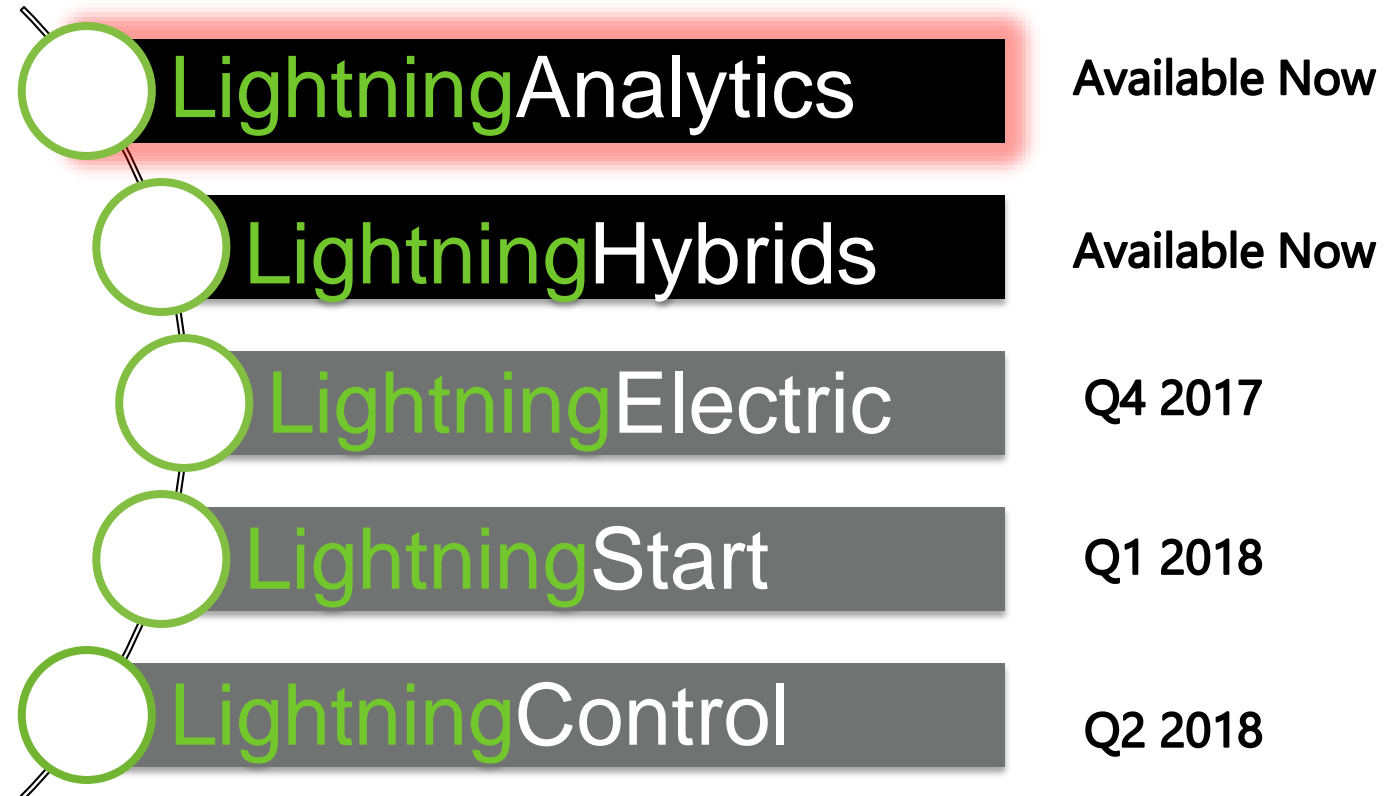*Lightning*Analytics **Overview**
September 2017

Company Mission

Lightning Systems
Aims to be the global leader in
Efficiency and Emissions Improvement Solutions
for fleets.

