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# Phase II- Factor 2: PWS

The National Telecommunications and Information Administration (NTIA) plays a critical role in expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth. The Manual of Regulations for Federal Radiofrequency Spectrum Management, known as the Redbook, needs modernization as it is a mission-critical digital communication tool, requiring a modern, usable, searchable, secure, FedRAMP compliant solution, as well as vendor with proven success developing and migrating large-scale Agency-level web applications and websites. **Team** **RIVA is that vendor—developing an interactive, digital Redbook experience with Drupal in Acquia is our solution.** We focus on long-term sustainability of the Redbook solution with consistent alignment to NTIA objectives.

Our Redbook solution applies **Team RIVA’s Integrated Digital Experience (iDX) Framework (Figure 1)** that uses a FedRAMP-compliant Drupal Content Management System (CMS) and combines User Experience (UX) and Content design, search, and analytics, offering the highest standards of security, compliance, usability, and accessibility to amplify NTIA’s mission.

A screen shot of a computer

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Figure 1: RIVA's Drupal-based iDX Delivery Framework Guides the Delivery of Federal Websites, Providing Low-Risk CMS Migrations and Compliance with Federal Digital Standards.

Our iDX Framework integrates human centered design (HCD), content strategy, UX, analytics, search, and CMS strategy, development, and migration. We provide large-scale agency website and web application strategy and services aligned with Federal digital policies (e.g., the 21st Century Individuals with Disabilities Education Act [IDEA] and the latest Office of Management and Budget (OMB) guidance on Delivering a Digital-First Public Experience Memorandum).

## A Modernized Online Presence [SOO Section 4.1]

The main objective of the Redbook modernization contract is to transform the Redbook into an interactive, searchable, and user-friendly online experience. Currently, the Redbook consists of static, unlinked PDF documents that lack interactivity and search functionality. To meet the needs of NTIA and its broad spectrum of users, including engineers, policymakers, and legal professionals, the Redbook needs to be modernized into an intuitive, accessible, and efficient online platform. The tasks described below align with best practices and federal standards to deliver a clean, interactive, and compliant user experience.

***(a) Clean Display of Information [SOO Section 4.1(1)a)].*** A clean display of information requires a responsible design fit to the user’s device, consistent formatting across all content, and an intuitive user interface (UI). Our approach to cleanly displaying Redbook content includes the following:

* Implementing a modern design built on USWDS (U.S. Web Design System) standards, maintaining a consistent interface across devices and following federal branding guidelines
* Using logical hierarchies and accessible navigation, improving readability and user flow
* Employing modern frontend tools, such as Bootstrap and React, for scalability, accessibility, and a smooth UX across various devices and platforms
* Supporting logical information flow for an improved UX, aligning with USWDS 3.0 standards ensuring website is scalable, repeatable, and compliant with government accessibility mandates, including Section 508 and Federal Information Technology Acquisition Reform Act (FITARA) guidelines
* Formatting consistently across all content types (tables, text, and graphics)
* Incorporating responsive design for accessibility across multiple devices (including mobile)

We will integrate all these elements into the Drupal CMS, so that the platform is scalable and compliant with federal mandates such as WCAG 2.1 accessibility standards.

***(b) Clickable Links and Easy Navigation [SOO Section 4.1(1)b].*** Team RIVA’s approach to linking specific sections of the document includes the following:

* Providingclickable links throughout the Redbook website, ensuring that users can navigate directly to relevant content or external references from any point in the document.
* A link to a section within the Redbook (hyperlink).
* A button that opens a modal window with additional information.
* A clickable tab that switches views in a multi-tabbed interface.
* Hyperlinking content throughout the website, enabling users to quickly access specific sections, tables, or figures.
* To organize the Redbook content in Drupal, each chapter, section, and subsection will be treated as distinct nodes using Drupal’s content type management, allowing each to have a unique URL for deep linking and easy navigation. An upfront content analysis will define the structure, ensuring that chapters, sections, and subsections are properly organized and interlinked. Nodes will be interconnected using Entity Reference fields, enabling content like subsections to reference their parent sections or chapters. A well-defined taxonomy and hierarchical menu structure will enhance searchability and navigation, allowing users to access specific rules or figures with ease. This approach ensures a cohesive and user-friendly experience for browsing large documents like the Redbook.

***(c) Footnotes Display on Hover [SOO Section 4.1(1)c].*** To allow additional information to appear when a user hovers over select terms or citations, we apply our method for enabling interactive footnotes as described below:

* Use JavaScript tooltips and custom Cascading Style Sheets (CSS) to show footnote content on hover, ensuring a seamless reading experience, ensuring users can access detailed information without leaving the page.
* Follow WCAG guidelines for accessibility for footnotes and references, so that they can be accessed by all users, including those using screen readers

***(d) Logical Information Organization [SOO Section 4.1(1)d].*** Clear and logically organized information is essential to a modernized Redbook. We will:

* Break down Redbook content into structured components such as sections, rules, tables, and figures, allowing users to easily find and access content
* Implement faceted search using Solr (or Elasticsearch if NTIA elects to purchase a more robust search capability) and content filtering features, allowing users to browse by categories such as topic, frequency, or regulation type
* Group information based on topic relevance, with clear headers, subsections, and a consistent layout to guide users seamlessly through the Redbook.

