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September 28, 2015

Rebecca Harnagel
California High-Speed Rail Authority
770 L Street, Suite 620 MS 2
Sacramento, CA 95814

RE: RFEI HSR #15-02

Dear Ms. Harnagel,

Thales is pleased to provide the attached information as requested for the California High-Speed Rail Authority's Request for Expressions of Interest for the Delivery of an Initial Operating Segment.

To best represent what Thales can offer, we suggest a presentation to CHRSA based upon the materials attached. We are available at your convenience; please do not hesitate to contact us if further information is required.

Sincerely,

[redacted]

Kevin Garben
Business Development Manager
Thales Transport & Security, Inc.
Phone: 412-358-8054
Email: Kevin.Garben@us.thalesgroup.com

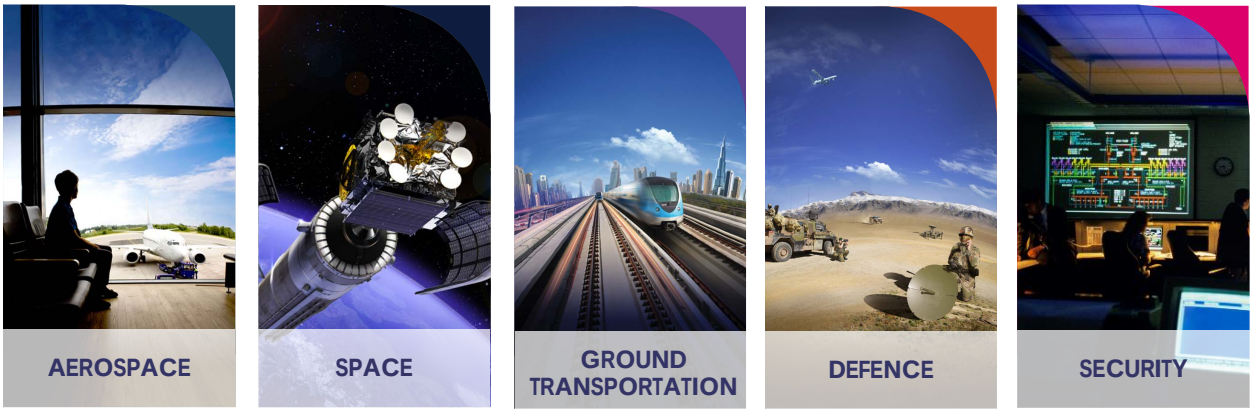
THALES

Request for Expressions of Interest for the Delivery of an Initial Operating Segment RFEI HSR#15-02

Thales Transport & Security, Inc.

1. FIRM EXPERIENCE AND TEAM STRUCTURE

Thales group is a key leader in global and regional Aerospace, Space and Defense, Security, and Transportation, providing world-class and innovative solutions to help its customers create a safer world.



TRUSTED PARTNER FOR A SAFER WORLD

In all its markets, aerospace, space, ground transportation, defense and security, Thales solutions help customers to make the right decisions at the right time.

World-class technology, with the combined expertise of 61,000 employees and operations in 56 countries have made Thales a key player in the public safety and security domain, guarding vital infrastructure and protecting the national security interests of countries around the globe.

Thales USA, Inc. has expanded its U.S. operations in recent years to focus on a wider range of core customer and market segments. With nearly 3,000 employees, Thales in the U.S. has demonstrated a commitment to the U.S. economy by establishing a solid local workforce and production capability with 21 US offices covering Transportation, In-Flight Entertainment, Defense, Airline Services, Cyber Security, and Space.

The Pittsburgh office serves as the Integration Center for US based transportation projects

- Signaling (Metros, APM's, and street running LRT)

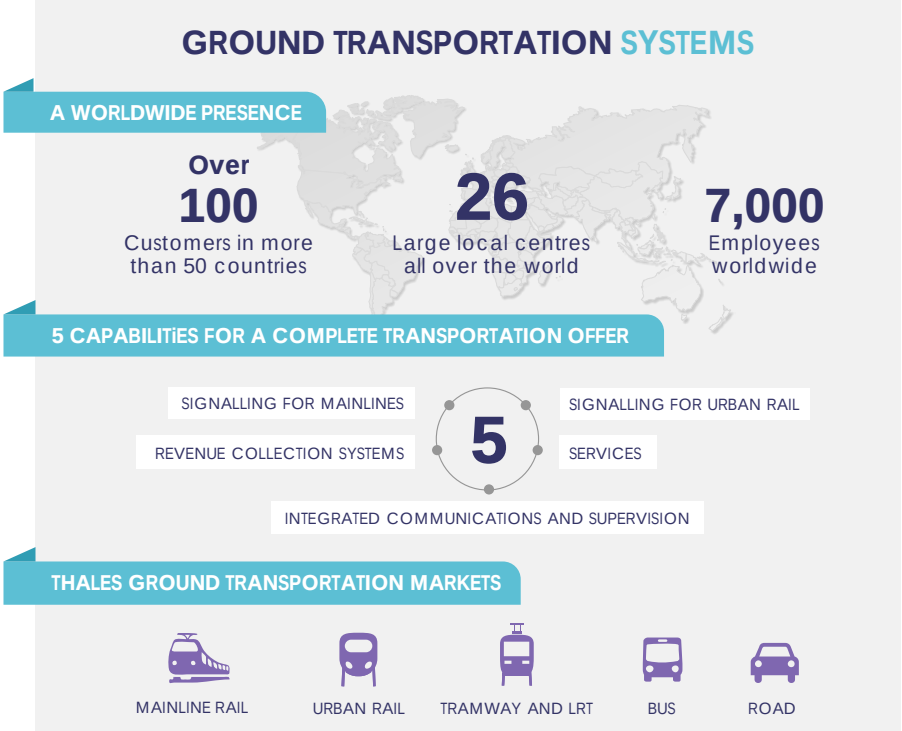
- Passenger Information Systems and Passenger Announcement Systems, Infotainment
- SCADA, Fixed Asset Control, Security Management, Decision Support
- Fare Collection
- CCTV, Telecom, Wired/Wireless backbones
- Services and Support

