JACKSONVILLE TRANSPORTATION AUTHORITY
REQUEST FOR INDUSTRY FEEDBACK

April 2015

REQUEST FOR INDUSTRY FEEDBACK (RFIF)

SKYWAY MONORAIL OPERATING SYSTEM

RESPONSE SUBMISSION DEADLINE:
BY 2:00 PM (LOCAL), WEDNESDAY MAY 6, 2015

RFIF NUMBER: I-15-003

JACKSONVILLE TRANSPORTATION AUTHORITY
121 WEST FORSYTH STREET, SUITE 200
JACKSONVILLE, FL 32202
REQUEST FOR INDUSTRY FEEDBACK (RFIF)

SUBJECT: SKYWAY MONORAIL OPERATING SYSTEM

RESPONSE DEADLINE: MAY 6, 2015, 2:00 PM (LOCAL TIME)

Request for Industry Feedback for Skyway Monorail Operating System will be received by the Jacksonville Transportation Authority ("Authority" or "JTA"), until the above-stated response deadline at the following location:

Jacksonville Transportation Authority
Receptionist Desk
Administration Building
121 West Forsyth Street, Suite 200
Jacksonville, Florida 32202

The complete Request for Industry Feedback package will be available on April 22, 2015 and must be obtained by sending an email request to JTA Purchasing, at purchasing@jtafla.com.

CONTACT INFORMATION - All questions or concerns regarding this RFIF must be submitted by email to JTA Purchasing, at purchasing@jtafla.com.

RESPONSE DELIVERY - JTA is exploring alternatives to upgrade the Skyway Monorail System and has identified three options described in the document: “Request for Industry Feedback”. Interested Respondents should provide a written response, and any questions they may have, to the JTA within the above deadline. Respondents are invited to submit a response that describes their interest in the proposed work, for one or several option(s). Respondents shall also describe their prior experience in similar work. The JTA may organize a site visit for interested Respondents to further their understanding of the anticipated work.

Responses must be submitted in an opaque sealed envelope and properly labelled with the name and number of the Solicitation. Responses must be submitted by the due date, at the location identified in the Notice (or as amended in an Addendum). The sealed envelope must contain one original, one copy, and one electronic copy of all of the exact response. No additional promotional or advertising information will be accepted. Facsimile and electronic transmissions will not be accepted. Late Responses will not be opened. Due to the lack of control over the standard postal delivery service, many companies hand-deliver or use a private delivery service to ensure delivery by the 2:00 PM deadline. The Authority is not responsible for the failure of the postal service or private delivery service to locate and deliver the Response in a timely manner. The Authority is the official timekeeper and the Authority’s determination of the time shall be deemed correct and final.
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1. **INTRODUCTION**

The Jacksonville Transportation Authority (JTA) is seeking feedback from selected operating system suppliers/manufacturers regarding the Jacksonville Skyway Monorail Operating System.

The Operating System Equipment consists of the Vehicles, Automatic Train Control (ATC), Central Control, Power Distribution System, SCADA, and Communication subsystems as well as Guideway mounted equipment and Maintenance tools and equipment.

This Request for Industry Feedback (RFIF) is to solicit input/recommendations on the following options:

- **Option 1:** Overhaul of the Jacksonville Skyway Monorail System,
- **Option 2:** a) The Replacement in-kind of the Jacksonville Skyway Monorail vehicles and b) The overhaul of the wayside Operating System elements.
- **Option 3:** a) the replacement of the existing Skyway vehicles with new vehicles “allowing infrastructure modifications that do not alter the existing beam structure, with no net increase in weight stress on guideway infrastructure” and b) the replacement, as required, of the wayside Operating System (train control, power distribution, guideway switches etc.)

The Fixed Facilities (guideway, stations) overhaul (drainage, structure repair etc.) will be addressed separately by the JTA.

Respondents are invited to submit a response that describes their interest in the proposed work, for one or several option(s). Respondents shall also describe their prior experience in similar work. Respondents may also submit questions and recommendations, in writing, to fully understand the JTA’s intention with regard to this RFIF. This RFIF is not a procurement solicitation, but merely a measure of the industry’s interest in the work.

The following includes a general description of the Jacksonville Skyway Operating System and a tentative description of the system elements.