***(e) Advanced Search Capabilities [SOO Section 4.1(1)e].*** A key requirement is a powerful search mechanism that supports advanced operators and wildcard characters, enabling users to search deeply within the document and related sections. Our approach to implementing this feature includes the following:

* Full text search capabilities powered by Apache Solr or Elasticsearch, indexing every piece of content within the Redbook
* Faceted search filters, allowing users to refine their searches based on document sections, frequency ranges, or policy areas
* Natural language processing (NLP)-based search improvements for intuitive query handling.

***(f) PDF Generation from Website Content [SOO Section 4.1(1)f].*** Users will be able to generate PDF versions of any part of the Redbook, so content can be easily downloaded and shared. Our approach includes:

* Custom PDF generation scripts using libraries such as dompdf or TCPDF, which will automatically compile sections of the document and make them available as PDF downloads
* Accurately representing the layout, tables, and figures in the generated PDF files, maintaining the integrity of the original content.

***(g) Expandable and Interactive Tables [SOO Section 4.1(1)g].*** One of the challenges of the current Redbook is its static tables. We will upgrade tables to be:

|  |  |
| --- | --- |
| Feature | Description |
| **Interactive and expandable** | Allows users to sort, filter, and manipulate the data as needed. We will build this functionality using JavaScript frameworks such as DataTables or React for dynamic content interaction and enhanced user control. The tables in scope include anything in a table format in the existing Redbook PDF file. |
| **Searchable** | Users can easily locate specific values or frequency allocations within the table. |

***(h) Alternative Views and Customizable Interfaces [SOO Section 4.1(1)h].*** Users can switch between different views of the content, depending on their preference:

* Users can select text-only, table, or graphical views for complex datasets and figures
* Users can personalize their experience by selecting default views, to allow them to access the content in the way that suits their needs best.

***(i) Interactive Diagrams and Graphics [SOO Section 4.1(1)i].*** To enhance comprehension of complex topics, the modernized Redbook will include interactive diagrams, visualizations and visual aids. These will be built using:

* D3.js or Chart.js to create interactive charts and graphs so users can manipulate data visually
* Scalable Vector Graphics (SVG)-based diagrams, which are interactive and responsive, allowing users to zoom, pan, or hover over elements for additional information.
* ***(j) Compliance with Federal Policies and Best Practices [SOO Section 4.1(1)j].***  Our solution fully complies with federal policy mandates, including FITARA, the Federal Information Security Modernization Act (FISMA), FedRAMP, the 21st Century Integrated Digital Experience Act (IDEA), OMB’s M-23-22 Memorandum, and NTIA and Department of Commerce (DOC)-specific instructions. We propose hosting the Redbook solution on **Acquia Cloud**, a **FedRAMP-certified** infrastructure, ensuring compliance with federal security standards.
* To meet accessibility requirements, all data displays and interactive elements will adhere to **Section 508 Compliance** standards, allowing users with disabilities to interact with the Redbook content seamlessly. The platform will include **version control and auditing** capabilities to log all changes for full transparency and compliance with auditing requirements.
* Additionally, regular **security audits and continuous monitoring** will be conducted to maintain compliance with **FISMA** and **NIST SP 800-53 controls**. The **Drupal CMS** will leverage automated workflows and machine-readable formats, ensuring the Redbook’s structured data is accessible, updated, and usable by both humans and machines.
* In line with the **21st Century IDEA Act**, our solution will deliver a **modern, user-centered, and mobile-friendly** digital experience that enhances accessibility, usability, and engagement for both internal staff and external users.

***(k) Complete and Well-Articulated Documentation [SOO Section 4.1(1)k].*** Our solution will include complete and well-articulated documentation to allow it to be understandable, repeatable, and scalable. This documentation will:

* Outline the technical architecture, including code structure, content management workflows, and deployment processes
* Provide a user guide for NTIA personnel to update and maintain Redbook content over time
* Include best practice guidelines for ensuring ongoing compliance with federal mandates.

The modernized Redbook solution will transform the current static PDFs into a fully interactive, compliant, and user-friendly platform. The solution will provide measurable outcomes, such as increased accessibility, improved searchability, and enhanced user engagement, all while complying with federal regulations and policies. The use of modern tools and a user-centered design approach so that that the platform not only meets NTIA’s current needs and is also scalable and futureproof for ongoing improvements.

