

ARRC TAM Phase 2

Options Analysis

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1. Purpose

This Options Analysis provides an assessment of the major challenges and considerations in evaluating options, assesses the viability of various Options, and summarizes Next Steps.

2. References

The EAM Functional Requirements Analysis produced during TAM Phase 1 laid the foundation for Options Analysis and Next Steps and should be consulted for additional context.

Document	Date	TAM Phase	Produced By
EAM Functional Requirements Analysis	9/9/19	Phase 1	Kimley Horn and Intueor
TAM Phase 2 Requirements Matrix	10/29/20	Phase 2	CTG

3. Challenges

There are two significant challenges in evaluating, selecting, and implementing asset management applications: the flexibility to handle dissimilar asset classes (e.g. Locomotive vs. Track) and the relationship of the asset applications to JDE.

3.1. Dissimilar Asset Categories

The most efficient option would be to accommodate all asset categories and classes within a single flexible asset management application. However, the different asset classes have unique and detailed sets of data attributes for assets and have different hierarchies.

The challenge is finding an application that would allow such flexibility and filter the application functionality so users do not have to see or use functionality not designed to accommodate their asset class.

This is particularly important with the requirements clearly pointing to the need for a centralized system of record for asset and work management with a digital-first and mobile-enabled approach.

3.2. JDE Relationship

Establishing the relationship between JDE and the asset management application(s) will be a significant and challenging effort with several parts: leveraging JDE information in asset management, determining the level of asset and work detail maintained in JDE, and moving functionality from JDE.

All asset management systems will require information that is maintained in JDE such as for financial cost codes, employee information, etc. This data is likely to be systematically imported and updated in the asset management system from JDE.

The level of detail that JDE maintains for assets and work would likely be reduced to the minimum, relying on the asset management system for detail.

Functionality that is integral to managing work such as purchasing and inventory would have to be integrated with JDE, or may need to be moved out of JDE and into an asset management application so

that parts and components can be managed in detail and end-to-end. This could be a significant challenge if more than one asset and work management system were implemented.

4. Considerations

Some key considerations when evaluating options include cost efficiency, accessibility and security, usability, integration, and reliability.

4.1. Cost Efficiency

The total cost of ownership of any asset and work management applications needs to be taken into account including licensing, hosting, training, implementation, integration, on-going support, and at least quarterly updates.

Particular care should be taken evaluating systems that are well established in the market but do not provide the flexibility and modern environment called for in the requirements to avoid the need to change systems again within the next decade.

If more than one asset and work management application was selected the on-going costs for integration between multiple systems should also be taken into account as those integrations have a cost for development and maintenance and may complicate reporting.

4.2. Accessibility and Security

The requirements clearly point to the need to be able to access the asset and work management system and documents related to assets from the point of work; including on mobile devices.

Mobile device functionality should be a key factor in application evaluation, as applications may have varying levels of support for mobile and web user interfaces - all the way from a mobile-first approach.

This level of accessibility is inherently related to security. The application architecture should have robust means of protecting access and information. Multi-factor authentication for user logons should be a minimum security feature.

4.3. Usability

Usability can often be an under-estimated factor in application selection.

An application could fulfill most other requirements but require work that doesn't have a clear relationship to the organization's objectives, users may not be able to efficiently find and record data relevant to them, and management may not have a clear understanding of asset state, availability, and capital plans.

4.4. Integration

Asset and work management applications may support varying levels of integration into and out of the application. Consider the system integration requirements and avoid a "black box". Preference should be for technologies and skill sets that can be well supported now and into the future.

4.5. Reliability

Consider how asset and work management would be performed if the applications were not available and what the manual work around would be until the availability is restored.

5. Option Viability

An assessment of Option Viability is presented in two parts: a Standard Approach and the ones that are likely a Best Fit for ARRC.

The requirements gathered in TAM Phase 2 were heavily prioritized in favor of the essentials of asset and work management with usability, accessibility and a modern mobile and digital-first approach.

5.1. Standard Approach

The Standard Approach would assess whether an existing application with base functionality can be extended, then if it could not then consider a single application, and if that was not feasible a mix of applications to fulfill the requirements.

Option	Name	Assessment
B	Enhance Existing	<p>The substantial investment in JDE would need to be increased with this option; likely with mixed results. Maximizing the use of an existing platform with basic capabilities is normally considered first but it has to be balanced between the cost of investment and the results.</p> <p>It has essentially been de-selected with efforts to enhance work management workflows for departments that do not use JDE for asset and work management.</p>
E	Implement EAM	<p>A single Enterprise Asset Management system would normally be the option considered if an existing application cannot address requirements. However, the smaller size of ARRC compared to the target market of EAM vendors should be taken into account as well as the need to focus on the fundamentals of asset and work management rather than complex features.</p>
C	Hybrid Model	<p>Implementing multiple solutions that have the same base function is normally the last option considered because of the additional complexity, which can create barriers and have substantial hidden costs.</p> <p>This is essentially implementing multiple Option D's Implement CMMS, as a CMMS for mechanical asset classes is unlikely to be a good fit for others.</p>

5.2. Best Fit

The Best Fit approach to Option Viability reduces the time and effort by removing Options that are known not to meet requirements, would create additional complexity, and be challenging to maintain in the long-term.

