The JTEP Takehome Package: An AAR Tool for Distributed Training

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ABSTRACT: *The Joint Training Experimentation Program (JTEP) is a multiphase, multiyear effort to develop a distributed training capability for the California National Guard (CNG) that includes live, virtual, and constructive (LVC) training simulation to support multi-echelon training. The first JTEP demonstration in May 2003 introduced a JTEP After Action Review (AAR) capability. The second JTEP demonstration, a battalion-level exercise conducted in December 2003, expanded that capability to include a distributed AAR linking the different training sites involved in the exercise with observers at two additional sites. The December demonstration linked the Joint Combat and Tactical Simulation (JCATS), a constructive simulation; the Close Combat Tactical Trainer (CCTT), a virtual simulation; the Deployable Force-on-Force Instrumented Range System (DFIRST™), a live instrumented training system; and observers at the Office of the Adjutant General (OTAG)and at Camp San Luis Obispo. Following the second demonstration, the program identified a need for an additional training feedback tool, a "takehome" package. One of the federates in this demonstration, DFIRST, has a takehome feedback capability that enables each user to bring the recorded exercise data home on a CD and play back the exercise using a 2-D map display view of all the maneuvers, interactions, and voice communications that occurred. To maximize the training value of the second demonstration, the JTEP program expanded this capability to incorporate all exercise data from all of the JTEP LVC federates. This package enables all JTEP participants to have this feedback tool; i.e., the participants who used CCTT and JCATS in the LVC demonstration now have a playback-based takehome package that was not previously available. The JTEP takehome package expands the value of LVC training to include an in-house AAR that can be tailored to individual warfare areas of interest and training objectives and can be viewed on a typical user PC.*

This paper describes the JTEP takehome package capabilities, the process of creating no-cost distribution CDs, key technical design issues and their resolution, and future capabilities, including expansion to the use of 3-D visualization.

1. Introduction

1.1 JTEP overview

The Joint Training Experimentation Program (JTEP) is a National Guard Bureau program managed by the California National Guard (CNG) . The Guard currently uses advanced live, virtual, and constructive (LVC) systems[1] to support training, but each system is stand-alone. JTEP was conceived to bring to the Guard the benefits of integrating existing or readily available training environments, and to enable LVC interaction over non-dedicated wide-area networks (WANs).

JTEP will leverage the integration successes of other programs whenever possible, but will also advance the state of the art in system and simulation interoperability as needed to meet Guard training needs. JTEP started with an initial study to determine which candidate systems and integration mechanisms will achieve the greatest training impact. After the initial study, the first demonstration linking live and constructive training systems was conducted in May 2003 [1]. The second demonstration, conducted in December 2003, built on the successes of the first and the results of the initial systems analysis study.

The second demonstration provided a battalion-level training capability for the California National Guard by linking existing LVC training systems [2]. In particular, JTEP linked two live training systems, the Deployable Force-on-Force Instrumented Range System (DFIRST™), which provides instrumentation and engagement simulation for ground vehicles, and the Integrated Global Positioning System (GPS) Radio System (IGRS), which provides tracking for dismounts and interface to the Multiple Integrated Laser Engagement System (MILES) 2000 for engagement simulation. Live entities were able to engage other live entities and constructive Joint Combat and Tactical Simulation (JCATS) entities. Additionally, the demonstration included the Close Combat Tactical Trainer (CCTT) virtual simulation, which was capable of engaging JCATS entities, and virtual-constructive unmanned aerial vehicles (UAVs), which had a common view of the battlespace and all LVC entities [3,4]. Figure 1 illustrates the mapping of LVC system components to the entities in the December demo scenario. The systems were integrated according to Distributed Interactive Simulation (DIS) protocols, and the participants at each simulation type (L, V, and C) communicated via DIS radios. In accordance with JTEP program goals, each demonstration is designed to establish an integrated LVC training capability that can serve as the basis of a leave-behind capability suitable for routine use in training. Demo 2 provided the basis for a battalion-level LVC training capability [5]. Further information on the JTEP program is provided at www.jtepforguard.com.

