Using Information Management to Automate Truck Refueling

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Introduction

Haul Truck refueling operation represents one of the biggest costs for day to day mining operations

It's not just the fuel being a large expense, but an inefficient fueling operation can lead to a decrease in availability of important mining equipment. Which can significantly alter a mine's overall production.

Introduction

Mine's that don't have an efficient refueling operation

- Equipment are removed from production to refuel to often
- Refuel on a given time schedule
- Possibly refuel without knowing the current fuel levels
- Spend unnecessary man hours fueling equipment when it's not needed

Study of Fueling Operations

A key producer in the oil sands region of Alberta, Canada, has started using Wenco's automated fuel dispatching service, in early 2015, that has increased both its hours between fueling and production numbers. The operation is a large crude oil and natural gas production site near the community of Wood Buffalo, Alberta.

- Current production involves a truck and shovel mining operation
- Total of 61 ultra-class haul trucks,
  - 34 Caterpillar 797
  - 13 Caterpillar 793B units (excluded from calculations of this presentation).
  - 14 Komatsu 930E models

Study of Fueling Operations

Starting November 2014, the mine began investigating their past fueling data and found concerning results.

During the previous year:

- Caterpillar 797 haulers were averaging 12.6 hours between fueling sessions — a tolerable amount of time
- The smaller Komatsu 930E trucks, without OEM fuel monitors, averaged 9 or 10 hours between fuel sessions — an unacceptable result.

Prior to 2015, Fueling Operations

Prior to 2015 the operation did not use a fuel efficiency system to govern its haul truck fueling. Rather, dispatchers used data drawn from vehicles' OEM systems or a standard heuristic model to determine appropriate points at which to send trucks for fuel.

- Caterpillar 797s were sent for fueling based on the remaining fuel hours indicated by their VIMS systems

- Komatsu 930E trucks were filled every shift, irrespective of the amount of fuel left in their tanks.

- Operators would perform fuel runs independently of a dispatcher assignment when concerned about their remaining fuel levels.

- Communication of OEM fuel levels weren't sent to fueling operations with any consistency.

Without a fuel efficiency system, most site personnel were unable to know the remaining fuel hours with accuracy and, instead, erred on the side of caution.

Box Plot Fueling Level- Pre 2015

Fuel Levels at refuel times (without Fuel Dispatch; January 2015)
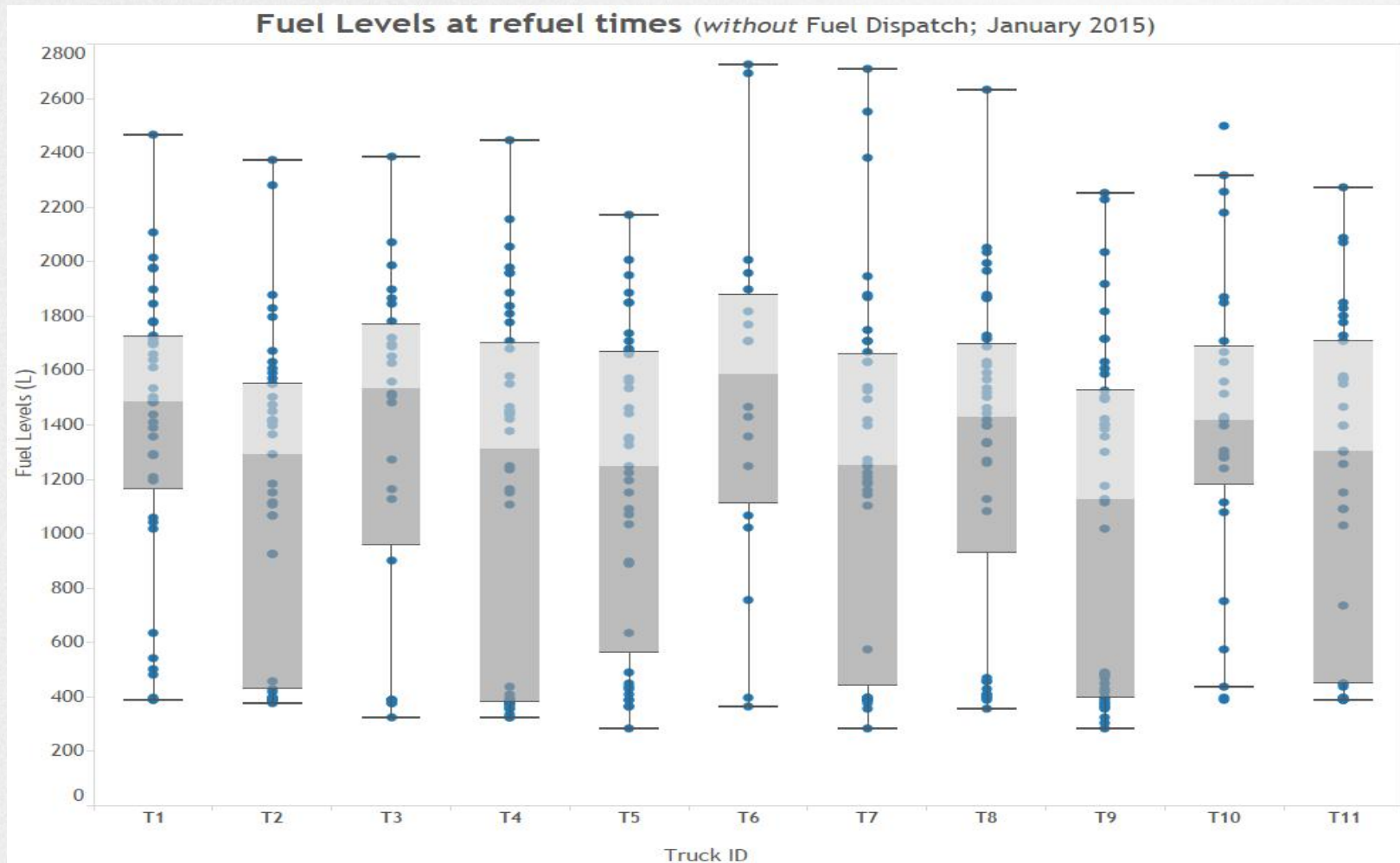
Fuel Management Dispatch

