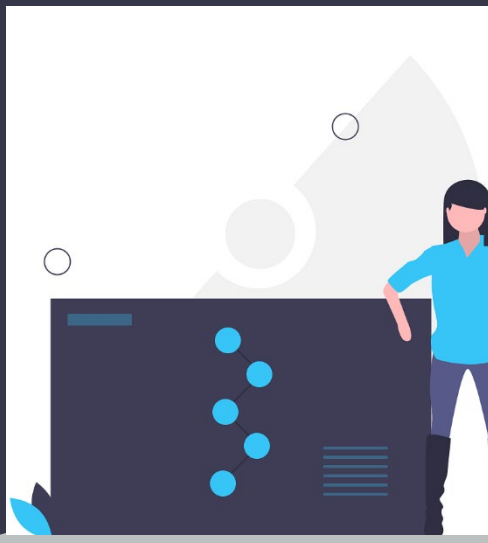
ElyonStrategies

a

CARS PROJECT ASSESSMENT

PROJECT ROADMAP



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DED	WHR	9/13/2021	Original DED
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Approvals

Role	Name	Signature	Date
Author	William Roetzheim		12/22/2021
Author	*Keith Morehouse*	12/22/2021	12/22/2021
Author	Scott Ohlund		12/22/2021
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1 Executive Summary

This roadmap supplements our Independent Project assessment by providing budgetary and other guidance for the California Automated Lobbyist and Campaign Contribution and Expenditure Search System (CAL-ACCESS) Replacement System (CARS) restart. The key components of our previous assessment report, for the purposes of this document, are:

1. The CARS project is in a restart[1] rather than a "stay the course" situation.
2. The restart will not require Salesforce, and if Salesforce is used at all it will be used as a forms processing engine to supplement other architectural components. The budgets in this roadmap assume that Salesforce is not used, an no Salesforce license costs were included in the budgets.
3. The restart will involve a new acquisition to select both the system integration vendor and the solution approach.
4. The Secretary of State (SOS) will make several process changes as part of the project restart, all designed to improve the probability of project success.

Recommended process changes, as defined in our 60-day assessment, may be thought of in three different major categories:

1. Recommendations related to contract management and vendor negotiations (section 6.1 from that report); communication management (section 6.2); governance and sponsorship (section 6.3); requirement definition and management (section 5.1); and project schedule management (section 5.2) should be implemented as part of the acquisition phase of work described in this roadmap, and the effort required to implement those process changes is included in the budgets included herein.
2. Recommendations related to data conversion and migration (section 4.2); release management (section 4.3); and testing (section 4.4) should inform the RFP development and associated evaluation criteria, with the work performed as part of the design-build phase of work. Process improvements in these areas is included in the design-build.
3. Recommendations related to risk management (section 5.3); organizational change management (section 6.4); and quality management (section 6.5) may be implemented prior to selecting the system integration vendor, or as part of the design-build phase of work. In either case, process improvement activities in these areas were not included in the budgets included in this roadmap.

[1] By *restart* we mean salvaging and updating existing documents related to requirements, processes, data migration rules, and the original (Perspecta) RFP and using those as the basis for a new acquisition of a new solution.

The estimates presented in this document are Rough Order of Magnitude (ROM) estimates for budgetary purposes only. The Project Management Body of Knowledge (PM-BOK) specifies a range of +/- 50% for estimates at the ROM stage, although our target is +/- 35% for ROM estimates. Put another way, the standard deviation of the estimate will be roughly 17.5%.

Table 1 shows the benchmark-based schedule for the CARS restart. The acquisition preparation process will proceed from 1 January 2022 through contract award on or about 11/10/2022. For budgeting purposes, we have assumed a project start date of 1 December 2022, which we believe is achievable. The design-build work will then require almost twenty-seven months of work. That schedule, also shown in Table 1 and graphically shown in Figure 1, is characterized by gate reviews and a phased delivery approach, each of which will be discussed next.

We are proposing that the CARS project should be managed using a series of gate-review milestones. These formal reviews will examine project artifacts to that point, project financials, and overall project satisfaction levels (often using a mechanism such as a balanced scorecard) to decide whether the project is ready to proceed to the next phase of work. Generally, these reviews are conducted as follows:

- IV&V, the project manager, or the two of them jointly may run the meeting.
- IV&V presents the results of their project artifact analysis.
- The SI vendor walks though project artifacts (e.g., documents) and demonstrates software.
- The project manager presents information related to budget, schedule, and risk.
- OCM presents the results of the balanced scorecard analysis, including stakeholder satisfaction scores.
- The Project Sponsor then uses this input to decide r.e., the gate review results. This may be pass (proceed forward), fail, or conditional pass (proceed forward but certain items must be performed within an indicated amount of time).

With this approach, project problems are exposed and corrected early.

The other notable element of the proposed schedule is the phase I deployment, scheduled for July/August of 2023. The current schedule (potentially subject to adjustment after vendor proposals are received) includes the following functionality as part of that deployment:

- The initial version of the CARS database, populated with the CAL-ACCESS data and with dirty data (data with errors or warnings) tagged. Also included is a one-way refresh capability from CAL-ACCESS to the new CARS database.
- The initial implementation of a public portal to report against the new DBMS.
- Implementation of electronic data interchange (EDI) to receive electronic files from external vendors using the current file format(s). A lookup table would then be used to split the data, with some form types loading into CAL-ACCESS and some form types loading into the new DBMS.
- Installation of the new business rules engine and forms engine. We would also expect to see some, but not all, forms implemented as part of this phase using these engines. The exact forms to be implemented as part of Phase I would be determined in consultation with the SI, or perhaps as part of the proposal process.

In developing our list of Phase I items for consideration by the CARS project, we met with internal and external stakeholders to identify areas that would offer value early, that could be implemented with only small incremental cost, and that would reduce overall risk for the project. With the approach identified above, the CARS system will reduce the dependency of external stakeholders on the CAL-ACCESS system to a large extent and will provide some immediate value with automation of some of the forms. This approach will also offer some concrete capabilities that the SI vendor can deliver to demonstrate progress. The implementation of the initial (Phase I) version of the CARS database would need to be done first, after which the other three bullets above could be done independently.

Table 1: CARS restart schedule.

Major activity	Start	End
Acquisition		
Business Case	1/1/2022	1/14/2022
Business Req.	1/14/2022	4/14/2022
Acquisition Planning	4/14/2022	4/20/2022
Market Research	4/20/2022	5/7/2022
RFP Development	5/7/2022	9/26/2022
Acquisition	9/26/2022	11/5/2022
Contracting	11/5/2022	11/10/2022
Design-Build		
Requirements	12/1/2022	1/5/2023
Software Requirements Review (SRR)	**1/5/2023**	**1/5/2023**
Phase I Functionality		
High Level Design	1/2/2023	2/7/2023
User Experience Design	2/4/2023	2/7/2023
Detailed Design	2/7/2023	2/26/2023
System Design Review (SDR)	**2/26/2023**	**2/26/2023**
Code and Unit Test	2/24/2023	4/27/2023
Code Walkthroughs	4/21/2023	5/3/2023
Test Readiness Review (TRR)	**5/3/2023**	**5/3/2023**
System Integration Test	5/2/2023	6/17/2023
User Acceptance Test	6/13/2023	7/8/2023
Production Readiness Review (PRR)	**7/8/2023**	**7/8/2023**
Deploy (Phase 1)	7/5/2023	8/14/2023
Remainder of CARS Functionality		
User Experience Design	8/10/2023	8/21/2023
Detailed Design	8/20/2023	10/12/2023
System Design Review (SDR)	**10/12/2023**	**10/12/2023**
Code and Unit Test	10/7/2023	4/1/2024
Code Walkthroughs	3/14/2024	4/18/2024
Test Readiness Review (TRR)	**4/18/2024**	**4/18/2024**
System Integration Test	4/15/2024	8/25/2024
User Acceptance Test	8/12/2024	10/22/2024
Production Readiness Review (PRR)	**10/22/2024**	**10/22/2024**
Deploy (Final)	10/15/2024	2/7/2025
Warranty	2/7/2025	5/7/2025
Post Implementation Evaluation Review (PIER)	**5/7/2025**	**5/12/2025**