US System and Signaling Project References:

- New York City Metro, Flushing Line, 2016
    - CBTC Signaling
- West Virginia University PRT, 2016
    - CBTC Signaling, Fare Collection, Passenger Information Systems
- Houston METRO, 2015
    - Axle Counters
- Walt Disney World Monorail, 1989, 2015 Upgrade
    - CBTC Signaling
- San Francisco LRT (MUNI), 1998, ATS Upgrade 2015, on-going small projects
    - CBTC Signaling, Axle Counters, Passenger Information Systems
- Washington Dulles International Airport, 2009
    - CBTC Signaling
- New York, Bergen Street SSI, 2005
    - Solid State Interlocking
- Las Vegas Monorail, 2004
    - CBTC Signaling
- New York JFK Airport Airtrain, 2003
    - CBTC Signaling
- Newark International Airport, 1996, 2001
    - CBTC Signaling
- Jacksonville Skyway Express APM, 1998, 2000
    - CBTC Signaling
- Tampa International Airport APM, 1991
    - CBTC Signaling
- Detroit People Mover, 1987
    - CBTC Signaling

Thales Ground Transportation Systems (GTS)

Thales has a solid experience in the railway sector worldwide. Throughout the years, Thales has developed railway solutions for over 100 Clients in more than 50 countries.



Thales embraces two different types of customer requests:

- Stand-alone products / solutions: Signaling or Supervision or Telecoms or Ticketing, etc.
- Integrated solutions for turnkey projects: Signaling / Supervision / Telecoms / Fare Collection including interfaces with equipment and vehicles

In order to provide its solutions, Thales counts not only on its products and solutions but also in:

- Thales' Ability to design and deliver complex engineering projects
- Thales' Project management skills and processes to successfully tackle the most complex turnkey implementations
- Thales' Human and financial resources
- Thales Services expertise

Thales is ranked:

#1 leader in Europe with European Train Control System (ETCS) trackside systems
#1 worldwide in Communications-Based Train Control systems (CBTC)
#2 worldwide in integrated communications and supervision systems for transportation networks

Thales helps its customers confront demands for safety and efficiency by getting the most out of their infrastructures. Thales provides intelligent systems and services for:

- **Signaling and train control**
  - Route control: Electronic interlocking
  - Train control: ETCS, CBTC, ATP, ATO
  - Field elements

- **Supervision**
  - Metro & tramway management systems
  - Rail network management
  - Real-time equipment supervision & control
  - Power supervision & optimization
  - Communication network management
  - Multi-application integrated supervision platform

- **Passenger Information and Comfort**
  - Passenger information and entertainment
  - Public announcement
  - Broadband internet access provision

- **Security**
  - Video surveillance systems - on board & in station
  - Site protection - access control, intrusion detection, fire detection…
  - Emergency call points
  - Infrastructure protection against cyber-attacks

- **Telecommunications**
  - Ground to train communications
  - Communication backbone & access network
  - Radio communication applications (GSM-R, TETRA)
  - Telephony & voice services

- **Fare Collection for public transport**
  - Equipment for vending, validating and controlling travel rights
  - Central processing systems suited for mono and multi-modal transport
  - Revenue clearing systems to deliver multi-operator interoperability

1.1.1 Railway Signaling and train control Solutions

Thales provides a wide range of signaling solutions that can be divided into three major groups:

- **Route control:**
  - Electronic interlocking
- **Train control:**
  - European Train Control System (ETCS) levels 1 & 2 for main line railways
  - Communication Based Train Control (CBTC) systems for urban rail
  - Conventional Automatic Train Protection (ATP)
  - Automatic Train Operation (ATO)
- **Field elements:**
  - Digital axle counters
  - Switch machines
  - Signals

1.2 Thales Group ETCS Experience

European Train Control System (ETCS) is the core signaling and train control component of ERTMS, the European Rail Traffic Management System for mainline networks.
From day one, ETCS has been a strategic priority for Thales. Being a major contributor to ETCS' global success, Thales has deployed more ETCS projects around the globe than any of our competitors, and is recognized as a pioneer in ETCS infrastructure.

Thales participated in the creation of ETCS and led the way with the very first implementations of this world-recognized standard. Created to enable interoperable operations throughout Europe, the standard also increases operational efficiency and safety for mainline traffic.

The ETCS On-Board System safely monitors train movements, and calculates the maximum speed limit and corresponding braking curves. Driver assistance is provided with cab signaling and, if necessary, takes control in the event of the permitted speed limit being exceeded.

