RT 167: Certifying SEEA Compliance with Section 508

Technical Report No. SERC-2016-TR-116

(Task3, Subtasks 3.1-3.2)

November 1, 2016

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Period of Performance: August 11, 2016 to August 10, 2017

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The Systems Engineering Research Center (SERC) is a federally funded University Affiliated Research Center managed by Stevens Institute of Technology.

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1 **BACKGROUND**

This report fulfills requirements for Tasks 3.1 and 3.2 as described in RT 167: *Developing Systems Engineering Experience Accelerator (SEEA) Prototype and Roadmap – Increment 4* - A009 Technical and Management Work Plan and below.

In the planning part, the objective is to determine the requirements for simulated learning technologies, specifically the EA, Section 508 Compliance, based on these requirements determine a compliance strategy for design, implementation and validation, and then provide an estimate for this work. The objective for Implementation part is to implement these changes to ensure that the EA is Section 508 compliant. The necessary migration of the Presentation Engine from Flash to HTML5 is being accomplished in the EA Tools Part 3 RT.

- T3.1: Determine methods for evaluating Section 508 compliance, authoring content and developing simulated learning applications
- T3.2: Determine necessary changes for Section 508 compliance

1.1 **SECTION 508**

In 1998, Congress amended the Rehabilitation Act of 1973 to require Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities. The law (29 U.S.C. § 794 (d)) applies to all Federal agencies when they develop, procure, maintain, or use electronic and information technology. Under Section 508, agencies must give disabled employees and members of the public access to information that is comparable to access available to others.

The United States Access Board has responsibility for developing and maintaining accessibility standards for EIT to incorporate into regulations that govern Federal procurement practices. Section 508 Standards were published in the Federal Register on December 21, 2000 (36 CFR Part 1194). These Standards apply to electronic and information technology developed, procured, maintained, or used by federal agencies. They contain technical criteria specific to various types of technologies and performance-based requirements that focus on functional capabilities of covered products.¹

Implementation of Section 508 also amends the Federal Acquisition Regulation (FAR) to ensure that agency acquisitions of EIT comply with the Access Board’s standards. The FAR change implementing section 508 was published along with an explanatory preamble in the Federal Register on April 25, 2001 (66 Fed. Reg. 20894) and is effective as of June 25, 2001. The FAR rule can be found on the Section 508 website. Section 1194.24(c) and (d) of the Access Board’s standards require that all training or informational video and multimedia productions which support the agency’s mission and which have audio information or visual information that is necessary for the comprehension of the content, be captioned or audio described. Hence, if the production is multimedia (e.g. image and sound) and is considered "training or informational," then it must meet the applicable requirements of 1194.24 (c) and (d) of the Access Board's standards. If the production is web-based, regardless of

¹ [https://www.section508.gov](https://www.section508.gov)
whether it is multimedia, such as a live webcast of a speech, then it must also meet the applicable requirements of 1194.22. For this reason, we assert that the SEEA is an education tool with a web-based user interface, and acknowledge Section 508 applies to its user interface design and construction.

Outside of the US federal government, a number of voluntary consensus standards have been developed by standards organizations worldwide over the past decade. Examples of these standards include: the Web Accessibility Initiative’s Web Content Accessibility Guidelines (WCAG) 2.0, EN 301 549 V1.1.1 (2014-02), “Accessibility requirements for public procurement of ICT products and services in Europe,” and the Human Factors Ergonomics Society’s ANSI/HFES 200.2 (2008) ergonomics specifications for the design of accessible software.

This evolution of these global standards has led the Access Board to propose revisions to the existing 508 Standards to harmonize it with the newcomers. They believe such a harmonization would support the goals of the US law, while also creating a larger marketplace with commercial competition that could lower costs to federal agencies as well as commercial manufacturers for providing accessible electronic information and communication technology.²

Although the changes may take some time to be developed, reviewed and released, we intend to comply with the current Section 508 requirements and include as many additional requirements from the industry standards as seem appropriate.

1.2 Experience Accelerator Components

The Systems Engineering Experience Accelerator is a suite of software and manual tools that provides immersive problem-solving experiences to accelerate the competency of systems engineers. The suite consists of two major systems:

- The Experience Delivery System comprises the User (Learner) Interface client component, a server component that controls the experience, and a simulation and collection of artifacts and other data that provide information through the User Interface.

- The Experience Construction System comprises tools that help develop experiences, including dialog construction, artifact development, experience scripting and phasing, and simulation development and tuning.

A website with access to the accelerator and tools, as well as information and support, is also under construction.

The part of SEEA targeted for Section 508 compliance is the User (Learner) Interface component of the EDS, as it represents the primary interface for learners using the system.

