LEADER®

TRAIN HANDLING SYSTEM

BUSINESS CASE WORKBOOK

NEW YORK AIR BRAKE
Train Dynamic Systems Division

LEADER®
Train Handling System

The business case is straight forward: LEADER® will improve your operating ratio

Through superior train handling and the reduction of in-train forces, New York Air Brake's LEADER Train Handling System is a powerful ally in your effort to reduce operating costs and boost network efficiency. In fact, by reducing fuel consumption, overtime expense, and repair costs – and even earning more money from increased throughput, CO_2 energy credits, and improved crew performance – LEADER can improve your operating ratio today, tomorrow, and well into the future.

Let's do the math!

While every railroad is different, every train is subject to the same laws of physics. The following worksheets will allow you and your NYAB advisor to estimate how LEADER can positively impact YOUR railroad's bottom line.

Once completed, simply jot down the sub-totals below for a quick read on the business case for LEADER.

Potential Cost Savings	**Fuel Savings**	$ _____
	Repair, Labor & Overtime Savings	$ _____
Potential New Revenue	**Longer Trains**	$ _____
	Increased Customer Satisfaction	$ _____
	TOTAL	$ _____

Fuel Savings

In operation since 2008 and now on board thousands of locomotives worldwide, LEADER has a long track record of delivering 6% or more in fuel savings to railroads.

Here are some real-world data points to help you run some numbers on LEADER's ability to save fuel in your operation.

- In a study using two years of log data on EMD locomotives operating on a Class 1 railroad, NYAB found that LEADER's overall, network-wide fuel savings were 11.8%.[1] After evaluating the data, EMD prepared a submission to have LEADER classified as an energy savings device that was approved by the EPA in 2015.
- As an additional point-of-reference, according to the AAR, in 2015 North American Class 1 railroad's fuel costs were as follows[2]:

Railroad	Fuel Cost
CSX	$1,500,000,000
NS	$1,430,000,000
CN	$370,000,000
BNSF	$4,290,000,000
KCS	$200,000,000
CP	$240,000,000
UP	$3,450,000,000

[1] Source, NYAB/EMD 2015
[2] Analysis of Class 1 Railroads, 2015, Economics Dept, AAR

Do the math.

All railroads are different, but the same laws of physics apply to them all. How much money would LEADER's proven fuel savings deliver to your bottom line?

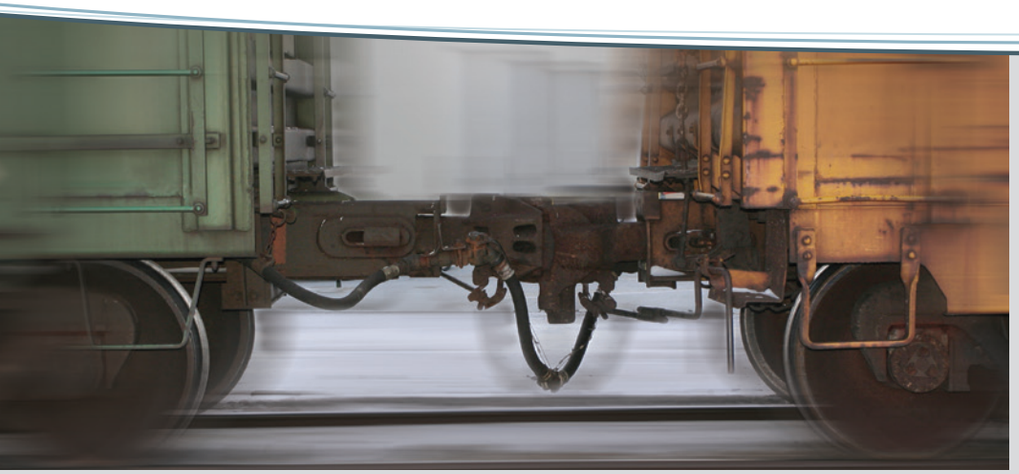
(For a conservative case, choose a percentage at the lower end of our performance record, such as 6 or 7%; for a best case, select a percentage from the other end of the scale, like 12 or 15%.)