Some highlights of Thales' ETCS experience are as follows:

- **First commercial opening of an ETCS line -** AlTrac/ETCS Level 1 solution was put into service along 250 km of line and in 25 stations between the capital Sofia and port of Burgas with the Bulgarian Railways BDZ in October 2001.

- **First Cross-Border Corridor Link -** ETCS Level 1 link between the Danube capitals Vienna and Budapest in September 2005.

- **First Level2 systems for high speed passenger service -** Thales managed 200,000 kilometers of test runs on the first operational ETCS Level2 solution before the Berlin-Halle/Leipzig line opened for passenger services in 2005.

- **First fully-interoperable national network -** Thales designed, installed and commissioned AlTrac/ETCS Level 1 solutions for Chemins de Fer de Luxembourg the first national railway to introduce ETCS network-wide.

- **First for suburban application in Mexico City -** North America's first ETCS technology application allows 3 minute headways on the high-density Cuautitlán - Buenavista line. 25 km of double track line serving 7 stations – 5 municipalities and a total of 4.8 million inhabitants. Meets the needs of 280,000 passengers daily. Total trip time: 23 minutes

- **World's longest high-speed land tunnel -** Up to 110 trains at speeds of up to 250 km/h safely travel through the Lötschberg base tunnel. Thales delivered Level 2 ETCS technology and overall equipment interoperability.

- **Madrid suburban C4 Line -** First implementation of ETCS L1/L2 in Europe specific for a suburban area.

- **Ankara – Istanbul HSL, Sincan – Inönü section** - First implementation of ETCS in Turkey

- **Spanish High Speed lines -** Thales' signaling technology is under operation in most of HSL network in Spain (widest HSL Network in Europe):
    - Madrid - Seville - 473 km (LZB)

- Cordoba - Malaga - 156 km
- La Sagra – Toledo – 21 km
- Madrid - Lérida – 450 km (only Telecom)
- Lerida – Barcelona – 171 km
- Madrid – Valladolid – 179 km
- Barcelona – Figueras – 131 km
- Madrid – Valencia/Albacete – 447 km
- Sevilla – Cadiz (Ultrera-Jerez Section) - 72 km
- Orense - Santiago de Compostela - 84 km
- Antequera – Granada – 126km
- Almusaffes-Valencia-Castellón

Relevant ETCS experience in similar projects:

- **Algeria**
  - ETCS L1 & 2 for the Rocade Nord Railway

- **Austria**
  - ETCS L1 from Vienna to Nickelsdorf & from Vienna to Salzburg & from Wels to Passau
  - ETCS L2 from Vienna to Nickelsdorf & from Neubaustrecke to Unterrintal & from Bestandsstrecke to Brennerachse

- **Bulgaria**
  - ETCS L1 from Sofia to Burgas, track side and On-Board Unit
  - ETCS L1 from Plovdiv to Svilengrad
  - ETCS L1 from Septemvri to Plovdiv

- **Czech Republic**
  - On-Board Unit

- **Denmark**
  - ETCS L2 on 60% of the Danish mainlines

- **Finland**
  - ETCS L1 for the HSL from Kerava to Lahti

- **Germany**
  - ETCS L1 & 2 though Nuremberg, Ingoldstadt and Munich
  - On board Unit

- **Greece**
  - ETCS L1 from Athens to Thessaloniki and the Bulgarian border

- ETCS L1 from Kiato to Rododafni

- **Hungary**
  - ETCS L1 from Kelenföld to the Hungarian border (approx. 180km)
  - ETCS L2 from Boda to Bajànsenye
  - ETCS L2 from Szajol to Püspöklandàny
  - ETCS L2 from Gyoma to Békéscsaba
  - ETCS L2 from Ferencvàros to Monor

- **India**
  - ETCS L1 from Gummidipundi to Elavur

- **Luxembourg**
  - ETCS L1 on 90% of its network

- **Malaysia**
  - ETCS L1 for Kuala Lumpur monorail

- **Mexico**
  - ETCS L2 for the Mexico-Toluca Line
  - ETCS L1 for the Cuautitlan – Buenavista surburban line

- **Morocco**
  - ETCS L1 from Casablanca to Rabat

- **Netherlands**
  - ETCS L1 & 2 for the HSL Zuid

- **Nigeria**
  - ETCS L2 Ajaokuta-Warri

- **Poland**
  - ETCS L1 from Grodzisk Mazowiecki to Zawiercie
  - ETCS L2 for E20 and E65 lines

- **Romania**
  - ETCS L1 from Fetesti to Constanta
  - ETCS L2 from Buftea to Brazi

- **Saudi Arabia**
  - ETCS L2 for the North-South Rail (NSR) Link

- **Slovakia**
  - On-Board Unit

- **Slovenia**
  - ETCS L1 on Corridor V

- **South Korea**
  - ETCS L1 for the Gyeonchun Line
  - ETCS L1 for the Jeolla line

