifecycle. Pitch Visual OMT™ provides graphical inspection and editing on standard workstations, and provides wizards to migrate object models from older standards. The graphical interface, as well as the HTML output, enables collaboration and sharing of models.		•		•		•					•				CL

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AA-1200000-HLAP-001	Pitch Developer Studio™	Pitch Developer Studio™ generates middleware through an API, allowing the developer you to perform "set value" and "get value" operations on attributes of shared objects. Remote objects are automatically discovered, created and updated with interactions handled as method calls. Simple and complex data types are automatically encoded and decoded, both standard HLA types and popular RPR FOM data types. Best-practice patterns are used to separate HLA handling from applications to get performance and fault tolerance. Pitch Developer Studio™ handles HLA/RTI communication, declarations, object registration/updating, data encoding/decoding, object/attribute reflection, dispatching interactions, initialization/auto provide support, fault tolerance and HLA version independence.		•	•	•							•				CL
EA-0000567-MIXI-009	Pitch Google Earth (GE) Adapter™	Pitch GE Adapter™ is a 2D/3D viewer that makes HLA simulation data available in the Google Earth application. The user can inspect data, pan, zoom and overlay with other information such as satellite images, roads, cities and borders. Pitch GE Adapter™ creates a live data source that can be accessed from local or remote sites.		•					•	•	•					•	CL

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DA-0000560-HLAX-053	Fed Director™	Fed Director uses FOM and MOM information to provide a comprehensive view of the federation execution. FedDirector™ reads the FOM and allows declaration interest in object classes during run-time for ease of adaptation. This tool provides views for managing each federate's declarations, objects, ownership, and time settings.	•						•	•			•				CO
DB-0000560-HLAX-009	FedProxy™	HLA integration and test harness	•						•	•			•				CO
AC-0204000-HLAP-002	Object Model Development Tool (OMDT) Pro	OMDT Pro provides (1) Tree view navigation to locate information in object models; (2) access to a property sheet with detailed information for review or edit; (3) access the OMT tables with the tabbed sheets; (4) display of warning and error messages in an output window to reduce workspace clutter; (5) drag and drop of object model items from one model to another; (6) functions to check and correct for HLA consistency errors. Supports 1.3vNG and 1516 only, not HLAEvolved.		•		•		•					•				CL

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DA-0000560-HLAX-054	oMni™	oMni is a set of related software components and applications that together give simulations the ability to establish a Federation Object Model independent interface to the HLA Runtime Infrastructure. FOM-independence is important because it significantly reduces the amount of software development effort required for a federate to participate in more than one federation. OMni combines current industry-best practices with a clear vision for delivering the HLA promise of an open and extensible architecture. An HLA-compliant simulation achieves FOM-independence using OMni by replacing its existing RTI interface with the API provided by OMni middleware. In turn, OMni interfaces to the existing RTI; this native RTI interface continually adapts to different FOMs in order to allow the federate to support different federations.	•						•	•		•				CO
AA-1200000-HLAP-002	Calytrix SIMplicity™	SIMplicity is an IDE that enables developers and scientists to rapidly assemble component based HLA simulations from new and pre-existing components in a visual environment. SIMplicity assists the developer throughout the development life cycle, from design to development, deployment and execution. SIMplicity uses a template-driven code generation process to create all of the simulation entities for the targeted platform specific simulation model (PSM).	•		•	•							•				CO

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AA-1200067-MIXA-003	Calytrix Mentor™	Calytrix Mentor is a web-based Training Management and Readiness Assessment system for conducting individual and collective/team training; recording results and knowledge; and generating reports and trend analysis. Mentor captures the whole training life cycle, from planning to execution through to generating reports/After Action Reviews, in a standardized and repeatable manner.		•	•	•				•	•					•	CL
FA-0000567-HLAA-021	Data Collection Tool	Defense Modeling and Simulation Office (DMSO) AAR Tool	•						•	•	•		•				GA
BA-0004000-NATG-001	Presagis Database Automated Re-use Technology (DART™) Tool	DART™ is an enterprise-level tool that uses common source and common processing to support the re-use of legacy databases, the production of new databases, and the industry's highest level of correlated outputs. TerraVista™ option.		•				•								•	CL
CE-0004000-OTHG-001	Presagis AI.implant™	Presagis AI.implant™ is a multi-platform artificial intelligence (AI) authoring and runtime software solution for serious games, simulations, and training applications with intelligent populations of computer controlled characters, including people and vehicles, AI.implant™ enables these simulated characters to make sophisticated context specific decisions and to move in a realistic fashion within their environment.		•				•								•	CL

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BA-0004000-OTHG-002	Presagis Creator™	Presagis Creator™ is a cross platform 3D modeling tool; its native file format is OpenFlight. This tool is used to build model geometry and apply textures at varying levels of detail, as well as support 3D animation.		•				•								•	CL
BA-0004000-OTHG-003	Presagis Creator Terrain Studio™	The Creator Terrain Studio™ terrain generation software manages the terrain building process and workflow for real-time 3D applications. This tool enables the user to design a hierarchical, top-down terrain database generation workflow. Workflows can be designed, saved and modified for reuse on multiple projects.		•				•								•	CL
BA-0004000-OTHG-004	Presagis Creator Virtual Texture Studio™	Creator Virtual Texture Studio™ provides the key components of Creator Terrain Studio (CTS) for imagery optimization and for deploying existing databases in Vega Prime. Excelling at the generation of virtual textures and the re-use of existing OpenFlight, TerraPage, and SGI Clip Texture databases, Creator VT Studio converts and optimizes these databases to take advantage of the performance and advanced rendering techniques of Virtual Texture in Vega Prime.		•				•								•	CL
AA-1234507-MIXI-004	Presagis Aeria™	Aeria™ is an enterprise tool that integrates Presagis product line tools with open industry and government standards into a single workflow to build modeling & simulation applications. This tool supports the Common Database Specification, OpenFlight, Terrapage (OTF), Compact Terrain Database (CTDB), Joint Conflict and Tactical Simulation (JCATS), and Global Information Systems (GIS) data formats in a DIS and/or HLA environment.			•	•	•	•	•		•	•	•			•	CL

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EA-0000567-MIXX-010	SOFViz	SOFViz is a GOTS executable for US DoD and INTEL agencies. SOFViz is a turn-key solution that incorporates the best of open source libraries with the knowledge of some of the industry's leading real-time developers. In addition, SOFViz is configuration managed, includes industry style help that is both interactive and knowledge based, and has support available as an annual contract.		•					•	•						•	GD
CA-0200000-OTHG-003	Presagis STAGE™	STAGE™ provides users with the ability to generate and execute complex scenarios for training and analysis, building dynamic and interactive tactical and operational scenarios.		•		•										•	CL
BA-0004000-OTHG-005	Presagis Terra Vista™	Presagis Terra Vista™ is a COTS terrain database generation system. The Terra Vista™ product line offers a Base and a ProBuilder option. ProBuilder also offers native support for TerraPage and OpenFlight® visual formats and Digital Terrain Elevation Data (DTED), ASCII, Geo-Tiff, ECW, and Shapefile source data formats. The product also supports several, separately sold, optional Semi-Automated Forces (SAF) output compilers including CTDB, Joint SAF (JSAF), Synthetic Environment Data Representation & Interchange Specification (SEDRIS), JCATS and OTF. ProBuilder also comes with a 3D viewer that allows the user to fly through built terrain in either TerraPage or OpenFlight format, make screen shots, or record videos.		•				•								•	CL
EA-0004567-OHTV-010	Thea Lite	Thea Lite is a visualization application for viewing and sharing synthetic environments in Open Flight, Terrapage, and Compact Database (CDB) format.		•				•	•	•	•					•	CL

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EA-0004567-OHTV-011	Presagis Vega Prime™	Vega Prime is a software environment for the creation and deployment of real-time visual simulation, virtual reality, sensor and general visualization applications. Vega Prime combines advanced simulation functionality with easy-to-use tools to create an infrastructure to build, edit and run sophisticated applications.		•				•	•	•	•					•	CL
AA-1200000-OTHP-005	DOORS	Requirement Management Tool		•	•	•										•	CL
BA-0004000-OTHG-006	Equater™	COTS Terrain Database Generation Tool		•				•								•	CL
AD-0034500-HLAP-005	Federation Execution Planner's Workbook (FEPW)	HLA support DMSO tools	•				•	•	•				•				GA
DA-0000560-HLAX-058	HLA Federation Management Tool (FMT)	DMSO federation status monitoring tool, based on the Management Object Model.37	•						•	•			•				GA
DB-0000560-HLAX-010	HLA Federate Compliance Test Tool	FVT assists developers in the Federation Integration and Test phase of the FEDEP. It verifies that federates fulfill their update/reflect and send/receive responsibilities. Information about federate responsibilities can be entered directly or can be imported from FEPW Data Interchange Format (DIF) format files.		•					•	•							GD