Comprehensive Efficiency Product Line

Lightning Systems

LightningAnalytics — Available Now

LightningHybrids — Available Now

LightningElectric — Q4 2017

LightningStart — Q1 2018

LightningControl — Q2 2018

Actionable live analytics immediately validate in-the-field fleet efficiency initiatives

LightningAnalytics

Overview

Customizable and Configurable to Solve Specific Challenges

Focusing on **Predictive Failure Detection** and Preventative Maintenance

Ability to **add** and **customize modules** as needed to solve specific problems

Modules built for:

Vehicle Health

Predictive Maintenance

Hybrid and Electric

Driver Coaching

Actionable Reports from Real People

LightningSystems

LightningAnalytics

Overview

Advanced Fleet Analytics Based on CAN Bus Data

Deeply **integrated** with other LS solutions

Fully **integrates** with other programs currently in use

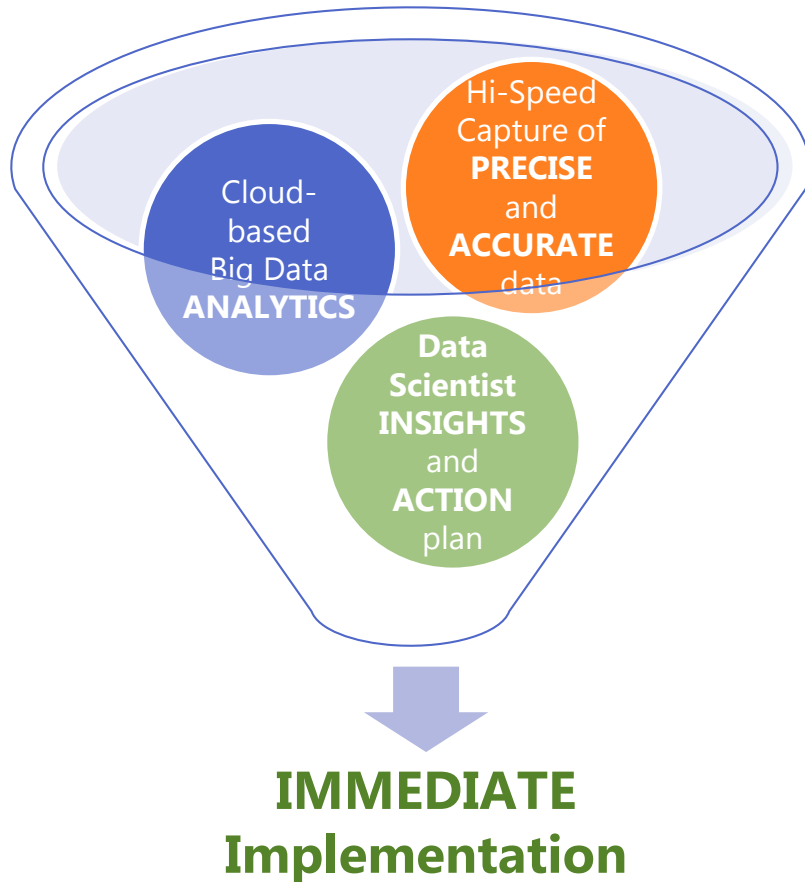Precise information to improve **efficiency and cost of ownership**

Customizable to any vehicle chassis, duty cycle and customer application

Monitors and reports on:

Driver behavior

Vehicle health

Route data

Vehicle Compliance

Actionable Reports from Real People

LightningAnalytics Solution

Accurate and Actionable Efficiency Analysis and Recommendations

Hi-Speed Capture of **PRECISE** and **ACCURATE** data

Cloud-based Big Data **ANALYTICS**

Data Scientist **INSIGHTS** and **ACTION** plan

IMMEDIATE Implementation

REDUCE FUEL USE
Recommendations for optimizing routes, driver behavior and vehicle technology

PREDICTIVE MAINTENANCE
Real-time vehicle health alerts across your fleet allow for predictive and conditional maintenance and repairs

IMPROVE DRIVER BEHAVIOR
Reward or correct drivers in real-time, reduce idling and harsh driving

DEDICATED FLEET EXPERTS
Lightning Data Scientists and a dedicated Fleet Specialist interpret and deliver actionable information directly to you for immediate implementation

CUT SECURITY RISKS
Encrypted connections mean your data and your vehicle are protected from hackers

CUSTOMIZABLE FLEETWIDE
Customizable across your fleet, integrates and enhances other telematics and fleet management programs

LightningAnalytics Solution

Hardware Options

Standalone:

- Retrofit onto any vehicle
- 1Hz data for high resolution analytics
- Plug and play compatibility

Integrated:

- The brain and heart of
  - LightningHybrids
  - LightningElectric
  - LightningControls
  - LightningStart
- Advanced features and control available