2 Compliance Certification Approach

Generally, we are taking a constructional approach to Section 508. As we move forward with building out the initial UAS experience, we will be adapting the existing

software for Section 508 compliance. The following sections describe the three ways in which we will accomplish this.

2.1 **FLASH TO HTML CONVERSION**
The EA User Interface was originally developed using Adobe Flash for displaying information. This particular technology has been overtaken by the capabilities include in newer web-based standards, primarily HTML5. The flash technology was neither designed for, nor easily adapted in order to meet 508 requirements. However, early in its evolution, HTML acknowledged accessibility as a significant design factor\(^3\), and included a growing number of accessibility-based capabilities. The SEEA team can leverage these capabilities by converting the existing flash interface to HTML5. This conversion also provides more flexibility and functionality for current and future experience developers than the current implementation. In particular, it will allow us to develop a generalized tool with tailorable templates to support designing user interface displays and reactive features for new and existing experiences that align with their specific environments and learning objectives.

2.2 **COMPLIANCE THROUGH TEMPLATES**
Several HTML5 web page templates have been developed in the past few years that are already certified to meet the Section 508 requirements. There are also numerous open source and freeware accessibility components designed to work with HTML5. By redesigning the EA interface and adopting the templates, much of the compliance design burden is lifted. That does not mean it will be an easy task, but the templates we have identified can save significant effort by providing display methods that are by default constrained to accessible requirements such as font, color, contrast, and interoperability with common screen readers and other accessibility enhancement tools. Using a template also greatly reduces the work required to build the user interface design tool.

2.3 **CERTIFICATION BY TOOLS AND EXPERTS**
There are also automated compliance checkers that will evaluate web pages using HTML5 code and other languages to assure compliance to a variety of accessibility standards of the webpage software as well as browser-specific concerns. We do not, however, believe that running such checkers constitutes a sufficient compliance case. We will engage with the Section 508 experts at DAU and will work with them to identify additional compliance-checking tasks as we design and develop the interfaces. We will also consider them to be the final authority on compliance certification.

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\(^3\) "Good semantic HTML also improves the accessibility of web documents (see also Web Content Accessibility Guidelines). For example, when a screen reader or audio browser can correctly ascertain the structure of a document, it will not waste the visually impaired user’s time by reading out repeated or irrelevant information when it has been marked up correctly. "https://en.wikipedia.org/wiki/HTML."
3 Templates and Tools Selected

Several templates and tools were identified and evaluated for use in the development and compliance certification.

3.1 Basic Template

At this juncture, we have decided on Accessible+. Accessible+ is a website template that complies with Section 508 and WCAG 2.0AA. Based on the CMS.GOV Assets Framework (a section 508 compliant responsive framework), bootstrap 3.3 and JQuery-ui, it provides a large variety of accessible display media, and the interface between it and the java-based server seems adequate. If it does not meet our needs, there are several other possibilities.

3.2 Compliance Checkers

We have not settled on a specific set of compliance checkers, but will discuss their use and reliability with DAU experts as well as other industrial sources. We will most likely use some combination of the following:

- SortSite - Accessibility Checker and Validator
- GSA AMP Tool for 508 Compliance Testing (Government-provided)
- Cryptzone Cynthia Says™ Portal - joint education and outreach project of Cryptzone, ICDRI, and the Internet Society Disability and Special Needs Chapter
- Deque aXe Accessibility Engine for Firefox and Chrome
- Tenon.io - can identify 508 and WCAG 2.0 issues in any environment - even on the developer's laptop
- Total Validator – evaluates against WCAG (1.0 and 2.0) and Section 508
- WebAim WAVE – a suite of tools and online service

4 Specific Changes Required to the Current User Interface

This section lists the specific items that need to be changed. The transition to HTML 5 provides additional flexibility, so the functionality of the pages and the organization may change.

4.1 Changes to the User Interface Pages

The existing user interface uses Adobe Flash technology. Flash technology does not provide essential components for section 508 compliance. The update process will include translation and consolidation of the existing pages, and the updated pages will utilize Section 508 compliant assets. Table 1 depicts the changes required to the current user interface pages. The entries in the 508 Issues column refer to the Section 508 paragraphs. These are available in the Appendix.