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DB-0000560-HLAI-011	RTI Verification Tool	The RTI Verification Tool is used to certify HLA compliance with the applicable HLA Interface Specification.		•					•	•							GD
DA-0000560-HLAX-059	HLA Exercise explorer	A fully functional HLA Manager Federate designed to aid in the development of HLA Federates and Federations. The Exercise Explorer provides the developer with critical information about the current running state of an HLA Federation Execution including run time information on each Execution Member.	•						•	•			•				CO
DB-0000560-HLAX-013	HP Openview Network Node Manager	Local area and wide area network management tool.		•					•	•		•	•	•	•	•	CL
AC-0204000-HLAP-003	Ibis Model Editor	Ibis Model Editor is a Computer Aided Federation Development Environment (CAFDE)-compliant software package designed to create HLA-compliant models. Model Editor is still in a beta, not final, stage. As such it may not be as refined as a final product would be. Trial copies may be downloaded for evaluation purposes only.		•		•		•					•				CL
DA-0000560-HLAI-062	Liteflite	LiteFlite TM Re-Configurable Simulation Toolkit Is Low-Cost, PC Based Solution Providing Photo-Realistic Geo-Specific Dynamic Environments.		•					•	•		•	•				CL
EA-0000567-MIXV-012	ModIOS 2D PVD	The Plan View Display (PVD) is one application in the ModIOS tool suite. It provides a 2D view of the simulation and configurable icons. Designed for DIS and included HLA gateway.		•					•	•	•	•	•				CL

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EA-0000567-MIXV-013	ModIOS 3D Stealth Viewer	The Stealth Viewer is one application in the ModIOS tool suite. It provides a 3D display of the special effects such as explosions, and atmospheric effects. Designed battlefield from various points of view (cockpit, independent, etc.) Supports smoothing of entity positions, for DIS and included HLA gateway.		•					•	•	•	•	•				CL
FA-0000567-MIXA-022	ModIOS AAR	The AAR is one application in the ModIOS tool suite. It provides a data logging and replay facility, automatic generation of performance reports, and remote control of the 2D PVD and 3D Stealth Viewer. Designed for DIS and included HLA gateway.		•					•	•	•	•	•				CL
DA-0000560-MIXI-063	ModIOS Exercise Controller	The Exercise Controller is one application in the ModIOS tool suite. It provides configurable control of simulation applications, including 2D and 3D displays, computer-generated forces, etc. It is used to start, resume, stop and freeze simulations, generate reports, create and remove entities, etc. Designed for DIS and included HLA gateway.		•					•	•		•	•				CL
FA-0000567-MIXA-023	ModIOS logger/player	The Logger/Player is one application in the ModIOS tool suite. It provides a data logging and replay facility. Designed for DIS and included HLA gateway		•					•	•	•	•	•				CL
DA-0000560-MIXI-064	Modular Interoperable Synthetic Environment (ModISE)	Framework that facilitates composition of and interoperability among interactive simulation applications. It includes a web-based model repository, a GUI and a run-time Interoperability engine. ModISE stands for Modular Interoperable Synthetic Environment.		•					•	•		•	•				CL

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DA-0000560-HLAI-067	S2Focus™ Framework	S2Focus™ provides the critical infrastructure for executing distributed simulation and training exercises. Key functions include data recording, data analysis, data filtering and control, data visualization, and mission planning.		•					•	•		•	•				CL
CE-0004560-MIXG-002	S2Focus™ Mission Planner	The S2Focus™ Mission Planner provides a means to plan a mission by defining and laying down platforms, and providing routes for the platforms to follow. Once the mission is planned, the Mission Planner provides the capability to simulate the movements of the platform entities.		•				•	•			•	•				CL
FA-0000567-MIXA-024	S2Focus™ Recorder	The Recorder component provides the ability to record, and playback simulation data. In addition, record/playback functionality is protocol independent. In other words, the Recorder is capable of recording simulation data using one protocol (e.g. DIS), and playing back the recorded log file using a different protocol (e.g. HLA).		•					•	•	•	•	•				CL
DA-0000560-MIXI-068	S2Focus™ Manager	The S2Focus™ Manager component allows the user to monitor and control objects on the network, such as entities participating in an exercise, as well as local and remote simulation tools using the S2Focus Tools FOM and HLA Direct™ simulation protocol.		•					•	•		•	•				CL
EA-0000567-MIXV-014	S2Focus™ Viewer	The Viewer component is a comprehensive visualization tool that presents a real-time, 2D and 3D perspective view of the battlefield. It allows the user to interact with, and move about, the 2D and/or 3D visual database without any interference or effect on the environment or the entities/objects involved in the simulation. Multiple views into the same virtual world are supported.		•					•	•		•	•				CL

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FB-0000007-MIXA-003	S2Focus™ Analyzer	The Analyzer component collects, displays, and analyzes recorded and real-time simulation data. It includes two views: a Report View that displays event information in a tabular form, and an Event View that displays event information as markers on a trace.		•							•	•	•				CL
BA-0004000-OTHG-007	SEDRIS CTDB to SEDRIS Transmittal Format(STF) Converter	SEDRIS is a synthetic environment data interchange program. This free tool converts from the CTDB format, an optimized run-time format used by the ModSAF and OneSAF applications, to STF.		•				•								•	GA
BA-0004000-OTHG-008	GeoTIFF to STF Converter	This free tool converts digital elevation models (DEM) in the GeoTIFF format to STF transmittals.		•				•								•	GA
BA-0004000-OTHG-009	SEDRIS GRIB to STF Converter	This free tool creates an STF from either a set of gridded binary (GRIB) messages or meteorological grid format (METGM) messages.		•				•								•	GA
BA-0004000-OTHG-010	Gridded Raster or Imagery Data to STF (GRIDS) Converter	This free tool converts National Geospatial-Intelligence Agency (NGA) DTED elevation data, ArcInfo ASCII Grid, or US Geological Service (USGS) DEM ASCII data to STF. Available for all SEDRIS SDK supported platforms. (This application was formerly known as the DTED to STF Converter.)		•				•								•	GA
BA-0004000-OTHG-011	Shape to STF Converter	This free tool converts ESRI Shape files to STF transmittals.		•				•								•	GA
BA-0004000-OTHG-012	STF 4.0.x to 4.1.x Converter	This free tool converts 4.0.x STF transmittals to 4.1.x STF transmittals. Available for all SEDRIS SDK supported platforms.		•				•								•	GA

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BA-0004000-OTHG-013	STF to CTDB Converter	This free tool converts from STF to the CTDB format, an optimized run-time format used by the ModSAF and OneSAF applications.		•				•								•	GA
BA-0004000-OTHG-014	STF to DTED Converter	This free tool extracts gridded terrain elevation data from STFs and creates NGA DTED files and directories.		•				•								•	GA
BA-0004000-OTHG-015	STF to Shape Converter	This free tool extracts features from SEDRIS Transmittals and creates ESRI Shape files.		•				•								•	GA
BA-0004000-OTHG-016	VPF to STF Converter	This free tool converts National Geospatial-Intelligence Agency (NGA) feature data in Vector Product Format (VPF) to SEDRIS Transmittal Format.		•				•								•	GA
BA-0004000-OTHG-017	EDCS Query Tool	This free tool is a graphical user interface to browse and query the EDCS, as well as access the mappings from other classification catalogs to EDCS. Available for all SEDRIS SDK supported platforms.						•								•	GA
BA-0004000-OTHG-018	Focus (SEDRIS 4.1 BETA)	This free tool is useful for examining, editing, and correcting STF transmittals. Focus can also run other applications, and includes tools such as Depth, Model Viewer, Rules Checker and Syntax Checker. For more details, please see the Release Notes, Users' Guide, and System Requirements. Available for Linux and Windows platforms only.						•								•	GA

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BA-0004000-OTHG-019	SEDRIS SDK Validation Suite	This free suite contains the Depth, Rules Checker, and Syntax Checker tools (also included in the SEDRIS SDK). Available for all SEDRIS SDK supported platforms. Depth performs a depth-first search traversal of the given STF transmittal, and prints the output to stdout. Rules Checker verifies the structural semantics of a given STF transmittal against the DRM Constraints. Syntax Checker verifies the syntactic correctness of a given STF transmittal.		•				•								•	GA
BA-0004000-OTHG-020	Synthetic Environment Evaluation - Inspection Tool (SEE-IT)	This free tool performs complete analytical inspections of terrain databases. Available for Linux, SGI, and Windows platforms.		•				•								•	GA
BA-0004000-OTHG-021	XTCRS Checker	The XTCRS Checker validates requirements captured in XML-encoded Transmittal Content Requirements Specification (XTCRS) files, and evaluates a given STF against those requirements. This free tool is available for Linux and Windows platforms.		•				•				.				•	GA
BA-0004000-OTHV-022	AcuSoft Side-by-Side Viewer (SbS)	This free AcuSoft tool can display terrain, models, and images from multiple transmittals to allow for visual comparisons. The SbS also displays the transmittal in a tree-like window so that the objects and their attributes can be examined. Available for Windows platforms only.		•				•								•	CF