## Extraction, Management, and Display of Data in the Redbook [SOO Section 4.2]

The transition will begin with an upfront content analysis to define the structure of the Redbook manual, ensuring that each section is appropriately categorized. The process will involve automated tools like OCR (Optical Character Recognition) to extract text from the PDF and convert it into HTML. After cleanup, the HTML content will be imported into Drupal using the Migrate API or Feeds Module to map chapters, sections, and subsections into nodes. Media files such as images will be handled using Drupal’s Media Module.

**Mapping of Redbook PDF into Drupal CMS Components**

|  |  |
| --- | --- |
| Current Redbook PDF Structure | Mapping to Drupal Components |
| Manual Title | Drupal **Landing Page**: A single landing page or homepage for the entire manual. |
| Chapters | **Content Types**: Each chapter will be a unique node under the custom content type "Chapter." Each node will have its own unique URL. |
| Sections within Chapters | **Subsections as Drupal Nodes**: Sections under each chapter will be created as distinct nodes and interlinked via entity references. These sections will also have their own URLs for deep linking. |
| Subsections (e.g., 1.1 Authority and Functions Directed by the Secretary) | **Taxonomy Terms**: A hierarchy of terms will be created to tag content for filtering, search, and organization (e.g., "Authority," "Functions"). |
| Tables (e.g., frequency charts) | **Structured Data Fields**: Tables will be stored as structured data using Drupal’s content types or fields for tabular data, allowing for advanced sorting, filtering, and searching. This ensures tables are treated as queryable data rather than static content. Create Visualizations of key tables such as frequency charts to improve user interactions. |
| Figures and Appendices | **Media Entities**: Use Drupal's **Media Module** to handle non-text elements like figures and appendices, allowing proper referencing and embedding within chapters and sections. Media files will have its own URL for reuse and linking. |
| Cross-references in the manual | **Entity Reference Fields**: These fields will be used to interlink nodes (e.g., link Chapter 1 with a related Section 2.3.4, or a figure in Chapter 3). |
| Table of Contents | **Custom Menu**: A hierarchical menu reflecting the manual's structure, providing easy navigation between chapters and sections. |

***Data Extraction.*** To extract structured data, such as the Table of Frequency Allocations and channel plans, from the current PDF-based Redbook, our automation-based approach will reduce manual work and increase accuracy. Tools such as Optical Character Recognition (OCR) and dompdf will automate the extraction of tables and structured data from the static PDF. Custom scripts will convert the data into reusable formats such as CSV, JSON, or XML. These formats will allow for both human and machine consumption, so the data can be reused programmatically.

|  |  |
| --- | --- |
| Feature | Description |
| **Data Transformation** | Extracted data will undergo cleaning and validation to verify accuracy and consistency. We will standardize and map the data into the relevant content types in Drupal for easy management and display and check that all frequency tables and channel plans are properly structured and stored in a logical format. |
| **Structured Content Models** | We will create custom content types in Drupal for each dataset, such as the Table of Frequency Allocations, allowing NTIA staff to manage the data effectively. Each content type will include fields for frequency range, allocation details, and regulatory notes, enabling easy updates and retrieval. |

***Data Management.*** Once extracted, the data will be managed within the Drupal CMS, ensuring it remains organized, accessible, and up to date. Key aspects of our data management approach include the following:

| Feature | Description |
| --- | --- |
| **Drupal** | Drupal will serve as the central hub for managing Redbook data. Each table or dataset will be treated as a content node, allowing for easy editing, version control, and collaboration. Custom taxonomies will be used to categorize and filter the data, ensuring it can be easily navigated by users. |
| **Metadata** | The extracted data will be enriched with metadata to enhance its discoverability. Metadata attributes such as frequency range, spectrum use, and legal references will be stored, enabling users to search and filter the data efficiently. Each dataset will have version control, allowing NTIA to track changes and updates. All data updates are logged, and the previous versions can be easily retrieved for reference. Automated workflows in Drupal will streamline content updates. Staff can submit changes for approval, and review updates before going live. This approach allows Team RIVA to implement a controlled and transparent update process. |

***A blue and white text on a white background

Description automatically generatedData Display.*** Once managed in Drupal, the structured data will display an interactive and user-friendly way, using visualizations, dynamic tables and interactive charts built with tools such as DataTables, Vue.js, or Chart.js. This allows users to sort, filter, and manipulate data on the fly. For example, users can filter the Table of Frequency Allocations by frequency range or usage type. As noted in the customer success story for Acquisition.gov, we will apply a similar approach using interactive tables within dynamic pages for the Redbook, using proven technologies to enable NTIA users to interact dynamically with structured frequency and channel allocation data. Users will be able to view the data in various formats, including tabular views, graphical representations, and simplified text views. These different views allow both technical and nontechnical users to interact with the data in a way that meets their needs. The system will include advanced search capability powered by Apache Solr or Elasticsearch, enabling complex searches based on frequency, allocation type, or other metadata attributes. Faceted search will further enhance the user experience, allowing users to filter results based on predefined categories. Hover-based tooltips for key data points will enhance usability. Users can hover over a table entry or chart element to view additional details, such as footnotes or legal references, without leaving the page. Team RIVA will work closely with NTIA to enable/implement AI powered search capabilities (Such as Conversational Search) in accordance with PWS requirements either via released Drupal AI modules or custom integrations.

