

## With Uncertainty Comes Opportunity: Solving the DoD's Flash® Problem

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### ABSTRACT

The Department of Defense (DoD) currently hosts an estimated 70,000 hours of Adobe® Flash-based e-learning content. This presents a considerable challenge, as all major browsers will soon remove Flash Player functionality, and Adobe will discontinue Flash support in 2020. The Advanced Distributed Learning (ADL) Initiative is working with personnel from the Office of the DoD Chief Management Officer (CMO), the Armed Services, and other Defense Components through the *Flash Deprecation Analysis of Alternatives (AoA) Working Group* to understand the scope of the migration effort and identify potential solutions that create best value across the DoD enterprise.

Given the complexity and variety of content created using Flash and ActionScript®, no silver bullet exists for converting this content into a modern standard, such as HTML5; however, through the working group, participants are sharing technical approaches, best practices, tools, and acquisition strategies for migrating courses away from Flash. In addition to addressing the immediate problem of Flash deprecation, the scale of this effort presents an opportunity to modernize the technical underpinnings of converted Flash courses, integrating metadata and embedded performance tracking. These enhancements align with other initiatives from the CMO IT & Business System Reform, including the DoD common course catalog and learning record repository.

This paper summarizes the technical guidance and policy discussions from the working group. It also articulates the approach for identifying, prioritizing, and migrating Flash content, and it provides links to tools, scripts, and calculators shared by the working group. These resources support both Flash migration and the additional modernization of those legacy digital learning resources.

### ABOUT THE AUTHORS

**Trey Hayden** is a SETA contractor serving as a senior software engineer with the ADL Initiative. His primary roles include designing and building reference components for the Total Learning Architecture, researching and integrating xAPI and Kafka® at enterprise scale, implementing xAPI within the Unity3D game engine, reviewing and maintaining vendor code submissions, and rejecting pull requests to the ADL Initiative's GitHub projects. Mr. Hayden serves as a technical advisor to the working group and works as a liaison to other engineers reviewing and evaluating different technical approaches, specifically researching best practices for common media conversion templates, intermediate language transpilation, and Shockwave® Flash (SWF) decompilers. Prior to supporting the ADL Initiative, his work included gamified augmented reality healthcare simulations, Flash-to-HTML5 conversions, data analysis and operational testing for Customs and Border Protection, and autonomous guidance systems for the Navy. He received his M.S. in Applied Mathematics from Old Dominion University and B.S. from Christopher Newport University.

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### INTRODUCTION

The Department of Defense (DoD) currently hosts an estimated 70,000 hours of Adobe Flash-based e-learning content that will soon stop working. Flash Player functionality will be removed by all major browsers and support for Flash discontinued by Adobe in 2020 (Keizer, 2017). Any courseware, web pages, and operational software utilizing Flash will either lose functionality or cease functioning entirely. To further complicate this issue, Adobe Flash is often incorporated in operational systems and tools that exist outside of traditional training and education programs—some of which may even be hidden in critical DoD systems.

**Deprecate ( dep-ri-keyt ):** In technology contexts, *deprecation* refers to the phasing-out of software features, e.g., because they are flawed or being replaced by newer versions. Often, deprecated items lose functionality, sometimes when first deprecated but more commonly at some point afterward. *Deprecation* should not be confused with the term *depreciation*.

To state it plainly, if you are in a leadership position within the DoD:

- Web browsers will stop supporting your Flash content by the end of 2020.
- Ensure your organization is actively transitioning away from anything using Adobe Flash.
- If you do not act, then your operational readiness will be impacted.

The DoD's Flash conversion efforts thus far have been inefficient. As each organization manages its conversion efforts internally with minimal outside interaction, organizations' conversion teams have inevitably developed their own conversion techniques and pipelines. While suitable for each organization, those teams are often duplicating efforts, solving problems locally that are common across the enterprise.

Aside from conversion challenges, organizations frequently cite a general lack of awareness among DoD leadership of this problem and the effect it will have on readiness. Even those leaders aware of the issue may not fully realize its timeline or urgency, with browsers already disabling Flash by default. Furthermore, it is important to note that Flash software exists in operational systems, like simulations and embedded trainers, in addition to e-learning content. All these systems will lose the functionality dependent on Flash components. And, as Flash components are often embedded within other software applications, it is difficult to estimate the problem's scale and its subsequent impact on readiness. (While discussions of Flash outside of browser-based training and education contexts are beyond the scope of this paper, the pervasiveness of Flash software across diverse training and operational software is worth noting.)