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BA-0004000-OTHV-023	SEDRIS Model Viewer	This free tool (also included in the SEDRIS SDK) displays the 3D models and images in STF transmittals. Available for all SEDRIS SDK supported platforms.		•				•				.				•	GA
BA-0004000-OTHG-024	Maya to STF Converter	This free (beta version) CoDiC tool converts a Maya 5.0 file to STF. Available for Windows platforms only.		•				•								•	GA
BA-0004000-OTHG-025	SEDRIS Ocean Profile Tool	This free tool is an acoustic data software package designed to show how the SEDRIS Read API can be used to extract data from an STF transmittal in a form needed by data applications software.		•				•								•	GA
BA-0004000-OTHG-026	SEDRIS Wind Map Tool	This free tool is a Meteorological and Oceanographic (METOC) data visualization tool developed to demonstrate the ability of the SEDRIS transmittal format to accept and manipulate atmospheric data in the international GRIB meteorological standard distribution format.		•				•								•	GA
BA-0004000-OTHG-027	E&S Generalized Data Format (GDF) to STF Converter	The Rockwell Collins (formerly Evans & Sutherland) database generation tools are capable of importing and exporting STF files to and from the native GDF format.	•					•								•	CL
DA-0000560-HLAI-069	Sequoia Integrator for HLA	The Integrator provides the means to rapidly integrate new or existing simulation systems into HLA environments. SEQUOIA Integrator for HLA v1.0 is currently available on Windows NT© for use with RTI1.3NG-V3.		•					•	•			•				CL

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AB-00234000-HLAP-001	Scenario Generation Toolset (SGT)	The Scenario Generator and Execution Planner, together referred to as the Scenario Generation Toolset, was being developed by AEgis Research under the direction of the Air Force's Modeling, Analysis and Simulation Center (MASC) at Hanscom Air Force Base.		•		•	•	•					•				GD
DA-0000560-OTHI-070	Simplex 3 with HLA Interface	Simplex 3 is a discrete and continuous system simulation developed at the University of Passau. The HLA-interface of Simplex 3 hides all HLA-functionality from the model developer and leaves the entire model description of Simplex 3 models unchanged, whether run as stand-alone models or as HLA federates. This facilitates the re-use of existing models.							•	•			•			•	CL
DA-0000560-OTHI-071	Simulation Support Environment DUCTOR	DUCTOR is an architecture which allows the user to develop operational simulations running stand-alone or as an HLA federate. It is Object Oriented (OO) (UML based) and promotes re-use of scenarios, specific behaviors and platforms.		•					•	•			•			•	GD
DA-0000560-HLAI-072	Simulation Support Environment ESCADRE	Environnement de simulation en conception orientée objet et ADA pour le développement et la réutilisation des etudes (ESCADRE) is an HLA-Capable simulation support environment that encapsulates and hides low level HLA interface functionality, providing high level services for HLA interoperability. It provides an object oriented methodology and a tool set to design, implement and run standalone simulations and HLA federates.		•					•	•			•				GD

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EA-0000567-HLAV-014	Skopeo Animation System	Skopeo is a Java/VRML based 2D/3D viewer which has been extended for HLA. This extension uses the Beta release of the Java RTI API from DMSO. Skopeo once was developed as Proof Animation ® compatible 2D animation tool for post-run trace-file based animation. It is written in Java and runs stand-alone or as applet in any java capable web browser. In a second step, Skopeo was enhanced for 3D animation using VRML2.0 if an appropriate browser plug-in can be found. Additionally, Common Object Request Broker Architecture (CORBA) mechanisms are used for communication between the Skopeo Applet and the Skopeo server.							•	•	•		•				CL
DA-0000560-HLAI-073	Simulation Language with Extensibility (SLX) Simulation Environment	HLA interface provided SLX is a very fast discrete event simulation tool for the Windows 95/98/NT operating systems. It is a simulation language oriented tool. The SLX user is provided with an easy-to-use interface to the RTI and the possibility of "doing" distributed simulation based on HLA without having to deal with the lowest API-level of HLA.							•	•			•				CL
DA-0000560-HLAI-074	SmartFED	SmartFED is a generic reusable tool-suite that provides support to the human exercise manager(s) controlling a (real-time) distributed simulation execution. Supports HLA and native CORBA interfaces.							•	•			•			•	CL

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DA-0000560-MIXI-075	Simulation Object Middleware Classes (SMOC) Gateway	SMOC is a standard interface to HLA for developers of models and simulations. Serves as a DIS/HLA gateway to avoid expensive modifications to DIS-compliant systems.	•						•	•		•	•				GD
DA-0000560-MIXI-076	Synthetic Tactical Real-time Interactive Virtual Environment (STRIVE)	STRIVE is a COTS simulation development environment. Reduces development through existing libraries of models. Many aspects of the software can be modified or replaced with user-defined software. It also has a computer generated forces (CGF) capability. Although quite new, Strive is expected to be a major COTS software product of CAE. It can run as a federate and provides a framework for creating the same.	•						•	•			•			•	CO
CB-0004000-OTHG-005	Unit Order of Battle Data Access Tool (UOB-DAT)	UOB-DAT provides simulation developers with consistent and authoritative order of battle information. The tool consists of three main components: a data interchange format, a data extraction tool, and a set of authoritative data sources.		•				•								•	GD
AB-00234000-HLAP-002	Simventions ConceptualWorks™	ConceptualWorks provides the user with the ability to develop data models which will enhance the understanding of software architectures, systems, and simulations. ConceptualWorks levels the Base Object Model (BOM) standard, which provides a means to represent aspects of an integrated M&S and BC architecture. Functions include creating, editing, visualization, validation, and export of data models in UML-like diagrams that can be exported to HTML or other model standards such as the HLA OMT.		•		•	•	•					•				CL

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CB-0004000-OTHG-006	Global Force Management Initiative (GFMI) Organization Server	The GFMI Organization Server provides a joint way to electronically document "authorized" force structure data for integration across service lines. The GFMI Exchange Data Model (GFMIEDM) provides common data exchange with XML tagging for web services (e.g., discovery, collaboration, mediation, etc.).		•				•								•	GD
CB-0004000-OTHG-007	Joint Training Data Services (JTDS) Order of Battle Service (OBS)	JTDS OBS is used to create scenario initialization data sets for simulations and federations. The benefits of scenario creation utilizing OBS are access to fused data sets that are simulation useful. XML-based client server architecture using Oracle.		•				•								•	GD
BA-0004000-MIXG-028	JTDS Terrain and Weather Effects Services	JTDS provides web-based scenario generation services developed to support the needs of the US DoD Modeling & Simulation Training Community. The JTDS objective is to evolve current capabilities to enable short notice support of Mission Rehearsal by producing correlated terrain and weather effects databases used by simulations and federations to support training events. XML-based client server architecture using Oracle.		•				•				•	•	•		•	GD

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CB-0004000-MIXG-008	Joint Rapid Scenario Generation (JSRG)	JRSG is a serviced oriented architecture (SOA) based integration framework for the acquisition and rapid translation of authoritative data into a set of initialization products that support mission critical timelines. JSRG complies with the Net-Centric Data Strategy (NCDS) and Universal Core (UC) data schema; utilizes Net-Centric Enterprise Services (NCES); synchronizes capability development with Net-Enabled Combat Capability (NECC) and the Command and Control (C2) Domain Core data schema; and adheres to Information Assurance policies.						•				•	•	•		•	ML
DA-0000560-MIXI-079	StarGen	StarGen is used to write scripts that start applications and key components of the infrastructure as well as a scripting capability that can be used to shutdown test range assets after data has been harvested.		•					•	•		•	•	•			GD
BA-0004000-MIXI-029	Environmental Datacube Support System (EDCSS)	EDCSS supports production of full spectrum of correlated environmental support products with efficient distribution and inject of data and correlated effects.		•				•								•	GD
DA-0000560-TNAI-080	Advanced Range Data Systems (ARDS) TENA Gateway	The ARDS TENA Gateway performs all of the functions necessary to subscribe to ARDS Host Range Interface Protocol (HRIP) data, translate them to the TENA Object Model, and publish them on the TENA network.		•					•	•				•		•	GD

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DA-0000560-MIXI-082	Advanced Simulation Combat Operations Trainer (ASCOT)	ASCOT is a real-time interactive simulation tool that easily manages the entire battlespace from single ship Close Air Support (CAS) missions to multi-axis, multi-ship Special Operations. Multiple systems can be networked together at a single site, or at multiple sites around the world for dynamic large-scale joint and coalition exercises. ASCOT is fielded as a major component of the USAF's Distributed Mission Operations (DMO) simulation-based training program. ASCOT integrates with other simulation platforms through DIS or HLA. It is a major component of the DMO Airborne Warning and Control System (AWACS) Mission Training Center (MTC) integrating with virtual F-15 and F-16 cockpits across the network. Live Aircraft Control allows real-time integration of live aircraft platforms into the simulation platform		•					•	•		•	•			•	ML
CA-0200000-MIXG-003	ATOXGEN (Air Tasking Order Exercise Generator)	ATOXGEN enables scenario developers to create large scale exercises from Theater Battle Management Core System (TBMCS) generated air tasking orders (ATOs) and air control order (ACOs). Conversion is quick, a matter of seconds for a 2,400 sortie ATO, and flight paths are realistic - following airspace constraints defined in the ACO. After conversion, the resulting file can be immediately flown in the ASCOT, or reviewed in the Scenario Creation Tool to add or merge other training events.		•		•						•	•			•	ML