***Machine Friendly Format.*** Extracted data will be made available in machine readable formats such as XML and JSON, ensuring that it can be easily integrated into other systems and tools. Our solution features include:

* RESTful APIs that allow external systems and users to programmatically access the structured data in XML and JSON formats, so that the data is not only accessible via the web interface but can also be used by third party applications, researchers, and engineers for analysis and integration into their workflows
* Option to download datasets in machine readable formats, such as CSV or JSON, from the Drupal interface. NTIA staff and external users can export the data for offline analysis or use in other applications

## Content Delivery [SOO Section 4.3]

NTIA requires improved content delivery for the Redbook and its website, taking into account compatibility to Microsoft (MS) Word, cost and long-term sustainability, and affects to the organization required for these improvements.

### A close-up of a sign Description automatically generatedProvide a Content Delivery System [SOO Section 4.3(1)]

***(a) Allows for editing [SOO Section 4.2(1)a].*** Our solution allows for seamless editing and content management across both Word and the Drupal CMS. By providing Word interaction, users will be able to edit content in Word and import it to the Drupal system. Similarly, they will be able to export to a basic MS word format document after the document is finalized.

**Custom CKEditor Configuration.** In the Drupal CMS, we will configure CKEditor to offer Word-like editing functionality for staff. This offers a consistent editing experience across Word and Drupal, allowing users to format text, manage tables, and work with complex documents. Similar to our customer success story for GSA.gov, our team will enable NTIA staff to draft and review Redbook content in Word, to preserve formatting. Documents can then be imported directly into Drupal for web publishing, with minimal manual intervention. As in our work with GSA’s FAR and procurement regulations, where we managed structured regulation content in Drupal, we will create custom content types for the Redbook, allowing NTIA staff to easily manage sections, tables, and figures. Version control and workflows will allow them to easily log, track, and review content updates before publishing.

***(b) MS Word Integration [SOO Section 4.2(1)b].*** A critical feature of our solution is its ability to interact with MS Word while preserving complex formatting, including tables, footnotes, and figures. In GSA.gov, we successfully implemented a system where regulatory documents could be imported from Word. For the Redbook, we will use similar techniques so the Redbook’s complex formatting (e.g., frequency tables) remains intact when word documents are imported to the website. Similarly, a feature to export the document to word and other formats like pdf will be provided. We recommend that once the documents are imported the final editing happen at a specific location, which is Drupal so that workflow, track changes, versions will be available at a single place for review for everyone involved.

***(c) Produces final Word and PDF products of the Redbook [SOO Section 4.2(1)c].*** The system will support the creation of final Word and PDF versions of the Redbook, automating much of the manual work currently involved in assembling these documents. Based on our experience automating the generation of final FAR documents for GSA.gov, we will integrate tools such as dompdf or TCPDF into Drupal to generate high quality, print ready PDFs. For Word exports, we will create custom templates to meet NTIA’s formatting and style requirements for the final Redbook documents.

***(d) Allows for updating information on website [SOO Section 4.2(1)d].*** NTIA staff want to update Redbook content in real time. Our solution will ensure any changes made in Word or Drupal are immediately reflected on the website after passing though the basic workflow. In GSA’s FAR modernization project, we implemented a system where regulation updates made in Word were synchronized with the website. Similarly, for NTIA, we will automate the process of syncing Redbook content updates between Word and Drupal, ensuring the website is always up to date. This eliminates the need for manual updates and reduces the likelihood of errors.

### Refine Process with Stakeholder Engagement [SOO Section 4.3(2)]

***(a) Utilize an agile methodology to engage stakeholders and refine the solution.*** NTIA aims to streamline and enhance the content delivery process for both the creation of the Redbook and its corresponding website management. This includes seamless interaction with Word for drafting, reviewing, and publishing updates to the Redbook, as well as the automatic synchronization of updates on the website. To meet the objectives of the SOO and efficiently manage and deliver content, our approach centers on an agile methodology for frequent stakeholder feedback and iterative development, while reducing manual process, enhancing automation, and ensuring sustainability.

| Agile Element | Approach Details |
| --- | --- |
| **Agile Methodology for Stakeholder Engagement** | Deliver incremental updates and functional prototypes to NTIA stakeholders.  Utilize short development cycles (sprints) to develop and refine features.  Focus on core functionalities such as Word integration, PDF generation, and website updates. This approach ensures that NTIA can provide feedback early and often, helping us tailor the solution to meet real world needs.  Schedule frequent reviews and demos for NTIA staff.  Allow users to test the system early, to evolve the system using their feedback. |
| **Coordinating Organizational Change Management** | Support NTIA staff through the transition with comprehensive training.  Provide training sessions and user documentation for regulatory staff.  Establish clear communication channels so stakeholders are informed of project progress. |
| **Long Term Maintainability** | Allow staff to manage content independently, without requiring extensive technical support.  Implement automated workflows to manage updates.  Develop workflows for Redbook content updates by reducing manual effort and ensuring content is reviewed and approved before going live.  Provide documentation for all system aspects from Word integration to PDF generation.  Update documentation regularly to reflect any changes made during the project, so the solution remains easy to use and maintain.  Deliver a content delivery system for NTIA that simplifies the creation, management, and publication of the Redbook.  Deliver a cost-effective, sustainable, and compliant system. |