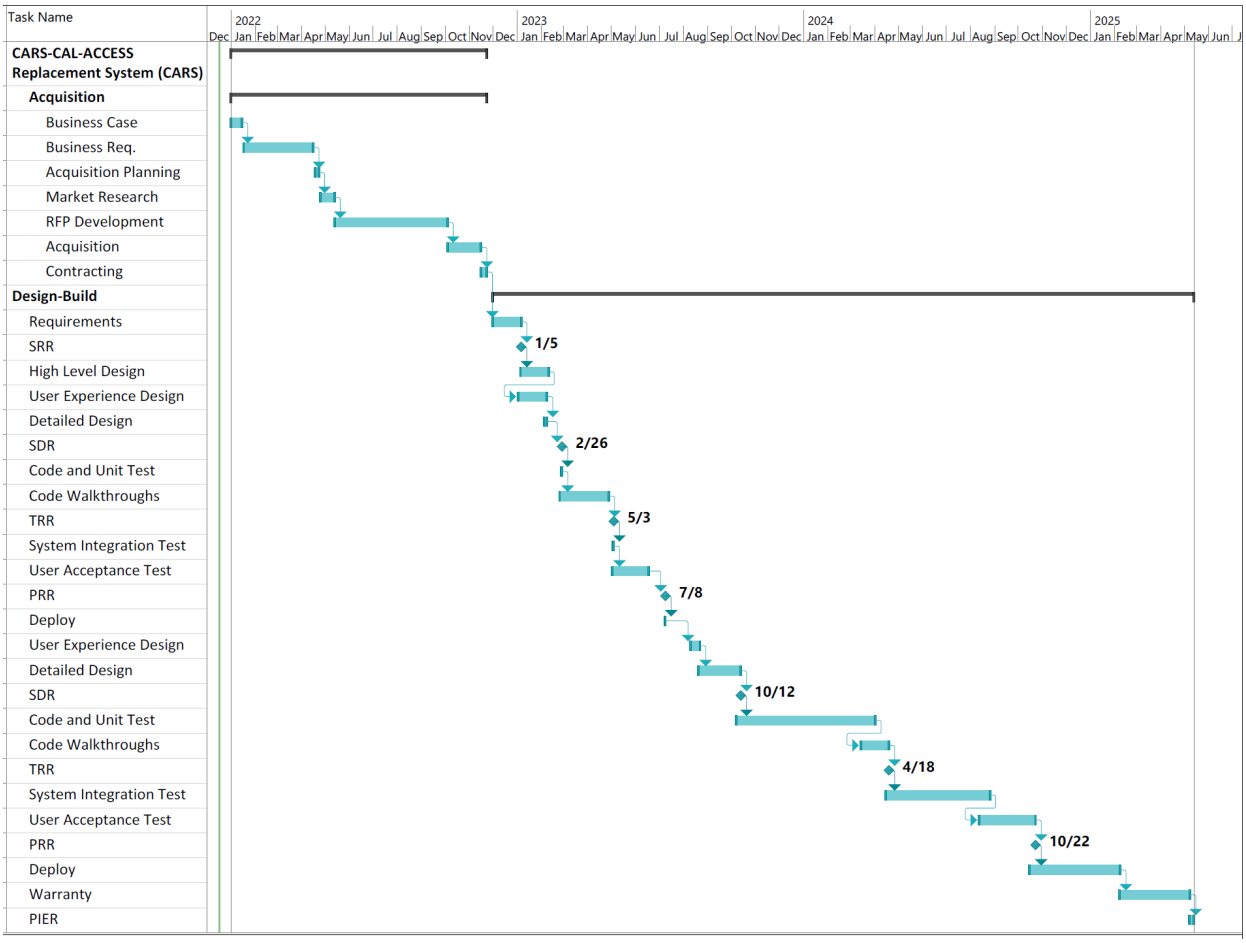

Table 2 shows the benchmark-based budget for the CARS project going forward, including acquisition costs, design-build costs, and Maintenance and Operations (M&O) costs. We are confident that these numbers are accurate within the indicated +/- 35% tolerance range for ROM budgetary estimates. The actual numbers will be finalized after vendor proposals are received, and a Special Project Report (SPR) will then presumably approve the final budget numbers.

Table 2: Five-year CARS restart budget[2].

	FY 22	FY 23	FY 24	FY 25	FY 26
Project Costs (One-Time Costs)					
Acquisition Costs	$ 150,117	$ 111,337			
ITD/PMO		$446,631	$663,605	$351,364	$0
Contractor		$3,885,143	$11,618,379	$6,943,540	$0
Offshore		$0	$0	$0	$0
Consultant		$145,389	$273,671	$152,791	$0
PRD		$317,439	$729,020	$426,434	$0
Hardware		$40,995	$147,315	$89,165	$0
Infrastructure SW		$2,027,991	$1,643,449	$658,618	$0
ODC-Other		$2,987,146	$1,083,749	$53,008	$0
Travel		$0	$0	$0	$0
Contingency		$1,009,299	$1,730,227	$1,153,485	$0
Risk-Mitigation		$20,192	$34,616	$23,077	$0
Maintenance and Operations - Project		$0	$1,235,307	$2,884,699	$0
On-Going Costs					
Maintenance					
Corrective		$0	$0	$400,998	$2,361,567
Adaptive		$0	$0	$400,998	$1,096,262
Perfective		$0	$0	$601,497	$1,198,673
Enhancements		$0	$0	$799,600	$2,225,283
Manufacturer's					
Hardware		$0	$0	$13,502	$81,418
Software		$0	$0	$180,489	$1,088,350
Operations		$0	$0	$93,125	$564,001
Help Desk					
Tier 1		$0	$0	$14,011	$85,309
Tier 2		$0	$0	$5,004	$30,468
Tier 3		$0	$0	$8,340	$50,779
TOTAL One Time		$10,991,562	$19,159,337	$12,736,181	$0
Total On-Going		$0	$0	$2,517,564	$8,782,111
FY Total		**$10,991,562**	**$19,159,337**	**$15,253,745**	**$8,782,111**

There are some natural questions that may occur to the reader, and that we would like to explicitly address.

Will some relatively minor changes allow the existing work to be deployed and used for CARS?

No. It's likely correct that there are some components of what's been built thus far that could potentially be deployed with additional work, but these components only meet a fraction of the needs of the internal and external stakeholders. The system will need to be rearchitected to meet the complete set of requirements in a way that is supportable. As part of that rearchitecting, even those initial pieces that are completed will need to be rewritten. So, the existing work will end up being throw-away work. Overall, the very

[2] Columns are Fiscal Year (FY) ending 30 June of the indicated year, e.g., 2022. So for example, FY 22 covers the period 7/1/2021 through 6/30/2022.

best possible outcome would be that the existing work is a temporary solution to a small portion of the requirements, and that work will ultimately be discarded. Looking at the risks, costs, and benefits associated with attempting to get some interim value from the existing code base, we believe that the best strategy is to focus the SOS resources on a successful restart instead. Specifically, we believe that there are reusable components in the areas of requirements, work process descriptions, data migration rules, and the RFP used for the initial CARS acquisition (the one that Perspecta won). All will need to be updated and improved, but they are good starting points for the new work. There are also a variety of project management documents (e.g., Data Conversion Plan) that would be a good starting point for developing the equivalent document going forward. However, we do not believe that any of the existing code or data is usable going forward.

The project has had two troubled attempts to build CARS already. How confident should we be in the path forward if we follow the recommendations, and budget the resources, as defined in your report?

We have a 100% track record of successful projects for those projects that have followed our recommendations in terms of approach, budget, and schedule. This includes some of California's most complex and difficult Information Technology (IT) projects, including LEADER (Social Services, LA County), LEADER-Replacement (Social Services, HHS), Cal-SAWS (Welfare, HHS), C-IV (Welfare, HHS), EDR (Taxation, FTB), EDR2 (Taxation, FTB), CCSAS, (Child Support, HHS), and CROS (Taxation, CDTFA). All these California projects were between $100M and $1B in size, and all of them ultimately completed successfully. We are completely confident that if the SOS proceeds forward with the CARS restart in accordance with our recommendations, the project will be successful.

The state has spent a considerable amount of money to date, and we still don't have a system. Who's at fault for that situation?

As is always the case with challenged IT projects, it's a shared responsibility and accountability situation. There were many small problems, as documented in our full report, but the most significant in terms of ultimate project success or failure, were:

- Perspecta: Failed to recognize the complex and unique business requirements of SOS and proposed an inappropriate Commercial Off-the-Shelf (COTS) solution (in other words, a poor architectural choice), then failed to recognize the problem (or at least, do anything meaningful about it) until after years of work. Specifically, they did not do a detailed fit-gap of the SOS requirements versus the COTS product capabilities as part of their initial detailed design work, or if they did, they never provided the results of that to the SOS or took corrective action based on the analysis. They should have identified the problem at that stage, shifted to a new architectural approach, and re-baselined the project. It's not unusual for projects to propose a mostly COTS approach, but to then end up needing to do

significant custom development once the requirements are fully analyzed. Perspecta didn't recognize the problem until much too late in the process.

- SOS: After the failure of the Perspecta COTS approach, SOS jumped too quickly to an alternate approach (Salesforce) and vendor OSaaS) without sufficient analysis, then put pressure on the vendor to do two-year's worth of work in eight months. In addition, the SOS never aligned conflicting expectations of the stakeholders. Specifically, the priority of PRD and the external stakeholders was on quality and functionality, while the priority of ITD and the PMO was on schedule. In the end, neither group achieved their goals.

- OSaaS: Under-scoped, underbid, and over-promised for the CARS pivot. OSaaS began development prior to fully understanding the complete requirements and thereby failed to architect a solution to meet that full requirement set. Allowed optimism and a "can-do attitude" to obscure early warning signs of problems.

How qualified is the team that is making these recommendations?

The Elyon team has a total of 165 years and an average of 33 years of information technology project experience. Relevant team experience includes strategy and governance, project and risk management, budgeting/estimating, and technical architecture. Specific experience includes:

Carl Engel: Experience: 39 years. **Relevant Education**: Double Major Computer Science and Electronic Engineering, CSUC; EA Certifications including Level 4 ZCEA (trainer), PEAF, EACOE.

Chief Architect and CEO at Elyon Enterprise Strategies, Inc. is a Business and IT visionary with nearly 40 years of hands-on public and private sector experience including Health, Revenue, Finance, and Technology. His experience illustrates a strong record of success maturing enterprise architecture to create sustainable enterprises with a concentration in Public Sector Transformation. He has proven his ability to bring value to the organization through architecture, governance, solution design, integration, and change management. In the process, he has become a trusted advisor to executives, project teams, technical leads, project managers, and other enterprise architects across the country.

Carl began his career providing chip design, software development and systems integration services. In addition, Carl has served as a solution design consultant, system designer, solutions architect, and Enterprise Architect. Most relevantly for California State Projects such as Image Assisted Data Capture, MARCS, TSM, EDR (Franchise Tax Board), CALHEERS, HCIS, CAMMIS (CHHS), TEAMS (EDD). Carl has also served several private organizations on large technology projects such as KPMG, Unisys, Trinity Health, before starting his own Architecture and Strategy Consulting Firm, Elyon Enterprise Strategies, Inc. Carl has provided EA training for countless

frameworks to students from Lawrence Livermore National Laboratories, WellMark, US Airforce, Hewlett Packard, Cigna, to name a few. In addition, Carl is a noted author and speaker providing leadership in projects on 5 continents.

Carl achieved state level recognition in 2011 as Innovator of the Year in the State of California, for his role in developing long range strategic plans that have supported more than a decade of transformation at the Franchise Tax Board. That experience earned him Gartner recognition and inspired him to start his own company, which has earned a reputation as a firm to count on for Health Care and other complex industry transformations. His expertise has been sought out in departs of Tax/Revenue, Medicaid, Humans services and State CIOs as they face their largest improvement projects. He is a regular featured speaker at numerous conferences and training events. His work results in business aligned with organization vision and goals, defined governance structures, strategic IT spend, and minimized risks.