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CA-0200000-MIXG-004	ASCOT (PLEXSYS) Scenario Creation Tool (SCT)	The Scenario Creation Tool (SCT) provides the ability to create large scale HLA and DIS compliant wargaming scenarios. With two separate windows, one for command entry and editing, and a second for viewing immediate playback, the SCT is easy to use. All types of entities, ranging from ships and submarines to tanks and SAM sites, as well as aircraft can be readily created and maneuvered. All commands for each entity are fully described and listed in time order. As entities are created, they can be viewed in "Fast Motion" so the entire command path can be viewed in a matter of seconds or minutes. Small scenarios can also be merged with others to create larger or more complex scenarios.		•		•						•	•			•	ML
EA-0000567-MIXV-015	ASCOT Map	ASCOT Map is configurable in real-time. Operators can select and apply backgrounds, map overlays and entity features as needed in response to the virtual battlespace situation. Utilize Compressed ARC Digitized Raster Graphics (CADRG) Maps for real-world visual references within any theater. Terrain images from aerial photography, satellites, or a specific image or graphic can also be used as the Map background. Load and display any number or combination of Digital Aeronautical Flight Information File (DAFIF) data map layers, VMap data, exercise specific map overlays or map layers dynamically created. Operators can activate an entity's 3D visual display of detection and engagement cones. ASCOT will automatically display engagement lines and weapons fly-out.		•					•	•	•	•	•			•	ML

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CD-0004560-OTHG-001	Automated Scriptor Simulator Exercise Trainer (ASSET)	ASSET enables users to specify the activity of exercise military forces, either by graphically scripting the activity or interfacing with a system that provides computer generated or simulated forces. ASSET simulates collector activity and generates appropriate intelligence events and transforms these intelligence events into messages based on one of several different protocols (e.g. Tactical Electronic Intelligence (TACELINT), Sensor Report (SENSOREP), TABULAR-37, Over-the-Horizon (OTH) Gold, etc.).The application injects chronological scripted messages directly into tactical data processors (TDPs) or through various Intelligence Broadcast Systems (IBS) broadcasts.		•				•	•	•						•	GD
CD-0004560-OTHG-002	ASCOT Background Traffic Generator	Background Traffic Generator is a new capability within ASCOT. Background Traffic Generator immediately populates the virtual environment with up to 100,000 entities. Cars automatically follow roads, and aircraft automatically follow air routes. Background Traffic Generator allows trainers to enhance training with realistic background traffic.		•				•	•	•		•	•			•	ML
DA-0000560-MIXI-084	C3 Driver	C3 Driver is an integrated collection of Army Test and Evaluation Command (ATEC) tools in a single box that provides end-to-end, system-of- systems event/exercise planning, monitoring, execution and control.		•					•	•			•	•		•	GD

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FA-0000567-MIXA-025	Combined Air Operations Center (CAOC) Performance Assessment System (CPAS)	CPAS provides multi-data source and multi-instance per data source C2 analysis and monitoring capability for collaborative C2 processes in Air Operations Center and tactical datalink environments. CPAS provides correlation and associated multi-source data analysis and activity history data archiving for C2 mission execution tools [Joint Automated Deep Operations Coordination System (JADOCS)], multiple chat collaboration tools, selected Link 16 C2 messages and some surveillance/track messages, multiple source digitized audio, and C2 center workstation screen captures. Part of JFCOM Joint After Action Review tool.							•	•	•	•				•	ML
FA-0000560-HLAA-026	Joint Forces Command (JFCOM) Decision Support Tool (DST) Data Collector	The DC is a RTI federate that can be easily configured to receive as little, or as much, of the RTI FOM data as is desired. It is a non-regulating federate, which means it does not prevent the rest of the federation from advancing time. Additionally, it is a "listen only" federate, as it only receives data and does not publish data.		•					•	•	•		•				GD
FB-0000067-HLAA-004	JFCOM Decision Support Tool Data Analyzer	The Data Analyzer uses the data from the Oracle database (stored by the DC) to present to the user the state data (FOM attributes) of the simulation objects in the game. The state of these objects can be queried and displayed at a user specified point in the federation, and may consist of either current state or historical state.		•						•	•		•				GD

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FB-0000007-HLAA-005	JFCOM Decision Support Tool) Playback Review	The Playback Review uses the data stored in the database to present the user with a graphical display of the simulation data. This component uses the same data from the Oracle database as the data analyzer, but displays the objects (that have location fields) using standard joint symbol icons defined in the MIL-STD 2525B specification.		•							•		•				GD
DA-0000560-TNAI-085	Execution Manager GUI (EMgui)	Emgui is a cross platform script that uses multi threading and pipes to run the TENA Network Naming Service (NNS) and Execution Manager (EM) and exchanges information with the running processes.		•					•	•				•			GD
DA-0000560-HLAS-086	FedControl	The FedControl federate provides simulation planning, execution, and performance monitoring capability with features that permit optimization of High Level Architecture federations. It includes a topological visualization interface and provides alerts when network statistics vary from user-defined thresholds, assisting in diagnosing federation runtime problems. FedControl also synchronizes federates and provides time control for the federation.		•					•	•			•				GD
HA-1234567-OTHI-001	Flawfinder	Flawfinder examines source code and reports possible security weaknesses (``flaws'') sorted by risk level. This tool is used to quickly find and remove potential security problems before a program is widely released to the public.		•	•	•	•	•	•	•	•					•	CF

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BA-0004000-OTHG-030	Geospatial Intelligence Data Management (GIDM) system	The GIDMsystem is being developed to allow data sharing between multiple geospatial data users. GIDM's primary benefit is the storage and distribution of credible geospatial data, resulting in generation of fewer redundant databases. GIDM demonstrates the utility of advanced Storage Area Network (SAN) technology to ingest, process, and share standardized common interchange formatted geospatial information to simulations and operational cells. The GIDM system consists of workstations running two custom GIDS applications, Librarian and Project Q. These applications are necessary for manipulation and storage of geospatial data that is intended to be loaded on and shared between nodes in the GIDM enterprise. Data loading, Hash-ID (a configuration management file marker), and data management are performed by the Librarian desktop application. Screening of geospatial data through quality assurance/quality control (QA/QC) is performed by the Project Q application. Third party software, including Arc Geographic Information Systems (ArcGIS), Geospatial Analysis and Integrity Tool (GAIT), and SEE-IT, can be utilized for further screening, via scripts, to complete the verification and validation of data.		•				•								•	ML

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DB-0000560-TNAX-014	Interface Verification Tool	A Windows command-line application that performs several interface testing functions and also some monitoring, logging, and statistics gathering functions.		•					•	•		•		•			CF
DC-0000560-TNAI-001	Joint Mission Environment Test Capability (JMETC) LiveCD (Prototype)	A live CD is a CD containing a bootable computer operating system. Live CDs are unique in that they have the ability to run a complete, modern operating system on a computer lacking mutable secondary storage, such as a hard disk drive. The term "live" derives from the fact that these CDs each contain a complete, functioning and operational operating system on the distribution medium. This is a developmental tool intended to provide a rapidly deployed testing capability which does not affect its host machine. The LiveCD is password enabled to prevent accidental use if left in a CD-ROM drive. Additionally, a customized DoD warning banner provides the standard DoD warning text along with indications that the system is hosting the LiveCD. To further ensure appropriate use, the network interface is not enabled until it has been explicitly configured for the environment in which it is intended to be operated from.		•					•	•				•			GD

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FA-0000567-TNAD-027	Joint National Training Capability (JNTC) LROM Results	Records Test and Training Enabling Architecture objects and messages to a MySQL database. Provides a front-end viewer that allows for user interaction, wherein an operator uses a command line interface to interact with JNTC Logical Range Object Model (LROM) Playback. 8075Results and Playback are TENA logger and playback programs. JNTC LROM Results records TENA objects and messages to a MySQL database. The Results tool has a front-end viewer that allows for user interaction.		•					•	•	•			•			GD
FB-0000007-TNAA-006	JNTC LROM Playback	JNTC LROM Playback is a TENA playback programs. The Playback tool plays recorded TENA objects and messages back to the TENA Middleware, wherein an operator uses a command line interface to interact with Playback.		•							•			•			GD
FA-0000567-MIXD-028	Joint Data Archival System (JDAS)	The JDAS is a suite of servers used to log and archive live instrumentation and range data. Derived from the Army's Digital Collection, Analysis, and Review System (DCARS), JDAS can collect DIS, HLA, TENA instrumentation data, and JVMF messaging data to create a common event archive for post-event analysis and data recovery.		•					•	•	•	•	•	•		•	GD