Additional details are available in **Section *1.6.***

## Minimum Viable Product [SOO Section 4.5]

The Minimum Viable Product (MVP) for the NTIA Redbook modernization project requires end-user availability for the intended solution at aggressive and clearly documented intervals not to exceed six months for the initial demonstration and one year for the delivery of a solution that meets the baseline objectives identified in the SOO. This requirement allows NTIA to begin interacting with the core functionalities of the system early, ensuring that stakeholder feedback is incorporated iteratively into the development cycle, leading to a more refined final product.

### Objective of the MVP

The primary goals of the MVP are to create a working prototype with key functionalities within six months to allow stakeholders to review, test, and provide feedback on the solution. Within one year, the solution must meet baseline functionalities including:

* Content extraction, editing, and management through a Drupal based CMS
* Integration with Word for seamless content drafting, importing, and exporting, preserving the formatting between Word and the website
* Interactive search and retrieval functionalities, including advanced filtering for structured data like frequency tables and channel plans
* Automated PDF generation and real time website updates.

### Core Features of the MVP

The MVP will focus on core functions to allow NTIA users to interact with it. This includes:

| Feature | Description of MVP Component or Feature |
| --- | --- |
| **Basic Content Management** | Users will be able to import, edit, and manage Redbook content within the Drupal CMS. The MVP will support advanced editing tools, version control, workflows for content approval. |
| **Search and Retrieval** | A basic search engine (likely powered by Solr or Elasticsearch) will allow users to search through Redbook content. Search capabilities will include keyword searches, along with filters based on metadata. |
| **Word Integration** | Content will be importable from Word, ensuring the preservation of formatting while importing. The system will also allow content to be exported to Word and other formats from the website as needed. |
| **Agile Development** | We will implement an Agile development process, with iterative releases allowing NTIA to regularly test and review new features. |
| **User Feedback** | Stakeholder and user feedback will be integrated into each development cycle, ensuring the final product is built with end user needs in mind |

### Baseline Delivery Within 1 Year

By the end of one year, the MVP will evolve into a fully functional baseline solution, with expanded features and more polished interfaces. Primary goals for the baseline solution include:

| Feature | Description of Fully Functional Baseline Solution Component or Feature |
| --- | --- |
| **Advanced Content Editing/Browsing** | Advanced content editing features and seamless browsing capabilities. |
| **Complete Content Editing Workflow** | Integration of advanced workflow management tools for drafting, reviewing, and approving Redbook updates. |
| **Enhanced Search Features** | Implementation of advanced search filters (faceted search) and the ability to search across metadata attributes like frequency ranges, channel allocations, and usage notes. |
| **Auto-Generated Documents** | Tools to automatically generate PDFs and structured Word documents from Redbook content for distribution and publication. |
| **Scalability and Compliance** | A scalable solution hosted on Acquia’s FedRAMP certified infrastructure, allows the system to comply with federal security requirements and policies. |

### Timeline for Delivery

***Six Month Milestone.*** Our approach includes demonstrating the MVP to NTIA within six months, providing stakeholders with access to the system’s core functionalities (content editing, basic search, and Word integration). Feedback from this demo will inform further iterations.

***One Year Baseline Delivery.*** Our approach will yield a full solution in a year, meeting the SOO objectives including content management, document generation, and compliance features.

## Modern, Reuseable, Sustainable System Development Lifecycle (SDLC) Best Practice [SOO Section 4.5]

A modern, reusable, and sustainable SDLC is essential for the long-term viability and success of the NTIA Redbook modernization effort. NTIA’s objective is to implement SDLC best practices that automate as much of the software development lifecycle as possible, minimize manual coding efforts, so the system remains flexible, secure, and scalable over time. By leveraging opensource solutions, modular development, and agile methodologies, our approach allows for efficient content delivery, adherence to government standards, and the ability to rapidly prototype and iterate based on stakeholder feedback.