---

4 http://www.accessible-template.com/index.html
### Table 1. Current pages that will be changed

<table>
<thead>
<tr>
<th>Page</th>
<th>Subpage</th>
<th>Description</th>
<th>508 Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>User_Profile_Design</td>
<td>Page</td>
<td>Page displaying user’s profile</td>
<td>(a)(l)</td>
</tr>
<tr>
<td>Profile_Update_Design</td>
<td>Page</td>
<td>Profile update page</td>
<td>(n)</td>
</tr>
<tr>
<td>Profile_Design</td>
<td>Page</td>
<td>Welcoming screen</td>
<td></td>
</tr>
<tr>
<td>Logout_Design</td>
<td>Page</td>
<td>Logout screen</td>
<td></td>
</tr>
<tr>
<td>Login_Design</td>
<td>Page</td>
<td>Login screen</td>
<td>(n)</td>
</tr>
<tr>
<td>Error_Design</td>
<td>Page</td>
<td>Error screen overlay</td>
<td>(l)</td>
</tr>
<tr>
<td>File_Explorer_Design</td>
<td>Page</td>
<td>File explorer screen</td>
<td>(l)</td>
</tr>
<tr>
<td>ProjectStatus_Folder_Design</td>
<td>Page</td>
<td>Chart viewer screen</td>
<td>(a)(e)(f)(i)(l)</td>
</tr>
<tr>
<td>Email_Design</td>
<td>Page</td>
<td>Email screen</td>
<td>(l)</td>
</tr>
<tr>
<td>Inbox_Subpage_Design</td>
<td>Page</td>
<td>Inbox subpage</td>
<td>(l)</td>
</tr>
<tr>
<td>Compose_Subpage_Design</td>
<td>Page</td>
<td>Compose subpage</td>
<td>(l)</td>
</tr>
<tr>
<td>Desktop_Design</td>
<td>Page</td>
<td>Desktop screen</td>
<td>(l)</td>
</tr>
<tr>
<td>RecommendationForm_report_Design</td>
<td>Page</td>
<td>Recommendation form page</td>
<td>(l)(n)</td>
</tr>
<tr>
<td>Feedback_Form_Design</td>
<td>Page</td>
<td>Feedback form page</td>
<td>(k)</td>
</tr>
<tr>
<td>Multiplayer_Main_Design</td>
<td>Page</td>
<td>Multiplayer main page</td>
<td>(l)</td>
</tr>
<tr>
<td>Multiplayer_Waiting_Design</td>
<td>Page</td>
<td>Waiting page for multiplayer</td>
<td>(l)</td>
</tr>
<tr>
<td>Multiplayer_Lobby_Design</td>
<td>Page</td>
<td>Game searching page for multiplayer</td>
<td>(n)</td>
</tr>
<tr>
<td>Multiplayer_Join_Design</td>
<td>Page</td>
<td>Join page for multiplayer</td>
<td>(n)</td>
</tr>
<tr>
<td>Multiplayer_Create_Design</td>
<td>Page</td>
<td>Game creation page for multiplayer</td>
<td>(n)</td>
</tr>
<tr>
<td>Dashboard_Design</td>
<td>Page</td>
<td>Dashboard page</td>
<td>(e)(f)</td>
</tr>
<tr>
<td>Callv2_Design</td>
<td>Page</td>
<td>Phone call main page</td>
<td>(e)(l)</td>
</tr>
<tr>
<td>Call_Subpagev3_Design</td>
<td>Page</td>
<td>Phone call subpage</td>
<td>(e)(l)</td>
</tr>
<tr>
<td>Chat_Subpage_Design</td>
<td>Page</td>
<td>Web chat subpage</td>
<td>(e)(l)</td>
</tr>
<tr>
<td>Voicemail_Subpagev2_Design</td>
<td>Page</td>
<td>Voicemail subpage</td>
<td>(e)(l)</td>
</tr>
</tbody>
</table>

#### 4.2 Changes to the Artifacts:
The current EA system utilizes document artifacts in PDF/SWF format which is not Section 508 compliant. To achieve compliance, we will use Adobe or third-party software. Current artifacts that require updates are:

- DUAVCdrFormp2.swf
- DUAVCdrFormp3.swf
- DUAVCdrFormp5.swf
- P1-UAV-Program-Info.swf
- P3-UAV-Program-Info.swf
- P4-UAV-Program-Info.swf
- P5-UAV-Program-Info.swf
- UAV Background.swf
- UAV-CDR.swf
- UAV-PDR.swf
- UAV-Status-Chart-Info.swf
- UAV-Status-Chart-Info-0.21.swf
- EVM-Gold-Card-Info.swf
- IUISp1.swf
- IUISp2.swf
- IUISp3.swf
- IUISp4.swf
- IUISp5.swf
APPENDIX – ACCESSIBILITY REQUIREMENTS/GUIDELINES

SECTION 508 (§ 1194.22 WEB-BASED INTRANET AND INTERNET INFORMATION AND APPLICATIONS.)