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FA-0000567-MIXD-029	Joint Digital Collection, Analysis, and Review System (JDCARS)	The JDCARS collects data from local and distributed networks and stores this data in relational databases for real-time viewing, analysis, preparation of AAR products, and archiving. The objective data includes tactical messages and other digital message traffic, simulation objects and interactions. Tactical message collection includes JVMF and United States Message Text Format (USMTF). Supported simulation architectures include DIS, HLA OneSAF, and TENA.		•					•	•	•	•	•	•		•	GD
FA-0000567-MIXD-030	Joint Interoperability Modular Evaluation System (JIMES)	Tactical, planning, and simulation protocol monitoring and analysis system. JIMES monitors exercise activity, providing a real time picture of the exercise, and stores data for post exercise analysis. JIMES uses Windows XP platforms developed with object-oriented tools to provide a flexible, scalable system. JIMES's modular components can be configured on a laptop for a single analyst or on a room full of systems supporting multiple analysts. JIMES can support multiple independent network data feeds, and both real-time and playback capabilities simultaneously. JIMES contains a suite of utilities, which provide both real time and posttest analysis capabilities. These tools include generation of message listings based on user selectable message filters, Link 16 "Kill Thread" reports, automated Minimum Implementation (MIN IMP) analysis, multiple source message comparison and rule based analysis based on analyst defined rules.		•					•	•	•	•	•	•		•	GD

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DA-0000560-DISX-093	Joint Mission Preparation, Rehearsal, and Operation (JMPRO)	Joint Mission Preparation, Rehearsal, and Operation (JMPRO) consists of a software application package that provides a digital representation of the operational terrain, real world intelligence gathering, and a fusion capability to provide an operational picture and support Joint or Service-specific training and mission rehearsal. JMPRO can interface with live, virtual and constructive entities using DIS protocol, LANs and WANs using Transmission Control Protocol/Internet Protocol (TCP/IP).		•					•	•		•				•	GD
FA-0000567-MIXD-031	Joint Windows Warfare Assessment Module (JWinWAM)	JWinWAM is a government-owned, PC-based, AARtool capable of exercise monitoring, data and audio logging, and post-event replay. JWinWAM is also capable of accepting and displaying real-time and near real-time input from simulation links via a DIS interface, and TENA compatible systems.		•					•	•	•	•		•			GD
AC-0204000-HLAP-004	Kabic Assimilated into TENA (Kantena)	An application to take native kabic data and output a Tena Object Model		•		•		•						•			GD
DB-0000560-TNAS-015	LREstatPlot	LREstatPlot is a TENA application that subscribes to the standard Stateful Distributed Objects (SDOs)/messages and provides visualization for the volume of traffic for SDO and messages types over a specified period of time.		•					•	•				•			CL
DB-0000560-MIXS-016	Net-centric Evaluation Services Toolkit	Tactical, planning, and simulation protocol monitoring and analysis system		•					•	•		•	•				GD

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DB-0000560-OTHS-017	nuttcp	nuttcp is a network performance measurement tool intended for use by network and system managers. Its most basic usage is to determine the raw TCP (or UDP) network layer throughput by transferring memory buffers from a source system across an interconnecting network to a destination system, either transferring data for a specified time interval, or alternatively transferring a specified number of bytes. In addition to reporting the achieved network throughput in Mbps, nuttcp also provides additional useful information related to the data transfer such as user, system, and wall-clock time, transmitter and receiver CPU utilization, and loss percentage (for UDP transfers). nuttcp is a freely available TCP/UDP network connectivity & throughput test tool.		•					•	•						•	GA
DB-0000560-OTHS-018	One-way Active Measurement Protocol (one-way ping) (OWAMP)	OWAMP is a command line client application and a policy daemon used to determine one-way latencies between hosts.		•					•	•						•	CF
DA-0000560-TNAI-096	Operational Dashboard (OpsDash)	The Pacific Region Interoperability Test & Evaluation Capability (PRITEC) OpsDash is a collaboration framework designed to host a collection of web-based tools and facilitate communications before, during, and after an operation/event. The OpsDash resides on the JMETC network for global connectivity in a Joint Forces context. The centralized display framework of the OpsDash supports the DoD emphasis on Service Oriented Architectures. Operational Dashboard is a Mission/Event Situational Awareness Display		•					•	•				•		•	GD

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DB-0000560-OTHS-019	Orion Network Configuration Manager	The Orion Network Configuration Manager provides network configuration and change management. Can be used standalone or can be integrated with Orion Network Performance Monitor (NPM) to provide a view into network health.		•					•	•						•	CL
DB-0000560-OTHS-020	Peakflow X Web	Peakflow X continually collects detailed host-to-host traffic data. The Web Reports page allows users to generate reports from this traffic data to help monitor how the JMETC VPN is being used. You can either create one-time reports, templates to use multiple times, or reports that run at specifically scheduled times. Users can create and view reports, but they can only delete reports that they create.		•					•	•						•	CL
FB-0000007-MIXA-007	Personal Computer Debriefing System (PCDS)	The PCDS is a live range data display and analysis tool that was originally developed to provide individual pilots at their home bases with the capability to review missions flown on the training ranges. It displays tracks from multiple live data formats such as DIS, TENA, HRIP, and Computational & Control Subsystem (CCS).		•							•	•		•			GD

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DA-0000560-TNAX-097	TENA Player ID Server	The TENA Player ID Server has three purposes. First, the server is responsible for tracking TENA::Platform IDs that have been published. A TENA::Platform ID is the TENA::UniqueID identifier for each platform. Second, the server is responsible for assigning Player IDs to requesting publishers. A Player ID is a TENA::UniqueID and can be used as a TENA::Platform ID. A requesting publisher is an application that needs a TENA::Platform ID and metadata to publish a TENA::Platform. Finally, the server is responsible for providing simulation or identity metadata to requesting publishers.		•					•	•				•			GD
FB-0000007-MIXA-007	Plot-XY	Plot-XY is an OpenGL application created to graph two-dimensional sets of TSPI, and any real, integer or Boolean value history data. Uses the SIMDIS API.		•							•			•			GD
EA-0000567-TNAV-016	RangeView	RangeView displays data in real time and processes many range data formats . RangeView overlays live entities on a geographical map, and provides the user with a variety of ways to view them, including zooming, panning, and data querying		•					•	•	•					•	GD
DA-0000560-TNAI-099	RangeView /RangeView Integrated TENA plug-in (RVIT)	The RangeView Integrated TENA (RVIT) plug-in allows it to display the objects/messages published by TENA applications. TENA objects typically represent live entities.		•					•	•				•			GD
FA-0000567-TNAD-032	Reflect	Reflect is a suite of tools for TENA that can log and playback data from one or multiple LROMS.		•					•	•	•			•			GD

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HA-1234567-OTHI-002	Rough Auditing Tool for Security (RATS)	RATS is a tool for scanning C, C++, Perl, PHP and Python source code and flagging common security related programming errors such as buffer overflows and Time Of Check, Time Of Use (TOCTOU) race conditions.		•	•	•	•	•	•	•	•					•	CF
DB-0000560-OTHS-021	Secure Defense Research & Engineering Network (SDREN) Active Measurement Program (SAMP)	SAMP systems perform scheduled network testing, data aggregation, and reporting		•					•	•						•	GD
EA-0000567-TNAV-017	SIMDIS 3D Visualization and Analysis Tool	SIMDIS™ is a product of the United States Naval Research Lab (NRL), a corporate research laboratory for the Navy and Marine Corps. SIMDIS™ is a set of software tools that provide two-and three-dimensional (2-D and 3-D, respectively) interactive graphical and video display of live and post-processed simulation, test and operational data. SIMDIS provides a 3D display of normally seen data such as platform position and orientation as well as the unseen data such as the interactions of sensor systems and targets, counter measures and the environment. SIMDIS provides tools for interactively analyzing data using custom tools for displaying equipment modes, spatial grids, ranges, angles and antennae patterns. SIMDIS provides the capability to view time synchronized 2D and 3D data on a single standalone workstation or across multiple networked platforms.		•					•	•	•			•			GD

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DB-0000560-HLAS-022	Simulation Interoperability Test Harness (SITH)	The SITH is a development, diagnostic, and monitoring tool used to assist in the development, integration, and testing of HLA federations. The SITH is used extensively by the Joint Development Integration Facility (JDIF) to provide simulation engineering expertise to numerous programs for federation development, integration, and event execution.		•					•	•			•				GD
DA-0000560-MIXX-101	StarShip/Starship II	Starship/Starship II is a test infrastructure planning, verification, monitoring and control application. Starship II is an advanced software application that provides test Command and Control for distributed test or exercise environments. Starship II and its companion application StarGen are designed to facilitate and automate the C2 functions of test planning, test execution, and test status reporting. Together they enable a test director to verify a test lay down, configure test instruments, initialize a test sequence, synchronize test events, monitor status, and provide a means to control test resources.		•					•	•			•	•			GD
CB-0004000-TNAG-009	Static Target Generator (STG)	STG is a tool for publishing non-moving range targets on the JTEN.		•				•						•			GD
DA-0000560-TNAI-103	TENA- Air Combat Maneuvering Instrumentation (ACMI)	TENA-ACMI provides connectivity between a TENA-9C2 component communicating via TENA and a legacy CCS for the purpose of controlling UMTEs		•					•	•				•			GD