LightningAnalytics

Fleet-Centric Dashboards

Lightning **Data Scientists and Fleet Specialists** take proprietary captured data and convert it into actionable information and recommendations, all easily accessed with a customized dashboard
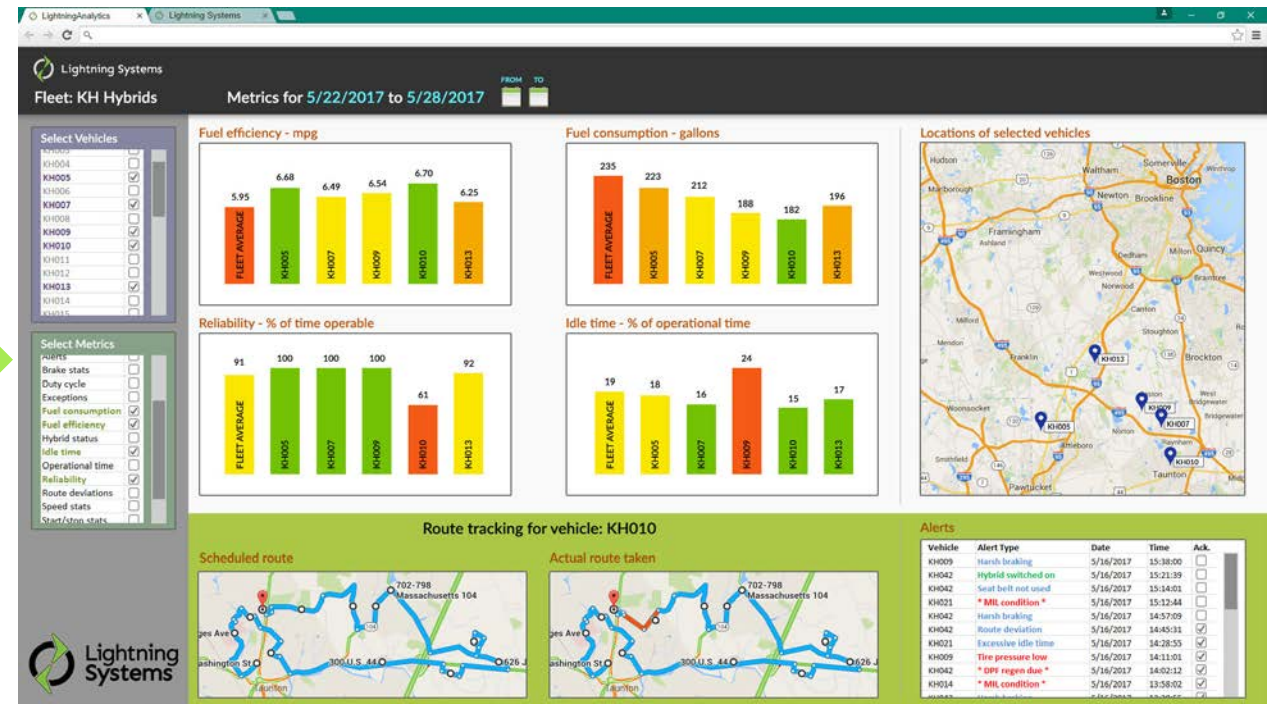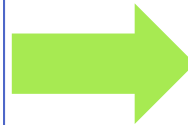
Integrates and enhances other fleet management and telematics products!

Industry Partners

Take Control of Your Machine
- Industry leader in vehicle control systems
- Specializes in automotive control and hardware systems, software development, and engineering services

A True Revolution in Accurate Identification of Driving Behavior
- Industry leader in driver scoring for fleets and insurers
- Focus is placed on driver improvement by understanding driving behavior, all the time

Industrial-Grade Artificial Intelligence – Powered with Human Like Reasoning
- Industry leader in machine learning and artificial intelligence
- Co-developing learning algorithms and predictive models for fuel economy improvements, failure prevention, and route optimization

LightningAnalytics

Current Projects

New York City Department of Sanitation

- DPF filter regen problem – drivers aren't doing it, causing the fleet thousands of dollars in maintenance and down time
  - Sending real time notification of DPF regen alerts and low DEF alerts
  - Predictive models identify and indicate regen services before they are critical
- Real-Time Diagnostic Trouble Codes – drivers are operating vehicles with active DTCs, causing unnecessary vehicle down time and maintenance costs

Arriva

- A complete predictive maintenance application to predict and prevent engine and vehicle related failure and downtime

