



Enterprise Learner Record Repository (ELRR)

Initial Operational Capability (IOC) Report

30 June 2022

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14. ABSTRACT A federated Enterprise Learner Record Repository (ELRR) provides the ability to look across many distributed learner records as if they were from a single source and enables the sharing of local and global learner data across the DoD. This learner data will be pulled from authoritative sources for publishing, customizing, and harmonizing individual profiles, performance records, and training records. This document presents the requirements needed to advance the ELRR toward its Initial Operational Capability (IOC).						
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1 Introduction

1.1 Purpose of the Enterprise Learner Record Repository:

A federated Enterprise Learner Record Repository (ELRR) provides the ability to look across many distributed learner records as if they were from a single source and enables the sharing of local and global learner data across the DoD. This learner data will be pulled from authoritative sources for publishing, customizing, and harmonizing individual profiles, performance records, and training records. These data may be used to support adaptive instruction, improved decision making, and analytical insights into learners and the systems they interact with.

Once launched, personnel can access their training records throughout their learning journey at DoD and use this information to ensure they have the skills and credentials required for their career path. These data facilitate the longitudinal analysis of a military career to evaluate systemic readiness issues, efficiency of education/training activities, completeness of standards, and media efficacy. This can lead to reduced variance in training outcomes, improved rate of return on assets for training media and facility acquisition, and improved lethality due to increased proficiency.

1.2 Purpose of This Document:

This document presents the requirements needed to advance the ELRR toward its Initial Operational Capability (IOC).

1.3 The ELRR as a Part of the Total Learning Architecture

The ELRR capability is an integral part of the ADL Initiative's Total Learning Architecture (TLA) research and development project. The TLA includes a set of technical specifications, standards, and policy guidance that define a uniform approach for integrating current and emerging learning technologies into a learning services environment.

The ADL Initiative is working with the Institute of Electrical and Electronics Engineers (IEEE), an internationally recognized standards-development organization, to formally establish the data standards required for successful TLA implementation. One such standard includes the IEEE P2997 Enterprise Learner Record standard for harmonizing the structure of learner record metadata generated and used by education and training activities. This standard is a critical component of the ELRR capability as it will facilitate the creation of portable learner records that can be shared across DoD organizations to improve education/training efficiency and increase military readiness. The records will also benefit learners themselves as they navigate their career paths within and outside of DoD.

The data underpinning the ELRR is sourced from various ADL TLA data sources by custom connectors, known as ELRR Services, which transform and standardize human performance and assertions of competence. These data are presented to DoD learning managers and learners via the ELRR Portal.

The primary method for tracking and communicating human performance within TLA-connected applications is through the Experience API (xAPI) standard. The xAPI standard is used to track learner performance from different systems (e.g., learning activity, registration system). The standard defines the general structures for creating xAPI statements. These statements are stored in a Learning Record Store (LRS), which is formally part of the standard. These runtime performance data can be leveraged to optimize formal/informal training and work/life experience (Figure 1, Control Loop 1).

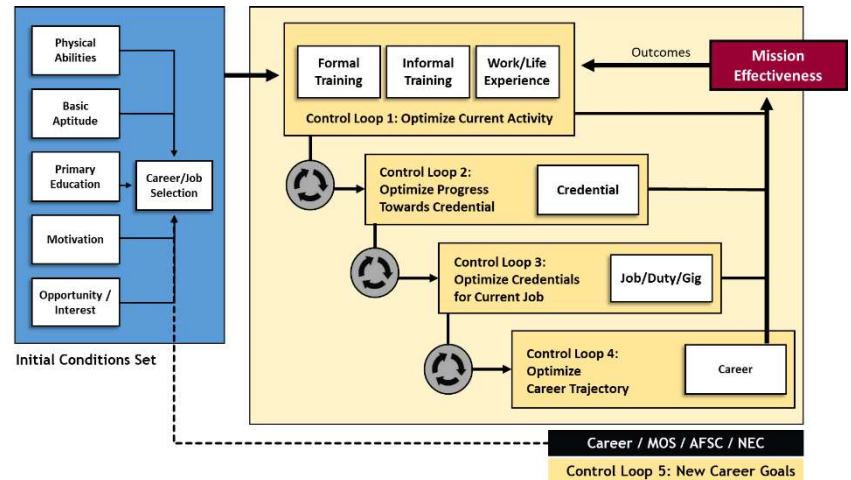


Figure 1. Talent Management Control Loops

Assertion of competence – the progress made based on the mapping of the learning event towards a defined credential – is based on the combination of individual learner records, and the environment in which the learning activity occurred (Control Loop 2). Multiple credentials together form competency-based assertions in relation to a learner’s job, duty, gig, or assignment.

