Track Integrity System Demonstration

Project Scope

The Alaska Railroad (ARRC) is testing a system for detecting broken rail along track that is not equipped with automatic signals. The Track Integrity System test is a Federal Railroad Administration (FRA) technology demonstration project that is funded by FRA’s Next Generation High Speed Rail Program. Although the Alaska Railroad is not on a designated high speed rail corridor, it was chosen because of Alaska’s challenging climatic conditions.

The 24-month project involves the purchase and installation of rail break detection, system monitoring, and alerting hardware and software. ARRC will test the system during all seasons of the year, document results and evaluate how well it meets FRA fail-safe criteria, as well as rail industry performance requirements.

In ARRC’s “signalized” territory, electricity-generating equipment is placed along the track every 10,000 feet, on average. This equipment produces a low voltage current that runs through the steel rails so that they function as wires in the signal circuit. Because a train has steel wheels connected by a steel axle, when the train is on the track it effectively links the positively-charged rail with the negatively charged rail, thus causing a “short” in the circuit. This in turn activates a signal along the track (similar to a traffic light). Circuits created in track for signaling purposes can also detect broken rail. In this case, when a rail breaks, the circuit’s electrical current is disrupted.

About 85% of ARRC’s track corridor is not equipped with signals. In these “dark” areas, rail defects are discovered by frequent track inspections, as well as ongoing rail and roadbed maintenance. The Track Integrity System is expected to identify rail breaks in dark territory with a reliability level similar to that of signal territory.

The infrastructure required to support the Track Integrity System is comprised of wayside (along the track) and locomotive equipment, and office software. The track integrity test bed will consist of three five-mile sections of track and one locomotive. Test track beds are located along the 20-mile stretch of track between Pittman Siding (northwest end of Wasilla) and Willow.

Once installed, the test system will apply electricity to the track to create circuits similar to those in signalized territory. However, the system is designed to make the electrical current travel farther, up to five miles. It is also designed to conserve energy by putting the circuit into a “sleep” or suspended mode until activated by an approaching train. When a train approaches, the locomotive’s on-board system signals the wayside device, activating the circuits, and conducting a circuit continuity check. If the circuit is intact, the wayside device confirms track integrity and the train proceeds. If the circuit is not clear, the wayside system feeds this information to a data radio, which then forwards it to the approaching train, where it is displayed on the on-
board computer console. If the crew does not respond, the on-board system forces the train to stop, and then allows the train to proceed at a restricted speed. The system will also be used to notify maintenance crews who would be dispatched to repair the rail.

**Benefits**

Successful testing of the Track Integrity System would:

- Validate and demonstrate low-cost fail-safe technology for use in freight and passenger train service. Because ARRC is both a passenger and freight railroad – one of the last full-service railroads in the U.S. – results of the test can be attributed to both types of services.
- Create a prototype for the Alaska Railroad to enhance safety by expediting the discovery and repair of broken rail in areas without signals.
- Create a prototype for use industry-wide. FRA’s Next Generation High Speed Rail technology demonstration projects are intended to advance the implementation of higher speed rail service through demonstration of methods which will contribute to the safety and cost-effectiveness of operating at faster speeds. The program also targets techniques for more effectively accommodating freight and higher speed passenger service operating on the same tracks.

**Status**

- System vendors include:
  - Union Switch & Signal Inc. (US&S) will provide the sleep mode MicroTrax Coded Track Circuit System for the wayside track integrity portion of the project. US&S has developed a cost effective, technically innovative approach to extending track circuit lengths and relaying information to approaching trains.
  - US&S will provide the locomotive interface. US&S is the major on-board computer vendor for ARRC’s Collision Avoidance System (CAS). Completing the CAS will involve installation of on-board computers and computer displays. The Track Integrity System will be integrated into the CAS with this installation.
  - Meteor Communications Corporation (MCC) will provide wireless VHF packet switched network, and a wide area network for mobile data communications. As part of the CAS project, MCC and ARRC installed a data radio network at 28 base stations and on 56 locomotives. Data radios are now in use to transmit GPS location information.
- Preparation for Track Integrity System installation began in summer 2004. Equipment arrived in 2005, followed by installation. The system should go into service by May 2006, and system testing will be complete by summer 2006. ARRC will report results to FRA by early fall 2006.

**Cost and Funding**

The project budget is $409,740, funded 93% ($380,993) by FRA’s Next Generation High Speed Rail Program and 7% ($28,747) by ARRC.

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**Track segments used in the system demonstration are located along the 20-mile stretch between Pittman Siding at Alaska Railroad Milepost (MP) 166 and the Willow Siding at ARRC MP 186.**