Kiessling Transit

- Improving driver behavior and reducing idle fuel consumption
- Engine health reporting (predictive analytics to prevent engine replacements due to lack of oil and other harsh operating conditions)
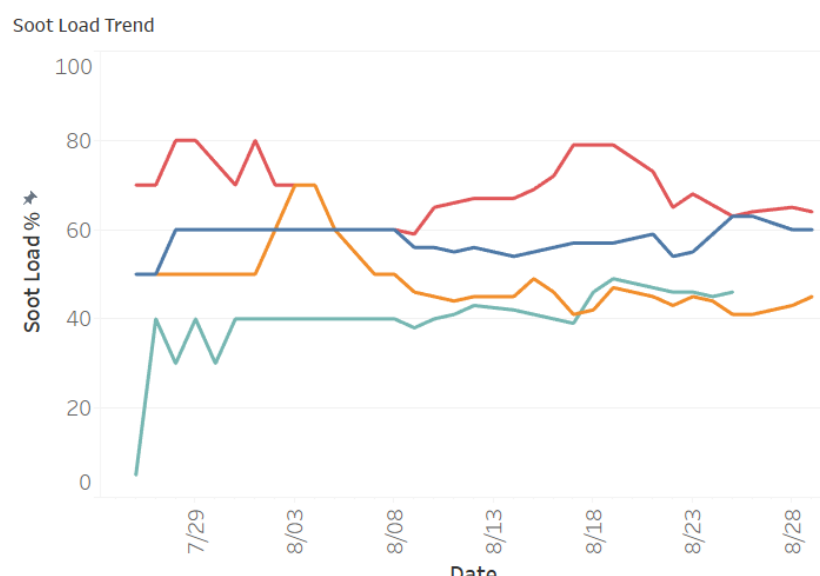
LightningAnalytics

DSNY Project Details

Developed a custom solution to collect and record desired CAN messages, encode them for upload and analysis, and report vehicle operating conditions in real-time.
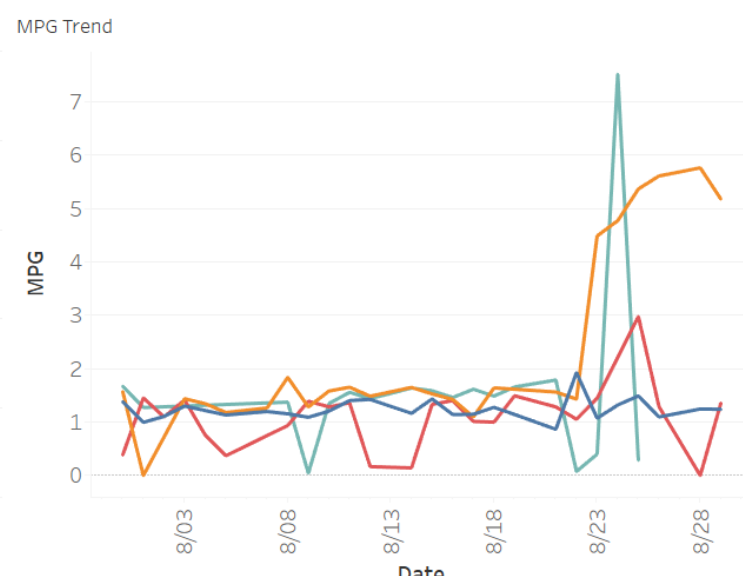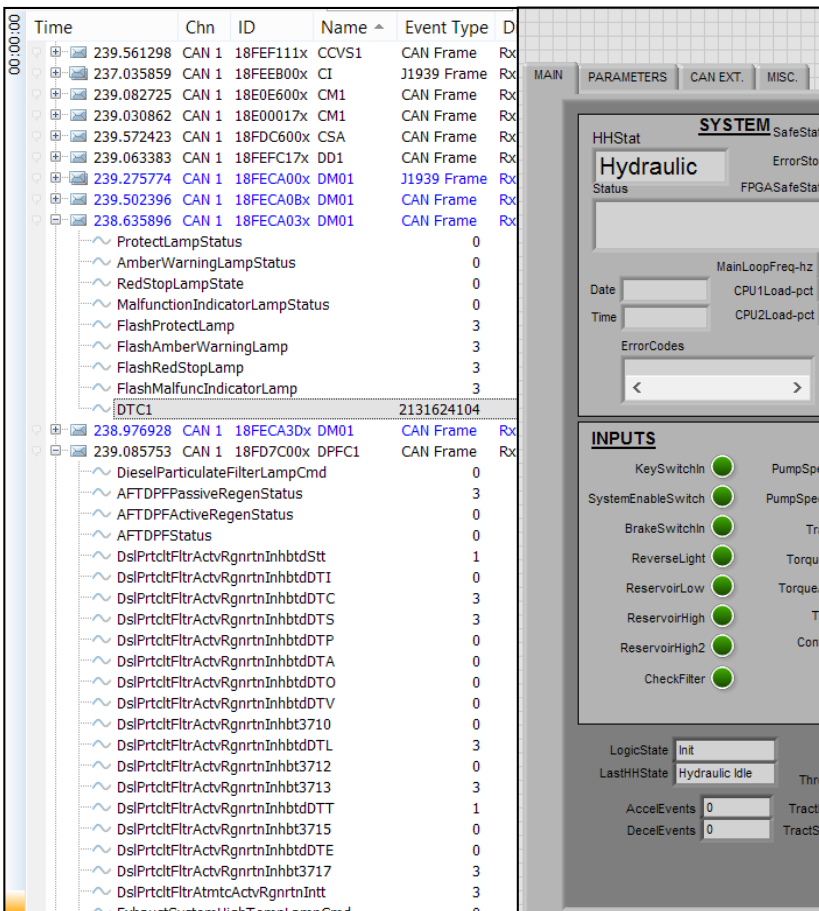
DSNY Project Details