Taken together across multiple jobs, duties, gigs, or assignments in a learner’s lifecycle of work and training performance (Control Loop 3), the sum of learning activities, learning credentials, and the current job form the basis of a career trajectory (Control Loop 4). These elements may or may not include a separate career trajectory (Control Loop 5) should a learner entertain or embark on a new career trajectory unrelated to the expected one described above. The data exchanges across this control loop hierarchy form the abstract basis of an “evidentiary chain” critical to the implementation of the ELRR.

2 Requirements Beyond IOC

In September 2020, a one-year contract to develop an ELRR functional prototype was awarded. The prototype builds upon software services and tools developed to support the ADL Initiative’s TLA project and the Naval Education and Training Command (NETC) MyNavy Learning (MNL) project. These include technologies and methods for connecting different authoritative data sources – each of which store fragments of an individual’s lifelong learning data – into a continuous system of systems. This structure supports the shift from an outdated “conveyor belt” approach to individual development, to a more effective career/lifelong learning and development approach.

FY22 work built off the ELRR Prototype to begin development of the ELRR IOC. This work included maturing the underlying data model and improving the Learner API that serves as the primary interface for connecting the ELRR to other DoD systems (i.e., Joint Information Environment, MNL, Airman Learner Record, Joint Service Transcript (JST), Army Training Information System).

The ELRR IOC is scheduled for release in Q3 FY23. It is comprised of three core components: 1) ELRR Presentation Layer, 2) ELRR Application / Data Mesh Layer, and 3) ELRR Data Storage / Database. The ELRR Presentation layer represents the user-facing components of the ELRR to enable users to interact

with the aggregated learner data. The front-end offers views for learners, training and career managers, and system administrators, with tailored data. The ELRR Application / Data Mesh contains the business or functional process logic for the ELRR Prototype. This process logic is critical in receiving, transforming, validating, and storing learner record data from ADL TLA systems. The ELRR Storage / Database contains the persistent storage in a relational and graph database management system.

The ELRR IOC deployment approach relies on repeatable, well-defined steps that involve compiling code, building the application, conducting automated unit tests, provisioning servers, and uploading code to Platform One GitLab. The ELRR deployment is orchestrated by a continuous integration/continuous delivery (CI/CD) pipeline. Leveraging the CI/CD pipeline enables quicker releases and improves code quality resulting in fewer bugs following a release.

As the ELRR is intended to be highly usable software within a learning services environment that leverages the TLA, it must be viable in a DoD environment. Consequently, ELRR requirements take on multiple forms, listed below and described in corresponding subsections:

- Security
- Availability and Accessibility
- IOC Functionality
- Documentation
- Testing and Evaluation
- Tutorials, Templates, and Support

2.1 Security

The ELRR is currently being integrated into the DoD Learning Enclave (DLE) which is being deployed through the Air Force Platform One program. Platform One is a modern cloud-era platform that provides valuable tooling, hosts CI/CD DevSecOps pipelines, and offers a secure Kubernetes platform for hosting microservices. The integration of the ELRR into the DLE covers a majority of NIST 800-53 RMF controls for hosting applications in DoD Impact Level (IL) 2, 4, and 5 environments.

The deployment into Platform One's CI/CD environment results in a Certificate to Field (CtF) for the ELRR. The CtF will allow the ELRR to run under the Platform One Continuous Authority to Operate (cATO) for their IL4 environment. The CtF process uses many of the test results from the DevSecOps pipeline to evaluate the NIST 800-53-RMF controls that are specific to the ELRR (components, languages, architecture). The CtF is valid for one year or until the architecture changes. It is important to note that the ELRR CtF only applies to its use in the Platform One IL4 environment and is specific to the Platform One cATO. However, the security controls that the ELRR must meet to receive the IL4 CtF are similar to the security controls that will be required by other Authorizing Officials (and other ATOs) across the DoD.

Current State: The ELRR CI/CD pipeline (Figure 2) is in the process of being established inside Platform One. The pipeline connects the ELRR source code in the Platform One GitLab repository to an IL2 staging server that will be used to establish the development, test, and production environments of the operational system. The development and test environments will be established in the Platform One IL2 environment. The production environment will run in the Platform One IL4 environment. All are hosted on AWS servers secured through Platform One / Cloud One.