He provides Management Advisory Services Enterprise Transformation using Enterprise Architecture; Business and Technical Architecture; Organization/Staff Development and Alignment; IT Cost Control, Investment Strategies, and Innovation; Strategic Planning, Roadmapping, Governance, and Portfolio Management; Vast Modeling capabilities

Karen Morphy: Experience: 41 years. **BTech Systems Software**, Rochester Institute of Technology, Ms. Karen Morphy specializes in enterprise transformation and executive leadership, utilizing her skills in team building, relationship management, executive strategy, and innovation. She has coached C-level executives and executive teams, led world-wide organizations of diverse people, and successfully navigated consensus to complex issues while motivating teams to accomplish difficult tasks in organizations such as: SAS, General Motors, Xerox, Electronic Data Systems (now HPE), DST Systems, Gartner, Sony, Apple, Sun, and numerous State Government Agencies. These include California's Franchise Tax Board, Health and Human Services Agency, Office of Health Information Integrity, Center for Data Insights and Innovation, Medicaid Management Information System, and other government transformation projects in other states including Oregon, Washington, and South Carolina.

As a Transformation Coach certified and trained by MIT's Organizational Learning Center, Ms. Morphy led cross-functional teams to overcome issues inhibiting organizational effectiveness and complex transformation. She uses design thinking principles and a lean startup framework to guide complex change. She is a certified enterprise architect, systems thinker, and TQM practitioner. With 30+ years in leadership, executive coaching, and successful team dynamic initiatives plus a strong passion for helping others succeed, Karen provides consulting services to CEO's and Government executive teams looking to improve collaboration, agility, effectiveness, and efficiency.

William Roetzheim: Experience: 44 years. **MBA**, Statistics, University of La Verne; BA, Chemistry, University of Illinois; **30 Post-Graduate Semester Units, Computer**

Science, San Diego State University; **Six Sigma Black Belt**; ISACA Certified Information System Auditor (**CISA**); PMI Certified **PMP** (Project Management Professional); ISACA Certified in Risk and Information Systems Control (**CRISC**); PMI Certified **RMP** (Risk Management Professional); ICEAA Certified Cost Estimation Analyst (**CCEA**). William began his career as a programmer, working his way up to system architect, enterprise architect, project manager, and ultimately, group manager. His programming work primarily focused on embedded development, and he was a pioneer in the areas of artificial intelligence, system dynamic modeling, and spread spectrum communications (his code was part of the Space Shuttle, Brilliant Anti-Tank missile, and MILSTAR satellite systems). As an architect, he led teams that built the H&R Block tax website, the AT&T Billing System, the Hollywood Video point-of-sale system, and the ACBS Commercial Lending & Trading system used by most of the large banks.

Later in his career he focused on cost estimation, benchmarking, productivity analysis and forecasting, economic analysis, fee analysis, performance reviews, feasibility studies, information technology governance and strategy, activity-based costing (ABC) and cost allocation, and oversight for large, complex organizations and projects. He has developed two of the industry's leading benchmarking tools (Cost Xpert and ExcelerPlan) and he maintains the industry's largest database of productivity related benchmark data.

Mr. Roetzheim has provided this support to Federal agencies including GSA, USPS, DOI, DOE, NASA, DHS, ACF, USAF, CNCS; California state agencies including the Franchise Tax Board, Board of Equalization, Department of Child Support, Department of Social Services, Public Utility Commission, Department of Health Care Services, State Controller's Office, and Covered California; for other large State agencies in Texas, Colorado, Washington, and Florida; and for private companies including BB&T, Wells Fargo, IBM, Accenture, US Bank, Mass Mutual, Halliburton, CGI, and KPMG. He has written 27 published books, over 100 articles, and three columns dealing with a variety of management and technology issues.

Keith Morehouse: Experience: 32 years. **Bachelor's, Information Systems**, Eastern Michigan University. Mr. Morehouse has proven success in envisioning, planning, and executing strategies to improve service delivery models and systems in Federal, State, Regional and Commercial settings. His experience encompasses strategic formulation and model-driven digital engineering approaches to leadership envisioning, capability maturity assessment, planning, and design; procurement and implementation; requirements analyses; feasibility studies; business process improvement studies, system functionality, cost/benefit analysis and recommendations; system acceptance testing; implementation monitoring, IV&V, quality management, decision support and governance.

He is experienced across the breadth of service models and domains in government, including commercial health and social services such as Medicaid, integrated eligibility, health insurance and information exchange, child welfare, adult and aging, behavioral

health and addictions, medical case management, and integrated delivery systems. Mr. Morehouse specializes in: Enterprise project, engagement, and stakeholder management skills; Human service enterprise engineering, architecture, and modeling; Service oriented architecture (SOA), process modeling, integrated/collaborative case management, and composite applications; Dynamic collaboration and team building skills; Proficient with mainstream technologies.

Mr. Morehouse's projects span across Federal, State and Local Governments, Commercial Suppliers, System Integrators, and Solution/Technology organizations. This includes complex transformation projects in 13 states and the US Department of Defense.

Scott Ohlund: Experience: 9 years. **Certifications:** Salesforce Certified Application Architect; Salesforce Certified Education Cloud Consultant; Salesforce Certified Data Architecture & Management Designer; Salesforce Certified Sharing and Visibility Designer; Salesforce Certified Advanced Administrator; Salesforce Certified Pardot Specialist; Salesforce Certified Platform Developer I; Salesforce Certified Sales Cloud Consultant; Salesforce Certified Platform App Builder; Salesforce Certified Administration. Mr. Ohlund is an accomplished technical leader with experience in the High Tech/Software industry delivering Cloud Computing and SaaS Software Solutions. He has managed and architected several complicated technical projects since 2013 using Salesforce. He provides solution architecture, project design, coding, administration, and project management of the multiple different Salesforce projects.

He has led the technical and architectural efforts regarding the Salesforce platform for multiple clients, leading a team of Salesforce Engineers to design, build, maintain, and expand the use of the platform. He partners with and works closely with internal business partners to ascertain and fulfill their needs. His success is based on a strong and strategic relationship with Salesforce in having a healthy partner relationship to get the work done.

His experience includes the implementation of a very important and highly visible Communities integration project in the FamilySearch website. This was the first of its kind using an existing SaaS solution with the custom homegrown FamilySearch website. He is focused on operationalizing Salesforce support activities within the client's organization for better on call rotation, incident management, monitoring and alerting, ALM build and release management and implementation of Agile methodologies.

The schedule looks like waterfall development, but a lot of vendors like to use Agile. Should we allow Agile development?

We do not believe that pure Agile development is well suited to large, complex government projects operating with fixed requirements and budgets. However, Agile concepts can be effectively applied to components of the work on these projects. We

recommend that, if Agile is used, it is used as an approach to delivering some or all the work between the major milestones that are identified in our proposed schedule.

Does the SOS have the skills and resources needed to effectively execute the plan that you've laid out in this document?

We believe that the SOS does have the skills and resources to successfully deliver a CARS restart, when supplemented with the resources specifically called out in the budget defined in detail in this document. With the right SI vendor selected and using the correct architecture to meet the correctly understood objectives, most of the SOS responsibility will be one of providing subject matter expertise and vendor oversight. There may be some situations where the SOS may have difficulty delivering the necessary hours of support, especially with the initial design sessions and then with testing, as required by the resource plan. We've identified this as a risk factor in our plan below, and we believe that a viable contingency plan is to supplement the SOS staff with some temp support through the State's MSA contract, with those resources working under direct SOS subject matter expert supervision.

There may be more of a skill gap with respect to the technical skills needed to assume responsibility for maintaining the system during the M&O stage. The degree to which this is an issue won't be known until we know the exact tools that the SI vendor is proposing to use. However, this potential skill gap is several years in the future, providing the SOS with plenty of time to identify the necessary skills and train staff on the appropriate tools.

What's your degree of confidence in your recommendations?

For our primary recommendations, we are completely confident with no hesitations at all. We have multiple independent data points all telling us consistent things. Specifically:

1. We are completely confident that continuing down the path of trying to make the existing code base fully meet the needs of the SOS, and then supporting and maintaining that code base, will be an expensive and ultimately unsuccessful endeavor.
2. We are completely confident that a CARS restart as described in this report can and will result in a successful project. We acknowledge that the project will have problems (all IT projects have problems), and that there will be some grumbling during the first year following deployment (again, there always is some grumbling), but the project will overcome those problems and win over the resistors to be accepted as a success.

For the specific, detailed recommendations in our report, we're confident that most of them are right, and that all of them are good ideas. If the SOS implements 80% of our detailed recommendations, the project will be better run than most IT projects, in

California government or elsewhere. And as we've previously stated, for our budgetary guidance we're confident of the total numbers within a +/- 35% range.

2 Project Budget and Schedule Analysis

This roadmap supplements our Independent Project assessment by providing budgetary and other guidance for the California Automated Lobbyist and Campaign Contribution and Expenditure Search System (CAL-ACCESS) Replacement System (CARS) restart[3]. The key components of our previous assessment report, for the purposes of this document, are:

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Recommended process changes, as defined in our 60-day assessment, may be thought of in three different major categories:

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[3] By *restart* we mean salvaging and updating existing documents related to requirements, processes, data migration rules, and the original (Perspecta) RFP and using those as the basis for a new acquisition of a new solution.

The estimates in this document were primarily prepared by the Elyon team project manager, William Roetzheim. William is one of the nation's leading Information Technology (IT) cost estimation experts. He has prepared over 500 previous IT cost estimates with a total value of over $4 Billion, including over fifty estimates for California state government agencies. Among other certifications, he is a Certified Cost Estimation Analyst (CCEA). He has written 27 published books, over 100 articles, and three columns dealing with a variety of management and technology issues, with most of his publications dealing with cost estimation in one form or another. Of the projects that he has estimated, in 100% of the cases where his recommendations were followed, the project was ultimately successful. This includes some of the largest and most complex projects in California.

> The estimates presented in this document are Rough Order of Magnitude (ROM) estimates for budgetary purposes only. The Project Management Body of Knowledge (PM-BOK) specifies a range of +/- 50% for estimates at the ROM stage, although our target is +/- 35% for ROM estimates. Put another way, the standard deviation of the estimate will be roughly 17.5%.

2.1 Benchmark Estimation Approach.

There are two primary approaches to estimating costs for complex IT projects, bottom-up and parametric. For bottom-up estimates, the work is decomposed into the activities that will be the responsibility of different teams. Those teams then spend the time and effort necessary to understand the scope of their required work, after which they use their best judgement to estimate the effort and cost. The specific solution architecture is then defined, and based on that definition, the cost to purchase the necessary other direct charge (ODC) items is determined, normally using a catalog lookup approach. For complex projects, bottom-up estimation tends to have significant errors, and those errors tend to result in underestimates. The sources of the errors include components of work that are inadvertently left out, and a psychological tendency to underestimate that is termed "estimator bias." Bottom-up estimation also requires a lot of time by the subject matter experts, and a thorough understanding of the final solution approach. Bottom-up estimation is analogous to the process that a general contractor might go through when estimating a house, obtaining bids from all the subcontractors, adding the cost for doors and windows, and so on.