***(a) 508 Compliance [SOO Section 4.5.a].*** Ensuring 508 compliance is critical, so our solution will prioritize accessibility and adhere to WCAG 2.1 guidelines throughout the SDLC, including:

| Element | Approach |
| --- | --- |
| **Automated Accessibility Testing** | Automated accessibility checks at each stage of development will allow the final product to meet Section 508 compliance. We will integrate tools such as Axe or Pa11y into the Continuous Integration/Continuous Deployment (CI/CD) pipeline to identify accessibility issues early in the process. |
| **Human Centered Design** | Using HCD principles will create a solution that is intuitive and accessible. We will conduct regular usability testing with users requiring assistive technologies (e.g., screen readers), and incorporate that feedback for compliance. |

***(b) Frequent incremental delivery in compliance with FITARA [SOO Section 4.5.b].*** Our SDLC approach will be in full compliance with FITARA, ensuring that the solution adheres to federal IT acquisition standards. This involves delivering frequent, incremental updates to the system, allowing NTIA to continually assess the progress and provide feedback during the development process. Using Agile allows us to frequently deliver working software through short development cycles (sprints). Each sprint will deliver functional components of the system, allowing stakeholders to review and test the solution throughout its development. We will also conduct regular demos to obtain feedback. Stakeholders will participate in sprint reviews and product demos at the end of each sprint, so we are developing the system according to NTIA’s requirements, and we assess that the product meets FITARA standards for transparency, accountability, and measurable progress.

***(c) An understandable, repeatable, and validated solution which can be leveraged by other development teams for future requirements [SOO Section 4.5.c].*** NTIA requires a solution that is understandable, repeatable, and validated, allowing it to be leveraged by other development teams for future requirements across various NTIA and federal initiatives.

| Element | Approach |
| --- | --- |
| **Modular and Reusable Components** | Our solution will use modular development practices, allowing reuse of Open Source based individual components in future projects including the Drupal Paragraphs Views and Workflow modules. By focusing on modularity, we create a system where individual features and functionalities can be extracted and repurposed for other use cases without requiring significant changes to the overall system architecture. |
| **Comprehensive Documentation** | Comprehensive documentation will support reuse and understanding by other teams. This will include technical specifications, configuration guides, and step by step instructions for setting up and deploying the system. Regular documentation updates reflect any changes made during development. |
| **Testing Automation** | Our test-driven development (TDD) approach automates tests created for every new feature or functionality. This supports system validation at each step of the SDLC and easy regression testing for future changes. |

***(d) Implementation of automation in development methodology [SOO Section 4.5.d].*** Automation is key to improving the efficiency of the SDLC, reducing manual errors, and speeding up the delivery of software. Our SDLC practices will leverage automation wherever possible to streamline development, testing, and deployment processes.

* **CI/CD Pipeline.** Using tools like Jenkins, GitHub Actions, or Acquia Pipelines will automatically build, test, and deploy code whenever changes are made.
* **Automated Testing**. Our Testing Automation approach includes Our test-driven development (TDD) approach automates tests created for every new feature or functionality. Automated testing at multiple stages in the CI/CD pipeline includes
* **Unit Tests** to test individual functions or components.
* **Integration Tests** to demonstrate that various components work together as intended.
* **End-to-end Tests** to simulate real-world use scenarios and validate the entire system.
* **Performance and Security Testing** to verify the system meets performance benchmarks and complies with federal security standards.
* **Automated Code Analysis**. Tools like SonarQube or Codacy perform static code analysis, identifying potential bugs, vulnerabilities or code quality issues before they become risks.

***(e) Leverage sustainable and secure solutions to reduce the creation of custom code [SOO Section 4.5.e].*** NTIA requiresa modern SDLC solution that is sustainable, secure, and minimizes custom code. This reduces long term maintenance costs, enhances security, and evolves the system with changing requirements. Our approach includes:

* **Opensource Technologies** reduce the need for proprietary solutions and custom code. Implementation of a community driven development model with regular security updates and feature enhancements, such as the widely adopted opensource platform Drupal.
* **SaaS and PaaS integration** minimize custom development. Acquia’s PaaS platform will manage hosting, security, and performance optimization without using custom infrastructure.
* **Security Best Practices** such as FedRAMP, FISMA, and NIST SP 80053 guidelines, maintain system security and compliance with federal regulations.

Our approach emphasizes long-term sustainability and reusability. With a combination of opensource technologies, automation, and modular components, our approach yields a flexible and adaptable solution for future use cases. We minimize custom code use by:

* **Leveraging Existing Drupal Modules.** Building on top of existing Drupal modules, reduces the need for custom development. This enables system benefits from regular updates, security patches, and community support
* **Extending Functionality w/ Configuration.** Extending the functionality of existing solutions through configurations rather than custom coding new features, allows the system to meet specific NTIA needs without introducing technical debt.

Our SDLC approach optimizes the ease of system maintenance and upgrades:

* **Modular Design.** By building the system in a modular fashion, individual components can be upgraded or replaced without affecting the entire system
* **Automated Monitoring and Logging**. Implementing automated monitoring tools (such as New Relic or Acquia Cloud Metrics) to track system performance, identify potential issues, and maintain uptime. This supports quick identification and resolution of problems.