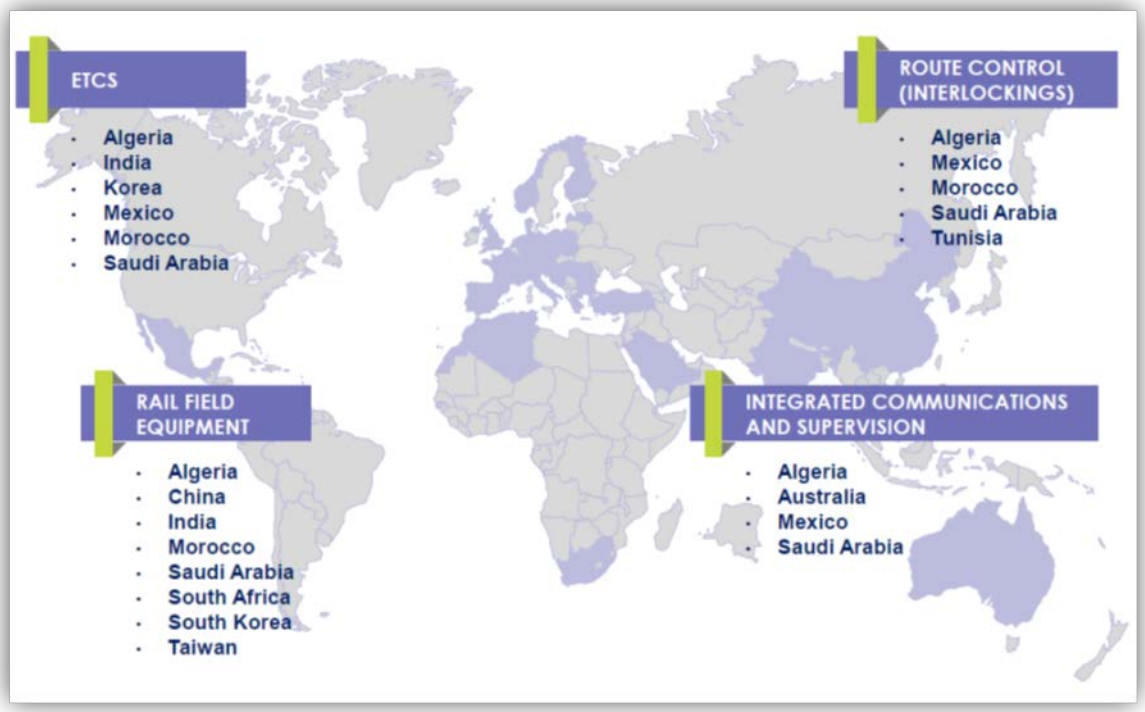
- **Spain**
  - ETCS L1 & 2 Lerida – Barcelona HSL
  - ETCS L1 & 2 Madrid - Segovia –Valladolid HSL
  - ETCS L1 & 2 Barcelona – Figueras HSL
  - ETCS L1 & 2 Ourense – Santiago HSL
  - ETCS L1 & 2 for Madrid commuter network

- **Switzerland**
  - ETCS L2 through the Lötschberg Tunnel
  - ETCS L2 through the Gotthard Tunnel

- **Turkey**
  - ETCS L1 & L2 from Ankara to Eskisehir, part of the Ankara to Istanbul HSL
  - ETCS L1 from Inönü to Kosekoy, part of the Ankara to Istanbul HSL
  - ETCS L1 & L2 for the commuter line from Cumaovasi to Tepekoy

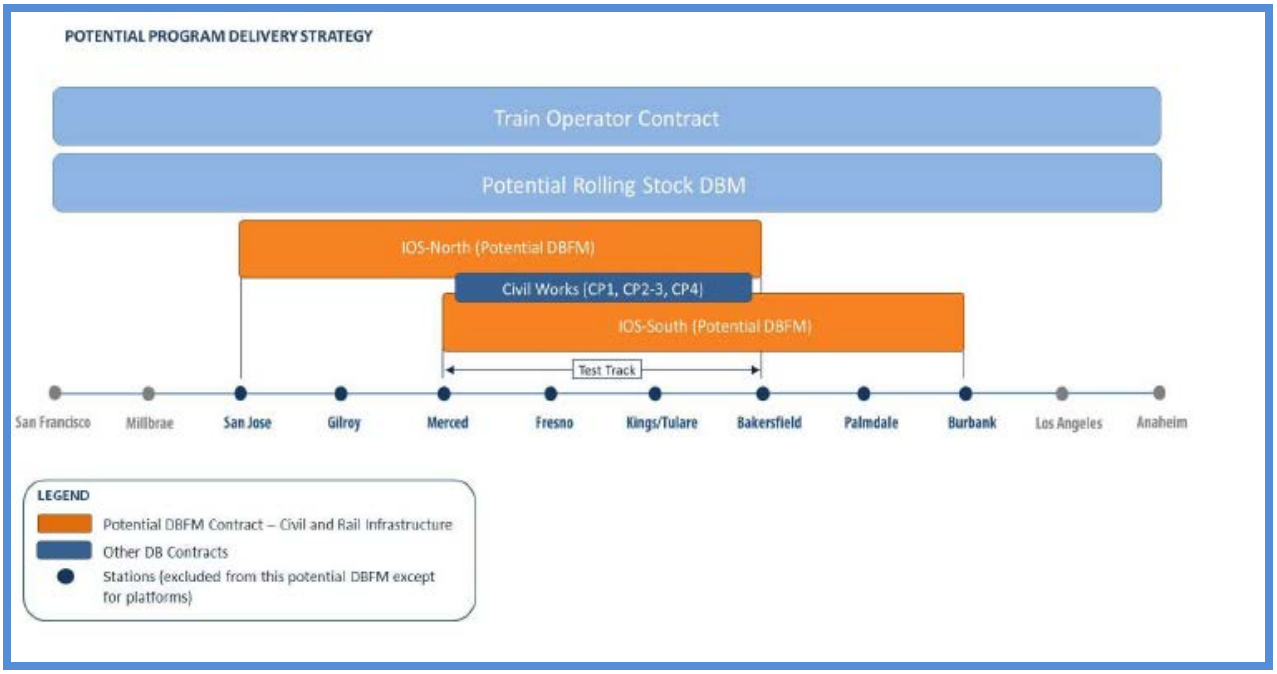
Thales Mainline solutions provided in Europe:

Thales Mainline solutions provided outside Europe:



2. PROJECT APPROACH

The following program delivery strategy has been defined by CHSRA:

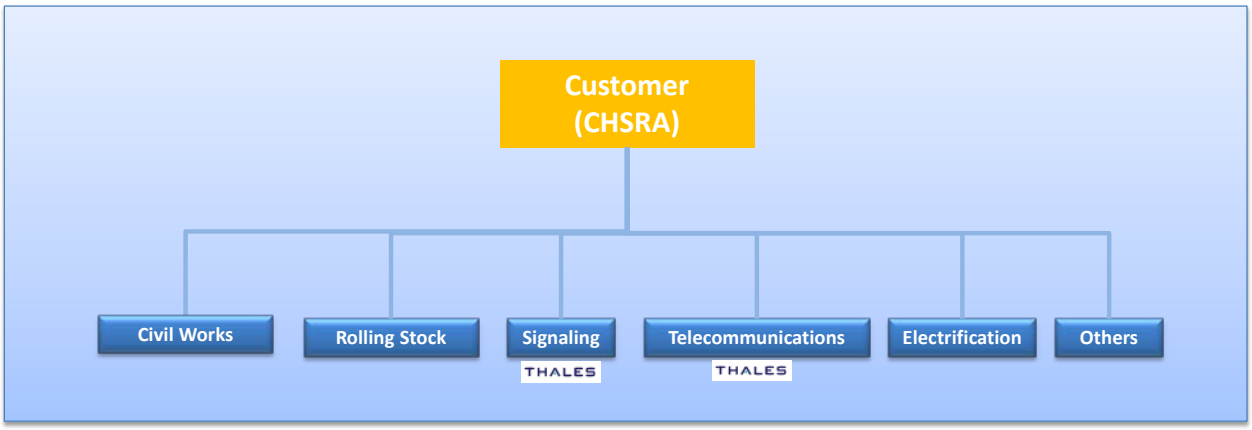


CHSRA is proposing a Model based on a fully integrated DBFM solution for the project deployment, which includes:

1. Design-Build-Maintain for Rolling Stock
2. Train Operator
3. DBFM or Other Delivery Model for Civil Works, Track, and Infrastructure
4. Design, build and maintain the civil works besides those civil works being delivered under separate DB contracts for CP1, CP2-3, and CP4;
5. Maintain the civil works being delivered under separate DB contracts for CP1, CP2-3, and CP4;
6. Install and maintain the track
7. Design, construct/install, and maintain the communications, signaling, and traction power systems
8. Provide financing based on an availability payment mechanism
9. Ensure full integration of all components across the alignment