2. **General**

The JTA Skyway is a driverless monorail train system running on an elevated 2.5 mile dual-lane guideway serving eight stations in downtown Jacksonville: five in the core downtown and LaVilla areas, and three across the St. Johns River on the Southbank. The original Skyway that operated from 1989 to 1996 was designed by Matra, a French company that has since been acquired by Siemens. Matra design included the driverless VAL 256 rubber-tire train operating in two car train consists between Central Station and the Convention Center Station for a distance of 0.7 mile. In 1997, the system was replaced by Bombardier Transportation Inc. using the UM III monorail technology and was extended from Central Station to Rosa Park Station. The UM III monorail operates on beams 34 inches wide and 28 inches deep fixed on an eleven (11) foot wide guide-way with parapet barrier walls. With some modification, such as insertion of a middle car, or a C-car, each train consist can be configured from two cars up to three-cars and can travel at speeds up to 30 mph. The southern segment of the Skyway system opened in 1998, adding service to San Marco Station on the Southbank. Subsequently, in 2000, the Riverplace and Kings Avenue Stations opened, completing the Southbank segment and Phase I of the current Skyway system as it exists today; with two routes running south from Rosa Parks Station and branching at Central Station: one going west and terminating at Convention Center. See Figure 1.
3. System Features

The UM III Monorail trains are fully automated, with no driver or attendant. The two-car train is 48 feet long and can carry a maximum capacity of 56 passengers. The trains have been designed to allow insertion of a middle car, or a C-car to increase capacity to 84 passengers. The body is composed of a steel under-frame with a reinforced fiberglass monocoque shell. The trains are climate controlled, ADA compliant with two-way voice communications to central control. For passenger security, a CCTV system records all train interior activity during revenue operation. All three bogies on the two car train are motorized. The propulsion/brake system utilizes a DC brushless, permanent magnet motor, with three (3) IGBT propulsion inverters. Train braking is regenerative, converting dynamic energy into electric energy (power) and feeding it back into the 480 Volts three-phase Alternating Current distribution system. Wayside braking resistors that dissipate excess energy are located at substations.

The train control hardware and software (Low Density Control System, “LDCS”) was supplied by Thales Transport Inc. formerly SEL/ALCATEL Inc. as a subcontractor to Bombardier. The fixed block, microprocessor based train control system, utilizes a total of 109 Automatic Train Control (ATC) blocks throughout its 2.5 mile guideway. The Wayside Control Units (WCUs) are located in the signal room of each station. Train occupancy of these blocks is monitored and controlled by way of redundant communications links between the trains, WCUs and Central Control (O&M Center). Signal transponders are mounted along the guideway, and trains pick up each transponder’s unique signal with a specialized train antenna, thereby precisely positioning the train on the guideway. All train movement, switch and block status information are transmitted to the O&M Center and displayed on the monitors located in the Central Control room. Control Operators monitor system operation and issue system commands as deemed necessary. Table 1 below provides a summary of the system features:
### Jacksonville Skyway System Characteristics

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet Size</td>
<td>10 2-car trains (20 cars)</td>
</tr>
<tr>
<td>Number of Stations</td>
<td>8 elevated stations</td>
</tr>
<tr>
<td>Total Length of line in miles</td>
<td>2.5 miles of elevated dual-lane guideway</td>
</tr>
<tr>
<td>Traction Power supply</td>
<td>480 VAC, 3-phase</td>
</tr>
<tr>
<td>Type of Signaling</td>
<td>Low Density Control System, Microprocessor-based fixed block (Thales)</td>
</tr>
<tr>
<td>Train operation (Grade of Automation level)</td>
<td>GoA4, Unattended Train Operation (UTO)</td>
</tr>
<tr>
<td>Type of Monorail</td>
<td>Straddle Type</td>
</tr>
<tr>
<td>Additional Components</td>
<td>- 10 rotary switches, 1 pivot switch, all automatically controlled by ATC</td>
</tr>
<tr>
<td></td>
<td>- 2-750 kVA mainline power distribution substations</td>
</tr>
<tr>
<td></td>
<td>- Fully automated train control system</td>
</tr>
<tr>
<td></td>
<td>- Communications systems</td>
</tr>
<tr>
<td></td>
<td>- Supervisory control and data acquisition system (SCADA)</td>
</tr>
<tr>
<td></td>
<td>- Platform Edge Railing and Intrusion Detection</td>
</tr>
<tr>
<td></td>
<td>- Interfaced with ATC</td>
</tr>
<tr>
<td></td>
<td>- Maintenance Facility and Storage Area</td>
</tr>
</tbody>
</table>

#### 3.1 Propulsion

The train propulsion system was provided by Bombardier Transportation as part of the UM III Monorail system delivery in 1997. The propulsion system, which is powered by 480 VAC, 3-Phase power, is comprised of three (3) motor/ gear box sets and one (1) Propulsion Control Unit (PCU). The motor/gear box is mounted on each bogie and the PCU is located inside the B car. The motor/gear box was manufactured by Kaman Electromagnetics Corporation, and the PCU was manufactured by a Bombardier subsidiary located in Germany.