Since Flash deprecation is unavoidable, the DoD can seize this opportunity to efficiently achieve another one of its long-standing goals: courseware modernization. Instead of merely repackaging legacy Flash content without creating any additional value, making negligible investments in modernization during the conversion process will allow the Department to take advantage of decades of technological advancements. Specifically, there is an opportunity to both convert legacy content and simultaneously streamline its integration with the DoD common course catalog and enterprise learning record repository, both currently in early development.

## **FLASH DEPRECATION AOA WORKING GROUP**

To help coordinate this effort, personnel from the Office of the DoD Chief Management Officer (CMO), Armed Services, and other Defense Components are working with the ADL Initiative through the Flash Deprecation Analysis of Alternatives (AoA) Working Group to understand the scope of the migration effort and share potential solutions that create best value across the DoD enterprise (ADL Initiative, 2019). This group has three primary objectives:

- Inform the DoD about the upcoming removal of Flash and its potential impact.
- Pool resources and influence to expedite associated policy change.
- Coordinate research and solutions for the conversion effort and subsequent modernization opportunities.

### **(1) Policy Discussion**

Among the most critical discussion topics of the working group is the immediate cessation of Flash acquisitions. When Adobe ends support for Flash in 2020, all Flash content will lose accreditation for use on government networks due to cybersecurity concerns. Even before that date, systems using Flash content are vulnerable and are likely to encounter accessibility issues, as most popular web browsers have already discontinued their support for Flash.

While many individual organizations had already implemented language in acquisition contracts that prohibited Flash development, the working group standardized that language for use across the DoD. To that end, the DoD Instruction (DoDI) 1322.26—the overarching distributed learning instruction that covers all Components of the Department—now prohibits further Flash acquisition per direction from the working group (ADL Initiative, 2019). Additionally, the group worked with personnel from the DoD CMO’s office to inform DoD leadership of the issue. The DoD IT & Business System Reform Lead within the CMO’s office signed a Department-wide memorandum (DoD, 2019) recommending that all DoD Components:

- Suspend further acquisition of training and education course content supported by Adobe Flash.
- Identify policy and process issues creating inefficiencies because of Flash conversion.
- Identify current vendor contracts and relationships related to that issue.
- Ensure that, whenever possible, courses are developed or converted with standardized metadata and embedded “hooks” for interoperable learner performance data collection, formatted to enable the future development of a DoD-wide common course catalog and learning record repository, as directed by the DoD Reform Management Group, the senior governance body overseeing presidentially mandated top-down reforms (see Executive Order 13781).

Additionally, the memo included two directives stating that all DoD Components must:

- Review all training/education systems for course content and report on their use of Flash and, where applicable, the status of the Flash usage (e.g., active, inactive, converted, remade).
- Provide current and accurate content, technical, and financial data—regarding learning management systems (LMSs), content management systems, interfaces with other internal or external systems, and other training and educational technologies or capabilities—to support the periodic reporting of progress on the implementation of the activities directed by the memo.

### **(2) Conversion Guidance**

While policy and Department-wide guidance are necessary preventative measures, the working group also researched several different methods for migrating and converting Flash-dependent content to the current web standard: HTML5. (As indicated earlier in this paper, the scope of our work focuses solely on Flash e-learning content; however, many of these strategies are applicable to other learning platforms, such as computer-based trainers.)

At first, the group explored problem mitigation strategies. The first consideration was asking Adobe to extend the service life of Flash, but this was deemed inviable due to its low probability of success, its failure to address security issues, and the impending elimination of Flash support in major internet browsers (which is outside of Adobe’s

control). Next, group members discussed the creation of a DoD-specific Flash player to run Flash in an HTML5 environment. While the group found existing JavaScript-based applications to meet this need, they were not actively maintained and only partially addressed Flash's security vulnerabilities. Furthermore, maintenance costs across the software lifecycle were excessive for a temporary solution.