Parametric estimation is based on a completely different approach. Parametric estimation uses historic data of time, effort, and cost for successful benchmark projects. That benchmark data is selected to match the current project as closely as possible. In the case of CARS, we selected data for IT projects in California and taxation modernization projects in particular. Staying with the construction analogy, parametric estimation is analogous to estimating costs based on the number of square feet and type of construction, using catalogs of reference cost data.

Because no two projects are *exactly* the same, simply using historic data without adjustments would introduce unnecessary errors. Instead, research has been

performed (in particular by Capers Jones and Barry Boehm) to identify variables that characterize projects and define project scope in standardized ways. Those project specific adjustments allow parametric estimation to be highly effective, often achieving accuracies within +/- 10% of actual project costs.

Another advantage of this approach is that accurate estimates can be prepared prior to the final definition of the solution approach. Going back to our construction analogy, bottom-up estimation requires early decisions about the specific windows, doors, siding, roofing material, appliances, light fixtures, and so on. On the other hand, the parametric approach does not require this information. Instead, the project receives a *typical allowance* for these items, based on similar construction projects completed in the past.

2.2 Estimation Scope.

2.2.1 Estimation Boundaries, Scope Inclusions, and Scope Exclusions.

In preparing the roadmap, we have prepared three separate estimates:

- An acquisition estimate covering the work from the present through award of a contract to a system integration vendor.

- A design-build (implementation) estimate covering work from the system integration contract award through the completion of the system and expiration of the vendor warranty period.

- A Maintenance and Operations (M&O) estimate covering the on-going M&O costs for a ten-year period, commencing at the end of the vendor warranty period.

We have included work by the SOS, by the selected system integrator, and by support vendors (e.g., Independent Verification and Validation (IV&V)). We have not included:

- State facilities costs (e.g., office space, phone, janitorial), either directly or as part of an overhead charge.

- DGS charged contract fees, if any.

- CDT charges for assistance with project oversight, if any.

- Decommissioning costs associated with archiving the CAL-ACCESS data and shutting that system down after the transition to CARS.

- Mailing costs associated with public outreach (if any) that might be planned as part of the system cutover and transition.

2.2.2 Application Scope.

Function Point Equivalents (FPE) are a widely used method of quantifying business functionality in a universal way to allow comparative analysis of benchmark data from different projects. The CARS application is 4,449 FPE in size, putting it in the moderate size category. Systems under 1K FPE are considered to be small; systems between 1K and 10K are moderate; and systems over 10K FPE are considered to be large. By way of comparison, the FTB EDR2 taxation modernization project is roughly 50K FPE in size. The primary assumptions driving this size are:

- CARS will support 32 forms, along with associated highly complex business rules and field level version control. The forms must use a data centric approach to avoid duplicate data entry, with a wizard type capability a possibly useful user interface approach. The forms and business rules must be configurable to support changes over time.

- CARS will support 60 workflows, along with related status dashboards and alerting. The workflows must be configurable to support changes over time.

- CARS will support 106 outbound forms (templates) that are populated from data in the database. The templates must be configurable and expandable over time.

- Existing CAL-ACCESS data stored in 87 tables containing 2,142 fields will be converted. The target database must support dirty data, tagging the data with an error or warning where appropriate. In addition, an ongoing data synchronization capability from CAL-ACCESS to CARS (one-way) is required.

- CARS will support an incoming interface for use by external filing partners. This interface must be delivered in two versions. The first version accepts data in the current CAL-ACCESS format, using a configuration table to move the received data to either the CAL-ACCESS database or the CARS database. The second version accepts data in a new, CARS format that was developed in coordination with those external interface partners (e.g., Netfile).

- CARS will include 3 portals (Public, Partner (e.g., Fair Political Practices Commission (FPPC, Franchise Tax Board (FTB)), and Political Reform Division (PRD)). We estimate that the vendor will need to implement one universe (data lake), eleven cubes (Online Analytical Process (OLAP) datamarts), 55 pages (including dashboards), and ten traditional Management Information System (MIS) type reports.

2.2.3 Labor Costs.

Labor components of benchmark data are always stored and applied in terms of labor hours rather than dollars. This approach is used because labor rates vary widely by project, while the required level of effort for a given amount of work is much more consistent. In addition, using hours as the basis of benchmarking avoids issues with inflation. However, to develop project budgets, at some point we must convert between labor hours and dollars. To do this, labor is first categorized into labor cost pools, and we then apply a blended labor rate to the work within each labor cost pool. In the case of CARS, the following labor cost pools, and associated blended labor rates, were used:

Table 3: Labor cost pools and associated blended rates.

Labor Cost Pool	Blended Rate Per Hour
ITD/PMO	$ 84.82
Contractor	$ 200.00
Offshore	$ 50.00
Consultant	$ 250.00
PRD	$ 71.02
Operations	$ 84.82
Help Desk-Tier 1	$ 48.00
Help Desk-Tier 2	$ 60.00
Help Desk-Tier 3	$ 200.00

2.2.4 Project Adjustments.

The ExcelerPlan benchmark driven modeling tool is configured using project specific environmental variables that have an impact on both efficiency and non-linear impacts of economies and diseconomies of scale. These specific variable settings are used to develop the CARS forecasts of cost, schedule, and labor requirements included in this budgetary estimate. Some of these variables (e.g., Precedence) are simply project characteristics. Others (e.g., Language and Tool Experience) are variables that can and should be confirmed through the acquisition process via the structure of the Request for Proposal (RFP) requirements. The variable settings that we propose to use are shown in Appendix B., along with the justification for each setting. The values (Very Low, Low, Nominal, High, or Very High) for each setting are used as one of the inputs by the estimation models to develop the ROM budgets, schedule, labor requirements, and so on.

The ROM estimation modeling overall architecture is shown in Figure 2. The project scope is defined using High Level Objects. Project specific environment variables are then used as adjustments to the project estimation. With those inputs defined, the ExcelerPlan models compute a system size in Function Point Equivalents (FPE), then use historic project benchmark data, expressed as parametric curves, to compute the total forecast project cost, schedule, and level of effort. Historic allocation templates for

other similar projects in California are then used to allocate the effort and cost to the various groups that will be working on the project.

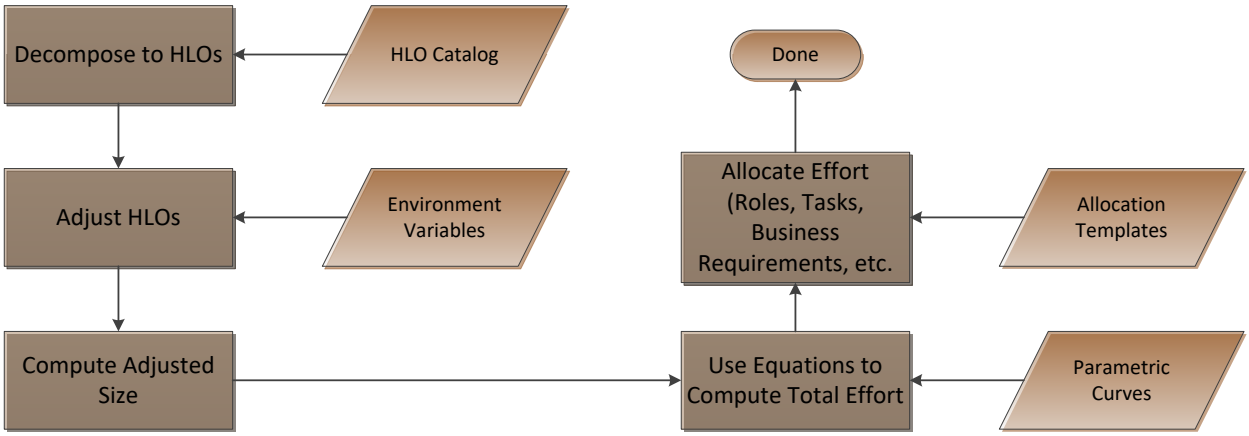

Figure 2: ROM estimation modelling approach.

Note that these settings are *not* an evaluation of the existing CARS project with respect to these variables. Rather, they are the expected situation for the CARS Restart going forward, and thus the basis of our estimates for that future work. These settings were reviewed with the SOS CARS Project Sponsor to align expectations.

2.2.5 Other Direct Charge (ODC) Assumptions.

We assume a cloud-based solution deployment. For budgeting purposes, we are assuming that 9 environments are deployed, consisting of one each of:

- Conversion.
- Data Warehouse (used for external portals).
- Development.
- Production.
- Staging.
- Training.
- Testing (three environments).

Any standard DBMS will meet the CARS requirements, so the selection will largely be determined by vendor preference based on vendor familiarity, plus DBMS support by the tools that the System Integration (SI) vendor elects to deploy in support of the project. Oracle is the most expense DBMS option, so we based our budgeting on Oracle, but we want to stress that this should not be interpreted as a preference for Oracle for this application.

Until we get to the proposal stage, we won't know what tools the vendor plans to purchase (or build) to support functions including business rules, workflows, and security. We would expect the SI contractor to perform a tool fit-gap as part of their proposal effort, and that the vendor's tool selections will be one of the key technical evaluation criteria during the acquisition. Our tool based ODC estimate is based on tool costs for other similar projects. If the vendor choses a build versus buy approach for some of the tools, the budgeted cost might show up as labor costs rather than ODC costs, but we presume that in this situation they have determined that the cost to build the necessary tool was less than the cost to purchase an equivalent tool, so the budgeted amount would still be valid. In this case the allocated ODC budget for virtual machine software is $2,628,079 for one-time project costs, plus $814,708 per year in on-going support and licensing costs.

We assume that the SOS puts in place some support contracts to support and supplement the SOS staff. These support contracts, which are typically firm fixed price, are treated as other direct charges for budgeting purposes. We assume a $30K per month cost per Full-Time Equivalents (FTE), and assume that the following support contracts, with the indicated level of effort, are awarded:

- IV&V: 0.5 FTE
- Project Management: 1 FTE
- OCM: 0.5 FTE
- Test Support: 3 FTE

For budgeting purposes, we are assuming no significant travel related costs.

