SONOMA-MARIN SMART AREA RAIL TRANSIT

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October 19, 2016

Sonoma-Marin Area Rail Transit Board of Directors
5401 Old Redwood Highway, Suite 200
Petaluma, CA 94954

SUBJECT: Start of Passenger Service

Dear Board Members:

RECOMMENDATION: Target passenger service launch for late spring 2017 *(Discussion and Information)*

SUMMARY:
At your September 21 Board meeting, various staff members informed your board and members of the public on the progress of the SMART project. We also reported on work that needs to be completed in anticipation of the potential opening of passenger service at the end of 2016. These projects and tasks will continue and are still on target for the beginning of passenger service. This presentation also demonstrated the very complex and challenging nature of this initial 43-mile system.

However, in order for us to begin our revenue service a number of major items must be completed in sequence in order for us to be confident that safe and reliable service can be provided. These are also many of the steps required to receive approval from the Federal Railroad Administration (FRA) to begin passenger service.

A recent development with our train car engines, and our goal of addressing all issues prior to the start of passenger service make it difficult to meet our existing timeline. We would much rather address any and all issues before we open, so that we can provide the safe and reliable service we have promised on Day One, even if it means waiting a few months longer.

Today we will be discussing these major tasks that remain and review our progress thus far:

TRAIN CARS
Our train car is a Diesel Multiple Unit (DMU) designed and built by Nippon Sharyo, which is one of the top train car manufacturers in the world. Since receiving our 14 train cars, we have been testing the cars themselves and conducting training for our engineers for signal testing.

As with any new design and construction project, we have had our share of challenges, but in partnership with our train car vendor and their sub-contractors we have been addressing these issues while continuing to test our system.

In early July we received notification from our car designer that a similar car in Toronto had experienced an engine failure, and that they were working with their vendor (Cummins Engines) to address the cause and the potential solutions. Cummins has informed us that this failure was a result of a design flaw with the crank shaft. We then sent our Superintendent of Vehicles and our Vehicle Engineers to Cummins' facility in Indiana so they could all work together and recommend the right course of action.

The attached report from our Vehicle and Systems Engineering Program Manager provides the details of this issue. This report concludes that the nature of the engine problem creates an uncertainty and a risk that— particularly for a brand new service such as ours with a single track operation— should not be taken. The attached letter, dated October 13, from our car manufacturer describes an aggressive schedule that includes design, production and full replacement of all of our engines that continues through the spring of 2017.

SIGNAL TESTING

SMART is in the process of systemwide testing, including testing its grade crossing warning devices. While this testing is being performed, and until the testing is complete and certified, SMART's train crews are required by operating rules to approach each grade crossing prepared to stop. This operating rule is communicated to train crews by listing each grade crossing on the system as "malfunctioning" on SMART's Daily Operating Bulletin, which is the document that the train crews refer to each day as they operate through the alignment. The "malfunctioning" term is part of the General Code of Operating Rules, which is used by railroads across the United States and is being applied to all crossings, despite the fact they are not all malfunctioning. This cautious approach is being taken with public safety in mind, as it ensures that each train will be able to stop before entering the crossing if there are any issues with grade crossing warning devices, or if they see a safety emergency, such as cars stopped on the tracks. That testing is progressing well, and we are preparing to enter the next stage of testing more frequently and at increased speeds.

We have 63 active at grade crossings that have to perform consistently and repeatedly individually, as a block and then in complete harmony with the train cars and with the required Positive Train Control system. This systemwide safety testing is extensive, complex and essential as we progress toward the start of our passenger service. Conducting this systemwide testing is required to ensure our crossing gates, our train control and communication systems, and our train cars are working properly and efficiently.

In order for our system to determine train location, speed and direction, the train's wheels and the rail itself must consistently touch and maintain electrical contact. The electrical circuit between the rail and the train's wheels and axles is referred to as a "shunt", and the activity of this electrical circuit as the train moves down the track is referred to as "shunting".

Because our train cars are new, our rail is new, and because we are not running trains as frequently as needed, the shunting is inconsistent, causing some of our signals to perform inconsistently.