Thus, the focus of the discussion turned to the conversion process. As representatives from each organization walked through their respective technical approaches to Flash conversion, many similarities were discovered. In almost all cases, the first conversion step involved discovery of existing Flash content, which may exist independently or within larger content packages. To assist in the discovery process, the Army University Research, Standards, & Specifications Division created scripts to detect Flash within Sharable Content Object Reference Model® (SCORM) content packages. The ADL Initiative then modified these tools to find Flash content in any directory or archive file and to identify the version of Flash used. These scripts are open-source and available on the ADL Initiative GitHub page.<sup>1</sup>

After Flash content is discovered, courses and course components need to be prioritized for conversion. Educational administrators must decide whether to convert the content or simply rebuild the course, factoring in characteristics such as the availability of source files and the content's length, age, and complexity. Numerous organizations represented in the working group shared their internal decision trees for approaching this challenge, an example of which is shown in Figure 1. The Army Distributed Learning Program (TADLP) also shared its open-source calculator tool that estimates the cost of conversion based on factors such as cost per learner and total learner throughput. This open-source tool is freely available on the TADLP GitHub page.<sup>2</sup> For shorter, older, and less interactive content, it is more cost-efficient to rebuild the course, often repurposing the raw assets (e.g., graphics, audio files) used in the Flash-based material. For older material, this also presents an opportunity to update the course content.

In cases when semi-automated conversion (versus rebuilding) is the appropriate choice, all Flash content needs to be cataloged according to its authoring tool and Flash version. Due to variation among authoring tools, Flash media will have subtle differences that may introduce technical complications during the conversion effort. Additionally, the versions of Flash and ActionScript used to produce courseware vary, and older versions are often incompatible with automated conversion tools. Perhaps worst of all, the source files (a requirement for using many semi-automated conversion tools) are no longer available for most Flash-dependent courseware.

Despite these challenges, converting Flash courses to standards-based HTML5 files and inventorying the associated media will pay dividends in terms of future efficiency, interoperability, and program management for years to come. For example, cataloging gives organizations the opportunity to establish how courses and media assets are aligned to one another. It also allows organizations to group content according to a range of different features, including level of 508 compliance, metadata, original authoring tool, source file availability, and scope of interactivity. The Naval Education and Training Command, for instance, is storing such information in a relational database that shows the different types of interactivity, the relationships of raw assets, and the aggregation of Flash assets for each course.

Once the Flash-based content is cataloged, it needs to be converted into a format acceptable to modern browsers. Each learning content hour may comprise dozens of Flash objects that each need to be migrated to a new format, frequently HTML5. That is, every Flash object must be decomposed into its raw assets, converted to HTML5, and recombined back into the course or lesson from which it was originally derived. Given the range and complexity of Flash usage in DoD courses, many organizations are creating HTML5 templates that replace incompatible ActionScript logic while retaining as many of the raw assets as possible. Templates also reduce the need for highly technical labor by enabling workflow shortcuts and Python-based utility scripts.

The use of templates is common across working group members, which raises the possibility of a Department-wide template library that could be shared across DoD organizations to reduce costs by facilitating reuse. This requires a change to how these capabilities are acquired, and it will require different vendors to willingly use shared templates