2.2.6 Other Estimate Assumptions.

We are assuming a phased deployment with two deployments. Table 4 shows the estimation related High Level Requirements (HLRs) and the phase during which each requirement will be completed.

Table 4: High Level Requirements (HLR) and phasing strategy.

ReqID	Short Desc	Requirement	Phase
R.01	Stand up virtual machine.	Stand-up the virtual machine, to include the cloud-based environments, the DBMS, the business rules engine, the security components (including authentication, roles, and monitoring), the external communication manager (e.g., email alerts and notifications), and the workflow engine.	Phase 1

ReqID	Short Desc	Requirement	Phase
R.02	Data Conversion	Convert the CAL-ACCESS Data, to include the necessary target database design. Includes the ability to do on-going ETL to refresh the new DB from the old DB (one-way).	Phase 1
R.03	Public Portal-Initial	Implementation of the public portal to report against a data warehouse populated from the new DB.	Phase 1
R.04	External API-Initial	Implementation of the existing CSV import capability, with the ability to split data and direct to either CAL-ACCESS or CARS.	Phase 1
R.05	Extend virtual machine	Extend the virtual machine to include CARS specific core capabilities, including an added layer of logic for the business rule engine, workflow engine, and what's assumed to be a custom data validation engine.	Remaining Work
R.06	External filer-full implementation	Implement full external filing capability, beginning with new forms not currently supported by CAL-ACCESS, then forms not requiring PRD review, and finally, forms that do require PRD review. Implement necessary database modifications and configuration of the business rule, workflow, and data validation engines as work progresses. May do campaign and lobby separately.	Remaining Work
R.07	Public Portal-full implementation	Extend the public portal to support all CARS data, continuing to add capabilities as the data structures are finalized.	Remaining Work
R.08	External API-full implementation	Transition from the legacy CSV format to the target API format. Includes the work to build test harnesses for the interface for use by both interface teams. Includes defining interface certification requirements and certifying interface partners.	Remaining Work

ReqID	Short Desc	Requirement	Phase
R.09	Partner Portal-full implementation	Implementation of the partner portal for use by FPPC and FTB (possibly others).	Remaining Work
R.10	PRD Portal-full implementation	Implementation of the PRD portal used to review and manage submissions. Includes automated responses where they are built into the workflow. Includes the dashboards used to manage metrics.	Remaining Work
R.11	Support Contracts	Support contracts for IV&V, PM, OCM, and testing assistance.	Remaining Work

We assume that the RFP requires that the vendor provide a 3-month warranty on delivered software, and that during that warranty period the vendor is responsible for providing defect repairs, manufacturer's warranty, system operations, and Tier 3 help desk support.

3 Benchmarking Results – Acquisition Phase

This chapter presents our estimates for the CARS restart acquisition phase. The benchmark data used for this chapter is based on data from ninety-seven information technology acquisitions in California.

3.1 Schedule.

Our benchmark acquisition data assumes a full lifecycle acquisition, as opposed to a project restart. As such, it includes activities that are already fully or partially complete in the case of CARS. Table 5 shows the benchmark acquisition schedule for a system of the complexity of CARS, alongside our suggested schedule. For our suggested schedule, we assume that no feasibility analysis is required, and we reduce the time for the remaining acquisition activities by half. This is based on our belief that the existing material (business case, requirements, RFP, etc.) will be usable with modification for the CARS restart.

Table 5: CARS acquisition schedule (durations shown in months).

Phase/Activity	Benchmark	Start	End	CARS Adjusted	Start	End
Management	20.8	1/1/2022	11/16/2023	10.45	1/1/2022	11/14/2022
Feasibility Analysis	1.6	1/1/2022	2/18/2022	0	1/1/2022	1/1/2022
Business Case	0.9	2/13/2022	3/13/2022	0.46	1/1/2022	1/14/2022
Business Req.	5.9	3/10/2022	9/7/2022	2.97	1/14/2022	4/14/2022
Acquisition Planning	0.5	8/27/2022	9/10/2022	0.23	4/14/2022	4/20/2022
Market Research	1.1	9/9/2022	10/14/2022	0.57	4/20/2022	5/7/2022
RFP Development	9.4	10/10/2022	7/22/2023	4.69	5/7/2022	9/26/2022
Acquisition	2.7	6/24/2023	9/13/2023	1.33	9/26/2022	11/5/2022
Contracting	0.4	9/5/2023	9/17/2023	0.19	11/5/2022	11/10/2022

3.2 Staffing.

Table 6 shows the benchmark and the proposed staffing levels to support the acquisition effort. Again, the proposed staffing levels are simply one-half of the benchmark staffing levels, and again this is based on our belief that a significant amount of the relevant work has already been completed and simply needs to be updated.

Table 6: Benchmark and proposed staffing levels (person-hours).

	Benchmark		Proposed	
	ITD/PMO	PRD	ITD/PMO	PRD
Management Team	274	274	137	137
Contract Officer	343	-	171	-
Strategist	103	240	51	120
Business Analyst	1,029	1,029	514	514
Subject Matter Expert	302	2,716	151	1,358
Enterprise Services	411	-	206	-
Cost Analyst	137	-	69	-

3.3 Artifacts.

Table 7 shows the benchmark page counts for various acquisition related documents, for projects like CARS. The benchmark data for artifacts tends to have a significant amount of project specific variability, so we normally recommend considering artifact forecasts as +/- 50%. In the case of CARS, we understand that a Feasibility Study will likely not be needed, but for the other documents, we would expect the documents to end up somewhere near these numbers. Note that we are not cutting the CARS numbers in half like we did for the time and labor hour estimates. This is because the reusable components are expected to reduce the time and effort required to create documents, but they are not expected to reduce the final document lengths.

Table 7: Benchmark document page counts.

Artifact	Size/Quantity
Feasibility Study	17
Project Charter	12
Acquisition Plan	10
RFI	13
RFP	180
Evaluation Materials	12
SPR	24

3.4 Acquisition Budget.

Using the above labor hour estimates, and if SOS staff charge their time to the project during the acquisition stage, the forecast acquisition budget is $261,453. This does not include any outside support by vendors or other state agencies, such as CDT. If that support is needed, then it must be added to the budget.

3.5 Risk Analysis.

Our analysis of the most significant acquisition related risks, and our suggested mitigations, are shown in Table 8.

Table 8: Acquisition related risks and mitigations.

Risk	Mitigation
Threat: Inadequate competition.	Use the market research phase of the process to identify and educate potential vendors.
Threat: Vendors do not appreciate the complexity of the work and underbid the project.	Include cost realism as an evaluation criterion. Develop a comprehensive bidder's library for use by the bidders.
Opportunity: Participation by 3rd party filing vendors reduces cost, schedule, or improves technical design.	Seek out ways to involve those vendors in the process, starting with requirements, either independently or as subcontractors to the system integrator.
Threat: Vendors propose tools that are not well suited to the SOS requirements.	For key areas (e.g., business rules, workflows, dirty data with validation rules), create a scenario as part of the RFP. The scenario should include a realistic starting point, plus realistic requirement for maintenance changes. Have the vendors walk through exactly how their proposed tools will handle that scenario. This will help them select the correct tools, and help the SOS evaluate their tool selections.
Threat: Non-optimal detailed requirements at the RFP stage lead to either a non-optimal solution or a lot of change requests.	Keep contractual requirements at the RFP stage to a relatively high level and focused on business needs (workflows, templates, reports, pages, and so on). We suggest that the level of detail we used for our estimation work is appropriate for the vendor's to properly scope and bid the work. Work with the selected vendor to define detailed, derived requirements as part of the initial project work.
Threat: Vendor non-performance.	Include milestone gate reviews as part of the contract. For example, Software Requirement Review, System Design Review, Test Readiness Review (Phase 1 and final), Production Readiness Review (Phase 1 and final), and Post Implementation Evaluation Review (final).

4 Benchmarking Results – Design-Build Phase

This chapter presents our estimate covering the period from the contract award for the system integration vendor through the implementation and deployment of the CARS system, ending at the expiration of the system integrator warranty period. The following chapter picks up at that point and covers the on-going M&O support work.

In structuring the RFP, we suggest designing the vendor cost worksheets to align with the budgetary numbers in this chapter. That will simplify the cost realism process. When vendors are significantly lower than the budget numbers, that may represent a legitimate (and good) area of actual cost saving (e.g., substituting Aurora as the DBMS to replace the assumed Oracle); or it may represent a risk area (e.g., cutting the planned testing hours in half).

4.1 Schedule.

Based on the analysis in chapter 3, we assume a project start date of 12/1/2022. The benchmark data indicates that the CARS project will require 26.6 months to complete, plus the 3-month warranty period. Table 9 shows the benchmark driven CARS project schedule. The actual start and end dates may be adjusted if a different assumed project start date is desired.

Table 9: Benchmark CARS schedule.

Phase/Activity	Duration (months)	Start	End
Management	26.6	12/1/2022	4/23/2025
Technical Support	26.6	12/1/2022	4/23/2025
Requirements	1.2	12/1/2022	1/5/2023
Software Requirements Review (SRR)			
High Level Design	1.2	1/2/2023	2/7/2023
User Experience Design	0.1	2/4/2023	2/7/2023
Detailed Design	0.6	2/7/2023	2/26/2023
System Design Review (SDR)			
Code and Unit Test	2.0	2/24/2023	4/27/2023
Code Walkthroughs	0.4	4/21/2023	5/3/2023
Test Readiness Review (TRR)			
System Integration Test	1.5	5/2/2023	6/17/2023
User Acceptance Test	0.8	6/13/2023	7/8/2023
Production Readiness Review (PRR)			
Deploy (Phase 1)	1.3	7/5/2023	8/14/2023
User Experience Design	0.3	8/10/2023	8/21/2023
Detailed Design	1.7	8/20/2023	10/12/2023
System Design Review (SDR)			
Code and Unit Test	5.8	10/7/2023	4/1/2024
Code Walkthroughs	1.2	3/14/2024	4/18/2024
Test Readiness Review (TRR)			
System Integration Test	4.4	4/15/2024	8/25/2024
User Acceptance Test	2.3	8/12/2024	10/22/2024
Production Readiness Review (PRR)			
Deploy (Final)	3.8	10/15/2024	2/7/2025
Warranty	3	2/7/2025	5/7/2025
Post Implementation Evaluation Review (PIER)			

4.2 Resources.

4.2.1 Application Development.

For the CARS application development work, the benchmark labor hours and labor costs required are as shown in Table 10. We are assuming here that there is no work performed offshore. Note that the contractor hours are for the system integrator (plus their subcontractors, if any). Contracted hours for IV&V, project management, OCM, and test support are included as other direct charges, as discussed below. Table 11 shows the benchmark labor hours broken down by labor role and labor cost pool, and Table 12 shows the same data but in terms of cost.