Figure 1. JTEP LVC Demonstration Components Mapped to Scenario Entities

1.2 Background: Distributed After Action Review

The first JTEP demonstration in May 2003 introduced a JTEP after action review (AAR) capability that included:

- Synchronized playback of recorded tracking and engagement data and tactical voice nets.
- A 2-D display showing maneuvers and engagements against the background of a tactical map and maneuver planning graphics.
- A 3-D display showing the same data and graphics on geo-specific Camp Roberts terrain.

This capability enabled unit-level AARs to be conducted locally at each site after an exercise.

To meet the AAR needs of a distributed training exercise, the second JTEP demonstration added a commander-level distributed After Action Review (DAAR) capability [6]. Following the local unit-level AARs, the Battalion Commander at Camp San Luis Obispo (SLO) led the DAAR. Command elements and observers at the main site, and three remote sites (the DFIRST Base Station at Camp Roberts, OTAG, and a viewing site at Camp San

[1] A live "simulation" comprises real people, real vehicles, real environment, and simulated weapons. A virtual simulation comprises real people, simulated vehicles, simulated environment, and simulated weapons. A constructive simulation comprises some real people, some simulated people, simulated vehicles, simulated environment, and simulated weapons.

Luis Obispo) were able to view exercise playback on the JTEP high-resolution 2-D and 3-D map displays, and to view and interact with the DAAR presenters via a standard video teleconference (VTC). Each site had two screens, one showing the VTC, and the other switching between 2-D and 3-D displays.

1.3 Takehome Package Goals

Unit-level AARs and commander-level DAARs typically last about 30-45 minutes, cover an overview of movements, engagements, and results, and focus on a few key incidents or details. Additional feedback and, therefore, training value, is provided by enabling commanders and individual soldiers to bring the exercise data and playback tools to their home armory or office so they can explore the exercise in greater detail. The CD-ROM-based JTEP takehome package was designed to provide this capability. Key attributes of the takehome package include:

- *Exercise playback*. Soldiers can play back individual warfare areas in the context of the complete exercise scenario. A composite playback capability supports combining playback of DIS data together with higher fidelity native format data for selected systems.
- *Free distribution*. The CD is distributed to authorized exercise participants at no cost.
- *Ease of use*. Soldiers can operate the playback with no training and little reference to documentation.
- *High reliability*. The system is sufficiently reliable that the CDs can be distributed without need for a help desk support activity.

Furthermore, a common takehome package for all JTEP exercise participants provides an additional training and AAR tool regardless of the federate in which they participated. For example, while DFIRST possessed a takehome package, CCTT and JCATS did not. The JTEP takehome package provides a previously unavailable feedback capability for these federates.

1.4 Scope and organization of this paper

This paper provides a descriptive and technical overview of the takehome package capability that was developed for the second JTEP demonstration in December 2003. Section 2 describes takehome package contents and capabilities. Section 3 explains how CDs are produced after a mission for distribution to exercise participants. The assumed audience for Sections 2 and 3 are training system sponsors and support activities. Section 4 discusses several key technical issues. The assumed audience for Section 4 is developers.

2. Contents and capabilities

2.1 Data

The battalion-level exercise from the December demo included approximately 125 instrumented and live entities. Seven voice nets were allocated for the exercise. We recorded both DIS and DFIRST exercise data. The DIS data recorded during the 1.7 hour morning exercise contained 139 MB of non-radio Protocol Data Unit (PDU) data and 45 MB of radio PDU data. The DFIRST data provide a higher level of fidelity (see Section 2.2) for its own live system, while the DIS data provide the common view of all systems. The takehome package default control mode plays back both sets of data simultaneously. To provide a merged view of both data sets, a filter controls the updates that are sent to the 2-D display (see Section 4.1). This filter suppresses the DFIRST entities contained in the DIS data during combined playback. The same DFIRST entities from DIS data pass through to the 2-D display if the user enables DIS-only playback. We did not want to burden an average takehome user with the distinctions between playback modes, and so the best "quality" play control mode is enabled by default, and the option to enable or disable DFIRST or DIS log playback is reserved as an advanced selection available in a 2-D display menu.