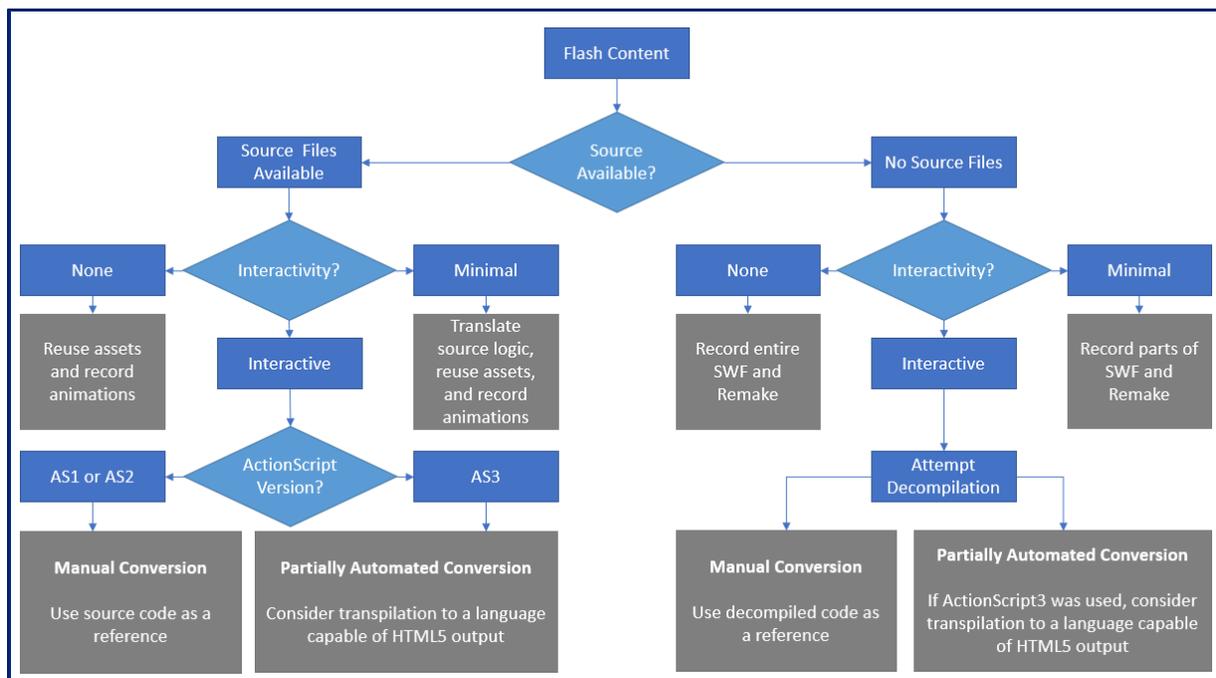
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<sup>1</sup> Flash Finder scripts: <https://github.com/adlnet/flash-finder>

<sup>2</sup> TADLP Calculator: <https://tadlp.github.io/imi-cost-calc/>

when possible. If no template exists to meet specific functionality requirements, a new template must be created and uploaded to a shared library. As a possible starting point, the United States Web Design System (USWDS) hosts a collection of Section 508-compliant HTML5 templates with documented components and styles. These templates are available for viewing through its site<sup>3</sup> and the code is available through its GitHub page.<sup>4</sup>

Before starting the conversion process, many organizations preprocess the Flash software by saving older Flash content to the latest Extensible Markup Language (XML)-based Flash format (XFL), which allows direct inspection and manipulation via scripts and provides a common starting point for all conversion activities. Flash decompilers are then used to extract the embedded multimedia and ActionScript assets, which are also saved as XFL files. Finally, XFL files are mapped to approved HTML5 templates. Once each Flash file has been converted, the assets can then be reassembled, published, tested, validated, and repackaged into a course.



*Figure 1. Flash Conversion Diagram*

### (3) Modernization Efforts

These Flash migration efforts form part of a broader goal among Flash Deprecation AoA Working Group constituents: learning modernization. While the importance of Flash migration should not be understated, the bigger picture is that no technology is immune from eventual deprecation and obsolescence. As such, it is vital to build the infrastructure needed to keep up with private sector technological advancements so that similar issues can be prevented in the future. Not only does outdated technology present disproportionate maintenance costs and security risks, it also becomes more difficult to develop for, as fewer engineers learn and use it.

To make the case for modernization, a skeptic should look at the Flash situation itself. In the case of Flash and its proprietary framework, courseware maintenance is not just difficult, but nearly impossible. Contractual oversights may leave an organization without its content's source code, which means that content cannot be modified. These black-box approaches to content development stand in sharp contrast to the modern open-source philosophy and the

<sup>3</sup> USWDS Component Demos: <https://designsystem.digital.gov/components/>

<sup>4</sup> USWDS GitHub: <https://github.com/uswds/uswds>

adoption of decentralized standards like HTML5. Failure to modernize has contributed to the Flash problem and will serve as a cautionary tale for those clinging to dated technology.

To expedite the modernization effort, the Flash Deprecation AoA Working Group has established several short-term targets. The first is for the group, with the assistance of the Services and various other Government organizations, to identify redundant courseware across the DoD to reduce the labor required in the conversion process. The second target is to incorporate open web standards into the migration process, ensuring compatibility with modern browsers and reducing dependence on proprietary technology. Finally, the third goal is to facilitate implementation of common courseware metadata and interoperable learner data specifications during the Flash migration process.