The solution for resolving inconsistent shunting, which is common among railroads throughout the country, especially new startup railroads with new rail, is consistent train operation and consistent maintenance, such as grinding and scrubbing the rail. We now have been running trains from 8 a.m. to 8 p.m. on weekdays and from 9 a.m. to 8 p.m. on weekends throughout the system. We also have been regularly scrubbing the rail at night in many of the segments. As a result of these efforts we are seeing improved shunting, and we are planning on beginning the next phase of testing at higher speeds in some of these areas.

Moving into this next phase of testing is excellent news — and it moves us closer to the next phase of testing our schedule, and closer to starting service.

STAFFING

We need to have a complement of 80 people in our operations department who can operate the train, maintain our signal and rail system, and maintain our train cars. In July we reported to your Board that due to the high cost of living and excessive housing costs, we were having a difficult time attracting experienced rail personnel to join our agency. At that time we were more than a dozen positions short. We recommended a more generous salary and relocation expenses for the three critical and most difficult to fill positions. Thanks to your Board's approval, we have now hired most of the staff we need. We have a few more positions to fill, and we have a number of applicants now going through background checks. The next step is to train and certify the new staff per the FRA requirements.

NEXT STEPS

Bringing a major train project online involves much work. And our work continues. Here is a summary of some of the key next steps for our SMART team:

- Replacement of our train car engines will begin in November and continue through March of 2017.
- Systemwide testing will move forward, with trains running more frequently. SMART will also begin testing in preparation for FRA approval of its Positive Train Control system, making us among the first in the nation to use this new safety technology.
- SMART will also begin testing its draft schedule to make any adjustments needed in advance of starting service. Providing our transit partners with our final schedule will allow them to adjust their schedules to ensure our customers have a smooth and seamless commute.

CONCLUSION

SMART staff and our contractors and consultants have been working very hard in order to make the targeted 2016 start date a reality. We understand that the public is anxiously waiting for service to begin, and we appreciate their support and their patience during our systemwide safety testing process.

SMART has always been transparent and we work hard to maintain public trust. That means sharing our challenges, as well as our successes. This new engine problem, and the need to complete our systemwide safety testing and all of the required approvals from FRA has led me to the conclusion that beginning of passenger service by the end of 2016 is not advisable. We must open our doors only when our system is safe, reliable and dependable, and not a moment sooner. This short delay will ensure we achieve that goal, and get it right from Day One.

We will be working even harder and target the late spring 2017 as our beginning of passenger rail service. I will provide you and the public with monthly progress reports, as we move this complex public transportation project forward and ready for passengers.

FISCAL IMPACT: The delay of targeted service will decrease our revenue and increase our testing expenses but could be offset by existing contractual duties and obligations.

Very truly yours,

Farhad Mansourian
General Manager

Attachment(s):
1. LTK Letter dated October 14, 2016
2. Sumitomo Corporation of Americas Letter dated October 13, 2016

LTK

LTK Engineering Services

Member of the Klauder Group

1318 Redwood Way, Suite 110

Petaluma, CA 94954

October 14, 2016

Mr. Farhad Mansourian
General Manager
Sonoma-Marin Area Rail Transit
5401 Old Redwood Highway, Suite 200
Petaluma, CA 94954

Dear Mr. Mansourian:

The purpose of this letter is to advise you of our recommendation, as requested, regarding the recent developments surrounding SMART's vehicle engines.

Background Event

As you know, the Toronto Airport rail service, established last year by the Ontario provincial rail agency, Metrolinx, is operated with Diesel Multiple Unit (DMU) equipment functionally identical to SMART's, and, in fact, purchased through an option on SMART's own vehicle procurement contract with Sumitomo Corporation of America (SCOA). The diesel engines used in the SMART and Toronto DMUs are manufactured by Cummins, Inc. On July 6, 2016, SMART was notified by SCOA that an engine in one of the DMUs being operated in Toronto had had a complete in-service destructive failure, the previous week. A piston rod penetrated the engine block, causing the engine to shut down and the train to lose power.