2.2 Playback capabilities

Playback controls

The JTEP takehome package contains all of the DIS and DFIRST log files recorded during the exercise for playback on a user's PC. Delivered on a CD-ROM, it is installed using the InstallShield™ setupwin32.exe program. In addition to the log data, the installation includes the JTEP takehome software, 2-D maps for the exercise area, and the Java runtime if a compatible version is not detected on the user's computer.

The package includes a launcher application that allows a user to select an exercise. Once a user starts the exercise, a 2-D SRIDisplay map appears. The SRIDisplay toolbar and menus have been integrated into the JTEP takehome. The playback time controls include direct selection using sliders, jump forward and backward by 1 or 5 minutes (configurable), and jump-to time associated with annotated events. Annotations entered during the live exercise are available, and new annotations may be added. Voice channels may be selected from a menu that

includes information identifying the contents of each channel. The playback rate may be set anywhere between 1x and 20x.

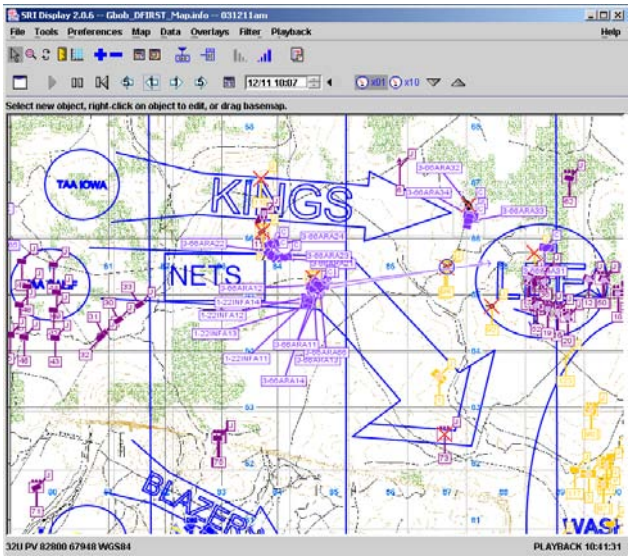

Figure 2. Screen Capture of JTEP Takehome Playback

The map view adjustments include a zoom in and zoom out capability, as well as a ”rubber band” function to outline and zoom into an area of interest. The map can also be centered on an entity. To do this, the user opens the resource panel and double clicks on the icon to center the map on that entity.

The 2-D display map, shown in Figure 2, is based on the tactical map that the units use to train. This provides commonality, and therefore additional familiarity, between the planning, operational, and training tools. Accordingly, unit graphics depicting tactical overlays can be added to the 2-D display, so that maneuvers can be referenced to phase lines, objectives, etc. All graphics that were developed for the live exercise are retained in the takehome. Graphics on the overlay may be hidden as desired to reduce clutter. Additionally, the takehome supports the ability to add graphics or text boxes.

Usage examples

The takehome package contains all the functionality of an on-site JTEP 2-D playback used for AARs, but it can be simply and reliably installed on any stand-alone laptop computer that meets basic requirements (see Section 4.6). A user with little computer expertise can replay an entire exercise at his or her own pace, skipping backward and forward as needed, annotating events, adding overlay graphics, etc. FM 25-101 defines an AAR as “…a review of training that allows soldiers, leaders, and units to discover for themselves what happened during the training ….”[7]. The JTEP takehome package with its stand-alone design and ease of use, truly helps users to “discover for themselves.”