#### DoD-wide IT & Business Systems Reforms for Training and Education

On May 3, 2019, the Office of Personnel Management (OPM) and the DoD signed a memorandum of agreement making OPM's USALearning® program the primary hub for the assisted acquisition of training and education supplies and services for the DoD. This agreement also marked the beginning of two DoD digital learning modernization initiatives. As described in the press release issued by the Pentagon (Lopez, 2019):

“The partnership is expected to produce a DoD-wide common course catalog and online access portal hosted by USALearning, as well as a DoD-wide common record repository.”

Based on the memorandum of agreement signed between OPM and DoD, organizations migrating their content away from Flash, especially content relevant to DoD training or education, will eventually be required to publish content metadata to a common course catalog and to report learners' completion data to a common repository. With this memorandum of agreement now in effect, these modernization targets are not far-off goals for the future—they now represent the direct guidance of senior leadership.

#### Enabling the Common Course Catalog: Learning Content Metadata

To streamline personnel development and reduce maintenance and acquisition costs, the DoD Reform Management Group directed development of a common course catalog to serve the Department. However, to meet this goal, DoD needs an automated way to construct the catalog. Course libraries are collectively too large for humans to parse and maintain; rather, metadata is needed to pave the way toward an aggregated index of up-to-date DoD learning offerings—a DoD common course catalog.

As the name suggests, *metadata* is simply data that describes other data. With respect to courseware, this may represent administrative data (e.g., creation date, author, software version) or descriptive data (e.g., learning objectives) tied to a specific piece of content. Metadata itself is not a new topic. SCORM, a collection of specifications for e-learning popularized in the early 2000s, already incorporates learning content metadata standards. However, as usage of metadata in SCORM was not required, its quality and consistency vary greatly across existing DoD content, so much of the DoD's existing e-learning metadata is effectively unusable for its current modernization goals.

When implemented correctly, metadata provides substantial immediate and long-term benefits. For example, with respect to Flash migration, adding metadata to existing courseware can help expose redundant or outdated content, which in turn can save significant time and money, particularly for an organization as large as the DoD. If two similar courses are deployed by different DoD entities, then ideally only one course needs to be retained (assuming that DoD stakeholders can agree to share and reuse material across organizations).

More broadly, implementation of metadata is a crucial first step toward long-term interoperability. The DoD is a vast organization with a complex structure and nearly three million employees across the military and civilian sectors. Most of its numerous subordinate organizations have their own libraries of training and educational material, compiled with little Department-wide collaboration. Expectedly, this has led to large quantities of redundant courseware with no standardized structure or format. The most exciting reward of metadata implementation is one that has been widely touted across the industry: it helps unlock the use of machine learning (ML) and the broader range of other artificial

intelligence (AI) capabilities for the learning and development domain. These rapidly advancing disciplines promise to enhance operational readiness by making full use of the bounteous data sets continuously produced by modern technology, which are far too vast for humans to interpret. Within the training and education domain, some of these advancements include:

- Adjusting learning content in real time according to student performance and instructor feedback.
- Determining the best learning path for students over time with respect to their individual goals and aptitudes.
- Evaluating the usefulness and relevance of learning materials.
- Estimating an individual's level of competence based on aggregated evidence and calculations of skill decay, mastery probabilities, and content weighting.

However, a fundamental limitation of machine learning in this context is its dependence on the input data. The quality of the results is inextricably linked to the quality of the information fed into the system—garbage in, garbage out. A large percentage of existing courseware lacks usable metadata, and without this information, any ML/AI effort will be severely hampered from the beginning. To maintain the competitive edge of the United States military, it is imperative to keep up with—or advance—the state of the art with respect to personnel training and education. Any initial investment of time and money toward consistent metadata implementation will be repaid many times over as ML/AI research marches forward into uncharted territory with boundless potential.

The ADL Initiative has conducted analyses of the common educational metadata standards in current use, including the Learning Resource Metadata Initiative (LRMI), Schema.org, the Dublin Core Metadata Initiative (DCMI), and Learning Object Metadata (LOM), the metadata model used in SCORM. To modernize Flash content, the Flash Deprecation AoA Working Group anticipates that existing SCORM courses (with Flash content) will be remade and reassembled as new SCORM courses (without Flash content); therefore, LOM will continue to play a prominent role in how we describe distributed learning courses for the immediate future. But most legacy standards cannot accommodate today's broad range of learning experiences. They are often limited in what data fields they include and where they can be used. As the DoD looks to the future of distributed learning, newer standards must be designed to incorporate other learning methods, such as simulator and virtual reality content. These next-generation metadata standards should also enable more detailed data collection as well as distribution and support for mobile and cloud technologies.