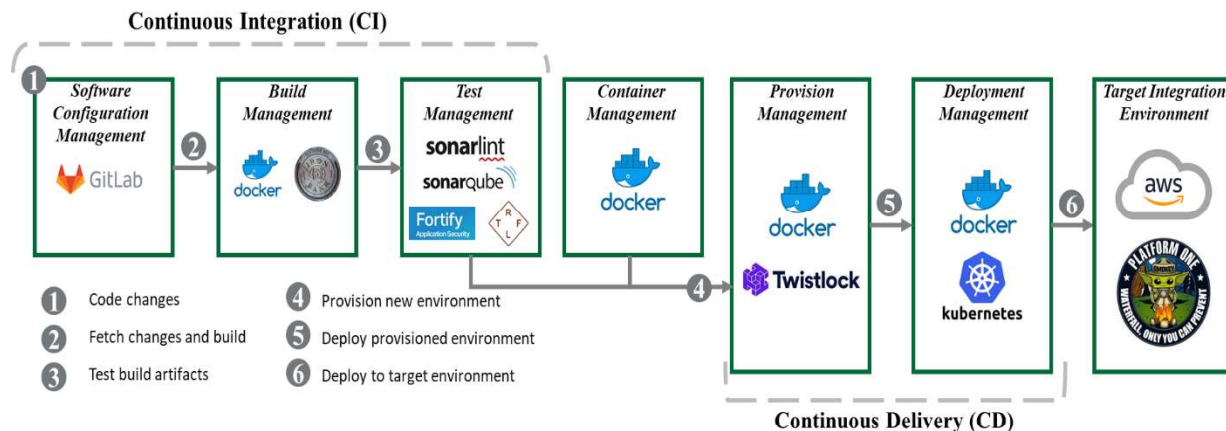


Figure 2. ELRR-Adopted Platform One CI/CD Pipeline for Party Bus Deployment

The source code delivered by the ELRR is currently being refactored to support Platform One DevSecOps requirements. This will work result in an ELRR IOC that runs in a secure IL4 environment. The migration to an established DevSecOps pipeline within the DLE mitigates cybersecurity risk for implementation of future versions of the ELRR. The ELRR IOC architecture will stay largely intact, and all updates will be automatically tested.

2.2 Availability and Accessibility

The ELRR needs to be available to the DoD and whole of government to support the search and discovery of education and training resources for all DoD personnel.

Current State: To support the defense-wide requires the software to run error free 24/7/365 with 99.999% uptime. It also requires the ability to conform to DoD's Identity, Credentialing, and Access Management (ICAM) policy using both CAC cards and multi-factor authentication. This requirement is being met for the ELRR IOC through Platform One's [Cloud Native Access Point](#) (CNAP).

ELRR IOC+ Requirement: The ELRR IOC needs to be readily available to all DoD components, academic institutions, and the various developer communities of software tools that support lifelong learning. ELRR IOC+ requirements for availability and accessibility include:

- 1. Create an approved ELRR Iron Bank Container:** This work leverages the work completed to develop and integrate the ELRR into the future Platform One Big Bang environment. The hardened ELRR source code must be optimized and packaged to provide local record discovery and management capabilities to DoD stakeholders. This benefits any DoD organization that needs to connect disparate individual profiles, performance records, and training records into a single portable learner profile. This also benefits developers of any DoD software system that support the whole human capital supply chain. By making the ELRR container available in Iron Bank, developers can integrate IEEE P2997 conformance natively within their systems so they can connect to other systems of record.
- 2. Establish and maintain a public ELRR Codebase:** Providing access to the ELRR source code for adoption and integration into other talent management systems (e.g., LMSs, LXPs, Human Resource Management Systems) is also important. [Platform One's Gitlab repositories](#) store the latest version of the ELRR source code. A public version of the ELRR source code needs to be

established in the [ADL Initiative's public GitHub](#). This repository will need to be updated and matured to provide records management vendors and other developers with the appropriate technical details required to make informed decisions on whether to use (or contribute to) the ELRR source code. Make-buy decisions for developers considering open-source technologies includes many factors including a determination of how active a project is, the development roadmap of features (e.g., GitHub Issues), and the availability of technical documentation. The ELRR repositories should provide the developer community with enough information to determine whether the project is a good fit for their needs.

3. **Implement the ELRR package into the Learning Technology Warehouse (LTW):** The LTW portal is a website where DoD end users can discover, access, and test a catalog of learning technologies that have been developed and endorsed by ADL. The LTW product catalog is designed to support a long-term vision of providing a comprehensive listing of accredited software solutions that are conformant with ADL's TLA. The LTW is essentially a hub for discovering, evaluating, and deploying interoperable learning applications across DoD. The products included within the LTW are evaluated for quality to include documentation, detailed certifications, terms and conditions for use, and any subordinate maintenance costs or licensing restrictions. An ELRR product page will need to be established to include detailed product information and links to live demonstration. All ELRR software executables and containers, as well as their associated metadata, documentation, and demo artifacts (e.g., reports, video, slides), will need to be regularly reviewed to ensure the ELRR project page is accurate and current within the LTW.