The train was taken to the maintenance facility where the failed engine was torn down and examined by Metrolinx, the carbuilder, and the manufacturer. On September 7, 2016, SMART was notified by SCOA that the failure was due to an underlying design flaw in the engine's crankshaft. Responding to this news, SMART's Vehicle Maintenance Superintendent, supported by LTK vehicle engineers, travelled to the Cummins Engine facility in Seymour, Indiana, and on September 14 met with Cummins, carbuilder Nippon Sharyo and SCOA. At that meeting it was agreed that the engines would be rebuilt with a new crankshaft designed for the life of the engine, as soon as possible.

Cummins Engine Rebuild Schedule

In an effort to compress the retrofit schedule, SMART's contractor team is providing two new engines with re-designed crankshafts for this program for use as "float", so that cars are not out of service for a

longer period than the actual engine replacement time. The program is scheduled to begin at the end of November, pending delivery of parts needed to assemble the replacement engines. SMART's engines will be removed one at a time and replaced until all cars have modified engines. To minimize disruption to SMART's current integration testing activities, each engine change-out will take place over a weekend. Repair of a removed engine and preparation for reinstallation takes just over a week, which is why two extra engines are required to meet a vehicle modification rate of one per week. Provided the work begins on time, and realistically taking holidays into account, all 14 cars will be re-engined by April 2017.

Effect of Cummins Engine Rebuild Schedule on SMART Operations

Given the timing of the engine modifications in relation to readiness for revenue service, SMART must assess whether to begin revenue service while the engine rebuilding work is underway. There are several factors that must be taken into account, including operational considerations.

From the supplier's point of view, the odds of an unmodified engine failing in service while the modification program is under way are reasonably low. In addition, the failure in Toronto did not result in a hazard to passengers. A system operator might decide the risk, though not zero, is low enough that service could begin while the program is underway. Indeed, despite the July 6 engine event, the Toronto Airport service has remained in continuous operation. Although its DMU trainsets have performed more than ten times the service hours as SMART's have in test, the Toronto fleet has not suffered another crankshaft failure in the last four months.

However, after consultation with SMART's Operating and Maintenance staff, in which the SMART-specific risks and consequences were reviewed, LTK recommends that SMART not begin service until the engine modifications are complete. The operating considerations influencing this recommendation are presented below.

SMART's conceptual revenue service timetable for the Initial Operating Segment requires six trainsets for peak service. SMART has 14 cars, or seven trains. The starting point for service on a railroad with a very low spares ratio such as this must be high reliability, and a known vulnerability runs counter to this principle.

In the event of this type of engine failure during service, the vehicle pair would lose power. From that starting point the operational results could range from the train proceeding at a limited speed of 30mph to a delayed arrival at the end of the line, by using the remaining engine in the DMU pair, to a more significant stranding of passengers mid-trip and initiation of a bus bridge. Depending on the severity of the event, the latter worst case, however unlikely, could require a mid-route evacuation of passengers. Given the lengthy segments of single track, and layout of passing sidings based on robust operating speeds, it is our opinion that even under the best circumstances the timetable schedule could not be maintained. Scheduled service could only resume at the next peak period, that is, afternoon of the same day or the following morning. In either of the aforementioned scenarios, once a spare train were put into service in the next peak period, SMART would be in a highly undesirable zero-spares situation until the next weekend's engine replacement.

Any time SMART has major delays or is forced to rely on a bus bridge, there will likely be a loss in passenger confidence in the system. There is not a "spare" fleet of busses with drivers on standby in the region to supply a bus bridge with sufficient capacity during peak periods, and although SMART is working with local operators to provide this service whenever possible for them to do so, the delay in passengers reaching their destination were a bus bridge to be needed would be unavoidably significant.

The risk to a start-up running under the circumstances associated with potential failure during engine modifications, and SMART's operating constraints is that perceived service problems could lead to a public characterization of the system as unreliable, one that fails to meet the demands of a commuting public that requires consistent on-time performance. It can take time to convince lost customers to ride even after the problem is resolved. This would be costly to SMART, therefore, waiting until the engine modifications are complete to begin revenue operations is a reasonable approach.