As part of its modernization work, the Flash Deprecation AoA Working Group reviewed and synthesized best practices from existing content metadata standards. These were evaluated on four primary criteria:

- **Usability:** The metadata must be searchable and filterable and provide the information necessary for someone not familiar with it to understand its use. Each field must fulfill at least one of those functions.
- **Extensibility:** The standard must be able to incorporate future enhancements.
- **Real-time performance:** Analytics is a vital component of the future learning ecosystem. The ability to work with detailed data is becoming increasingly important to learners, educators, administrators, and developers. The metadata standard should include the elements necessary to inform real-time analyses.
- **Human and machine readability:** The data must simultaneously be suitable for human consumption and scalable for use with advanced machine learning techniques.

This analysis was done in recognition of the issues that afflicted many older learning systems. While metadata existed before, the learning development infrastructure was often inadequate to capitalize on it. This underscores the challenge and the opportunity in the Flash migration process: the labor required to convert legacy courseware can also serve to improve refurbished content's reusability, drastically increasing the return on investment.

Through the metadata standards review process, the working group determined that while no one standard will satisfy all future requirements, a set of existing standards could collectively serve as a starting point for a comprehensive, enterprise-level metadata strategy. With these goals in mind, the group created the following list of activity metadata elements to describe all e-learning courses being migrated away from Adobe Flash. Each field is labeled as *Required*,

*Recommended*, or *Optional*. Fields that are *Recommended* should be included if relevant to the activity. Fields that are *Optional* are more situational but can add value in certain contexts. Implementation guidance, while not shown in this table, is available to describe the recommended data formats, controlled vocabularies, or other considerations specific to each field. To enable a smoother transition, many fields can be mapped to at least one existing metadata standard. This is particularly important to the Flash migration issue, since many Flash-enabled e-learning courses are still deployed using SCORM, which requires the LOM specification for metadata.

**Table 1. Draft Metadata Recommendations**

<i>Basic Properties</i>		
Unique ID	A globally unique identifier (GUID) that uniquely describes the activity.	Required
Name	The human-readable name of the activity.	Required
Description	A human-readable description of the activity.	Required
Language(s)	The primary language(s) used in the activity.	Recommended
Subject	The primary educational subject covered by the activity.	Optional
Topic(s)	The primary topic(s) of the activity.	Optional
Author(s)	Person or organization that created the activity.	Recommended
Contributor(s)	Person or organization that supported the author (e.g., artists, reviewers).	Recommended
Publisher(s)	The person or organization that produced and distributed the activity.	Recommended
Provider(s)	The service provider, service operator, or service performer; the goods producer. Another party (a seller) may offer those services or goods on behalf of the provider. A provider may also serve as the seller.	Recommended
Copyright Holder(s)	The party holding the legal copyright to the activity.	Recommended
License(s)	The legal constraints that govern distribution and use of the activity.	Recommended
Version(s)	A number representing the release version of the activity. Each should be related to a release date.	Required
Publication Date(s)	The date when the activity was created or updated. Each date should be related to a specific version.	Required
Size (Uncompressed)	A number representing the file size of the activity.	Optional
Publication Status	A description of the current lifecycle state of the activity (e.g., draft, alpha, beta, final).	Recommended
Keyword(s)	Search engine-compatible words that describe the activity.	Required
Full Text	The full text of the activity (if applicable).	Optional
User Guidance	Instructions describing activity usage and installation.	Optional
Citation(s)	Relevant bibliographic citations.	Optional
<i>Competency Relationships</i>		
Competency	A container element (which may require other identifying fields).	Recommended
Educational Framework(s)	The educational framework(s) that the activity is aligned to.	Recommended
Interactive Multimedia Instruction (IMI) Level of Interactivity	The level of interactivity the activity exhibits (passive, limited, complex, real-time).	Required
Difficulty	The amount of challenge that the activity presents to the learner.	Optional
Expected Mastery	The expected level of mastery per competency that the learner is expected to have upon completion of the activity with an affiliated confidence value.	Recommended
<i>Interoperability Properties</i>		
Launch URI	The web URI used to launch the activity.	Recommended
Conformance	The specifications/standards to which the activity conforms.	Optional