2.3 IOC Functionality

The ELRR IOC+ needs to have a core set of functions available to end users and must provide a user experience that facilitates the discovery of aggregated enterprise learner records by learners, training and career managers, and system administrators. The ELRR IOC will achieve TRL8 in a relevant environment and will conduct pilot testing in live IL-4 stakeholder environments.

Current State: The ELRR is designed to offer flexibility in automating machine-to-machine connectivity between source learner record systems, while offering learning managers and learners the ability to look at learning progress across the enterprise and view learner details through an ELRR Portal front-end. The ELRR is composed of the following components:

- **ELRR Portal:** The current version of the ELRR provides two main portals; 1) ELRR Learner and 2) ELRR Admin. The ELRR Learner portal enables record consumers (e.g., learners, training and career managers) to view aggregated learner records and to discover enterprise learner record data. To support maintenance and governance of learner records, the ELRR Admin portal provides system administrators a view of imports, endpoints, and errors.
- **ELRR Auth:** The ELRR Auth is the enterprise authentication client configured with ADL TLA reference architecture identity and access management solution, KeyCloak. When a user signs in through KeyCloak their role (e.g., learner, training or career manager, system admin) will dictate what data the user will see on the ELRR Portal. The roles within KeyCloak ensures all users within the ELRR have the least amount of access to ELRR to conduct their job.
- **ELRR Aggregator:** Enables data to be transferred from the Authoritative LRS to the API Gateway, which routes the learner record to the correct Kafka topic. The xAPI specification allows for validation of the Authoritative LRS learner records, which can improve ELRR data quality by rejecting records that do not match the expected structure. The API Gateway delivers scalability

and reliability to the ELRR by adding additional API paths for future ELRR data model enhancements, in addition to being able to handle a large amount of simultaneous learner records requests.

- **Kafka / Zookeeper:** Provides the streaming service to manage the various data streams from the Authoritative LRS. The streaming service provides a ledger of all communications between ELRR and source systems to ensure that any data streams successfully loaded into Kafka will be processed, thus improving ELRR reliability.
- **ELRR Services:** Executes the ELRR business logic by interacting with TLA components such as Learner Profiles, CaSS, and Enterprise Course Catalog (ECC) systems. Due to the highly specified function, ELRR Services can rapidly scale to meet high demand of data ingested into the ELRR.
- **ELRR Local Staging:** Stores the consolidated xAPI statements from ADL's authoritative LRS, according to the TLA MOM standard. Learning event and learner state records are in the JSON format defined for the xAPI (IEEE P9274), in addition to profile, competency data from CaSS, and course metadata from ECC source systems.
- **ELRR Storage:** ELRR Storage is the ELRR application database which stores the aggregated learner records. The data model is like the ELRR Local Staging database, but also includes metadata to enhance the learner records. The ELRR Portal leverages this database to populate the front-end screens used by end-users.

IOC+ Requirements:

As part of the ELRR IOC release, the current TRL5 capability should be expanded to achieve TRL8, where the ELRR system is completed and qualified through test and demonstration in real stakeholder environments. Additional work is needed to mature the underlying data model and improve the Learner API that serves as the primary interface for connecting to other DoD systems (e.g., Joint Information Environment, MNL, Airman's Learner Record, JST, Army Training Information System). Additional capabilities are also required to improve ELRR capabilities, mature the ELRR user experience, and foster adoption of the ELRR's core technologies (e.g., Learner API, P2997).

Building upon the development of the ELRR IOC, the following updates must be made:

1. **Continued Management and Development Activities:** The ADL Initiative must continue to manage, plan, and coordinate development and deployment activities for the ELRR. The ELRR must be operated efficiently and maintained by keeping the source code updated, patching security vulnerabilities, and adding technical features that help promote the adoption and integration of ELRR tools, technologies, and microservices by other DoD organizations. This work results in incremental minor ELRR releases as the source code is continually updated or other ELRR improvements are made.
2. **Mature the ELRR Data Model:** Expand and refine the IEEE P2997 data standard to:
 - a. Define the structure of the Learner Profile and the business rules and configuration control processes for exchanging that information across disparate systems
 - b. Support extensible and controlled linked vocabularies
3. **Privacy API Requirements Development:** The ADL Initiative needs to define / refine requirements for using, developing, and integrating a Privacy API that allows learners to manage their personal privacy settings from any connected devices. Market research is needed to identify current and conflicting policy guidance and to identify solutions for deconflicting policy guidance to inform the Privacy API requirements and planned development approach.

Requirements should be aligned to MIL HDBK 29612, TRADOC FM 350-70, and other DoD data strategy guidance.