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DB-0000560-TNAS-023	TENA Monitoring Tool (TMT)	TMT collects and analyzes data; this tool Provides TENA subscribers that perform data collection for analysis. Detects time between updates, missed publications, erroneous data, duplicate SDO's based on unique identifiers and internal SDO Id's. Writes data to database and/or XML file. Will convert XML files into database. Also performs Position coordinate conversions between coordinate systems for display. Scans ORBDebug dump file for MTU size over threshold amount		•					•	•				•			GD
DB-0000560-TNAS-024	TENA Protocol Dissector (TPD)	TPD is a Wireshark plug-in capable of capturing the TENA protocol packets on a network and interpreting the wire format of the packets into a human-readable form for display within the Wireshark application. The current version of TPD will support the TENA Beta.4-6.0 version of the Platform Object Model		•					•	•				•			GD
DB-0000560-OTHS-025	Wireshark	Wireshark is a network packet analyzer. A network packet analyzer will try to capture network packets and tries to display that packet data as detailed as possible		•					•	•						•	CF
DA-0000560-TNAS-107	TENA Video Distribution System (TVDS)	TVDS is a suite of tools used for streaming video, publishing data about streams on TENA, and controlling those streams using TENA. The suite currently consists of the TENA Video Distribution Server and the TENA Video Distribution Client (TVDC).		•					•	•				•			GD

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DA-0000560-HLAS-108	Theater Battle Management Core System (TBMCS) Adapter	The TBMCSAdapter is a java based, HLA compliant software product written to serve as an intermediate between an HLA Federation using the Joint Multi-Resolution Model (JMRM), FOM, and the TBMCS suite of systems.		•					•	•			•				GD
DA-0000560-OTHX-109	TransVerse	TransVerse is an open source government developed XMPP chat client that is used by the DOD and IC.		•					•	•						•	GD
EA-0000567-MIXV-018	Time Space Position Information (TSPI) Interactive Entity Reformatter (TIER)	TSPITIER is a geographical information system designed to send and receive various range and simulation protocols, acting as both a gateway and a situational display. TIER can be utilized as a TENA testing tool as it has the capability to internally generate TENA entities.		•					•	•	•	•	•	•		•	GD
DA-0000560-MIXI-110	United States Marine Corps (USMC) Tactical Environment Network (TEN)	The TEN is a non-proprietary government-owned and controlled software product that is the USMC standard tactical environment for its aircrew training devices. The TEN provides a simulation environment that includes airborne threats, land-based threats, sea-based threats, electronic warfare, countermeasures, own platform weapons, and the effects of terrain and weather for man-in-the-loop tactical training		•					•	•		•	•				GD

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DB-0000560-OTHS-026	WhatsUp Gold (WUG)	WUG provides network management and application monitoring for networks that installs, discovers and maps network connected assets. It enables predictive monitoring in combination with alerting/notification capabilities to keep network and application infrastructures running in real-time and when issues arise.		•					•	•						•	CL
DA-0000560-TNAI-111	Wrapped Innate JTIDS into TENA (WIJIT)	WIJIT is an application to take native Joint Tactical Information Distribution System (JTIDS) messages and output a Tena Object Model		•					•	•				•			GD
DA-0000560-TNAX-112	Application Management Object (AMO) Monitor	AMO Monitor is used to monitor Gateway Builder generated AMOs .		•					•	•				•			GD
DA-0000560-MIXI-114	Authentication via TENA	The Authentication via TENA implementation is based on public key cryptography (PKC). This is the technique of using digital signatures to sign and verify. The requester uses his private key to create a digital signature. The granter verifies signatures based on public keys of the authorized users. The implementation follows the RSA PKCS1v15 standard.		•					•	•				•			GD
DA-0000560-MIXI-115	TENA Authentication Key Generator	The TENA Authentication Key Generator is a cross-platform GUI application for generating public and private key files compliant with the RSA[5] PKCS1v15 standard. To use the tool, download the zip file below. The system must have Python, QT, and PyQT installed		•					•	•				•			ML
AC-0204000-TNAP-005	MagicDraw Plugin TDL Generator	The TDL generator is a plugin which uses the MagicDraw API to convert the UML model into a Java representation. This Java representation is used as a data model for a FreeMarker template. to generate TDL files.		•		•		•						•			ML

5. RSA, which stands for Rivest, Shamir, and Adleman, is an algorithm for public-key cryptography.

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DA-0000560-TNAI-116	TDL2MATLAB	The TDL2MATLAB program takes a standard TENA, TDL-built source code library implementation and changes it to provide Matlab support for the implemented object model while concurrently generating the source code for the required Matlab MEX shared library.		•					•	•				•			CF
DB-0000560-TNAS-027	TENA Network Analysis Tool (T-NAT)	T-NAT is application designed to simulate and capture realistic TENA event traffic for report generation. It publishes and subscribes to TENA Platforms; evokes AMO remote methods; produces real-time statistics of application status through the TENA AMO; logs snapshots of discoveries, state changes, and destructions in a standard format for precompiled reports and queries after the test.		•					•	•				•			GD
DA-0000560-TNAX-117	TENA Remote EXecutables (T-REX)	The T-REX application can be used to remotely control other TENA applications from a central station		•					•	•				•			GD
BA-0004000-OTHG-031	Environment Creation Tool (ECT)	ECT features a WYSIWYG interface for creating, modifying, and verifying visual databases. ECT accomplishes this by running the real-time system as an embedded application, layering editing functions on top. This tool complements the functionality of visual simulation systems that page source data (DEMs for terrain, vector data for terrain features, and OpenFlight models for features and vehicles) directly and delays combining them until render time. ECT is able to perform editing functions on source data rather than rendered polygons. Users are able to view, edit, review, and save each component of their simulation scene.		•				•								•	CL

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BA-0004000-OTHG-032	Feature Manipulation Engineer (FME) Desktop	FME Desktop is a spatial database (client-side) toolset used to quickly extract, translate, transform, integrate and load GIS data.		•				•								•	CL
BA-0004000-OTHG-033	Feature Manipulation Engineer Server	FME Server is a scalable spatial database platform that offers flexible spatial data distribution, extraction, translation and loading services to help organizations quickly meet diverse data access requirements.		•				•								•	CL
EA-0000567-OTHV-019	Geoweb 3D Desktop	Geoweb3d Desktop creates 3D scenes from source data by loading GIS datasets from various file formats and rendering them as thematic overlays, 3D models, and light points that illuminate surrounding terrain and objects. High-resolution imagery and terrain can be loaded to visualize and navigate freely through landscapes and urban settings. The users can group and select layered GIS data for visualization and analysis. ArcGIS format maps and geodatabases can be rendered directly. This tools supports an embedded geoenabled browser, access to a variety of web mapping sites, discover data, and other location-based information.		•					•	•	•					•	CL
EA-0000567-OTHV-020	Geoweb 3D View	Freeware viewer distributed with Geoweb 3D Desktop that can be redistributed to third parties		•					•	•	•					•	ML
EA-0000567-OTHV-021	LightInt	3D Visualization Tool used to traverse 3D visualization databases created with the Aegis feature data, extraction, 3d object and terrain modeling tools. Lightint viewer is licensed with purchase of a database build, and can be used to visualize other terrain databases built in the same environment.		•					•	•	•					•	ML

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AA-1200000-MIXP-006	MATREX Integrated Development Environment Systems Engineering Tools	The MATREX IDE is a content management system that provides a collaborative program management environment including various views into the MATREX system design. The core building blocks of the design and how it accomplishes the functionality are requirements functions, modeling design decisions, components and architectural strategies. It captures and stores the functional design and interface agreements dictated in the System Design Description (SDD) as well as providing a software configuration management repository for MATREX software integration and distribution.		•	•	•										•	GD
DA-0000560-OTHI-119	Integrated Range Status System (IRSS)	IRSS Provides an integrated situational awareness system comprised of a range management component, an air position location component for commercial and military aircraft, and a ground position location component, all of which are used in combination to control range assets. This system is a console in the Range Control room, generally with an Air, Ground and Supervisor seat with large flat panel screens on the wall which show any of the screens the operator wishes to view there.		•					•	•						•	GD

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FA-0000567-OTHD-033	Tactical Video Capture System (TVCS)	TVCS provides Real-Time Visualization, Situation Awareness, and After Action Review capabilities. The TVCS will support these capabilities by using a video-stitching process which combines raw/captured video from multiple cameras into a single wide-panoramic view. The panoramic view is used in real-time to observe Marine's Urban Warfare tactics and for later use during group and individual AAR evaluation sessions. The TVCS AAR will also allow for insertion of text, graphics, 3D views, and audio.		•					•	•	•					•	GD
FA-0000567-OTHD-034	Tactical Audio Capture System (TACS)	TACS provides the capability to transmit, receive, record, and playback tactical radio voice communication in support of live training exercises at Marine Air Ground Task Force Training Command (MAGTFTC) in 29 Palms, CA. This capability provides on-demand connectivity from the existing Range Modernization and Transformation (RM/T) Range Instrumentation System to the Joint Training and Experimentation Network (JTEN) to deliver 16 tactical channels to JTEN subscribers, as well as connectivity through virtual radios in support LV interoperability exercises.		•					•	•	•					•	GD
BA-0004000-OTHG-034	TerraTools™	TerraTools™ is a simulation database construction system for automated and rapid generation of high-fidelity 3D simulation databases from cartographic source materials. This tool supports heterogeneous data import, rapid and incremental database construction, geometry, feature attribution, paging support, and detailed diagnostics in a stand-alone package.		•				•								•	CL