(a) A text equivalent for every nontext element shall be provided (e.g., via “alt”, “longdesc”, or in element content).
(b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.
(c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.
(d) Documents shall be organized so they are readable without requiring an associated style sheet.
(e) Redundant text links shall be provided for each active region of a server-side image map.
(f) Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.
(g) Row and column headers shall be identified for data tables.
(h) Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.
(i) Frames shall be titled with text that facilitates frame identification and navigation.
(j) Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.
(k) A text-only page, with equivalent information or functionality, shall be provided to make a web site comply with the provisions of this part, when compliance cannot be accomplished in any other way. The content of the text-only page shall be updated whenever the primary page changes.
(l) When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by assistive technology.
(m) When a web page requires that an applet, plug-in or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with § 1194.21(a) through (l).
(n) When electronic forms are designed to be completed on-line, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues.
(o) A method shall be provided that permits users to skip repetitive navigation links.
(p) When a timed response is required, the user shall be alerted and given sufficient time to indicate more time is required.

Notes to § 1194.22:
1. The Board interprets paragraphs (a) through (k) of this section as consistent with the following priority 1 Checkpoints of the Web Content Accessibility Guidelines 1.0 (WCAG
1.0) (May 5, 1999) published by the Web Accessibility Initiative of the World Wide Web Consortium:

<table>
<thead>
<tr>
<th>Section 1194.22 Paragraph</th>
<th>WCAG 1.0 checkpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>1.1</td>
</tr>
<tr>
<td>(b)</td>
<td>1.4</td>
</tr>
<tr>
<td>(c)</td>
<td>2.1</td>
</tr>
<tr>
<td>(d)</td>
<td>6.1</td>
</tr>
<tr>
<td>(e)</td>
<td>1.2</td>
</tr>
<tr>
<td>(f)</td>
<td>9.1</td>
</tr>
<tr>
<td>(g)</td>
<td>5.1</td>
</tr>
<tr>
<td>(h)</td>
<td>5.2</td>
</tr>
<tr>
<td>(i)</td>
<td>12.1</td>
</tr>
<tr>
<td>(j)</td>
<td>7.1</td>
</tr>
<tr>
<td>(k)</td>
<td>11.4</td>
</tr>
</tbody>
</table>

2. Paragraphs (l), (m), (n), (o), and (p) of this section are different from WCAG 1.0. Web pages that conform to WCAG 1.0, level A (i.e., all priority 1 checkpoints) must also meet paragraphs (l), (m), (n), (o), and (p) of this section to comply with this section. WCAG 1.0 is available at http://www.w3.org/TR/1999/WAI–WEBCONTENT–19990505.

**WEB CONTENT ACCESSIBILITY GUIDELINES (WCAG)**

The Web Content Accessibility Guidelines (WCAG) are part of a series of web accessibility guidelines published by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C), the main international standards organization for the internet. They consist of a set of guidelines for making content accessible, primarily for people with disabilities, but also for all user agents, including highly limited devices, such as mobile phones. The current version, WCAG 2.0, was published in December 2008 and became an ISO standard, ISO/IEC 40500:2012 in October 2012. Numerous nations are using the WCAG standards as the basis for their accessible regulations.

WCAG is based on the following accessibility principles:

**PERCEIVABLE**

Information and user interface components must be presentable to users in ways they can perceive.

- Guideline 1.1: Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.
- Guideline 1.2: Time-based media: Provide alternatives for time-based media.
- Guideline 1.3: Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
- Guideline 1.4: Make it easier for users to see and hear content including separating foreground from background.

**OPERABLE**

User interface components and navigation must be operable.

- Guideline 2.1: Make all functionality available from a keyboard.
- Guideline 2.2: Provide users enough time to read and use content.
• Guideline 2.3: Do not design content in a way that is known to cause seizures.
• Guideline 2.4: Provide ways to help users navigate, find content, and determine where they are.

**Understanding**
Information and the operation of user interface must be understandable.
• Guideline 3.1: Make text content readable and understandable.
• Guideline 3.2: Make web pages appear and operate in predictable ways.
• Guideline 3.3: Help users avoid and correct mistakes.

**Robust**
Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies.
• Guideline 4.1: Maximize compatibility with current and future user agents, including assistive technologies.

**Relationship of WCAG 2.0 and Section 508**
The following is the general relationship between WCAG 2.0 and Section 508:
• WCAG 2.0 harmonizes with Section 508
• WCAG 2.0 Level AAA is Section 508 compliant
• WCAG 2.0 Level AA is a reasonable standard to strive for
• WCAG 2.0 Levels are prioritized based on time, money, audience, importance
• Priority 1 = Level A is required, you must do it
• Priority 2 = Level AA is preferred, it would be great if you did it
• Priority 3 = Level AAA is optional, it would be nice to have (but required for government use)
• WCAG 2.0 Level AAA is equivalent to Section 508 compliance, it is the government standard