For example:

$ 1.64B (Annual fuel cost) X 8 % (Fuel savings) = $ 131.2M (Annual fuel savings)

Notes & worksheet:

$ _____ (Annual fuel cost) X _____ % (Fuel savings) = $ _____ (Annual fuel savings)



Repair, Labor & Overtime Savings

LEADER anticipates in-train forces, uses your train's momentum when possible, and initiates small, perfectly timed dynamic brake and throttle applications to reduce wear and tear on end-of-car components. As a result, LEADER reduces your repair and associated labor costs. Moreover, because LEADER has never 'broken a train' on over 1,200,000 trips and 190,000,000 miles, you can also expect a reduction in overtime costs related to break-in-twos

Here again are some statistics useful to conducting your own end-of-car component and associated labor cost calculations:

- AAR interchange billings statistics say railroads replaced 717,320 end-of-car components[1]. (e.g. knuckles, draft gear, yokes, etc.)
- According to the AAR, in 2015 North American Class 1 overtime costs were as follows[2]:

Railroad	Overtime Cost[2]
CSX	$266,700,000
NS	$220,960,000
CN	$89,870,000
BNSF	$424,600,000
KCS	$19,300,000
CP	$31,870,000
UP	$379,900,000

[1] AAR Billings, 2015
[2] Analysis of Class 1 Railroads, 2015, Economics Dept, AAR

Do the math.

What percentage of overtime is incurred by your operation for delays and unscheduled repairs due to severe wear and tear on end-of-car components?

For example:

$ 205M (Overtime cost) X 5 (Savings) % = $ 10.25M (Overtime savings)

Notes & worksheet:

$ _____ (Overtime cost) X _____ (Savings) % = $ _____ (Overtime savings)

Longer Trains

LEADER's real-time, look-ahead simulations and AutoControl of asynchronous distributed power substantially reduces in-train forces. By accepting a slight increase on pulling force and better managing run-out and run-in forces, additional cars can be added to your train in some instances. (Think of it as a trade-off for a lot of added capacity for small amount of added in-train force.)

To calculate what potentially longer trains can mean to your operation, let's first take into account some industry-wide data:

- North American Class 1 operating revenue = $77.6 billion[1]
- North American Class 1 train trips = 515,0764[2]
- North American Class 1 average cars per train = 71.84[2]
- ($77.6 billion / 515,076 trains / 71.8 cars) = $2,098 in revenue per car, per trip.

[1] Analysis of Class 1 Railroads, 2015, Economics Dept, AAR
[2] 2015 AAR Railroad Facts

Do the math.

How much more revenue could an additional 3, 5 or even 10 cars earn your railroad?

For example:

5 (# of cars added per train) X $2,098 per car = $ 10,490 (Potential new revenue per train trip)

Notes & worksheet:

_____ (# of cars added per train) X $2,098 per car = $ _____ (Potential new revenue per train)

Increased Customer Satisfaction

LEADER is an on-board train control system that reacts to signal and route changes in real-time — giving you the ability to dynamically control your rail network without sacrifice. LEADER's real-time capability also reduces unwarranted 'drop-outs' that hand control of the train back to your operator, which can negatively impact efficiency and throughput. And, looking ahead, LEADER is PTC-ready – able to accept and implement signal and route changes from the I-ETMS, with no loss in performance and improved network efficiency in the future.

Bottom line: LEADER will increase velocity, throughput, on-time arrivals, and, as a result, improve customer satisfaction. All of which should indirectly improve sales and revenue.

Railroad	Revenue in 2015[1]
CSX	$12,342,404,000
NS	$11,624,231,000
CN	$3,550,351,000
BNSF	$23,035,998,000
CP	$1,771,298,000
UP	$23,975,239,000
KCS	$1,359,384,000

[1] Analysis of Class 1 Railroads, 2015, Economics Dept, AAR

Do the math.