#### 3.2 Vehicle

The Skyway vehicle characteristics are provided in the Table below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Existing (2- car) UMIII</th>
<th>Future (3- car) UMIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidance System:</td>
<td>Center Concrete Beam</td>
<td>Center Concrete Beam</td>
</tr>
<tr>
<td>Train Length (ft)</td>
<td>48</td>
<td>68</td>
</tr>
<tr>
<td>Train Width (ft)</td>
<td>7.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Train Height (ft)</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Unloaded Train Weight (lb per car)</td>
<td>26,100</td>
<td>33,100</td>
</tr>
<tr>
<td>Normal Train Weight (lb per car)</td>
<td>35,188</td>
<td>46,732</td>
</tr>
<tr>
<td>Crush Train Weight (lb per car)</td>
<td>39,540</td>
<td>53,260</td>
</tr>
<tr>
<td>Train Capacity (passengers, AW1)</td>
<td>56</td>
<td>84</td>
</tr>
<tr>
<td>Maximum Speed (mph)</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Minimum Curve Radius(ft)</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

#### Table 2: Jacksonville Skyway Train Characteristics
3.3 **Power Distribution System**

The Skyway trains are supplied with 480 V three-phase AC power, and there are three power distributions substations along the system; one at Central Station, one at San Marco Station and one at the O&M center.

3.4 **Central Control**

The Control center includes the Automatic Train Supervision, Supervisory Control and Data Acquisition (SCADA), CCTV control and monitoring, PA and Dynamic Signs controls and Telephones. Central Control is manned by 2 Central Control Operators (CCO); one operator is typically in charge of ATS, while the other operator is in charge of SCADA and Communications.

The Automatic Train Supervision System has been upgraded in 2009. The upgrade consisted of the migration of the OS/2 operating system to Windows XP in order to preclude interruptions to system operation due to the failure and lack of availability of obsolete existing ATS hardware. The upgrade also included:

- New Central Control Workstation hardware (rack-mounted PCs).
- A new graphical user interface that featured drag and drop operator functionality enhancements.

3.5 **ATC- Permissive Movement Authority**

The Permissive Movement Authority (PMA) signal is generated by the Automatic Train Control Wayside Unit (WCU), which are located at stations, and transmitted via an Inductive Data Transmission System (IDTS) Loop and 36 KHz antenna to the Vehicle On-Board Controller (VOBC). A train cannot move in Automatic Mode if it does not receive a PMA signal from the WCU. The WCU receives status inputs from all the wayside equipment (Track circuit occupancy, switch position, etc.) and determines if a train is safe to proceed into a block. The signal is then sent to the train with an authorization to proceed up to a given block number.

4. **Condition Assessment**

A Condition assessment of the Operating System was conducted by Lea+Elliott in October 2014 (see Section 7.0).

A Condition assessment of the Infrastructure was conducted by Reynolds Smiths and Hill (see Section 7.0) in October 2014 (see Section 7.0).

4.1 **Main System Issues**

The following includes a description of the main Operating System issues. Interested Respondents may solicit additional information.

4.1.1 **Permissive Movement Authority (PMA)**

Some trains have been experiencing emergency braking at specific guideway locations due to a loss of the Permissive Movement Authority (PMA) signal. PMA issues started about 5 years ago. There is evidence however, that the System experienced PMA issues during testing and commissioning, but those issues were apparently resolved at that time and started to occur again in around 2009 timeframe. Several attempts have been made to resolve the PMA problem. Those attempts indicated that PMA issues are directly related to a high level of in band noise generated from the traction motors during dynamic braking situations. This high level noise can cause data corruption in the 36 KHz frequency band that the trains use to receive PMA messages from the wayside equipment via the inductive loop cables. Additional information regarding PMA failures and investigations will be made available by the JTA.
4.1.2 Propulsion

The Propulsion Control Unit is also affected by obsolescence and a lack of spares. According to the JTA, the original manufacturer has indicated that Main Controller Boards (Part #3MUP0000001-0016 (DMC-120)) will no longer be available, and the JTA is in the process of acquiring twenty five (25) spare boards before the line is discontinued. These boards are not identical to the ones presently used on the system and will require modification in order to be used on the Skyway trains. It is difficult to determine how long these spares will support the fleet of 10 vehicles.

The JTA has also held discussions with a major propulsion supplier that indicated that there may be difficulties replacing the traction converter due to space constraints onboard the vehicles. The JTA efforts have not been successful thus far in finding a suitable alternative to the existing traction converter.

4.1.3 SCADA

The Supervisory Control and Data Acquisition system (SCADA) based on the DYNAC® OS64 developed by Transdyn Controls, provides the means of monitoring and controlling the following:

- Guideway Control and Monitoring.
- Substation Control and Monitoring.
- Passenger Station Control and Monitoring.
- Track Switch Control and Monitoring.

Even though the SCADA servers were replaced a few years ago, many of the overall SCADA subsystem components have become obsolete, and are no longer supported or reproduced by the manufacturer (Siemens). These obsolete components have been increasingly more difficult to obtain to keep the SCADA subsystem up and running.