<i>Interoperability Properties</i>		
Authorization Level(s)	The permissions needed to run the activity (e.g., security clearance).	Optional
Metadata URI(s)	The location of this metadata (potentially with extensions).	Optional
Technical Requirement(s)	The technical requirements necessary to run this activity (e.g., operating system types and versions, browsers, additional hardware or software).	Recommended
Metadata Author(s)	The creators of activity metadata. May be a person or a software component.	Optional
Accessibility Feature(s)	Content features of the resource, such as accessible media, alternatives, and supported enhancements for accessibility.	Optional
Accessibility API(s)	Indicates that the resource is compatible with the referenced accessibility API.	Optional
Accessibility Control	Identifies input methods that are sufficient to fully control the described resource.	Optional
Accessibility Hazard(s)	Characteristics of the described resource that are physiologically dangerous to some users.	Optional

<i>Learning Experience Properties</i>		
Target User Role	The intended activity user (e.g., learner, teacher, etc.).	Optional
Expected Completion Time	Estimated average time needed for completion of the activity. May be a range.	Optional
Duration	For a media file, its exact run time.	Optional
Maximum Time Allowed	Maximum allowed time for completion of the activity.	Optional
Time Limit Action	The action initiated upon exceeding the maximum time.	Optional
Educational Context	The level of education the activity was designed for (e.g., middle school, high school, university, training).	Optional
Content Granularity(s)	The functional granularity (e.g., course, unit, lesson) that the activity represents.	Recommended
Learning Resource Type(s)	The types of content presented by the activity (e.g., text, simulation, video, audio, augmented reality). It should be descriptive of the medium used by the activity rather than the educational purpose for which the activity is intended.	Required
Instructional Type(s)	The types of instructional use the activity was designed for (e.g., practice, assessment). It should be descriptive of the educational purpose the activity is intended for rather than the type of content presented by the activity.	Recommended

<i>Learner Relationships</i>		
Learner Language	The expected primary language of the learner that the activity was designed for.	Recommended
Learner Age	The expected age range of the learner that the activity was designed for.	Optional
Learner Physical Requirement(s)	Physical characteristics needed by the learner to be successful in this activity.	Optional
Learner Aptitude(s)	Aptitudes (e.g., ASVAB scores) that the activity was designed for.	Recommended
Learner Reading Level(s)	The range of reading levels (e.g., K–12) that the activity was designed for.	Recommended
Learner Job(s)	The expected learner job function, role, or Military Occupational Specialty (MOS) that the activity was designed for.	Optional
Prerequisite(s)	Competencies, credentials, or other activities required to begin this activity.	Recommended
Learner Job(s)	The expected learner job function, role, or MOS the activity was designed for.	Optional
Prerequisite(s)	Competencies, credentials, or other activities required to begin this activity.	Recommended

<i>Activity Relationships</i>		
Activity Relation(s)	Expresses the relationship of the activity to another specific activity (e.g., prerequisite activities, assessments that are appropriate for specific teaching activities, reference materials that relate to the activity). There may be many relationships.	Recommended

The AoA Working Group will continue to solicit feedback and recommendations from its stakeholders and other communities of interest to improve these metadata recommendations and implementation strategies. Once the guidance is finalized, the Defense Advanced Distributed Learning Advisory Committee (DADLAC), an advisory body mandated to support distributed learning policy and coordination across the DoD, will consider formalizing these standards in policy—specifically, DoD Instruction 1322.26 (“Distributed Learning”). That is, the DADLAC is expected to recommend that any new courseware developed across the DoD as well as any major refurbishments to existing courseware adhere to forthcoming content metadata guidelines. These recommendations will specifically apply to any e-learning content migrated from Flash to HTML5 or another approved format. Additionally, as new learning technologies become available, this metadata should also be used to describe those learning activities, including serious games, augmented/virtual reality, simulation scenarios, and even the curricula associated with in-person training and education activities such as classes, seminars, and field exercises.