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EA-0004567-OTHV-022	TSGFly ™	TSGFly is an advanced 3D viewer for Tiled Scene Graph (TSG) databases. The TSGFly viewer provides a real-time viewing environment for inspecting and demonstrating visualizations created in TerraTools.		•				•	•	•	•					•	CL
BA-0004000-OTHG-035	DEMTools™	DEMTools from TerraSim® is a DEM management tool enabling rapid and accurate fusion of multiple DEMs from a variety of sources that cover an area of interest, producing a single composite DEM. DEMTools gives you complete control over DEM extent, post spacing, and the coordinate system of the composite DEM. This product is available as an extension to all versions of the ESRI ArcGIS Desktop (ArcView®, ArcEditor®, ArcInfo®) family.		•				•								•	CL
BA-0004000-OTHG-036	RoadMAP™	RoadMAP from TerraSim® is a powerful road network extraction system utilizing advanced image understanding technology to automate the linear feature extraction process. Based upon cutting-edge research in image processing, photo-interpretation, and computer vision, RoadMAP seamlessly combines automated, semi-automated, and manual methods for detecting, delineating, and attributing road networks and other linear features.		•				•								•	CL

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DA-0000560-OTHI-120	Test Talk	Test Talk is an interactive test event management and control tool. Distributed test event or simulation conductors use this set of tools for managing time, human driven events, and data entry. The tools offer a synchronized environment, paperless test procedures, shared operator and conductor comments in real time, monitoring of test progress, and collect and report performance, anomaly and survey data. TestTalk provides an interactive means to both electronically distribute and display, time-ordered event lists to be used before, during, and after test events. These event lists are step-by-step 'to do' lists for each operator. As an item on the event list is completed, all participants are sent messages stating the progress of the test. No matter where the test participants are physically located, this system allows each operator to execute their listed events.		•					•	•					•	GD
DD-0000560-OTHI-001	Test Talk Chat Client	The Test Talk Chat Client allows users to send messages to each other, and display the messages of other operators to keep all test participants on the same step of the test event and aware of the next action to be executed to maximize coordination during test execution.		•					•	•						•	GD
AE-0030000-OTHI-001	ORION Electro-Magnetic Engineering Workbench (EMEW)	EMEW models to the performance of RF networks on live test ranges, It uses a Terrain Integrated Rough Earth Model (TIREM)-based model to model link profiles and link reliability, for dynamic radio networks; EMEW calculates path loss and received signal level based on raster and vector format GIS data.		•			•										GD

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AC-0204000-TNAP-006	MagicDraw	MagicDraw is a business process, architecture, software and system modeling tool designed for Business Analysts, Software Analysts, Programmers, QA Engineers, and Documentation Writers, this dynamic and versatile development tool facilitates analysis and design of Object Oriented systems and databases. It provides a code engineering mechanism (with full round-trip support for Java, C++, C#, CL (MSIL) and CORBA IDL programming languages), as well as database schema modeling, DDL generation and reverse engineering facilities.		•		•		•						•			CL
AE-0030000-OTHP-002	Shunra Virtual Enterprise (VE) Cloud	VE Cloud is a network simulation software solution designed to replicate a point-to-point network link in a local lab or test bed. Shunra's network simulator enables the user to test, compare and predict the performance of applications over a WAN link under latency, packet loss, jitter, and bandwidth constraints.		•			•									•	CL
AF-0030000-OTHP-001	Shunra Virtual Enterprise Suite	VE Suite measures and predicts application performance in conjunction with a network emulator. The Shunra VE Suite Console provides insight into application performance by creating a virtual network environment in prior to deployment. It tests the performance of applications and network equipment under a wide variety of network impairments to assess the impact that the network and applications have on each other's performance and on remote end-users' experiences, and uncover and resolve production related problems.		•			•									•	CL

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DB-0000560-OTHS-028	VE Network Catcher	VE Network Catcher is a highly flexible agent-less network monitor that lets you simply and quickly record, import and replay production network conditions such as latency, packet loss and route changes. Using VE Network Catcher, interval statistics are automated and pulled into Shunra's VE Suite or VE Desktop for the most accurate WAN emulation results.		•			•									•	CL
AE-0030000-OTHP-0013	IT Guru ™	IT Guru Network Planner performs "what if" analysis to manage risk and cost associated with network growth and change—accelerating application deployments and migration to new technologies, such as VoIP, VPNs, IPv6, and more. IT Guru Network Planner's predictive design environment trends traffic growth for capacity planning, optimizes network designs to reduce the risk of downtime, and proposes QoS configurations to achieve desired network and application performance.		•			•									•	CL
HA-1234567-OTHI-003	IT Sentinel™	IT Sentinel is a software appliance for ensuring network integrity, security, and policy-compliance. It performs systematic configuration audits, analyzing an up-to date model of the production network to diagnose device misconfigurations, policy violations, inefficiencies, and security gaps. IT Sentinel enables organizations to reduce network outages, ensure network security, verify regulatory and policy compliance, and enhance staff productivity.		•	•	•	•	•	•	•	•					•	CL

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DB-0000560-OTHS-029	nCompass™	OPNET nCompass provides a unified, graphical visualization of large, heterogeneous production networks, including devices, their interconnectivity, traffic, and status. OPNET nCompass for Enterprises unifies data from a wide range of network management tools, providing consolidated views for more intuitive and productive navigation and analysis. Its geographical network dashboard is dynamically updated with real-time operational information. Third-party tools and programmed scripts can be launched from its console for deeper drill-down and assisted troubleshooting.		•					•	•						•	CL
AE-0030000-OTHI-004	NetRule	NetRule offers ability to obtain latency predictions in addition to utilization predictions. The network modeler can obtain predictions in network delay and in server and user delays. NetRule's multi-tier job structure provides round-trip times for complex transactions involving one or more servers. Additionally, using NetRule, a modeler can identify how to best make network changes in compliance to Service Level Agreements (SLAs), Check 21 regulations, and other performance and cost requirements.		•			•									•	CL
HA-0234000-OTHA-004	WinAD™	WinAD™ uses verification reports to check consistency between class diagrams and project dictionary. Supports data modeling.		•		•	•	•								•	CL

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HA-0004560-OTHA-005	LoadRunner™	LoadRunner ™ allows the user to measure end-to-end performance, diagnose application and system bottlenecks and tune for better performance from a single point of control. This tool includes integrated load test, performance test and application stress test features.		•				•	•	•	•					•	CL
HA-0234507-OTHA-006	PV-WAVE™	PV-WAVE™ is an array oriented fourth-generation programming language used by engineers, scientists, researchers, business analysts and software developers to build and deploy Visual Data Analysis applications. These applications let users manipulate and visualize complex or extremely large technical datasets to detect and display patterns, trends, anomalies and other vital information.		•		•	•	•	•		•					•	CL
HA-1234567-OTHA-007	DoD VV&A Documentation Tool (DVDT)	The DVDT automates the production of VV&A documents using a familiar interface (Microsoft Office Word © 2008 Microsoft Corporation). The tool provides a set of four (.doc) files representing each of the four VV&A documents pre-loaded with the associated sections outlined in MIL-STD-3022 Appendices A-D. These files are tailored to associated VV&A XML data files (.xml) also provided, which provide a convenient means of sharing information about VV&A documents for discovery via the Global Information Grid (GIG) Enterprise.		•	•	•	•	•	•	•	•					•	GD

LVC DEVELOPMENT TOOLS USAGE TABLES: REFERENCES

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APPENDIX C: ABBREVIATIONS AND ACRONYMS

2D	Two Dimension
3D	Three Dimension
AAC	Alarm and Alerts Component
AAR	After Action Review
ACMI	Air Combat Maneuvering Instrumentation
ACO	Air Control Order
ADRM	Asset Database Resource Manager
AI	Artificial Intelligence
a.k.a	also known as
AMO	Application Management Object
API	Application Programming Interface
ArcGIS	Arc Geographic Information Systems
ARDS	Advanced Range Data Systems
ASCOT	Advanced Simulation Combat Operations Trainer
ASSET	Automated Scriptor Simulator Exercise Trainer
ATEC	Army Test and Evaluation Command
ATO	Air Tasking Order
ATOXGEN	Air Tasking Order Exercise Generator
AWACS	Airborne Warning and Control System
BED	Battlefield Effect Devices
BOM	Base Object Model
C2	Command and Control
C4I	Command, Control, Communication, Computer Systems, and Intelligence
CAE	Canadian Aviation Electronics
CADRG	Compressed ARC Digitized Raster Graphics
CAFDE	Computer Aided Federation Development Environment
CAOC	Combined Air Operations Center
CAS	Close Air Support
CAST	Close Air Support Mission Editor Tool
CCS	Computational & Control Subsystem
CDB	Compact Database
CGF	Computer Generated Forces
CJMTK	Commercial Joint Mapping Toolkit
COI	Community of Interest
CORBA	Common Object Request Broker Architecture
COTS	Commercial-Off-the-Shelf
CPAS	CAOC Performance Assessment System
CPU	Central Processing Unit
CTC	Combat Training Center