DPF and DEF Solutions

- Reading CAN data to prevent Level 2 DPF regen alerts by notifying fleet managers when DPF levels are nearing a Level 1 regen amounts.
- Monitoring total fuel consumption and reporting on GHG17 emissions requirements, notifying when a fuel consumption related regen is due.
- Additionally, reading exhaust gas temperature to recommend implementation of aftermarket DPF solutions

CAN Signals

Source	Parameter Group	PGN Name
Engine	AT1S1 – Aftertreat	DPF Soot Load %
		Ash Load %
	DPFC1 – DPF Control	DPF Lamp
		Regen Status
		DPF Status
		Exhaust High Temp.
	IC1 – Intake/Exhaust	Exhaust Gas Temp.
	LFC1 – Fuel Consumpt.	Engine Total Fuel
Exhaust System	AT1T1I1 – Aftertreat	DEF Tank Volume
		DEF Fluid Temp.
		DEF Tank Low Lamp

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DSNY Project Details

Drillable Dashboards

Unit Id	Date	DPF Lamp	Soot Load %	DEF Tank %	Odometer	Total Fuel	Total Hours	Active DTCs
25DP-717	8/30/2017	OFF	76.0	84.4	1,932.6	958.5	361.9	1

Active DTCs

Source	Lamp	SPN	SPN Name	SPN Description	FMI Description	Occuren..
Transmission	Null	168	Battery Potential / Power Input 1	This parameter measures the first source of battery potential as measured at the input of the ECU/actuator etc. coming from one or more batteries, irrespective of ..	Special instructions	127

Soot Load Trend

ExhaustGasTemp

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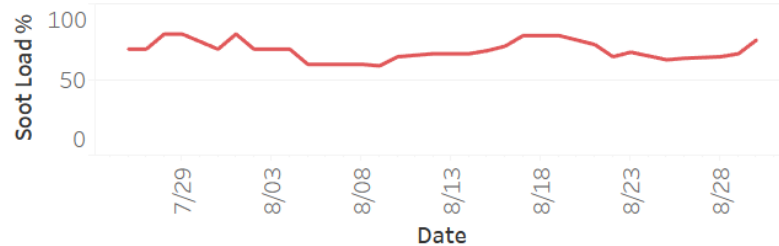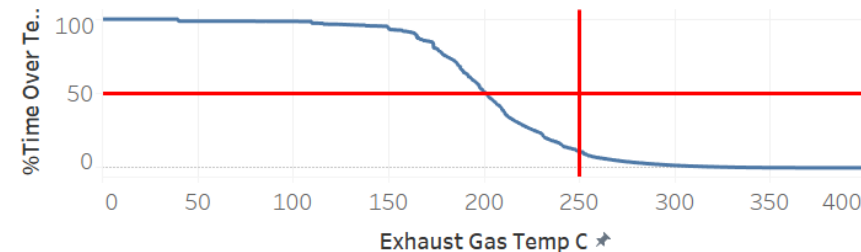
DSNY Project Details

General Vehicle Operating Information
- Vehicle speed
- Engine speed
- Transmission gear
- Engine hours (total and idle)
- Engine fuel consumption (total and idle)
- Distance driven (trip and odometer)

Using this information to report on how efficient the vehicles are operating, and making recommendations regarding idle reduction and general driver behavior.

PRECISE

PREDICTIVE

CUSTOMIZABLE

ACTIONABLE

LightningAnalytics

Predictive analytics for intelligent fleet management.

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