The takehome package has potential application as an instructional tool for extended military field training exercises conducted over the course of several days. During such exercises the instructors typically provide feedback to the participants at the end of each phase of the exercise as an informal AAR. “In an environment like the military, where field training opportunities are expensive and infrequent, it is important that the training audience be given every opportunity to learn and grow as they proceed” [8]. Instructors have little time to prepare an extensive AAR while in the field. A takehome package made available to leaders in the field after each phase of the exercise would give instructors a powerful tool with which to efficiently review trainee performance and provide reliable feedback in a timely manner. At the end of the entire exercise, the comprehensive takehome package would provide a valuable aid in compiling a traditional delayed feedback review of the entire exercise.

Composite playback

The takehome package supports playback composition in which log players from heterogeneous systems are used together in synchrony. JTEP currently combines DIS and DFIRST playbacks. The method for synchronizing the playbacks is described in Section 4.2 and [6]. This method could be extended to include any system that provides a stand-alone playback application and exposes a mechanism for external start/stop, time selection, and rate.

The composite playback allows best-source selection of data recorded in both “native” and “external” formats. DFIRST-native data are preferred for DFIRST entities because the DFIRST logs include all state updates reported by participants, but DIS logs contain a mix of “original” updates and “dead-reckoned” updates. In addition, some information is lost in the DIS PDUs that are published for use by external systems. For example, DIS entity state PDUs do not report data quality; i.e., all data are assumed to be reliable, whereas data for live instrumented entities are occasionally unreliable (e.g., loss of GPS-derived gun pointing angle due to a GPS receiver hardware failure). Subtle differences in the logged data do not usually matter for broad-brush AAR presentations, but they may be significant when the

takehome package is used to examine movements and engagements in detail.[2]

2.3 Usability

The JTEP takehome is a self-contained package that does not require the support of help desk activity. The CD contains documentation files to assist the user in the installation process, and in controlling exercise playback.

When the CD is inserted in the drive, the Installer is launched (shown in Figure 3). It guides the user through the steps necessary to provide the playback capability and add data and maps to the folder on the hard drive. During the installation process, a JTEP icon is placed on the user's desktop: 

Once a JTEP takehome package has been installed, the user may add maps and exercises to the takehome folder to create a library.

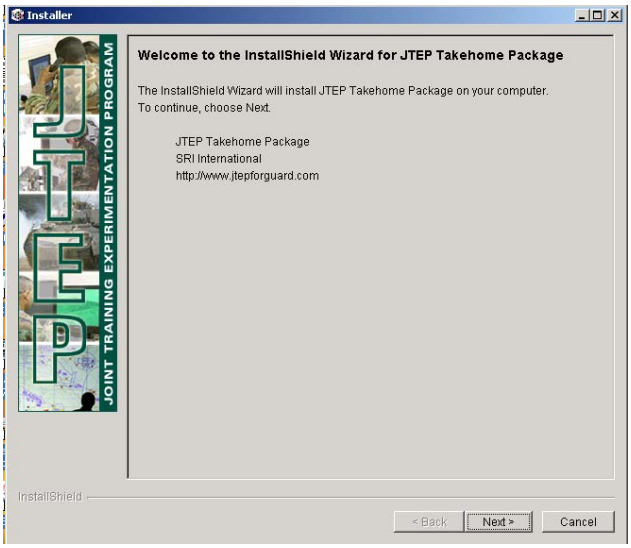

Figure 3. JTEP Takehome Package Install Screen

Once the package, data, maps, and software, have been installed, the user starts the playback by double-clicking the icon. Graphical user interface (GUI) windows inform the user of the start-up process progress. When the JTEP control window appears, as shown in Figure 4, the playback is ready to run.

[2] The differences between DFIRST-native data and DFIRST DIS data are characteristic of live systems. Such differences are typically less significant in virtual and constructive systems.