CTDB	Compact Terrain Database
CTIA	Common Training Instrumentation Architecture
CTS	Creator Terrain Studio
DAFIF	Digital Aeronautical Flight Information File
DART	Database Automated Re-use Technology
DB	Database
DCARS	Digital Collection, Analysis, and Review System
DCP	Data Collection Plan
DEM	Digital Elevation Model
DIF	Data Interchange Format
DIS	Distributed Interactive Simulation
DISR	Defense Information Technology Standards and Profile Registry
DMO	Distributed Mission Operations
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
DRTS	Digital Range Training Systems
DSEEP	Distributed Simulation Engineering and Execution Process
DST	Decision Support Tool
DTED	Digital Terrain Elevation Data
DTM	Digital Tactical Monitoring
DVDT	DoD VV&A Documentation Tool
DVR	Digital Video Recording
E&S	Evans & Sutherland
ECT	Environment Creation Tool
EDCSS	Environmental Datacube Support System
EGP	Event Generator Processor
EMEW	Electro-Magnetic Engineering Workbench
EMgui	Execution Manager GUI
EPG	Entity Property Grid
ESCADRE	Environnement de simulation en conception orientée objet et ADA pour le developpement et la réutilization des etudes
ESRI	Environmental Systems Research Institute
EXCON	Exercise Controller
FAR	Federation Acquisition Regulations
FBCB2	Force Battle Command, Brigade-and-Below
FEDEP	Federation Development and Execution Process
FEPW	Federation Execution Planner's Workbook
FLIR	Forward Looking Infrared
FME	Feature Manipulation Engineer
FMT	Federation Management Tool
FOM	Federation Object Model
FTE	Full-time Equivalent

GAIT	Geospatial Analysis and Integrity Tool
GC	Gatewary Controller
GDF	Generalized Data Format
GE	Google Earth
GFMI	Global Force Management Initiative
GFMIEDM	GFMI Exchange Data Model
GIDM	Geospatial Intelligence Data Management
GIG	Global Information Grid
GIS	Geographic Information System
GOTS	Government-Off-the-Shelf
GRIB	Gridded Binary
GRIDS	Gridded Raster or Imagery Data to STF
GUI	Graphical User Interface
HLA	High Level Architecture
HRIP	Host Range Interface Protocol
HTML	HyperText Markup Language
ICD	Interface Control Document
ID	Identification
IDE	Integrated Development Environment
IEEE	Institute of Electrical and Electronics Engineers
IG	Image Generator
I/ITSEC	Interservice/Industry Training, Simulation, and Education Conference
IRSS	Integrated Range Status System
ISC	Instrumentation Status and Control
ISO	International Organization for Standardization
JADOCS	Joint Automated Deep Operations Coordination System
JBUS	Joint Bus
JCATS	Joint Conflict and Tactical Simulation
JDAS	Joint Data Archival System
JDCARS	Joint Digital Collection, Analysis, and Review System
JDIF	Joint Development Integration Facility
JFCOM	Joint Forces Command
JIMES	Joint Interoperability Modular Evaluation System
JLVCDT	Joint Live Virtual Constructive Data Tool
JMETC	Joint Mission Environment Test Capability
JMPRO	Joint Mission Preparation, Rehearsal, and Operation
JMRM	Joint Multi-Resolution Model
JNTC	Joint National Training Capability
JSAF	Joint Semi-Automated Forces
JSRG	Joint Rapid Scenario Generation
JTDS	Joint Training Data Services
JTEN	Joint Training and Experimentation Network

JTIDS	Joint Tactical Information Distribution System
JVMF	Joint Variable Message Format
JWinWAM	Joint Windows Warfare Assessment Module (JWinWAM)
Kantena	Kabic Assimilated into TENA
LAN	Local Area Network
LROM	Logical Range Object Model
LT2	Live Training Transformation
LVC	Live-Virtual-Constructive
LVCAR	LVC Architecture Roadmap
M&S	Modeling & Simulation
M&S CO	Modeling & Simulation Coordination Office
MAGTFTC	Marine Air Ground Task Force Training Command
MASC	Modeling, Analysis and Simulation Center
METGM	Meteorological Grid Format
METOC	Meteorological and Oceanographic
MGRS	Military Grid Reference System
MIN IMP	Minimum Implementation
Mini-SMECS	Miniature Networked Spectrum Monitoring and Engineering Control System
ModISE	Modular Interoperable Synthetic Environment
MOM	Management Object Model
MTC	Mission Training Center
MUX	Multi-plexer
NCDS	Net-Centric Data Strategy
NCES	Net-Centric Enterprise Services
NECC	Net-Enabled Combat Capability
NGA DTED	National Geospatial-Intelligence Agency DTED
NNS	Network Naming Service
NPM	Network Performance Monitor
NRL	Naval Research Laboratory
OBS	Order of Battle Services
OCs	Observer/Controllers
OMDT	Object Model Development Tool
OMT	Object Model Template
OO	Object Oriented
OPNET	Optimized Network Engineering Tools
OpsDash	Operational Dashboard
ORT	Observation Recording Tool
OSG	Open Scene Graph
OTF	OneSAF Terrain Format
OTH	Over-the-Horizon
OWAMP	One-way Active Measurement Protocol

PC	Personal Computer
PCDS	Personal Computer Debriefing System
PDT	Participant Definition Tool
PDU	Protocol Data Unit
PKC	Public Key Cryptography
PM	Program Manager
POM	Program Objectives Memorandum
PPBES	Planning, Programming, Budgeting and Execution System
PRITEC	Pacific Region Interoperability Test & Evaluation Capability
PSM	Platform Specific Simulation Model
PU	Player Units
PVD	Plan View Display
QA/QC	Quality Assurance/Quality Control
R&D	Research and Development
RAT	Rough Auditing Tool for Security
RCP	Rolling Combat Power
RF	Radio Frequency
RFI	Request for Information
RM/T	Range Modernization and Transformation
ROC	Range Operations Center
ROI	Return on Investment
RTI	Run-Time Infrastructure
RVIT	RangeView /RangeView Integrated TENA
SA	Situational Awareness
SAF	Semi-Automated Forces
SAM	Surface-to-Air Missile
SAMP	SDREN Active Measurement Program
SAN	Storage Area Network
SbS	Side-by-Side
SCT	Scenario Creation Tool
SDD	System Design Description
SDOs	Stateful Distributed Objects
SDREN	Secure Defense Research & Engineering Network
SEDRIS	Synthetic Environment Data Representation and Interchange Specification
SEE-IT	Synthetic Environment Evaluation - Inspection Tool
SENSOREP	Sensor Report
SGT	Scenario Generation Toolset
SISO	Simulation Interoperability Standards Organization
SITH	Simulation Interoperability Test Harness
SLX	Simulation Language with Extensibility
SMOC	Simulation Middleware Object Classes
SNMP	Simple Network Management Protocol

SOA	Serviced Oriented Architecture
STF	SEDRIS Transmittal Format
STG	Static Target Generator
STM	System Technical Monitoring
STRIVE	Synthetic Tactical Real-time Interactive Virtual Environment
SYSCON	System Control
TACELINT	Tactical Electronic Intelligence
TACS	Tactical Audio Capture System
TAF	Training Analysis and Feedback
TBMCS	Theater Battle Management Core System
TC	Tracking Control
TCO	Tactical Control Officer
TCP/IP	Transmission Control Protocol/Internet Protocol
TCRS	Transmittal Content Requirements Specification
TDP	Tactical Data Processors
TEN	Tactical Environment Network
TENA	Test and Training Enabling Architecture
TEP	Target Event Processor
THP	Take Home Package
TIER	TSPI Interactive Entity Reformatter
TIREM	Terrain Integrated Rough Earth Model
TMT	TENA Monitoring Tool
TNAA	TENA Analysis Tool
T-NAT	TENA Network Analysis Tool
TNS	Tactical Net Selector
TOC2	Training Operations Command and Control
TOCTOU	Time Of Check, Time Of Use
TPD	TENA Protocol Dissector
T-RECCS	Training Range Exercise Command & Control Suite
T-REX	TENA Remote EXecutables
TSG	Tiled Scene Graph
TSPI	Time-Space-Position Information
TVCS	Tactical Video Capture System
TVDC	TENA Video Distribution Client
TVDS	TENA Video Distribution System
UC	Universal Core
UML	Unified Modeling Language
UOB-DAT	Unit Order of Battle Data Access Tool
US	United States
USAF	United States Air Force
USGS	United States Geological Service
USMC	United States Marine Corps
USMTF	Unites States Message Text Format
UTC	Universal Target Controller

V&V	Verification and Validation
VE	Virtual Enterprise
VPF	Vector Product Format
VR	Video Recording
VSS	Video System Suite
VV&A	Verification, Validation, and Accreditation
WAN	Wide Area Network
WIJIT	Wrapped Innate JTIDS into TENA
WSL	Weather Station Lite
WUG	WhatsUp Gold
WYSIWYG	What You See Is What You Get
XTCRS	XML-encoded TCRS

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