Table 10: CARS hours by labor cost pool.

Labor Cost Pool	Person-Hours	Labor Cost
ITD/PMO	17,232	$ 1,461,600
Contractor	112,235	$ 22,447,062
Offshore	-	$ -
Consultant	2,287	$ 571,851
PRD	20,739	$ 1,472,893

Table 11: CARS labor hours by role by labor cost pool.

Role	ITD/PMO	Contractor	Offshore	Consultant	PRD
Management Team	3,050	10,675	-	-	1,525
Strategist	457	2,287		-	1,830
Architect	762	6,862		-	-
Business Analyst	4,575	10,675		-	-
Designer	4,575	18,299		-	-
Developer	-	36,685			
Engineer	-	1,438			
Test/QA	3,355	23,484			6,710
Security Analyst	457	1,830		2,287	-
Subject Matter Expert	-	-		-	10,675

Table 12: Labor costs by role and labor cost pool.

Role	ITD/PMO	Contractor	Offshore	Consultant	PRD
Management Team	$ 258,690	$ 2,134,911	$ -	$ -	$ 108,301
Strategist	$ 38,804	$ 457,481		$ -	$ 129,961
Architect	$ 64,673	$ 1,372,443		$ -	$ -
Business Analyst	$ 388,035	$ 2,134,911		$ -	$ -
Designer	$ 388,035	$ 3,659,847		$ -	$ -
Developer	$ -	$ 7,337,085			
Engineer	$ -	$ 287,596			
Test/QA	$ 284,559	$ 4,696,804			$ 476,524
Security Analyst	$ 38,804	$ 365,985		$ 571,851	$ -
Subject Matter Expert	$ -	$ -		$ -	$ 758,107

4.2.2 Application Support.

In addition to the application development effort, there is work required to support the Phase 1 application deployment, and to support the application during the three-month warranty period.

Table 13: Application support costs during design-build.

Area of Work	Hours	Dollars
Maintenance		
Corrective	17,671	$ 3,007,485
Adaptive	-	$ -
Perfective	-	$ -
Enhancements	-	$ -
Operations	8,234	$ 698,437
Help Desk		
Tier 1	1,314	$ 63,050
Tier 2	375	$ 22,518
Tier 3	188	$ 37,530
Total	27,782	$ 3,829,019

4.3 Staffing.

The forecast application development staffing, expressed as Full-Time Equivalents (FTE), is shown in Table 14 for year one of the project, and Table 15 for the remainder of the project. These forecasts do include both SOS and system integrator personnel but exclude the application support work from Table 13. As discussed in Appendix B, the project staff overall are expected to average one-year of application domain knowledge; developers are assumed to have three-years of minimum experience with the programming tools/language they will be using; and the technical team are assumed to have a minimum of one-year experience with the virtual machine stack they will be using.

Table 14: Forecast staffing (FTE) for year one.

Role	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Management Team	1.0	2.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Strategist	1.0	2.0	3.1	4.1	4.1	4.1	4.1	4.1	3.6	-	-	-
Architect	1.7	3.4	5.1	6.8	6.8	6.8	6.8	6.8	6.0	-	-	-
Business Analyst	3.4	6.8	10.2	13.6	13.6	13.6	13.6	13.6	11.9	-	-	-
Designer	-	-	-	-	-	0.6	3.8	5.7	7.5	7.5	7.5	7.5
Developer	-	-	-	-	-	1.0	6.0	9.1	12.1	12.1	12.1	12.1
Engineer	-	-	-	-	-	0.0	0.2	0.4	0.5	0.5	0.5	0.5
Test/QA	-	-	-	-	-	-	1.9	5.8	8.7	11.6	11.6	11.6
Security Analyst	0.3	0.7	1.0	1.4	1.4	1.4	1.5	1.9	2.0	1.1	1.1	1.1
Subject Matter Expert	0.8	1.6	2.4	3.2	3.2	3.2	3.6	4.4	4.6	2.5	2.5	2.5
TOTAL	8.2	16.5	24.7	33.0	33.0	34.6	45.5	55.6	60.9	39.2	39.2	39.2

Table 15: Forecast staffing (FTE) for remainder of project.

Role	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24	Month 25	Month 26	Month 27
Management Team	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	2.5
Strategist	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Architect	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Business Analyst	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Designer	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	4.8
Developer	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	7.7
Engineer	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3
Test/QA	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	7.4
Security Analyst	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.7
Subject Matter Expert	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.6
TOTAL	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	24.9

4.4 Other Direct Charges.

Other direct charges consist of costs associated with the virtual machine and vendor support contracts are summarized in Table 16. Costs associated with the virtual machine are based on the deployment of nine cloud-based environments, the purchase of the DBMS and other infrastructure software licenses, and the purchase or development of tools to be used for functions such as business rule management, workflow management, security, and form creation. We assume Oracle as the DBMS because it is the most expensive option, although a less expensive option such as SQL Server or Aurora are likely vendor solutions (and either would work fine). The indicated costs include the costs for the tools/service from project start through the expiration of the 3-month warranty period.

Table 16: Other direct charges.

	Budget
Virtual Machine Hardware	$ 285,690
Virtual Machine Software	$ 4,412,945
Support Vendor Contracts	
IV&V	$ 394,500
Project Management	$ 789,000
OCM	$ 394,500
Test Support	$ 2,367,000

4.5 Risk mitigation costs.

All IT projects have risks, and good risk management practices require risk mitigation to reduce the probability or impact of those risks. In our budgetary estimate we include the following risk mitigation budget line items:

- Contingency: We've included a 15% contingency budget. IT contingency budgets typically range from 10% to 20%, so this is the midpoint. Part of this contingency (typically 10% of each contract amount) will normally be added to the vendor contracts as an "allowance for unanticipated tasks." The remainder is included to cover work that will be required by others but that is not currently known. The total contingency budget is $3,893,011.

- Interface Risk Mitigation: The interfaces to external vendors (both for Phase 1 and for the final deployment) have been identified as a risk item. As mitigation, we have budgeted for a monthly Interface Control Working Group (ICWG) attended by two government representatives, the system integrator, and the external interface partners[4]. We have also budgeted for development of two interface test harnesses, the first to be used by interface partners to test and certify their interfaces to CARS, and the second to be used by the CARS system integrator to simulate the external interface partner interfaces, including load and boundary testing capabilities. We've budgeted $77,885 to support this work.

4.6 Artifacts.

Table 17 shows the forecast list of project artifacts (deliverables), along with quantities representing either the number of individual test cases or the document page counts. This information may be useful when structuring the RFP. The following notes apply:

- CDRL stands for Contract Deliverable Requirement List. It is the contract deliverable number.

- Size/Quantity should be considered +/- 50%.

- We do recommend including these estimates of size/quantity in the RFP, as they will help mitigate the risk of the vendor underestimating the required scope of work.

- The indicated number of document pages may be spread across multiple documents, either due to the way the deliverable is structured or due to the development of phase specific documents. The numbers shown are for the final page counts across all relevant documents.

- The relevant content for a given deliverable may be created and maintained in electronic form only (e.g., in a requirement management system). In that case, the page count would be for the equivalent printed version of those electronic requirements.
- As discussed in our 60-day assessment, we do recommend that all test cases be created early enough for them to be available to the developers during unit testing, as this will greatly improve the quality of unit testing and help to ensure successful later test phases. So, while the indicated due date for most of the test

[4] An ICWG is used to ensure full understanding of the interface specifications by the interface partners; define expectations for and coordinate the scheduling of testing; and to resolve any interface related concerns or issues.

cases is the completion of unit testing, we would desire them to be delivered incrementally prior to and during unit testing.

Table 17: Project artifact related forecasts.

CDRL	Artifact	Size/Quantity	Due
	TEST CASES (COUNT)		
0001	Unit Test Cases	500	8/21/2023
0002	System/Integration Test Cases	834	4/1/2024
0003	Performance Test Cases	222	4/1/2024
0004	Functional Test Cases	445	4/1/2024
0005	Regression Test Cases	389	2/7/2025
0006	User Acceptance Test Cases	222	4/1/2024
0007	Security Test Cases	167	4/1/2024
	DOCUMENTATION (PAGES)		
0008	Kickoff meeting slides	32	12/1/2022
0009	Monthly status reports	7	
0010	Data Conversion Plan	64	8/21/2023
0011	Data Conversion Test Plan	225	8/21/2023
0012	Database Design Description	544	8/21/2023
0013	Interface Design Description (IDD)	1,141	8/21/2023
0014	Project Management Plan	265	8/21/2023
0015	Software Design Description (SDD)	4,309	8/21/2023
0016	Software Requirements Specification (SRS)	1,136	8/21/2023
0017	Software Test Description (STD)	2,305	8/21/2023
0018	Software Test Plan (STP)	441	8/21/2023
0019	Software Test Report (STR)	576	2/7/2025
0020	Software Transition Plan (STrP)	220	4/1/2024
0021	Software User Manual (SUM)	651	4/1/2024
0022	Training Curriculum	113	4/1/2024
0023	Training Plan	59	8/21/2023
0024	User Interface Standard	63	8/21/2023

4.7 Risk Analysis.

Our analysis of the most significant design-build related risks, and our suggested mitigations, are shown in Table 18.

Table 18: Acquisition related risks and mitigations.