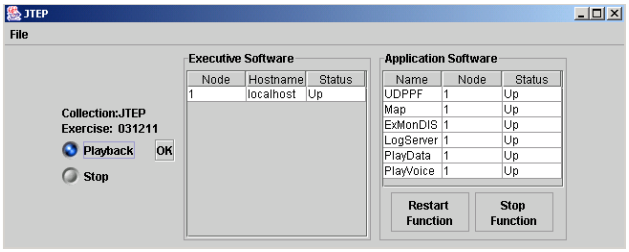

Figure 4. JTEP Takehome Package Play Control Window

Playback control tools are available from menus on the toolbar, or by selecting the appropriate icon. As the cursor hovers over an icon, its function appears.

3. Production

3.1 No-cost distribution

A key functional requirement of the takehome package design was the need for the CD-ROMs to be freely distributable to JTEP exercise participants. This constraint had important consequences in the selection and development of functional components to be included in the takehome package. The JTEP project uses some commercial off-the-shelf (COTS) products, especially tools needed to develop various system components, but license fees associated with providing copies in a production system are kept to a minimum because they are potentially problematic for the Guard. The situation is exacerbated when the requirement is to provide copies of a takehome package that could number in the hundreds for each exercise. For this reason, the design of the takehome package was restricted to using a combination of project-developed, open source, and SRI-developed software components that can be freely distributed in binary form to each JTEP exercise participant. The functional areas covered by these components include:

1. Executive control
2. Data routing
3. Playback operational control
4. Log file playback
5. 2-D display
6. Tactical voice playback

See Section 4.1 for a description of the components.

JTEP currently uses MetaVR's™ Virtual Reality Scene Generator (VRSG) 3-D viewer. VRSG is a licensed product, and could not be included in the distributed takehome package without incurring a prohibitive cost for

each copy. However, the takehome package does provide a capability for 3-D viewing if the user already has a 3-D viewer (see Section 4.7).

3.2 Creation process

The JTEP takehome package is easily created on a PC that has a CD writer, the takehome creator software, and access to the exercise data and maps. After the operator double-clicks on the takehome creator icon, the software guides the user through the process. The operator is first asked to choose the maps to put in the package. Then the operator is asked to select the exercise(s) to be added. (On the bottom of the GUI is a free space indicator.) Once the maps and exercises have been selected, the user clicks a "Copy Files" button to create a temporary directory and add the files to it. At this point any standard CD writing software may be used to write the files from the temporary directory onto the CD.

The takehome package CDs usually contain data for multiple exercises. The Demo-2 CD includes two battalion-level exercises of approximately 1½ hours each, totaling 520 MB, of which 475 MB is data. JTEP computer assets currently include a CD writer. When JTEP progresses to brigade-level exercises and longer exercise periods, a DVD writer will be required.

4. Technical design and challenges

4.1 Multi-application system

The takehome software package contains multiple applications that function together as a loosely coupled system under the control of the BaseCon executive process. BaseCon provides an operator GUI for selecting the exercise to be played back and for starting and stopping the playback. It invokes initialization scripts to start and stop the constituent applications. Although application crashes are rare in the takehome package distribution, BaseCon is designed to detect a crash and automatically restart a failed application.

DataRouter manages data distribution among applications. If multiple applications need to listen to messages originating on the same user datagram protocol (UDP) broadcast port, DataRouter intercepts the data and resends it on multiple unique ports. The applications are configured to listen on the DataRouter-assigned port.

LogServer is a plugin component to DataRouter that reads recorded DIS entity and tactical voice data and broadcasts it. To avoid port conflicts with other live or playback systems running on the same local area network (LAN), the broadcast socket assignments are configurable (see Section 4.7 for additional detail). Ancillary plugins enable DIS message parsing and radio frequency filtering/tuning control.

DFIRST PlayData reads recorded entity state and event data and broadcasts it on the LAN.

SRIDisplay is a 2-D display that shows all DIS and DFIRST entity data. It has a PlayControl plugin that allows the operator to invoke playback controls from a toolbar and menus. Operator control actions are reported to log player applications in messages that are broadcast on the LAN. SRIDisplay has a helper application called ExMon that listens to DIS, DFIRST, and IGRS messages and controls, filters, and formats updates to the 2-D display.