#### Enabling the Learning Record Repository: Learner Data Specifications

Running parallel to the common course catalog, the Reform Management Group also seeks the establishment of a common repository for learner data. While both the DoD and the e-learning community at large have made progress toward the standardization of learner records, some specifications have begun showing their age as the world of e-learning continues its evolution. For example, SCORM, the dominant e-learning standard for nearly two decades, underpins much of the DoD’s existing Flash-dependent courseware. But while still suitable for highly structured LMS-centric environments, SCORM’s industry dominance is waning. As learning platforms continue to diversify (e.g., simulators, mobile learning, augmented reality), SCORM’s dependence on an LMS naturally limits the available delivery modalities available for education and training. Further, with its predefined fields for learner data, SCORM courseware can only track basic learner actions (such as completions, completion times, and assessment scores), limiting its potential contributions to the learning record repository. Given SCORM’s presence within Flash-based content and the eventual integration with the common learning record repository, conversion teams may wish to incorporate additional functionality to complement SCORM’s shortcomings.

The Experience Application Programming Interface (xAPI) specification is a sound choice to lay the foundation for more meaningful contributions to the learning record repository and fill the gaps left by SCORM. xAPI is not merely an incremental upgrade to SCORM. It represents a paradigm shift in how e-learning interoperability is conceptualized: away from learning content interoperability across LMSs and toward output data interoperability across diverse digital systems. As such, courseware using xAPI does not require an LMS, freeing content developers to choose whatever platform best suits their material. At the same time, organizations enjoying their existing LMS configurations can still implement xAPI without interrupting their existing SCORM workflow. This can be accomplished using the *cmi5* specification (an extension of xAPI that incorporates SCORM-like functions, such as packaging, launch, and credential handshakes) or a SCORM-to-xAPI wrapper (software for converting SCORM events into xAPI data).<sup>5,6</sup>

As with the common course catalog and the Flash timeline itself, organizations caught dragging their feet with respect to the common learning record repository integration may find themselves modifying courseware again soon. Conversion teams have an opportunity to seize the moment and update existing SCORM-based content with more modern specifications, enabling richer learner records and allowing organizations to get ahead of the modernization curve.

#### **CONCLUSION: PRIORITIZING READINESS**

As the scale of the Flash problem continues to grow, the Flash Deprecation AoA Working Group is actively coordinating with its DoD partners and other Government stakeholders to streamline the transition out of Flash-based content and mitigate the overall impact of Flash’s deprecation on DoD readiness. Given the problem’s shrinking timeline, many organizations worry about the quantity of content requiring migration, the time and resources those

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<sup>5</sup> xAPI Wrapper open-source resources: <https://github.com/adlnet/xAPIWrapper>

<sup>6</sup> SCORM-to-xAPI Wrapper: <https://github.com/adlnet/SCORM-to-xAPI-Wrapper>

migration efforts will require, and the availability of a skilled workforce to support the conversion itself. Additionally, not all affected content has been discovered; organizations are still identifying it in operational LMSs, server-based maintenance systems, performance support tools, and mission-critical training programs where training content is purchased as part of the system.

Because of those immediately pressing challenges, it may be tempting to forego the benefits of content metadata and xAPI. However, these endeavors are a crucial step toward the DoD IT & Business Systems Reforms for Training and Education. Senior leadership at DoD and at OPM have identified training and education as a key capability to reform in order to maximize operational efficiency, as evidenced by the common course catalog and learning record initiatives. With those efforts in place, the process of creating metadata early in the discovery-and-cataloging process will produce significant cost savings by identifying redundancies and prioritizing conversion of critical content. xAPI will then complement the new metadata by allowing administrators and developers to gather and analyze learner data at higher resolutions than ever before possible.

If this is your first time hearing about the Flash deprecation timeline and its potential impact on DoD readiness, then you might naturally ask: How did we get here? Although private sector decisions triggered that timeline, its feasibility varies significantly among DoD organizations. Those organizations that actively researched the issue and prioritized early conversion and modernization are well poised to withstand the 2020 removal date while less proactive organizations are struggling. As a cautionary tale, a lesson worth learning from the Flash deprecation issue is that maintaining the status quo for the sake of convenience or time savings may, ironically, provide neither. Simply put: organizations intending to migrate out of Flash without accounting for the future may once again find themselves behind the curve.

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