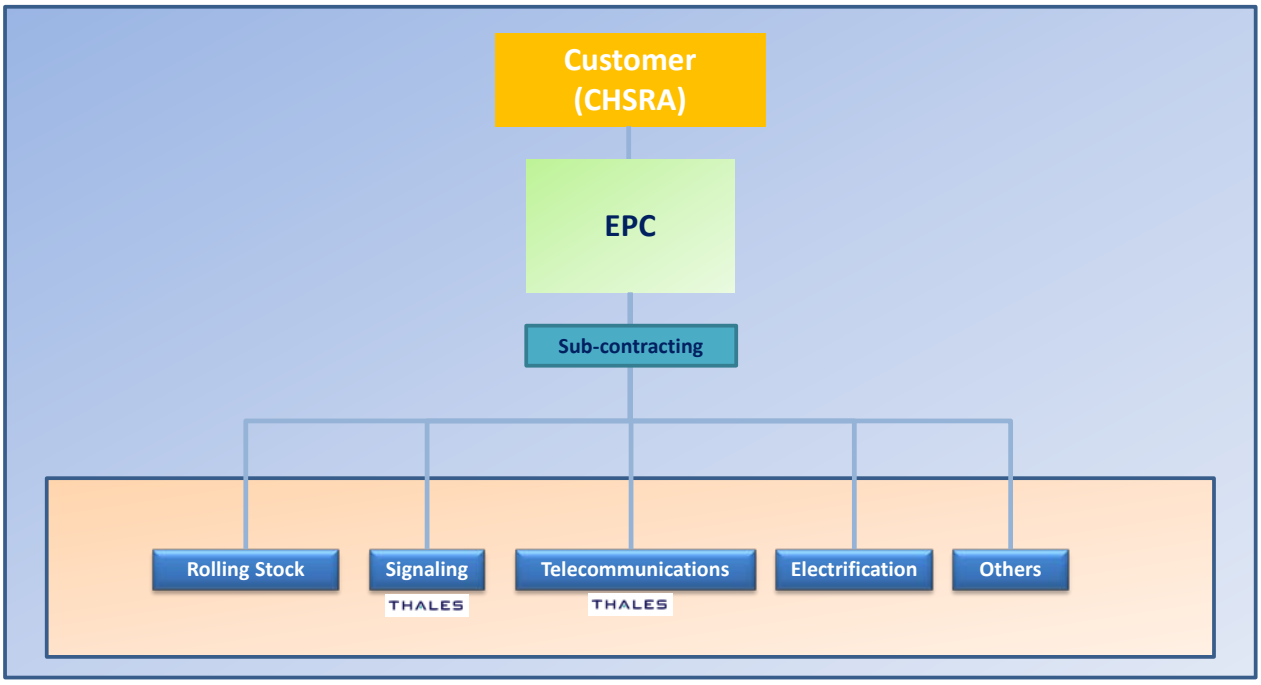
2.1 Thales Approach

Thales is very interested in participating in the California High Speed Rail project and has extensive experience in different team structures. Given the size and complexity of the project, Thales considers that the most efficient way to deliver the project is to divide it into different packages, covering all the scopes that must be covered to complete the project.

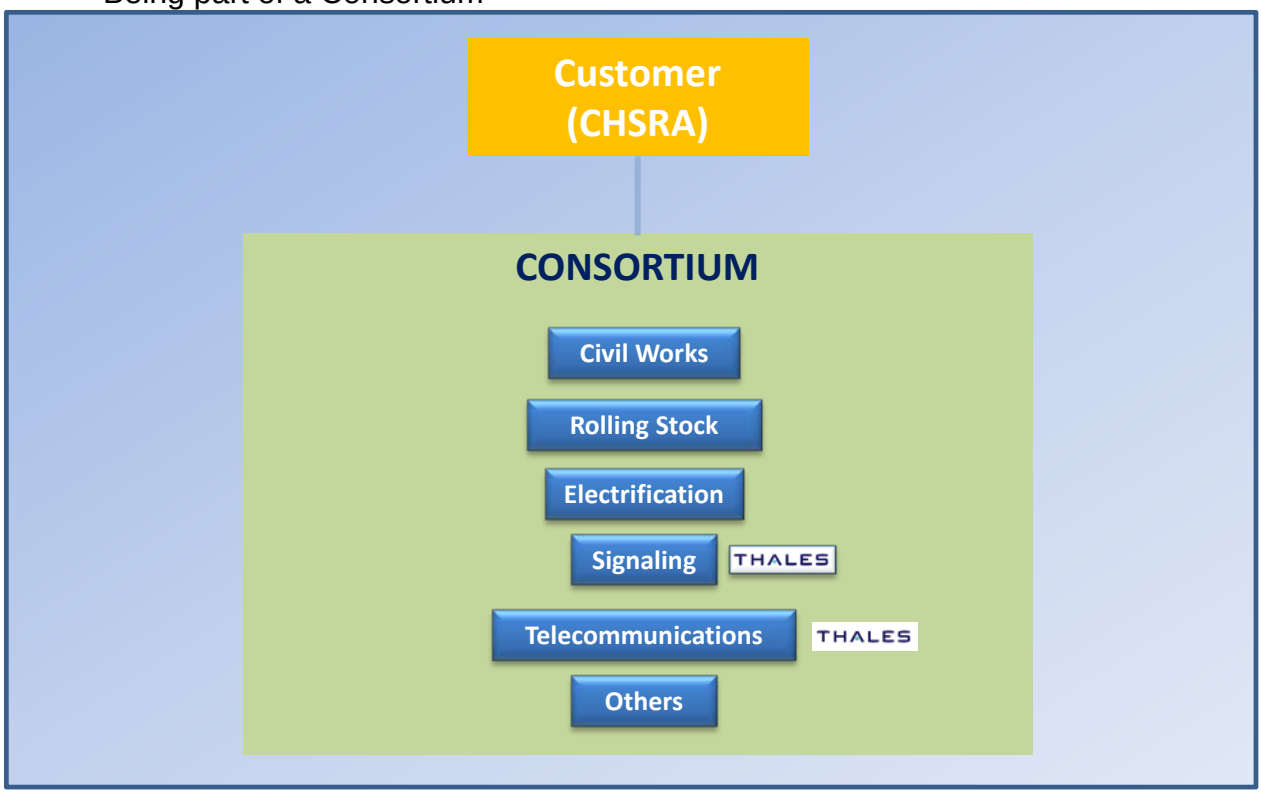


Nevertheless, Thales has a wide experience in similar projects that have granted Thales the opportunity of participating in other kinds of team structures:

- Being sub-contracted by an EPC



- Being part of a Consortium



3. COMMERCIAL QUESTIONS

1. *Is the delivery strategy (i.e., combining civil works, track, traction power, and infrastructure) likely to yield innovation that will minimize whole-life costs and accelerate schedule? If so, please describe how. If not, please recommend changes to the delivery strategy and describe how those changes will better maximize innovation and minimize whole-life costs and schedule.*

The delivery strategy has great impact in the way the project is deployed. Both a combined delivery and a separate packages strategy have their benefits and disadvantages that must be taken into account.

<u>Combined delivery:</u>

- **Advantages:**
  - One single point of contact for the client.
  - One contract only

- Possible synergies between companies of major groups, that can provide turnkey solutions and be translated into cost savings
- Schedule might be an issue as there will be many dependencies within the same provider. Once there are delays these will be likely to generate global project delays, as there might not be a clear split of responsibilities and scopes of work.