Option	Name	Assessment
E	Implement EAM	A single Enterprise Asset Management system would normally be the option considered if an existing application cannot address requirements. However, the smaller size of ARRC compared to the target market of EAM vendors should be taken into account as well as the need to focus on the fundamentals of asset and work management rather than complex features.
F	Application Platform	<p>An option not identified in TAM Phase 1 was the selection of an application platform that provides modern application “building blocks”. This is the enterprise equivalent to custom development as the foundation platform is provided, maintained, and expanded by the vendor and ARRC can extensively customize it (from the beginning if needed) and select from a variety of functionalities to address their needs.</p> <p>Has the capability to provide the fit-for-purpose functionality of Option E Implement EAM and Option C Hybrid Model but likely on a longer time scale - though not necessarily higher cost.</p>

6. Next Steps

Recommended next steps were covered extensively in TAM Phase 1 EAM Functional Requirements Analysis Section 6 and the outline below summarizes those. The Phases have been renumbered to account for the previous TAM Phase 1 and current TAM Phase 2.

However, this Options Analysis does recommend that an additional Evaluate Budget step be performed before evaluating options. Knowing what resources are available in conjunction with the prioritized requirements will allow for a more efficient and productive evaluation process.

In addition, a final step of Maintain and Extend has been added to ensure that long-term maintenance, upgrades, and integration costs are considered.

6.1. Phase 2 - Requirements Development

These have been developed during TAM Phase 2 and have been prioritized by departments. They are suitable for the Options Evaluation phase.

6.2. Phase 3 - Evaluate Budget

Evaluate what the realistic financial resources will be available to implement and support any Option over the long-term. Resources in personnel and funding are limited and it is not practical to spend them evaluating Options and applications that would exceed the ability for ARRC to implement and support.

6.3. Phase 4 - Options Evaluation

This Phase will identify the range of vendor solutions within the Options identified and how well they fit the requirements and available resources. The objective is to select an Option to progress for vendor selection.

When moving into Phase 4 - Options Evaluation it is recommended the project team include the following dedicated roles:

- Project Manager
- Consultant
- Systems Analyst
- Data Analyst
- Business Analyst

See TAM Phase 1 EAM Section 6.2 Phase 2 - Options Evaluation for additional context.

6.4. Phase 4 - Business Case Analysis

Establish the business case and justification for a selected Option and vendor solution(s); including the full life-cycle costs and estimate the Return on Investment (ROI).

See TAM Phase 1 EAM Section 6.4 Phase 3 - Business Case Analysis / ROI for additional context.

6.5. Phase 5 - Project Programming & Funding

Finalize the scope, funding, and obtain necessary approvals for acquiring a selected solution.

See TAM Phase 1 EAM Section 6.4 Phase 4 - Project Programming & Funding for additional context.

6.6. Phase 6 - Solution Acquisition

Based upon ARRC's process for procurement acquire the software, hardware, and services required to implement the selected solution. This includes developing the procurement method and strategy, developing the RFP(s), evaluating responses, and selecting and awarding contract(s).

See TAM Phase 1 EAM Section 6.4 Phase 5 - Solution Acquisition for additional context.

6.7. Phase 7 - Implementation

Implement selected solution including any integrations, changes to existing applications for interoperability, and retire any applications or workflows that are being replaced.

The detailed plan for Maintain and Extend should be developed during this Phase.

See TAM Phase 1 EAM Section 6.6 Phase 6 - System Implementation for additional context.

6.8. Phase 8 - Maintain and Extend

Implement the plan to maintain, upgrade, and extend the asset and work management solutions over the long-term.

7. Option Descriptions

7.1. Option A - Status Quo

The Status Quo fails to meet the requirements identified, which clearly identify a need for the essentials of asset and work management.

Table information from TAM Phase 1 EAM Options 5.1:

Option	Description	Pros	Cons	Implementation
A	Status Quo: Continue using current processes and tools	No upfront costs No disruption to organization No project implementation risk	Will not support full lifecycle asset management JDE, as an ERP system provides limited work and asset management benefits to ARRC Unrealized long-term cost benefits Unrealized efficiency gains Difficult to adhere to Federal standards Limited ability to support maturing asset management practices	Upfront cost: None Additional Effort: None Return on Investment (ROI): N/A

7.2. Option B - Enhance Existing

The substantial investment in JDE would need to be increased with this option; likely with mixed results. Maximizing the use of an existing platform with basic capabilities is normally considered first but it has to be balanced between the cost of investment and the results.

Table information from TAM Phase 1 EAM Options 5.1:

Option	Description	Pros	Cons	Implementation
B	Continue using JDE, but invest in additional configuration modification to utilize JDE more efficiently	<p>Leverage current technology in place</p> <p>Some improvement in asset management functionality</p>	<p>Modifications will not provide adequate asset management functionality to support ARRC asset management</p> <p>Only marginal gains in efficiency and cost</p>	<p>Upfront cost: Low</p> <p>Additional Effort: Low</p> <p>ROI: Low</p>

7.3. Option C - Hybrid Model

Implementing multiple solutions that have the same base function is normally the last option considered because of the additional complexity, which can create barriers and have substantial hidden costs.