In light of the factors discussed above, we recommend that before opening, all engine modifications be completed and tested.

Sincerely,

Lisa M. Cobb

Lisa M. Cobb, PE

Senior Engineer, SMART Program Manager

Sumitomo Corporation of Americas

October 13, 2016

Mr. Farhad Mansourian
General Manager
Sonoma Marin Area Rail Transit District
5401 Old Redwood Highway
Petaluma, CA 94954

Contract: **SMART Contract No. VS-EQ-10-001**
Subject: **DMU Readiness**

Dear Mr. Mansourian:

Please reference our ongoing discussion regarding issues with the Cummins QSK-19R engine that is installed in SMART's Nippon Sharyo DMUs. Sumitomo and Nippon Sharyo (SCOA/NS) have been proactive and transparent with SMART since the crankshaft issue first came to light, beginning in end of June 2016 when we informed SMART that an engine had failed in one DMU operated by Metrolinx in Toronto, through reporting results of Cummins' root cause analysis, to agreement on corrective action.

Although our vendor, Cummins, has recommended that the crankshaft replacement does not need to occur immediately but can be deferred until "mid-life" maintenance, SCOA/NS has taken a more proactive approach and requested that Cummins replace all old-design crankshafts as soon as practicable. Cummins has agreed to this approach and, together with the support of SMART and SCOA/NS, has developed a campaign schedule to complete crankshaft replacement on all SMART DMU engines – together with additional engine improvements – between November 2016 and March 2017.

We are committed to work with SMART on this issue to get all issues resolved as soon as possible.

We would be happy to answer any questions or concerns you may have regarding the Cummins engine or the Nippon Sharyo DMU's readiness for service.

Very truly yours,

_____
Hideyuki 'Hugh' Ninomiya
Program Manager
SMART DMU Program

NIPPON SHARYO MANUFACTURING, LLC.

October 12, 2016

Mr. Hideyuki Ninomiya
Sumitomo Corporation of Americas
2340 S. Arlington Heights Road
Suite 605
Arlington Heights, IL 60005

Subject: SMART DMU Cummins Engine

Dear Mr. Ninomiya,

As we have discussed, attached please find a letter from Cummins, Inc. which describes the current status of their engine field modification.

Please forward the same to SMART for their review and understanding.

If you have any questions, please feel free to contact us.

Sincerely Yours,

Akira "Kevin" Koyasu
President

Cc: T. Shirai
T. Ishihara
T. Morita
K. Atsumi
Y. Suzuki

1600 Ritchie Court, Rochelle, IL 61068

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October 12, 2016

Akira Kevin Koyasu
Nippon Sharyo USA

Dear Kevin:

Thank you for your October 6 email regarding SMART. Cummins understands the customer's concerns and appreciates you bringing them to the forefront of our on-going discussion. Based on our analysis of the SMART application, Cummins has recommended it is possible to wait to replace the crankshaft at engine mid-life. However, we understand Nippon Sharyo and SMART would like to proceed with crankshaft replacement as soon as possible which Cummins is prepared to implement.

To accommodate Nippon Sharyo and SMART's schedules, which we understand are based on when SMART plans to begin revenue service, Cummins plans to begin the crankshaft campaign as soon as November 14th with new design gaskets. With Nippon Sharyo and SMART's cooperation, we will continue at a rate of one engine replacement per weekend until the replacements are complete. At this time, we communicated we will have completed engine replacements on the SMART application on or before April 2017. However we are working with SMART to try to push that date up as they have requested. Cummins is currently working on that but would like to start the campaign in November as planned. To further expedite this process, Cummins proposes that the engine and transmission be assembled prior to the engine swing.

Cummins Inc.
500 Jackson Street
Columbus, IN 47201 USA

Again, thank you for your time and attention to this issue. We look forward to resolving this together on behalf of the customer.

Sincerely,

Melina Kennedy
General Manager – Rail and Defense
Cummins Inc.