- **Disadvantages**
  - Fewer companies will participate on the tender process and will not bet on innovation. These companies will be playing on the safe side, used proven solutions that have been used in similar contracts, than rather using a new tailor made solution for this project.
  - A slower decision making process on the side of the companies
  - Structure costs are higher (Consortium costs, etc.)

<u>Separate packages delivery</u>

- **Advantages:**
  - Greater competitiveness as not only major turnkey solution providers will be participating
  - Higher level of technological solutions will be present, which might lead to more innovation
  - Higher pressure on providers to finish their projects on time. Lower structure costs (no Consortiums or Joint Ventures creation and management costs)
- **Disadvantages**
  - More stakeholders involved in the projects to deal with the client, which means that CHSRA will need to dedicate more efforts to project management

From the point of view of a systems solution provider and taking into account the characteristics of the project and in order to ensure the CHSRA announced objectives (innovation, whole-life costs reduction and schedule optimization), we strongly recommend a separate package strategy for Systems and Signaling, as it will:

- Attract a higher number of interested companies, that will present state-of-the-art solutions, especially designed and conceived for CHSRA specific needs,

- Optimize the whole-life cycle of the equipment to be used through homogeneous maintenance plans, warranty periods, etc., that will contribute to reductions on costs related to repairs, replacement and overhaul of the installed equipment.
- Schedule adherence is one of the main issues in most projects for a Systems provider. Thales is used to working under great time pressure and optimizing its own resources and past experiences to carry out this kind of projects. Being responsible for a separate package is a clear advantage for our company, as the dependencies from other companies and stakeholders are easier to handle and manage, which will contribute to an optimized schedule according to needs of the project and the available resources.

These differentiators lead Thales to advise that the combined delivery strategy will not yield innovation but will increase lifecycle costs and extend the project delivery schedule.

2. *Does the delivery strategy adequately transfer the integration and interface risks associated with delivering and operating a high-speed rail system? What are the key risks that will be borne by the State if such risk transfer is not affected? What are the key risks that are most appropriate to transfer to the private sector?*

Yes. Both the combined delivery and the separate package delivery models are possible when it comes to delivery and operation of a high-speed rail system.

In either delivery model, we recommend the following suggestions:

- To maximize the laboratory testing program, involve all suppliers in the development and validation process. This in turn, reduces track testing time and guarantees the performance of the integration and interfaces between subsystems. To use a reference laboratory consolidated in ERTMS
- To have a whole life cost approach with a long duration (20 years) of maintenance contracts including technology refresh
- To involve system operators early-on to test the system and to raise operational and technical competencies and awareness
- To have stable and empowered project management and technical authority to perform an effective management and co-ordination of multiple disciplines
- To freeze specification and delivery requirements early-on to allow on-time delivery
- Formalize delivery and test program with primary contractors and to facilitate open communications

Key risks borne by the State:

- Schedule delays
- Incomplete works
- Dependencies and interfaces between the stakeholders

- Unclear allocation of responsibilities and liabilities
- Operation problems due to insufficient performance
- Financing issues
- Project Management
- LCC management

Key risks borne by the Private Sector:

- Design and Build
- Maintenance for the lifecycle of the system including obsolesce management

3. *Are there any other components of a high-speed rail system that should be included in the scope of work for each project (e.g., rolling stock, train operations, stations)? If so, how will this help meet the Authority's objectives as stated in this RFEI?*

Separated systems packages: Thales proposes the following split of works for the separated systems packages strategy:

- Package 1: Infrastructure (bridges, tunnels)
- Package 2: Track
- Package 3: Stations
- Package 4: Electrification (catenary, power substation)
- Package 5: Rolling Stock
- Package 6: Signaling, telecom and ticketing
- Package 7: Operation

For packages 1 to 6 the maintenance should be included.

In all these scopes there are companies specialized in each subject, giving CHSRA the opportunity to select best-in class providers that will help ensure the realization of CHSRA's objectives, i.e.: cost effectiveness, interface management, schedule and milestones accomplishment.

The separation by packages will also be more efficient in order to structure the tendering process according to CHSRA's needs regarding timing, budget availability, progress of preceding packages, etc.

4*. What is the appropriate contract term for the potential DBFM contract? Will extending or reducing the contract term allow for more appropriate sharing of risk with the private sector? If the Respondent recommends a different delivery model, what would be the appropriate term for that/those contract(s)?*

Thales is recommending a delivery model by packages with a minimum contract term (depending on the length of the section) for Signaling and Communications system of 24-30 months after T0. For maintenance contract we recommend a minimum of 20 years duration

5. *What is the appropriate contract size for this type of contract? What are the advantages and disadvantages of procuring a contract of this size and magnitude? Do you think that both project scopes should be combined into a single DBFM contract?*

Concerning the size and magnitude of the projects, uniting both projects scopes into a single DBFM contract would possibly be a complex move, as the project would be hard to manage and control at all levels.
For example, in the systems point of view, it would require a great amount of resources where more than two companies (at least) would have to unite forces in order to be capable of delivering the project in a safe way. Given the size of the project, resources would be a major issue, even participating in Consortium.
However there other issues that must be taken into account, such as timing, civil works possible delays, etc.