Table information from TAM Phase 1 EAM Options 5.1:

Option	Description	Pros	Cons	Implementation
C	Hybrid Model: Implementing multiple fit-for-purpose solutions by department	<p>Potentially lower implementation complexity for some functions</p> <p>Can be implemented modularly based on individual department</p> <p>Solution will potentially provide adequate functionality for each department</p>	<p>Ensures/promotes fractured management and reporting of asset management data for the foreseeable future</p> <p>Siloed systems with little or no integration</p> <p>Introduces the need for the procurement and maintenance of middleware to integrate asset management systems</p>	<p>Upfront cost: Medium-High</p> <p>Additional Effort: Medium-High</p> <p>ROI: Medium</p>

		<p>Allows ARRC to select the “Best of Breed” for each function</p> <p>Modest realization of system benefits within shortened timeline</p>	<p>More IT resources required with a complex mix of skills to support multiple software packages</p> <p>Separate contracts, licenses, and terms to manage and enforce with potentially higher cost</p>	
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7.4. Option D - Implement CMMS

Arguably, JDE already fills the majority of this Option for Rolling Stock. Implementing one or more CMMS across other departments may result in similar shortcomings as identified in the Cons below.

Table information from TAM Phase 1 EAM Options 5.1:

Option	Description	Pros	Cons	Implementation
D	Implement a robust CMMS tool	<p>Allows for realizing a central repository for asset management data</p> <p>May be able to realize a significant portion of ARRC’s asset management goals</p> <p>Provides an integrated central solution</p> <p>Slightly easier implementation with potentially less risk than a full EAM</p>	<p>System functionality limitations, such as linear asset and other management tools, likely not available</p> <p>Does not provide true enterprise wide tools/capabilities</p> <p>Does not provide visibility into business related practices, such as capital planning, project management, whole-life costing, trend analysis, etc.</p> <p>Will require supplemental manual / Excel systems to “fill in the blanks” in functionality</p> <p>Potentially implementing an older generation system</p>	<p>Upfront cost: High</p> <p>Additional Effort: Medium-High</p> <p>ROI: High</p>

7.5. Option E - Implement EAM

A single Enterprise Asset Management system would normally be the option considered if an existing application cannot address requirements. However, the smaller size of ARRC compared to the target market of EAM vendors should be taken into account as well as the need to focus on the fundamentals of asset and work management rather than complex features.

Table information from TAM Phase 1 EAM Options 5.1:

Option	Description	Pros	Cons	Implementation
E	Implement EAM Solution	<p>True, comprehensive solution in the asset management arena</p> <p>Highest ROI over time</p> <p>Potentially the highest level of ARRC requirements met</p>	<p>Potential for underutilization</p> <p>Highest up-front cost option</p> <p>More complex undertaking and highest implementation risk</p>	<p>Upfront cost: High</p> <p>Additional Effort: High</p> <p>ROI: High</p>

7.6. Option F - Application Platform

An option not identified in TAM Phase 1 was the selection of an application platform that provides modern application “building blocks”. This is the enterprise equivalent to custom development as the foundation platform is provided, maintained, and expanded by the vendor and ARRC can extensively customize it (from the beginning if needed) and select from a variety of functionalities to address their needs.

This is the only Option that enables an agile and incremental approach to a fit-for-purpose asset and work management system. However, it places far more responsibility on ARRC to define current and future requirements and to bring railroad expertise to that platform.

Examples of this include the Lightning platform by Salesforce and the Now platform by ServiceNow. In some cases vendors build on top of these platforms - for example ServiceMax uses the Lightning platform by Salesforce.

Option	Description	Pros	Cons	Implementation
F	Incremental Application Platform	<p>Can begin with an MVP (minimum viable product) and move on from there</p> <p>Using Agile development method can specify the</p>	<p>Requires a robust Agile development methodology</p> <p>For success, dedicated resources would</p>	<p>Upfront cost: High</p> <p>Additional Effort: High</p>

		<p>resources available and then regularly deliver incremental functionality</p> <p>Open-book platforms with the greatest opportunities for digital-first, mobile, and integration</p> <p>ARRC can prioritize functionality</p> <p>No underutilization of features; only those that fulfill a requirement are implemented</p> <p>Will always have modern up-to-date capabilities that can be implemented</p> <p>Costs are largely up to how ARRC defines and fulfills requirements</p>	<p>normally be used; partnering with the platform vendor and external implementation assistance</p> <p>ARRC will have to bring the railroad industry knowledge and expertise</p> <p>May be difficult to explain to stakeholders and may be a challenge to justify if it is intended to be funded by government agencies</p>	ROI: High
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8. Revision Log

Date	Version	Changed By	Change Description
12/10/20	Final	Sawyer	First Version
11/3/20	Draft	Sawyer	First Draft
12/24/19	Draft	Sawyer	Initial document outline