## A diagram of a user experience Description automatically generatedUtilization of Agile Process and Stakeholder Engagement [SOO Section 4.7]

***(a) Engagement with stakeholders involved in the construction of the manual and website process [SOO Section 4.7.a].*** The diverse community of NTIA Office of Spectrum Management (OSM), external agency, engineers, spectrum managers, and policy professionals who reference the Redbook routinely as the primary and authoritative source for rules authorizing federal government spectrum uses are the primary stakeholders for Redbook modernization. Internally, NTIA’s OSM staff and supporting contractors rely on the Redbook daily, from managing and overseeing interdepartmental radio uses, performing electromagnetic compatibility analyses, and assigning and certifying federal agency frequency assignment and equipment certification requests, among its wide range of responsibilities. These users also make updates to the Redbook as required, using Microsoft Word and PDF exports. Externally, a wide range of users look to the Redbook to understand Federal government spectrum uses and supporting processes, including:

Figure 2: We Will Use HCD To Maintain Redbook Stakeholder Engagement during All Phases of Redbook Solution Delivery.

| Typical Redbook User | Sample Use Cases |
| --- | --- |
| **Federal Communications Commission Staff** | Reference Redbook when making changes to non-federal spectrum use rules and to understand how proposed changes may impact federal operations. |
| **Federal spectrum users** | Reference the manual to develop requests for spectrum assignments, purchase and deploy radio-dependent systems and request funds from the Spectrum Relocation Fund to study spectrum repurposing. |
| **Lawyers, engineers, and policy professionals** | Interact with the Redbook for a wide range of purposes including supporting federal agencies, developing and manufacturing spectrum-dependent systems, planning and operating terrestrial and satellite systems, and pioneering new and emerging wireless technologies. |

Redbook modernization requires engagement with stakeholders involved in the construction of the manual and website process by performing HCD stakeholder engagement activities, which puts the wants, needs, and limitations of internal and external Redbook end-users and stakeholders at the focal point of all Redbook modernization design and delivery activities. This will allow for the capture and prioritization of the highest impact Redbook modernization features for the MVP and to plan the product roadmap that will deliver highly impactful solution features for all users and stakeholders. To meet the objectives of the SOO with modern, reuseable, and sustainable SDLC best-practices that include a direct interface with Redbook stakeholders to drive and assess requirements, our approach includes the following:

| Requirement | Approach Details |
| --- | --- |
| **Ongoing User Research** | Continuously engage with real internal and external Redbook end-users and stakeholders. Conduct initial baseline discovery with Redbook users and stakeholders, observing their behaviors, collecting feedback on existing systems, and documenting their journey to inform Redbook modernization feature definition and design. Capture and prioritize the highest impact Redbook modernization features for the MVP and to plan the product roadmap that will deliver a highly impactful solution features for all users and stakeholders. |
| **UX Design & Prototyping** | Using what is learned from baseline discovery efforts, define MVP features and design accessible interactions, information architectures, wireframes, content strategies, and interactive UX protypes, leveraging the **USWDS**.​  Consider GenAI user experiences, such as a ChatGPT-style conversational AI search experience for Redbook, which is being prototyped today and could be activated post-MVP and after baseline functionality is delivered.​Evaluate the AI-powered search’s ability to provide relevant and accurate results based on user queries, considering different content types and structures within Drupal. Tasks include evaluating the AI-powered search’s ability to provide relevant and accurate results based on user queries, considering different content types and structures within Drupal, assessing the integration of AI’s NLP capabilities in understanding user queries expressed in natural language (e.g., questions or conversational phrases), and evaluating the AI’s capability to enable faceted and filtered searches, ensuring that users can refine results based on Redbook specific content type, taxonomy, tags, or other metadata. |
| **Continuous Stakeholder Feedback** | In a sprint-based, agile cadence, collect ongoing Redbook stakeholder feedback on all modernized Redbook features and designs, typically with demos, task-based usability testing, card-sorting, tree-testing, and qualitative user satisfaction ratings. This will be an agile, iterative, and ongoing feedback collection and product evolution process. |

***(b) Establishment of a cadenced communication and delivery pipeline allowing for collaboration and progressive elaboration in alignment with government agile best practices [SOO Section 4.7.b].*** A cadenced communication and delivery pipeline is defined as the continuous, regularly scheduled methods for team and stakeholder communication and continuous software delivery on a predicable, regular timeline. Successful communication is measured by frequency and quality, and successful delivery of software is compliant, usable, and low defect features and functions that have be demoed and tested by stakeholders. Agile delivery, in alignment with established government and NTIA best practices, will combine planned, ongoing communication within and outside for the Redbook design and delivery teams. Upon project initiation, the contractor will meet with NTIA stakeholders to review specific agile methods in use at NTIA (such as Scrum) and adjust Redbook modernization team agile delivery methods. Agile methods rely on frequent, open communication using common agile ceremonies (Daily Stand Ups, Spring Retrospectives, Demos, and User Testing, Etc) tools (such as Jira), and processes (Increment and Sprint Planning, User Story Research and Documentation, Backlog Grooming, etc. and align with Agile best practices.