4. **Graph Model Integration:** The ELRR storage databases should expand to include a fully supported graph database. This graph database should use open-source solutions, like Neo4J, for storing aggregated ELRR records, resulting in a linked data model that can improve the definition and parameters of the data fabric. Such efforts will also clarify how the enterprise schema service can be a facilitating agent for ELRR development and stakeholder adoption. This work requires the following high-level tasks:
 - a. Mature and connect the Learner API with the graph database. The Learner API is used to push/pull P2997 metadata between TLA connected systems. By connecting to the graph model, we set the foundation for improved search times. This is important when considering the scope and scale of learner records across the DoD. These benefits support the development of 3rd party systems that use the data stored by the ELRR (e.g., career-field management tools, recommenders, personal assistants) to perform other tasks.
 - b. Connect the graph model to other ELRR components to enable the graph model as the primary database used to store P2997 metadata. The lessons learned and data models for the relational database should be preserved so developers using the ELRR capabilities can select which database they prefer.
5. **Learner API Enhancements:** Additional API paths for future ELRR data model enhancements are needed to accommodate other DoD organization's authoritative learner record stores and human capital supply chain systems that support the learning pipeline (e.g., Career Field Management tools). This includes enhancements to support machine-to-machine connections for future Artificial Intelligence capabilities.
6. **ELRR User Interface Enhancements and JST Alignment:** With the additional data sources and types of supported data, the ELRR Learner and Admin portals should be optimized and improved to allow users to better refine what they're looking for. The ELRR user interfaces should also be expanded to support all features and capabilities available within the existing JST to ensure individual service members can capture, aggregate, and report out on their military training, education, and experiences via their transcript. These features and capabilities include (at a minimum):
 - a. Transcript Portability: Transcripts should be available to send directly to academic institutions or made available for download by each service member.
 - b. Role-Based Access and Controls: The ELRR portals should provide role-based log-in for learners, administrators, and JST Operations Center staff.
 - c. JST Requirements Access: The ELRR portals should provide a common access point for accessing information about American Council on Education (ACE) credit recommendations, service member courses and experience, and reporting requirements for the JST.
 - d. Embedded Analytics: The ELRR Portals should be instrumented to collect analytics about usage (e.g., Google Analytics).
 - e. Support Resources: The ELRR Portals will include links to the JST help desk, technical support, and frequently asked questions. Detailed information will be provided for Veterans who have transcripts that pre-date the JST's existing digital records.

7. **JST Support and Maintenance:** The ELRR IOC should maintain all existing JST capabilities so there is no degradation of service for individual's using the JST. Data that is used to drive the JST functionality will be decoupled from the MyNavy Education portal and pulled from the ELRR as part of the IOC capability. Specifically, learner records within the JST application will be pulled from the ELRR, JST Course Identifiers, descriptions, and alignment to ACE credentials will be pulled from the ECC, and occupational competencies and credentials within the EDLM Competency and Credential registry will be aligned with ACE credit recommendations catalogued within the ACE Military Guide.
8. **UI/UX Design Documentation:** Updated ELRR UI/UX storyboards, wireframes, user flow diagrams, and documentation should be created to include alignment to JST. Demonstrations showing developmental progress and new iterations should be held for stakeholders as needed to support review and comment of the UI/UX design.

2.4 Documentation

ELRR documentation currently includes general instructions for installing, configuring, and integrating the ELRR into the DoD Learning Enclave. A System Integration Plan (SIP) was provided by the developer to help guide the installation and configuration of the ELRR project onto AWS servers. Architecture documents have also been provided throughout the development period. While technical documentation will require continuous updates, these should only be incremental and tied to the development work being performed. More focus should be placed on the creation of user-facing documentation that supports the different ELRR user communities.

IOC+ Requirement: The ELRR documentation should be available via multiple outlets including the GitHub.io website, the ADL Initiative website, the LTW, and the ELRR's support pages where other user-facing support is provided (e.g., FAQs, Knowledge Base, tutorials). Updates to the ELRR documentation should include:

1. **Requirements Traceability and Verification Matrix (RTVM):** An RTVM should be delivered that encapsulates the requirements and their associated test criteria for all improvements being made during this period of performance. This RTVM should be developed in collaboration with JST developers and designated stakeholders to define / refine and incorporate JST system requirements. Each requirement should be assigned a single verification method (test, demonstration, analysis, or examination) and a test case used to verify that requirement.
2. **System Architecture Report (SAR):** Update ELRR architecture documentation that describes the specification and deployment of hardware and software, interfaces and port/protocol usage, and other architecturally relevant information. The architecture should include a description of the concept of execution, which may be developed in concert with the user experience documentation. This report should include the JST MVP system architecture and the underlying conceptual model that defines its structure, behavior, and views of a system. This includes a formal description and representation of a system, organized in a way that supports reasoning about the operation of the system.
3. **Database Design Description (DBDD):** Update ELRR database design documentation to describe the data used internal to ELRR and available by default in the ELRR portals. The database schema should identify 1) where each data element resides, 2) owners / stewards of the systems where each data element is stored, and 3) how that data will be accessed.