Risk	Mitigation
Threat: Inadequate SOS resources to support the government required work.	Contingency: Use the California MSA to add dedicated temp resources to the government team, working directly under

Risk	Mitigation
	government personnel and supervision. These temp resources will likely have labor rates that are similar to the budgeted government labor rates, so minimal budget impact.
Opportunity: The ODC budget for the DBMS and supporting tools is worst case. There is the opportunity that the vendor may propose a less expensive DBMS and/or less expensive supporting tools.	Be careful that the RFP is structured to allow vendors to propose less expensive tools, as opposed to them thinking that the SOS necessarily prefers the more expensive tools.
Opportunity: The current budgetary numbers are based on vendors proposing 100% on-shore work. If the SOS allows vendors to propose a mixture of on-shore and off-shore resources, this will have a positive impact on the budget. The estimated total cost reduction is $5,443,690.	Accept the risk. This is largely an SOS executive policy decision.
Threat: SOS stakeholder interaction. Groups or individuals within the SOS may not support the CARS restart direction, tool choices, architectural approach, and so on. This lack of support may show up as passive or active resistance.	Mitigation: SOS executive leadership will need to make a clear and unambiguous decision with respect to the path forward. After that decision is made, find ways to convert the resistance to approval, or at least acceptance. If not possible, find ways to insulate the project from the ability of those individuals or groups to create hinderances formally or informally to project success. It is important that the problems the previous project sponsor experienced are not repeated.

5 Benchmarking Results – M&O Phase

The M&O phase of work commences when the SI vendor's warranty period expires and continues through the life of the application. Costs during the M&O phase fit into the following categories:

- Corrective Maintenance: This work involves fixing defects (bugs). These include defects that are hold-overs from the design-build phase plus defects that are inadvertently introduced during other system maintenance activities.

- Adaptive Maintenance: This work involves keeping the system working while the world around it changes. No new business functionality is added, but if there is an inadequate adaptive maintenance budget, then system capabilities will gradually erode over time. Examples of adaptive maintenance include version updates to the virtual machine (e.g., DBMS); changes to existing forms by the FPPC; interface changes; workflow changes; and legislative changes that impact existing system functionality.

- Perfective Maintenance: This work improves the way the system delivers existing business functionality, without adding new business capabilities. Examples include performance improvements, fixing security issues, improving workflows for efficiency, and improving error handling.

- Enhancements: These are added business capabilities. Examples include new forms, new pages or dashboards, new workflows, and new reports or templates.

- Manufacturer's Warranty/Licensing: This represents the annual cost for software and hardware maintenance, support, and licensing by the manufacturers.

- Operations: This budget area captures the work required to operate the system. Functions performed include release management, backups, database maintenance, incident response, running periodic reports and batch processes, and creating data extracts. Special requests (internal and external) that require data queries would often be handled by the operation's team as well.

- Help Desk: Help desk support includes internal and external help desk assistance. It is divided into three tiers. Tier 1 is the initial point of entry, and this level is expected to resolve all standard issues. Tier 2 is the supervisory level, which is expected to handle non-standard issues that do not require internal technical knowledge of the application or virtual machine. Finally, Tier 3 support is the technical development and engineering team. This level is expected to deal

with issues that do require internal technical knowledge of the application or virtual machine.

5.1 Ten-year M&O cost estimates.

It is common to include M&O support by the SI vendor for a period of time after completion of warranty work, normally in the form of annual options. These annual options would often allow for M&O work up to anywhere between 2 and 5 years. It's important to specify which of the M&O functions will be the responsibility of the SOS and which will be the responsibility of the M&O vendor. For example, the State will normally assume responsibility for the Tier 1 and Tier 2 help desk support. Table 19 shows the ten-year forecast for labor hours, and Table 20 shows the ten-year forecast for labor costs, including a 3% allowance for inflation.

Table 19: Ten-year forecast M&O level-of-effort (LOE).

Forecast Labor (hours)										
Maintenance	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Corrective	14,137	12,205	10,748	8,377	7,071	5,372	5,803	6,166	6,624	7,110
Adaptive	5,655	7,323	8,598	9,307	12,122	15,042	16,247	17,266	18,548	19,907
Perfective	8,482	4,882	2,150	931	1,010	1,074	1,161	1,233	1,325	1,422
Enhancements	11,276	15,140	18,054	20,935	19,346	18,061	16,339	14,884	13,052	11,111
Operations	6,587	6,756	6,756	6,989	7,033	7,321	7,342	7,621	7,615	7,879
Help Desk										
Tier 1	1,751	1,851	1,993	2,175	2,405	2,640	2,882	3,120	3,355	3,576
Tier 2	500	529	569	621	687	754	823	891	958	1,022
Tier 3	250	264	285	311	344	377	412	446	479	511
Total Labor	**48,639**	**48,950**	**49,153**	**49,645**	**50,018**	**50,642**	**51,008**	**51,627**	**51,956**	**52,536**

Table 20: Ten-year forecast M&O cost.

Forecast Cost										
Maintenance	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Corrective	$2,405,988	$2,139,461	$1,940,580	$1,557,827	$1,354,500	$1,059,914	$1,179,188	$1,290,700	$1,428,189	$1,578,789
Adaptive	$962,395	$1,283,677	$1,552,464	$1,730,919	$2,322,000	$2,967,760	$3,301,727	$3,613,959	$3,998,929	$4,420,611
Perfective	$1,443,593	$855,785	$388,116	$173,092	$193,500	$211,983	$235,838	$258,140	$285,638	$315,758
Enhancements	$1,919,040	$2,654,024	$3,259,774	$3,893,326	$3,705,818	$3,563,435	$3,320,433	$3,115,502	$2,813,894	$2,467,291
Manufacturer's										
Maint-Hardwa	$81,013	$83,443	$85,947	$88,525	$91,181	$93,916	$96,734	$99,636	$102,625	$105,704
Maint-Softwar	$1,082,935	$1,115,424	$1,148,886	$1,183,353	$1,218,853	$1,255,419	$1,293,082	$1,331,874	$1,371,830	$1,412,985
Operations	$558,750	$590,259	$607,966	$647,739	$671,431	$719,839	$743,605	$794,994	$818,164	$871,924
Help Desk										
Tier 1	$84,066	$91,526	$101,489	$114,077	$129,939	$146,931	$165,161	$184,172	$203,976	$223,962
Tier 2	$30,024	$32,688	$36,246	$40,742	$46,407	$52,475	$58,986	$65,776	$72,848	$79,986
Tier 3	$50,039	$54,480	$60,410	$67,903	$77,345	$87,459	$98,310	$109,626	$121,414	$133,311
Total Cost	**$8,617,843**	**$8,900,765**	**$9,181,879**	**$9,497,503**	**$9,810,973**	**$10,159,132**	**$10,493,063**	**$10,864,379**	**$11,217,507**	**$11,610,320**

5.2 Risk Analysis

Our analysis of the most significant M&O related risks, and our suggested mitigations, are shown in Table 21.

Table 21: M&O related risks and mitigations.

Risk	Mitigation
Opportunity: When an organization can successfully transition M&O for an application to state staff early in the application's life, the total cost of ownership is reduced because state labor tends to be less expensive than vendor labor in general, and SI vendor labor in particular.	Opportunity enhancement: Incorporate a State technical skill gap analysis as part of the OCM plan, with a focus on the virtual machine environment used for CARS. Implement technical training for state staff and look for opportunities for the state staff to be integrated into the overall project support environment during the M&O phase. Opportunity enhancement: Be sure to require that the bidders include a transition-out plan as part of their proposal. This would then be used at the point where the State is ready to transition-in. It would also be used if the vendor's performance was unsatisfactory, and the State was going to transition-in an alternate M&O vendor. Opportunity enhancement: Be sure that the vendor is required to provide the State with the software rights necessary to maintain and support the system. For all custom software this would include both the source code and the associated rights to the intellectual property. Standard CA state contracts handle this in a suitable manner, if those clauses are incorporated into the vendor contract.
Threat: SI vendors often have difficulties properly estimating the M&O work expectations. As a result, some vendors may over-estimate the hours required and then not be awarded the contract because their evaluated price is too high. Other vendors may under-estimate the hours required and then not be able to keep the system properly maintained. In both cases, keeping the competitive playing field level is a challenge.	Mitigation: We recommend that the M&O portion of the vendor bid and contract be structured as a firm fixed price based on delivering a fixed number of labor hours with specific levels of experience, or put another way, as a fixed Level of Effort (LOE) contract. In that way, all the bidders will be bidding the same number of labor hours for the M&O effort. The hour estimates in this roadmap may be a suitable basis for structuring the contract in that way.

6 Budget Summary

Table 22 shows the five-year CARS budget summary, including acquisition, project, and on-going M&O costs. These numbers are ROM estimates with an expected accuracy of +/- 35%. Acquisition Costs are the PRD/ITD/PMO staff costs to support the acquisition. The project one-time contractor costs would be roughly $5M lower if off-shore resourcing is allowed. The infrastructure software costs could be 25% to 50% lower based on the specific virtual machine software proposed by the system integrators. ODC-Other is the costs for the four support contracts (IV&V, PM, OCM, and testing support). Maintenance and Operations – Project is a combination of the cost to support the Phase I deployment plus the cost of the vendor warranty. The budget breakdowns by FY assume a 1 January 2022 start date for the acquisition support work, and a 12/1/2022 start date for the project implementation effort.

Table 22: Five-year CARS budget summary[5].

	FY 22	FY 23	FY 24	FY 25	FY 26
Project Costs (One-Time Costs)					
Acquisition Costs	$ 150,117	$ 111,337			
ITD/PMO		$446,631	$663,605	$351,364	$0
Contractor		$3,885,143	$11,618,379	$6,943,540	$0
Offshore		$0	$0	$0	$0
Consultant		$145,389	$273,671	$152,791	$0
PRD		$317,439	$729,020	$426,434	$0
Hardware		$40,995	$147,315	$89,165	$0
Infrastructure SW		$2,027,991	$1,643,449	$658,618	$0
ODC-Other		$2,987,146	$1,083,749	$53,008	$0
Travel		$0	$0	$0	$0
Contingency		$1,009,299	$1,730,227	$1,153,485	$0
Risk-Mitigation		$20,192	$34,616	$23,077	$0
Maintenance and Operations - Project		$0	$1,235,307	$2,884,699	$0
On-Going Costs					
Maintenance					
Corrective		$0	$0	$400,998	$2,361,567
Adaptive		$0	$0	$400,998	$1,096,262
Perfective		$0	$0	$601,497	$1,198,673
Enhancements		$0	$0	$799,600	$2,225,283
Manufacturer's					
Hardware		$0	$0	$13,502	$81,418
Software		$0	$0	$180,489	$1,088,350
Operations		$0	$0	$93,125	$564,001
Help Desk					
Tier 1		$0	$0	$14,011	$85,309
Tier 2		$0	$0	$5,004	$30,468
Tier 3		$0	$0	$8,340	$50,779
TOTAL One Time		$10,991,562	$19,159,337	$12,736,181	$0
Total On-Going		$0	$0	$2,517,564	$8,782,111
FY Total		**$10,991,562**	**$19,159,337**	**$15,253,745**	**$8,782,111**

[5] Columns are Fiscal Year (FY) ending 30 June of the indicated year, e.g., 2022. So, for example, FY 22 covers the period 7/1/2021 through 6/30/2022.