The Java Media Framework (JMF) is used for audio playback of μlaw and Linear voice data. Section 4.4 explains how we were required to convert voice data formats after the exercise to achieve license-free player distribution.

DFIRST PlayVoice reads recorded tactical voice data and plays it using J2SE and SRI vox2wav conversion libraries. Because all DFIRST voice channels used in Demo-2 were captured in equivalent quality DIS recordings, the DFIRST voice playback is disabled in the default setup configuration of the current takehome package distribution.

4.2 Multiple log players

The takehome package has a dedicated log player instance for each recorded file. The JTEP Demo-2 CD has log files for:

- DIS entity state and event data
- DIS voice data
- DFIRST and IGRS entity state and event data
- DFIRST tactical voice data. Each channel is recorded in a separate file.

The DIS and DFIRST recorded files have overlapping data for DFIRST entities. To avoid displaying duplicate data from the non-preferred source during playback, an argument is passed to the DIS entity data log server process instructing it to suppress DIS Entity State PDUs originating from DFIRST.

The players are easily synchronized because the log files all have a common time reference. The DIS and DFIRST logs in the current takehome package distribution support direct access to time-series data during playback by capturing the raw data in one file and storing indexing information in another. The index references messages in the log files to the system time on the logger machine at the time of capture.

When the operator selects a time, the JTEP playback control process synchronizes the players by sending an initial time and then a sequence of time pulse messages. Players interpret each time pulse as a "play-to" directive. They play all data in the interval between the last pulse received (or the initial time) and the current pulse. Playback pauses or stops when the flow of time sync messages stops. The granularity of the intervals is configurable—for example, once per second if the finest granularity of indexed time stamps among the log files is 1 s, or 10 times per second if the granularity is finer than 1 s.

It is not necessary to send rate information to players because fast playback is effected simply by scaling the play-to times in the pulse messages. For example, at 10X rate, the interval between the play-to time in two successive time pulse messages sent by the JTEP controller is 10 times as large as in normal speed playback. An alternative method would be to send the same messages as with 1X rate, but reduce the spacing between the messages by a factor of 10.

The control messages sent to JTEP DIS log players are formatted as DIS SetData PDUs. Control messages sent to DFIRST players are in a native DFIRST message format. In the future, JTEP will add support for other interoperability mechanisms, e.g., the Test and Training Enabling Architecture (TENA).

The initial start time should be sent reliably, but time pulses can be sent best effort because it does not matter if a message is occasionally lost in transmission. Because DIS uses best effort UDP rather than reliable TCP, and messages are occasionally lost, we include a redundant copy of the current initial time or "jump-to" time in all time pulse messages.

4.3 DIS player configuration

Data and Voice LogServers can be configured in a variety of fashions to play back recorded log files through filters and to route data to various end points (e.g., TCP or UDP sockets). The DataRouter software provides the flexibility that is needed to move components that are distributed across many different machines and locations in a live JTEP exercise onto a single PC. In addition to localhost network interface and in-process data flows, the routing software allows for special data and voice filters designed for use in the takehome package. The DataRouter XML configuration files can be manipulated by an advanced user to customize a takehome package to suit specialized needs and interoperate with new systems. For example, the LogServer configuration could be modified to broadcast UDP data across the LAN instead of the PC localhost to allow other systems to view the playback data. Such a technique is required to view the recorded data with a 3-D viewer on another machine.

As we determine which customizations are commonly used, we will add GUI configuration control options to the takehome package that will allow an inexperienced user to easily invoke these customizations.