4. **UI/UX Design Documentation:** Updated ELRR UI/UX storyboards, wireframes, user flow diagrams, and documentation should be created to include alignment to JST. Demonstrations showing developmental progress and new iterations should be held for stakeholders as needed to support review and comment of the UI/UX design.
5. **Cybersecurity Documentation:** The contractor will deliver the cybersecurity documentation required by Platform One to support testing and accreditation activities. This includes, at a minimum, development of:
 - a. System Security Plan to document and outline the ELRR security requirements and planned security controls for meeting those requirements.
 - b. Disaster Recovery Plan to identify contingency plans for minimizing the effects of a disaster (e.g., cyber-attacks, power outages). This plan should identify the required operational data, location, communication plan, and response steps that are needed in the event of a disaster. Secure, cloud-based disaster and offsite data backups should also be included.
 - c. Privacy Impact Assessment (PIA) to identify and mitigate privacy risks. The PIA should document all Personally Identifiable Information (PII) that the ELRR capability is collecting, why the PII is being collected, and how the PII will be collected, used, accessed, shared, safeguarded, and stored.
6. **ELRR System Integration Guide:** A detailed set of instructions for installing and configuring the ELRR software onto cloud servers based on best practices and lessons learned from the ELRR work within the DLE. This documentation needs to teach organizations how to create and/or modify ELRR components to work within their organization.
7. **ELRR Support Pages:** These web-based support pages should be integrated into the ELRR and the ADL's Jira issue tracking system to enable continuous tracking and management of ELRR issues. Support pages should include a knowledgebase, tutorials (e.g., System administrator training videos), FAQs, and documentation that ELRR users may use to improve their use of ELRR services.
8. **User Documentation:** At a minimum, user-facing documentation should be provided to help system administrators / operators, learners, and instructors. These documents should provide detailed instructions for performing various tasks within the ELRR.

2.5 Testing and Evaluation

Test and evaluation of the ELRR capability has been limited to a simplified test environment reflective of the current cybersecurity posture. Testing during the first year of ELRR development included System Integration, Functional, Performance, and Security and Access Control Testing in the ADL's TLA Sandbox. System Integration Testing was performed to test that the external interfaces, multiprogram and complex functionality, usability, and the interactions between the integrated components achieved the expected criteria. The purpose of Functional Testing was to test that target requirements could be traced directly to use cases, business rules, and/or business functions. This verified proper data acceptance, processing, and retrieval, and the appropriate implementation of the business rules. Performance Testing determined ELRR system parameters, which allowed the development team to observe application weaknesses and bottlenecks. Finally, Security and Access Control Testing ensured that only those users granted access to the system, in the hosting environment, were able to access the applications, and only through the appropriate gateways.

IOC+ Requirement: Once the ELRR has obtained the appropriate authorities to connect, operational testing will be conducted, to include an operational readiness test and stakeholder usability testing with ELRR designated stakeholders. The operational readiness test is designed to make sure the ELRR works as expected and that it is ready to be put in front of ELRR designated stakeholder representatives. User testing with stakeholders intends to verify that the user experience and user interface functionality of the ELRR works according to the user's function, including the ease of use relative to the identified business requirements, personas, and overall system acceptance criteria.

1. **ELRR Continuous Test and Evaluation Plan (CTEP):** This plan lays out a strategy for testing and evaluating the ELRR IOC as required updates are identified, defined, implemented, and deployed. Formative testing should include usability testing using small focus groups with targeted studies designed to improve workflows. Operational testing should take place after all IOC+ functionality has been deployed and integrated into ELRR designated stakeholder environments. Operational testing should be coordinated with designated stakeholders and should take place using operational systems running within the organization.
2. **ELRR Pilot Test:** Testing and evaluation of the ELRR's ability to connect to additional authoritative data sources (e.g., HR systems) should be conducted with ELRR stakeholders to inform the requirements and updates needed to improve the underlying API capabilities and front-end enhancements.
3. **ELRR Operational Test:** Based on available funding, a multi-modal, operational test should be performed to analyze ELRR usage, strengths, weaknesses, opportunities, and threats across all aspects of the system lifecycle. This test should be designed to minimize the impact on ELRR designated stakeholders and should predominantly use the data collected about organizational usage of the ELRR.
4. **ELRR Analytics Dashboard(s):** The continuous test and evaluation dashboards should be implemented on the ELRR Learner and Admin portals to identify usage trends, demographics, through-put, workflow optimization, and other insights to help prioritize requirements for updating and improving ELRR features.
5. **ELRR Verification and Validation (V&V) Report:** The V&V report should include all experimental details, technical approaches, outcomes, lessons learned, and recommended improvements.