5. ANTICIPATED WORK

5.1 General

The anticipated work will consist in the following:

OPTION 1: Overhaul of a) the existing monorail vehicles and b) the wayside operating system elements. The Infrastructure repair will be addressed separately by the JTA.


OPTION 3: Option 3: a) the replacement of the existing Skyway vehicles with new vehicles “allowing infrastructure modifications that do not alter the existing beam structure, with no net increase in weight stress on guideway infrastructure” and b) the replacement, as required, of the wayside Operating System (train control, power distribution, guideway switches etc.)

In their response, interested Respondents shall provide a list questions to gain a better understanding of the existing conditions and the JTA’s expectations.

5.2 OPTION 1

5.2.1 Vehicle Overhaul

The JTA has prepared a tentative list of vehicle overhaul items. This list is considered preliminary and should be used only as an illustration of work to be performed. Complete scope of the overhaul should be developed by the Contractor after performing a due diligence, including reliability and obsolescence analysis. Refer also to the Operating System condition assessment for additional details.
Table 3: Jacksonville Skyway Train Subsystems-Preliminary Overhaul Table

The overhauled vehicles shall exhibit the exact same characteristics as the existing vehicles and will use the same train control (by Thales), communications, power distribution, and switching technologies. The overhaul shall allow extending the service life of the vehicle and operating system by 15 years.

5.2.2 Operating System Overhaul

Noting the issues and the upgrades listed in this document as well as the Operating System condition assessment, the complete scope of the overhaul should be developed by the Contractor after performing a due diligence, including reliability and obsolescence analysis.

5.3 OPTION 2

5.3.1 General

The anticipated work will consist in a) The replacement in-kind of the existing monorail vehicles and b) The overhaul of the operating system elements. The Infrastructure repair will be addressed separately by the JTA. In their response, interested Respondents shall provide list questions to gain a better understanding of the existing conditions and the JTA’s expectations.

5.3.2 Vehicles

The replacement vehicles shall exhibit the exact same characteristics as the exiting vehicles and will use the same train control technology (by Thales), communications, power distribution, and switching technologies. The design life of the new vehicles will be 30 years.

5.3.3 Operating System Overhaul

Noting the issues and the upgrades listed in this document as well as the Operating System condition assessment, the complete scope of the overhaul should be developed by the Contractor after performing a due diligence, including reliability and obsolescence analysis. The existing technology will be maintained and/or overhauled as required to extend the service life by 15 years.
5.4 **OPTION 3**

This Request for Industry Feedback (RFIF) is to solicit input/recommendations for a) the replacement of the existing Skyway vehicles with new vehicles “allowing infrastructure modifications that do not alter the existing beam structure, with no net increase in weight stress on guideway infrastructure” and b) the replacement, as required, of the wayside Operating System (train control, power distribution, guideway switches etc.).

Infrastructure modifications required for the proposed new technology should be identified for the various operating system and infrastructure elements (power distribution, central control, guideway, guideway switches, stations and maintenance and storage facility). If the proposed new technology requires extensions to the existing guideway, such extensions should also be identified.

6. **DOCUMENTATION**

Project documentation is available at the JTA. A Preliminary list of documents is listed below.

1. Vehicle FDR- Bogie ((ING-683-014, Bombardier Transportation Group, December 21, 1995)
4. Power Rail Schematic Sectionalisation Diagram (Bombardier Transportation, 683-63-1002-1)
5. Friction Brake and Pneumatic System (ING-683-018, Bombardier Transportation Group, November 8, 1996)
6. Traction System FDR (Kaman Electromagnetics, December 21 1995)
7. Condition Assessment Operating System (Draft by Lea+Elliott and Ohmega, October 2014)
8. Condition Assessment Infrastructure (Draft by RS&H, Fit Engineering and GM Hill Engineering, October 2014)
10. PMA Failure Test Report (Thales Group, July 7, 2014)
11. PMA Service Trip Report (Thales Rail Signaling Solutions, Inc., October 2010)
12. Completion Option SCADA System FDR (Bombardier Transportation, 683-FDR-5501)
13. SCADA System Improvements Final Proposal- August 14, 2013 (Transdyn, Inc.)
15. Low Density Control System Design Overview (Thales Canada Transportation Solutions, April 16, 2014)
17. Guideway Structural Inspection Report Section 1 (TranSystem, July 31 2014)
18. Guideway Structural Inspection Report Section 2 (TranSystem, July 31 2014)
20. FDR Completion Option Switches- Appendix A (Bombardier Transportation, 683-FDR-4101, January 29 1999)
21. Starter Line Geometry (Reynolds Smith and Hill, November 1986)
25. FDR Guidebeam Design (Bombardier Transportation, TR 683-200-006, August 3, 1996)