Appendix A. Acronyms

ADA: Americans with Disabilities Act.

ADO: Azure DevOps.

API: Application Programming Interface.

AWS: Amazon Web Services.

CAL-ACCESS: California Automated Lobbyist and Campaign Contribution and Expenditure Search System.

CalHEERS: California Healthcare Eligibility, Enrollment, and Retention System.

CARES: California Automated Response and Engagement System.

CARS: CAL-ACCESS Replacement System.

CASE: Communications and Stakeholder Engagement.

CCSAS: California Child Support Automation System.

CDRL: Contract Deliverable Requirement List.

CDSS: California Department of Social Services.

CDTFA: California Department of Tax and Fee Administration.

CCEA: Certified Cost Estimation Analyst.

CHHS: California Health and Human Services.

CMAS: California Multiple Award Schedule.

CMMI: Capability Maturity Model Integrated.

CMS: Case Management System.

COTS: Commercial Off-The-Shelf.

CPI: Cost Performance Indicator.

CPU: Central Processing Unit.

CROS: Centralized Revenue Opportunity System.

CWS: Child Welfare System.

DBMS: Database Management System.

DDR: Detailed Design Review.

DMAIC: Define, Measure, Analyze, Improve, Control.

EAC: Estimate at Completion.

EDR: Enterprise Data to Revenue.

eMRI: enterprise Maturity Readiness Index.

ETC: Estimate to Complete.

ETL: Extract-Transform-Load.

FPE: Function Point Equivalent.

FPPC: Fair Political Practices Commission.

FTB: Franchise Tax Board.

FTE: Full-Time Equivalents.

GAAP: Generally Accepted Accounting Procedures.

HLO: High-Level Object.

ID: Identifier.

IEEE: Institute of Electronic and Electrical and Electronics Engineers.

IPS: Integrated Project Schedule.

ISACA: Information Systems Audit and Control Foundation.

ISO: International Standards Organization.

IT: Information Technology.

ITD: Information Technology Division.

IV&V: Independent Verification and Validation.

KPA: Key Process Area.

LEADER: Los Angeles Eligibility, Automated Determination, Evaluation and Reporting.

M&O: Maintenance and Operations.

MIS: Management Information System.

MOU: Memorandum of Understanding.

NIST: National Institute of Standards and Technology.

OCM: Organizational Change Management.

OCMP: Organizational Change Management Plan.

ODC: Other Direct Charge.

OLAP: Online Analytical Process.

OS: Operating System.

OSaaS: Outreach Solutions as a Service.

PAL: Project Approval Lifecycle.

PERT: Program Evaluation and Review Technique.

PIER: Post Implementation Evaluation Review.

PMBOK: Project Management Body of Knowledge.

PMO: Project Management Office.

PRA: Political Reform Act.

PRD: Political Reform Division.

PRR: Production Readiness Review.

R&D: Research and Development.

RFO: Request for Offer.

RMP: Risk Management Plan.

ROM: Rough Order of Magnitude

SAWS: Statewide Automated Welfare System.

SCSEM: Safeguard Computer Security Evaluation Matrix.

SDLC: Software Development Lifecycle.

SI: System Integration.

SIT: System Integration Testing.

SME: Subject Matter Expert.

SOS: Secretary of State.

SPI: Schedule Performance Indicator.

SRR: Software Requirement Review.

STP: Software Test Plan.

T&M: Time and Material.

TID: Tax ID.

TRR: Test Readiness Review.

UAT: User Acceptance Testing.

UI: User Interface.

Appendix B: Project Environment Settings

Table 23: Assumptions for CARS Roadmap Forward estimate.

Variable	Description	CARS Setting
Pace	Pace of development relative to normal project in similar organizations (VH is the maximum theoretical pace without reducing scope).	Nominal. Pace was set to match previous successful projects in the benchmark data.
Overlap	Degree of task overlap planned for in the baseline schedule. N=None; H = 10%; VH = 25%.	High. This setting was selected because it balances the need for CARS to be operational as quickly as possible with the risk and cost of accelerated development.
Plans & Requirements	Time spent on up-front planning and requirements relative to a benchmark project.	Very Low. CARS has already done a lot of the up-front requirement related work to quite a good level of detail. This is an area where the CARS restart will be saving money and schedule relative to the initial CARS effort.
Integration and Test	Time spent on integration and test (post unit test) activities relative to a benchmark project.	Nominal. The CARS integration and test effort should be typical of similar efforts.
Req. Volatility	Degree to which requirement changes/clarifications are absorbed by the project budget. Nominal is 7%.	Nominal. The CARS project is expected to be typical in terms of requirement volatility during development.
Team Cohesion	Degree to which stakeholders are cooperative. Nominal is basically cooperative. VL means very difficult interactions.	Low. There is the opportunity for this to move to either Nominal or High, based on the degree to which all stakeholders align with the project vision and are fully supportive of the project and each other.
Requirements Flexibility	Degree to which requirements can be relaxed based on technical challenges. Nominal is some relaxation. VL means rigorous requirements.	Nominal. The project has a typical mix of rigid and flexible requirements. Note that flexibility in this context does not mean that legislative requirements can be relaxed.
Project Risk	Degree to which project problems result in business risk, nominal is typical, very high is high business risk.	High. This setting is based on the risk associated with CalACCESS potentially failing prior to the project being prepared to replace that system.
Precedence	Degree to which the project may be considered R&D. VH is largely familiar, VL has many R&D characteristics.	Very High. This is another area where the work that CARS has already done has clarified the requirements and the required approach, therefore resulting in reduced costs and schedule going forward. To a large extent, CARS has performed exploratory Research and Development (R&D) to determine if a Commercial Off-The-Shelf (COTS) transfer product would meet the California needs (no), and to determine if Salesforce would meet the California needs (also no).
Process Maturity	Capability Maturity Model Integrated (CMMI) Level: VL=Level 1 lower half; L = Level 1 upper half; N = Level 2; H = Level 3; VH = Level 4 or 5	This variable measures the degree to which effective processes are in place and followed by the project. The OSaaS implementation setting would be Low,

Variable	Description	CARS Setting
		however going forward we assume that the SOS will be implementing most of the eMRI recommendations that we have included in our report. Based on that assumption, we are using a setting of High. Again, this is an area where the lessons-learned from the first two CARS iterations will now result in a cost and schedule saving going forward.
Availability of SMEs	Degree to which technical and business experts are available. VH means readily available.	For CARS the correct setting is High, which balances the need of the SMEs to continue with their on-going work versus the requirements for support to the project. This is another area where the CARS restart will benefit from the project experience thus far, resulting in a cost and schedule saving going forward.
Applications Experience	Average team experience with the application. N=1 year; VL= 2 months; L=6 months; H= 3 years; VH=6 years.	The correct setting is Nominal. This setting is based on the balance of SME experience, experience by external stakeholders (e.g., Netfiler), and the experience of the project implementation team. the OSaaS effort was Very Low, in that the project had a very large team of people with zero application domain experience and a relatively low offsetting pool of people with the necessary application experience. Again, this is an area where the lessons learned from the previous iterations will result in cost savings going forward. We recommend that the amount of application (California specific filing) experience by team members of the SI vendor be included as a scored desired qualification. Experience with taxation systems may be relevant as well and should be counted. We do not recommend that domain specific experience should be a mandatory requirement, however.
Language and Tool Experience	Average experience with the programming language/tools. N=1 year; L=6 months; VL=2 months; H=3 years; VH=6 years.	This setting applies specifically to the programmers. We recommend that developers working on this have a minimum of 3 years of previous experience working with the programming language/tools they will be working with, resulting in a setting of High.
Platform Experience	Average virtual machine experience (Operating System (OS), DBMS, etc.). N=1 year; L=6 months; VL=2 months; H=3 years; VH=6 years	This setting applies to the experience of the technical team (programmers and database developers) with the DBMS, operating system, and other virtual machine stack components. For example, if the solution was built using Amazon Web Services (AWS), it would include experience working with AWS. We

Variable	Description	CARS Setting
		recommend requiring that the technical team have a minimum of 1 year of experience working with the virtual machine proposed for implementation, resulting in a setting of Nominal.
Static/Dynamic Ratio	Data Conversion Only: VL=15%; L=35%; N=55%; H=75%; VH=90%	This variable applies to the data conversion. Ninety percent or more of the CAL-ACCESS data to be converted is static, resulting in a setting of Very High.
Acquisition Type	N=New or Replace; L=Upgrade	Nominal.
Acquisition Stakeholders	N=Few; H=Diverse (e.g., multiple States, multiple counties)	Nominal.
Acquisition Funding	L=Benefit; N=State; H=Federal + State	Nominal.
Procurement Approach	N=One-Step; H=Two Step. One-step acquisitions are traditional acquisitions, while two-step procurements award multiple vendors a small proof-of-concept or discovery contract; followed by a negotiated contract with one of the vendors from that initial acquisition.	Nominal.
Acquisition Speed	N=Typical; L=Fast, efficient processes; H=Slow, inefficient processes.	Low: It is our understanding that the acquisition will be fast-tracked.
Tier Level	VL=Tier 5 or 4; L=Tier 3; N=Tier 2; H=Tier 1; VH=Mainframe/Core	Nominal: The server environment is properly classified as a Tier 2 application from a Recovery Time Objective perspective.
Hardware Loading	User interaction loading, VL to VH	Nominal: The user interaction loading characteristics are typical.
Database Loading	Loading on database server, VL to VH	Nominal: The database loading characteristics are typical.
Infrastructure Integration	Computer-to-computer transaction loading, VL to VH	Nominal: The interface and batch processing characteristics are typical.