6. *Does the scope of work for each project expand or limit the teaming capabilities? Does it increase or reduce competition?*

As mentioned previously, if the scope of each project has a considerable size (combined scopes and projects), it will lead to a very limited participation. The Systems package would be highly affected, since the (already) limited number of key players in the sector would be forced to join in consortium structures, reducing the number of competitors and thus the competitiveness.

4. FUNDING AND FINANCING QUESTIONS

7. *Given the delivery approach and available funding sources, do you foresee any issues with raising the necessary financing to fund the IOS-South project scope? IOS-North project scope? Both? What are the limiting factors to the amount of financing that could be raised?*

Thales considers that the general aspects of the proposal seem interesting to carry out such a project, considering that:

- California has a high GDP ($2.31 trillion in 2014), ranking 8th in the world and being comparable to Brazil's GDP.

- Some funding sources have already been identified for this specific project and already represent 18% of the project needs ($4.5 Billion identified over $25 Billion needs as per the Business Plan 2014), providing assurance for future investors (to raise both equity and debt)
- The general obligation debt of the State of California has an A+ credit rating from Fitch Ratings (AA- from S&P) (=low risk), therefore creating appetite for investors.

However, more detailed information and a deeper analysis will be needed to identify potential issues.

From Thales point of view, the limiting factors have been identified:

- Uncertainty about future cash flows coming from the Cap & Trade Proceeds generating volatility and limiting revenue pledges. Detailed and secured forecasts of the inflow of Cap & Trade Proceeds over the period of repayment will be needed.
- Capacity for the industrial partners not to be too much exposed to the debt.

8*. What changes, if any, would you recommend be made to the existing funding sources? What impact would these changes have on raising financing?*

Thales suggests that the following financing be used:

- TIFIA (Transportation Infrastructure Finance and Innovation Act) secured loans (could also be used as a loan guarantee for the project) providing competitive rates.
- Export Credit Agencies, able to finance large amounts for long maturities.
- Pool of banks for debt.

Adding financing sources will diversify the risk and ease the raising of financing for such a mega-project. As a result of risk diversification, the financial interests should be lower in the new scheme, enabling project cost savings.

9. *Given the delivery approach and available funding sources, is an availability payment mechanism appropriate? Could financing be raised based on future revenue and ridership (i.e., a revenue concession)? Would a revenue concession delivery strategy better achieve the Authority's objectives?*

This mechanism seems adequate since it gives the Authority more comfort that the Developer will perform under the required RFQ technical specificities and schedule. The DBFM contract

would also have to include minimum unconditional availability payments each year to cover the debt service.

Financing could indeed be raised on future revenue and ridership (when pledged) but should be based considering the pessimistic hypotheses and scenarios from the Business plan.
In any case, it would be suitable to have the O&M costs and fare-box revenues validated, ensuring the net future profits to cover the O&M costs.

While a revenue concession could potentially be interesting for the Authority, this is not Thales' area of expertise as industrial partner. Therefore, Thales does not intend, at that stage, to assume the related risk.

5. TECHNICAL QUESTIONS

10. *Based on the Authority's capital, operating, and lifecycle costs from its 2014 Business Plan, describe how the preferred delivery model could reduce costs, schedule, or both. Please provide examples, where possible, of analogous projects and their cost and/or schedule savings from such delivery models.*

Thales would need a deeper analysis and hear CHSRA specific concerns regarding this matter. Thales would be glad to coordinate with CHSRA and a Spanish (or other) Railway operator, who could provide a more detailed insight of the subject based on their experiences.

11*. How does this compare to separately procuring each high-speed rail component (i.e., separate contracts for civil works, rail, systems, power separately)? Please discuss design/construction costs, operating/maintenance/lifecycle costs, and schedule implications.*

According to a recent study developed by the Australian High Speed Rail Authority, the choice of a separate signaling and telecommunications package is likely to be substantially, if not entirely, transferred to the private contractor. There would also be significant commissioning efficiencies, given the telecommunications train control and signaling systems would be developed in conjunction with each other.

Reflecting the unique nature of the signaling works, the preferred procurement option is a DSM contract, as opposed to a design and supply (D&S) contract. The rationale for this approach is that:

- The signaling systems components are likely to offer significant opportunities for contractor involvement in terms of market innovation in all aspects of the respective technical solutions. Delivery models that access innovation from multiple parties

through a competitive process should deliver the most innovation. A DSM model would achieve this outcome.

- The choice of signaling system would need to ensure it does not constrain flexibility and/ or competitive tension for future signaling procurements in subsequent stages of the HSR program. One approach would be for CHSRA to specify a signaling performance requirement based on open architecture systems, such as European Train Control System Level 2. This would facilitate interoperability with hardware from other suppliers utilizing the same protocols, thereby ensuring multiple suppliers could bid for signaling systems procurements for later HSR program stages.
- Linking supply and maintenance for a significant part of the equipment life encourages a whole-of-life approach by the contractor. A DSM model would likely drive the best value for money outcome, since contractors would be inherently incentivized to reflect the maintainability of the system in its design.

12. *For each project, are there any technical changes to the respective scope of work that would yield cost savings and/or schedule acceleration while still achieving the Authority's objectives? If so, please describe.*

Thales strongly recommends the use of ETCS as worldwide ATP standard and the acceptance of European standards like CENELEC for the Solid State Interlockings

Thales welcomes the opportunity to discuss specific technical changes that may yield cost savings in detail with CHSRA.