4.4 Voice playback issues

The DIS Radios for the demonstration were configured to a CVSD (continuously variable slope delta modulation) encoding to make them compatible with the CCTT radios. JTEP DIS radios use eMDee DisComm software. This software is not distributable without a fee. We have not been able to find a good quality, freely distributable, CVSD software decoder. However, the μlaw audio codec is supported by a wide variety of software audio players. Therefore, we chose to convert the CVSD radio data log files to a μlaw encoding and bundle a Java μlaw player into the takehome package software. Because the standard Java runtime, J2SE 1.4, support for μlaw does not support a wide variety of frequencies, we chose to include the JMF (Java Media Framework) software package to provide a variety of enhanced audio capabilities. The takehome package includes the platform-specific Windows JMF distribution instead of the platform-independent version, since performance can be significantly improved over the latter, even on a 2.4 GHz processor.

To produce a takehome package that is immediately available after an exercise, it would be preferable to record a compatible takehome package audio stream during the live demonstration rather than convert log files after the demonstration is over. For example, we might bridge the CCTT radios to a μlaw encoding.

4.5 Communications design

The takehome package leverages many of the communications services used by the DAAR. During DAAR, control messages are sent from the master 2-D

display controller to the data and voice LogServers and the ExMon display controller. The control messages for the takehome package must be port forwarded to the appropriate new control ports so that the components of the takehome package will function properly on the same machine.

In addition to port forwarding, the takehome package will broadcast the UDP data to the localhost interface instead of a connected network. This approach provides performance benefits and prevents a takehome package from interfering with another takehome package, or with other JTEP or DIS applications running on the LAN. In cases where we need the takehome package to broadcast data on the network, it is easy to customize the data routing configuration to broadcast and receive over the LAN.

The takehome package uses coarse and fine data filter services that are provided by the LogServer and ExMon applications. One LogServer filter inhibits reading of unneeded message data from the disk. Post-processing filters include voice filtering and channel swapping, which are effected by analyzing DIS Transmitter and Signal PDUs to determine if the detected frequency is one that should be played, or changed to a special playback frequency.[3] ExMon applies a fine filter that reduces network traffic by controlling entity state display update rates.

Data filtering is particularly useful when the playback rate is increased to faster than real time. For example, at a playback rate of 20X, the software will play and process 20 seconds of recorded data in 1 second. Voice data is suppressed at all rates other than 1X.

4.6 Recommended machine requirements

The JTEP takehome package combines many software components for use on a single machine. The baseline minimum requirement depends on the current optimizations configured in the software and, more critically, on how much data are being played back at any point in time. We are currently recommending Windows 2000™, or Windows XP™ with at least an 800 MHz CPU and 386 MB RAM. However, a 2+ GHz CPU is highly recommended.

[3] The takehome package has voice channel selection controls that allow the operator to direct any combination of radio nets to the left or right speaker by altering the original radio frequencies to a substitute frequency assigned to a speaker on the PC.

4.7 Installation process

The installation process is designed so that after the JTEP software is built and released, it can be repackaged with different sets of data or exercises. This design allows an operator to create new takehome packages without requiring software or installer configuration changes.

The DFIRST takehome installer, on which the JTEP installer is based, includes an option to install only the software onto the hard drive, and to leave the exercise data on the installation CD. However, due to the scale of the JTEP demonstration, the log files for each exercise are quite large. The JTEP installer copies all the files to the hard drive for better performance. In the future, we may add support for compressed log files or an installer that decompresses the logs from an installation CD during installation.

The recorded exercise data and other exercise-specific configuration information are kept in a separate data hierarchy than the software components and their takehome package configurations. This facilitates adding exercises to an existing takehome software installation, or installing a new software release without disturbing the existing data.

Map images are also stored independently of software components. Therefore, in addition to incrementally adding exercise data and exercise information to an existing takehome package installation, supplementary 2-D maps may also be added at any time.

4.8 3-D Display

A three dimensional display is a standard feature of JTEP but is not currently available in the takehome package:

1. Software license requirements for the 3-D viewers we have used and evaluated would add a significant cost to the takehome package.
2. The 3-D viewers currently used by JTEP have processing demands that would drive the minimum CPU and RAM for the takehome package beyond that which is available to a typical user.
3. A large terrain database is needed, and differs for each 3-D display package.