**Communication and Agile Delivery Pipelines for Redbook.** We will establish a delivery pipeline for the Redbook modernization project, leveraging any existing NTIA DevOps and other software delivery pipelines. The pipeline will utilize DevOps and CI.CD tools provided in the Acquia environment. To execute methods to drive ongoing, incremental value in the Agile delivery process, it is beneficial to use a *dual track agility* framework (**Figure 3**) where HCD and UX teams work in advance of software delivery (development) teams. User Researchers and UX Designers work together to analyze specific user needs for features, functions, and interaction and create information architectures, wireframes, and interactive UX design prototypes. User Researchers collect short-cycle usability feedback before designs are handed off for development. Links to final UX designs are provided in an established Agile toolset, often in the form of a link embedded in a Jira-housed user story to a Figma UX design prototype. Periodically, full-scale task-based usability tests are conducted, and results lead to validation of designs or improvements that can be made in development.

A diagram of a software development process

Description automatically generatedFigure 3: Dual-Track Agility plus DevOps and Continuous Deployment Leads to Releasing on Demand with a Minimum Weekly Communication Cadence

NTIA Product Owners, stakeholders, and design/delivery team must communicate openly and frequently. To foster a deeply integrated partnership between NTIA and the vendor team, minimum communication should happen weekly to maintain alignment and transparency. Transparency is key, and we will document Redbook requirements as user stories in a tool such as Jira and keep them available to all stakeholders. We will delivery weekly status reports, which will highlight accomplishments, plans for upcoming work, and risks. Sprint-based demos and presentations will showcase designs, prototypes, and delivered code/product. Opportunities for stakeholder feedback will be frequent, at a minimum on a sprint-based cadence.

## Deliverables

Deliverables outside of those standard deliverables mentioned in this section will be provided on an as-needed basis and determined by the NTIA. A deliverable is anything that can be physically delivered but may include non-physical things such as meeting minutes.

| Deliverables | Description | Frequency | Submit To |
| --- | --- | --- | --- |
| Monthly Status Meeting | Establish and facilitate  monthly progress meetings to include the Contracting Officer's Representative {COR}, and other Government personnel. | Monthly, to discuss contract status, staffing changes, milestones, risks, and opportunities to improve support. | COR, TPOC |
| Monthly Status  Report (MSR) | Monthly report that summarizes programmatic activities | Monthly, no later  than the 10th of the month | COR, TPOC |
| Weekly Status Report (WSR) | Weekly report that summarizes programmatic activities (MS Word of PDF) | Weekly on Monday, or next business day | COR, TPOC |
| Meeting Support Documentation | Briefing slides, agendas, handouts, and other supplementary materials at least 24 hours in advance (MS PowerPoint, or PDF) | 24 hours in advance of the scheduled meeting | COR, TPOC |
| Product Roadmap | A Product Roadmap for the NTIA Redbook website solution with major milestones and release information, which are updated based on stakeholder needs and feedback. | Initial Product Roadmap delivered no later than 60 days after contract start. Ongoing (at least quarterly) updates as required. | COR, TPOC |
| Website design document(s) | Definition of technical architecture, design specifications, and user interaction element for the NTIA Redbook site. Detailed designs for the User Experience (UX) and User Interface (UI) elements of the Redbook website (wireframes, information architecture, and interactive prototypes.) | For MVP Initial document within 75 days of contract start, final design document no later than 60 days after MVP Launch. Ongoing as required. | COR, TPOC |
| Quality assurance report | Overview of the quality assurance processes and testing results to ensure that the project meets the required standards | Monthly, or as required | COR, TPOC |
| Performance metrics report | A report capturing key performance indicators (KPIs) related to the website’s functionality, including load times, uptime, and user interactions. | Monthly, or as required | COR, TPOC |
| Section 508 conformance testing report | This report will detail the accessibility testing performed to ensure compliance with Section 508 standards, ensuring the website is accessible to individuals with disabilities. | Monthly, or as required | COR, TPOC |
| Security compliance checklist | A checklist outlining compliance with NTIA’s security protocols, including FISMA, FedRAMP, and other relevant federal cybersecurity guidelines. This will ensure the website meets necessary security standards and remains secure against threats. | Annually, or as required | COR, NTIA Security POC |
| Redbook personas and customer journey maps | The development of personas representing the different types of users and stakeholders of the Redbook, along with journey maps detailing their interactions with the platform. | Initial report no later than 45 days after contract start. Ongoing reports as required | COR, TPOC |
| Prioritized, stakeholder-driven, MVP and baseline product requirements | A continuously updated report listing the product requirements based on input from stakeholders. | Ongoing, or point-in-time requirements report as required | COR, TPOC |
| User feedback and usability reports, with prioritized backlog recommendations | Reports summarizing user feedback and the results of usability tests, along with recommendations for backlog prioritization. | Initial report no later than 60 days after MVP launch. Ongoing reports as required | COR, TPOC |