2.6 Tutorials, Templates, and Support

Throughout the development of the ELRR, ADL Initiative staff and the ELRR vendor have delivered multiple webinars, tutorials, articles, and publications to foster adoption of the ELRR and its underlying IEEE P2997 standard. Most of these have been about the broad set of capabilities being developed for the ELRR and have not been focused on 'how' different users can accomplish tasks required to operate and maintain the system.

IOC+ Requirements: Tutorials, articles, and other publications should also be developed using recorded videos and other presentation opportunities such as I/ITSEC, iFEST, and DADLAC meetings. Other recommended requirements include:

1. **Learner API Tutorial:** As part of the annual TLA PlugFest, a tutorial will be developed to help developers use the API to access, share, and update P2997 metadata.

2. **Technical Support:** As part of the ELRR Support portal, a help desk capability should tie into ADL's Jira / Confluence issue tracking system to establish traceability and facilitate the easy assignment of incoming issues to the appropriate personnel.

3 Full Operational Capability

ELRR FOC Requirements: The ELRR Full Operational Capability (FOC) requirements need to be defined in parallel to IOC deployment and operational testing. After the initial 'Go-Live' date for the ELRR IOC and upon analysis of the ELRR Analytics Dashboard, the system's FOC requirements should be developed to optimize the efficiency, usability, and functionality of the system to provide best value to DoD personnel. This work should be completed in concert with the overall requirements definition process for all DLE systems. Current plans are targeting a Go-Live date for all DLE IOC systems in Q1 FY23 and FOC requirements to be substantially defined 6 months after that.

4 Conclusion and Next Steps

The ELRR and the underlying P2997-based data model is a game-changer as far as specifications and standards are concerned. It enables the future learning environment by providing necessary structure to describe and share individual learner data across organizations, systems, and modalities.

The ELRR FOC requirements will be largely dependent on feature enhancements, adoption of the IOC capability, evolution of the P2997 standard, and emerging requirements as identified via ongoing collaboration with ELRR stakeholders.

4.1 Summary of Recommended Tasks

Line of Effort	Task Description
Availability and Accessibility	Creating an approved ELRR Iron Bank Container: This work leverages the work completed to develop and integrate the ELRR into Platform One's Big Bang environment. The hardened ELRR source code must be optimized and packaged to provide local record discovery and management capabilities to DoD stakeholders.
Availability and Accessibility	The ELRR codebase needs to be updated, matured, and expanded to be listed in the ADL Initiative's public GitHub . The ELRR codebase will provide developers with the appropriate technical details required to make informed decisions on whether to use (or contribute to) the ELRR source code.
Availability and Accessibility	An ELRR Product page needs to be established in the ADL Initiative's LTW to include detailed product information and links to live demonstration. All ELRR software executables and containers, as well as their associated metadata, documentation, and demo artifacts (e.g., reports, video, slides), will need to be regularly reviewed to ensure the ELRR project page is accurate and current within the LTW.
Functionality	The ELRR must be operated efficiently and maintained by keeping the source code updated, patching security vulnerabilities, and adding technical features that promote the adoption and integration of ELRR tools, technologies, and microservices by other DoD organizations.
Functionality	Expand and refine the IEEE P2997 data standard to Define the structure of the Learner Profile and the business rules for exchanging that information across disparate systems, and support extensible and controlled linked vocabularies.
Functionality	Define / refine requirements for using developing and integrating a Privacy API that allows learners to manage their personal privacy settings from any connected devices.