JTEP currently uses MetaVR's™ Virtual Reality Scene Generator (VRSG) 3-D viewer to display exercise data. VRSG currently runs on relatively high-end COTS PCs (P4 3.0 GHz with 2 GB of RAM and a 256 MB video card), which greatly exceeds the minimum required to run

the current takehome package (see Section 4.6). In addition to licensing considerations, the prohibitive cost of generating and storing the enormous .mdx formatted terrain databases required for a 3-D display, renders the VRSG viewer inappropriate for the general audience. Other options, including free 3-D viewers, are being considered for future JTEP demonstrations.

For the specialized user with access to a 3-D viewer which accepts DIS packets as input, the takehome package does provide a capability for 3-D viewing. The user can modify the LogServer configuration (see Section 4.3) to feed data to a 3-D display that runs on the local machine or on a remote platform. In this mode, the 2-D and 3-D display complement each other to provide the full JTEP playback capability.

5. Summary and Conclusions

The takehome package developed for the JTEP program resulted from a need to extend the AAR process from the immediate post-exercise reviews to longer-term, individually-tailored reviews at a Guardsman's home armory. The takehome package, therefore, had a number of technical and functional requirements to satisfy:

- The package had to provide a graphical display and audio recording of all of the exercise data (e.g., maneuver and engagement) and radio traffic that were recorded in the exercise from geographically distributed LVC systems.
- The package had to be able to run on a fairly generic PC that could be expected to be available at an armory
- The package, both executable software and exercise data, had to fit on a CD-ROM that was then freely distributable to the participants of the JTEP exercise.
- The package had to be sufficiently user friendly so that the typical exercise participant could run it without the need to contact a dedicated technical support service.

Through its overall design and its use of a combination of project-developed, open source, and SRI-developed software components that are freely distributed in binary format to each JTEP exercise participant, the JTEP takehome package satisfied the above requirements.

To accommodate longer exercises and more players in future demonstrations and exercises, we anticipate needing to expand the capacity of the recording medium to DVD-ROMs. We also anticipate the potential of freely available (at least to U.S. government users) 3-D viewer software that could be incorporated into the takehome package and would also be consistent with our processing requirements. Such an addition would provide a 3-D display capability to the general takehome package audience.

Development of the JTEP takehome package was motivated in part by reports from DFIRST users that the takehome playback capability was an extremely useful AAR tool. Participants in the JTEP December demonstration who were familiar with DFIRST requested a takehome package at the conclusion of the exercise. The JTEP takehome package extends that utility to each LVC system that is involved in the exercise. For example, it immediately provides a previously available takehome package to participants who use JCATS and CCTT. The JTEP takehome package provides a valuable additional feedback tool for distributed LVC exercises.

6. References

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Author Biographies

REGINALD FORD, Software Development Manager at SRI International, has 24 years of experience in test and training range instrumentation systems for the Army, Navy, Air Force, and Marine Corps. He helped establish SRI's Software Engineering and Development Program and is a member of the Instrumentation and Simulation Program. He manages DFIRST software development and the integration of JTEP software systems and components.

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RICHARD GIULI, Software Engineer at SRI International, is a member of the Software Engineering and Development Program and has 6 years of experience in software engineering. On JTEP he helped develop the distributed networking, VPN, and mapping display.

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JOHN SHOCKLEY, Senior Research Engineer at SRI International, has 20 years of experience in test and training range instrumentation systems for the Army, Navy, and Air Force. He began working on modeling and simulation aspects of these systems and has participated in DIS/HLA standards development activities for over 11 years since, concentrating on integrating live and virtual systems. He is the JTEP project leader.

ISOBEL WADSWORTH, Senior Research Engineer at SRI International, is a member of the Instrumentation and Simulation Program and has 25 years of experience in test and training range instrumentation systems. Her JTEP work has included DIS gateways, IGRS integration, and 2-D displays.