How much more revenue could you see thanks to increased throughput, more on-time arrivals, and increased customer satisfaction?

For example:

2 % X $ 11.14B = $ 222.8M

Increase in sales | Total operating revenue | Potential new revenue

Notes & worksheet:

_____ % X $ _____ = $ _____

Increase in sales | Total operating revenue | Potential new revenue

Additional Benefits of LEADER®

Superior Train Handling

LEADER performs high-fidelity on-board simulations that predict train performance several miles ahead and evaluates multiple train operating strategies. As new variables enter the equation, LEADER scores each strategy in real-time according to the railroad's operating goals and selects the strategy that is the best match for increased fuel economy, reduced dynamic and static in-train forces, and on-schedule performance.

LEADER's capability to model and prompt for Asynchronous Distributed Power (ADP) provides a material improvement in fuel savings over train handling in both hilly and flat terrain. There are two reasons for this:

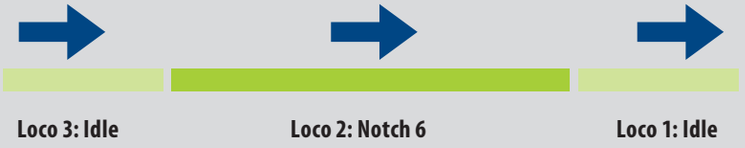
1) Asynchronous Distributed Power puts power where it's needed.

As a train crests a hill, the force of gravity pulls on the back end while it pushes the front end forward. ADP allows the front of the train to use gravity to its full advantage, while supplying the power to the rear cars to climb the hill.

ADP works in much the same way to reduce draft force and save fuel on curves by applying more power where it is needed.

2) Asynchronous Distributed Power chooses to use the most efficient power first.

When a train is on flat ground less power is needed, and fuel consumption is reduced by temporarily idling unneeded locomotives.



Optimized Crew Performance

LEADER technology improves crew performance by providing more information and more time. More information results in better train handling, more time allows the locomotive engineer's focus to shift from train operation to safety.

Delivering Performance Now and Into the Future

LEADER not only delivers today, LEADER is evolving and leveraging 'smart train' technologies to take your operation into the future:

- Compatibility with emerging worldwide train protection systems (e.g. PTC, CNTC, ATO, ERTMS, etc.)
- Advanced Analytics to enable predictive maintenance, real-time locomotive/train diagnostics, and improved scheduling across your operation
- Real-time Brake Monitoring to reduce inspection delays
- Dynamic Pacing
- Consist Management
- Compliance with Locomotive Command & Control Module (LCCM) and other interoperability standards

Earn EPA Credits

All locomotive types equipped with LEADER can be certified through the EPA and qualified to earn Energy Savings Credits. Locomotive manufacturers and re-manufacturers apply for credits and the EPA calculates the reduced emission levels from installing LEADER, which are substantial. For example, LEADER typically lowers emissions by enough to allow for a railroad to buy a Tier 3 locomotive vs. a Tier 4 unit, resulting in savings of $250,000-400,000 per locomotive.

Looked at another way, equipping your locomotive fleet with LEADER will earn EPA credits worth more than the total cost of deploying LEADER in the first place. With that kind of return – in addition to other savings experienced by customers – make LEADER one smart investment.

More about LEADER

- Real time physics means engine reacts immediately to signal changes.
- Captures sensor data right off the rails in real time, then analyzes and discovers hidden ways to define the best driver strategies.
- LEADER is operating fully driverless trains in Australia.
- Is PTC compliant and ready to integrate with TMC – CDU and I-ETMS.
- Is perfectly matched to nearly any locomotive – GE, EMD, among others.
- Quantifies operational improvement scenarios – event recorder data is easily queried and reports can be produced at the touch of a button.
- Is ISO 9001:2008 certified for software design development compliant with 90003, CENELEC Safety Integrity Level 2 (SIL 2).

RAILSERVICES
always on track

E2O
Engineered to Outperform

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