Line of Effort	Task Description
Functionality	Integrate a graph model into the ELRR capability. The Learner API should be matured and connected to the Neo4J graph database.
Functionality	Connect the graph model to other ELRR components to enable the graph model as the primary database used to store P2997 metadata.
Functionality	Establish additional API paths for future ELRR data model enhancements to accommodate other DoD organization's authoritative learner record stores and human capital supply chain systems that support the learning pipeline.
Functionality	Optimize and improve the ELRR Learner and Admin portals to reflect additional data sources and different types of supported data.
Functionality	Alignment of the ELRR capability to JST requirements to include incorporation of transcript portability, RBAC, integration of JST required content, embedded analytics, and support resources.
Functionality	Provide JST support and maintenance to include all existing JST capabilities so there is no degradation of service for individual's using the JST.
Documentation	Provide an updated RTVM that encapsulates the requirements and their associated test criteria for all improvements being made during this period of performance. This RTVM should be developed in collaboration with JST developers and designated stakeholders to define / refine and incorporate JST system requirements. Each requirement should be assigned a single verification method (test, demonstration, analysis, or examination) and a test case used to verify that requirement.
Documentation	Provide an updated System Architecture Report that describes the specification and deployment of hardware and software, interfaces and port/protocol usage, and other architecturally relevant information. The architecture should include a description of the concept of execution, which may be developed in concert with the user experience documentation. This report should include the JST MVP system architecture and the underlying conceptual model that defines its structure, behavior, and views of a system. This includes a formal description and representation of a system, organized in a way that supports reasoning about the operation of the system.
Documentation	Provide an updated ELRR database design documentation that describes the data used internal to ELRR and available by default in the ELRR portals. The database schema should identify 1) where each data element resides, 2) owners / stewards of the systems where each data element is stored, and 3) how that data will be accessed.
Documentation	Develop ELRR UI/UX storyboards, wireframes, user flow diagrams, and documentation to include alignment to JST. Demonstrations showing developmental progress and new iterations should be held for stakeholders as needed to support review and comment of the UI/UX design.
Documentation	Develop a System Security and Disaster Recovery Plan to document and outline the ELRR security requirements and planned security controls for meeting those requirements.
Documentation	Develop a Disaster Recovery Plan to identify contingency plans for minimizing the effects of a disaster (e.g., cyber-attacks). This plan should identify the required operational data, location, communication plan, and response steps that are needed in the event of a disaster. Secure, cloud-based disaster and offsite data backups should also be included.

Line of Effort	Task Description
Documentation	Conduct a PIA to identify and mitigate privacy risks. The PIA should document all PII that the ELRR capability is collecting, why the PII is being collected, and how the PII will be collected, used, accessed, shared, safeguarded, and stored.
Documentation	Develop a ELRR System Integration Guide that includes a detailed set of instructions for installing and configuring the ELRR software onto cloud servers based on best practices and lessons learned from the ELRR work within the DLE. This documentation should teach organizations how to create and/or modify ELRR components to work within their organization.
Documentation	Develop ELRR Support Pages. These web-based support pages should be integrated into the ELRR and the ADL's Jira issue tracking system to enable continuous tracking and management of ELRR issues. Support pages should include a knowledgebase, tutorials (E.g., System administrator training video), FAQs, and documentation that ELRR users may use to improve their use of ELRR services.
Documentation	Create User Documentation to help system administrators / operators, learners, and instructors. These documents should provide detailed instructions for performing various tasks within the ELRR.
Testing and Evaluation	ELRR Continuous Test and Evaluation Plan (CTEP): This plan lays out a strategy for testing and evaluating the ELRR IOC as required updates are identified, defined, implemented, and deployed. Formative testing should include usability testing using small focus groups with targeted studies designed to improve workflows. Operational testing should take place after all IOC+ functionality has been deployed and integrated into ELRR designated stakeholder environments. Operational testing should be coordinated with designated stakeholders and should take place using operational systems running within the organization.
Testing and Evaluation	ELRR Pilot Test: Testing and evaluation of the ELRR's ability to connect to additional authoritative data sources (e.g., HR systems) should be conducted with ELRR stakeholders to inform the requirements and updates needed to improve the underlying API capabilities and front-end enhancements.
Testing and Evaluation	ELRR Operational Test: Based on available funding, a multi-modal, operational test should be performed to analyze ELRR usage, strengths, weaknesses, opportunities, and threats across all aspects of the system lifecycle. This test should be designed to minimize the impact on ELRR designated stakeholders and should predominantly use the data collected about organizational usage of the ELRR.
Testing and Evaluation	ELRR Analytics Dashboard(s): The continuous test and evaluation dashboards should be implemented on the ELRR Learner and Admin portals to identify usage trends, demographics, through-put, workflow optimization, and other insights to help prioritize requirements for updating and improving ELRR features.
Testing and Evaluation	ELRR Verification and Validation (V&V) Report: The V&V report should include all experimental details, technical approaches, outcomes, lessons learned, and recommended improvements.
Tutorials, Templates, and Support	Learner API tutorial: As part of the annual TLA PlugFest, a tutorial will be developed to help developers use the API to access, share, and update P2997 metadata.
Tutorials, Templates, and Support	Technical Support: As part of the ELRR Support portal, a help desk capability should tie into ADL's Jira / Confluence issue tracking system to establish traceability and facilitate the easy assignment of incoming issues to the appropriate personnel.