In late January 2015, the mine commenced with the use of the Wenco Fuel Dispatch fuel efficiency system. This system connects to the Wencomine fleet management system and uses the data it collects to automate the fueling process. They continued to monitor their fuel process and found extraordinary results, when compared to their prior fuel management operations.

Fuel Dispatching & How It Works

The fuel dispatching system automatically checks fuel hours and matches hauling units with the fuel location that will get it fueled the soonest.
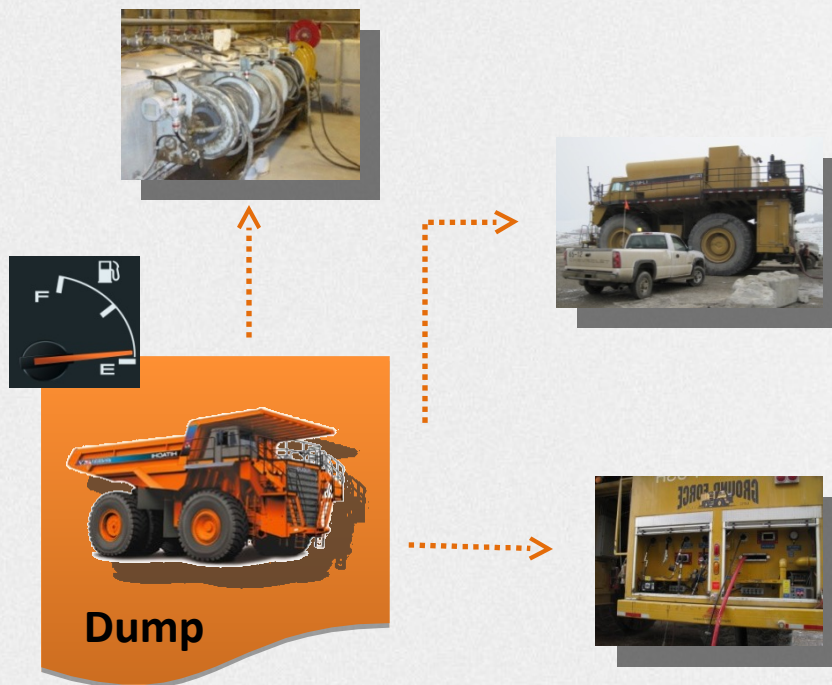

Benefits

❖ Reduce interruption of operations

❖ Control unnecessary refueling

❖ Limit attention required by dispatcher

❖ Reduce wait times at fuel locations

Truck Candidates

Checking Fuel Hours Remaining

Dump

❖ **At dumps**, after hauling units empty their loads

❖ **"Suggested"** fuel hours

❖ **"Critical"** fuel hours

A. Measured by onboard fuel sensor
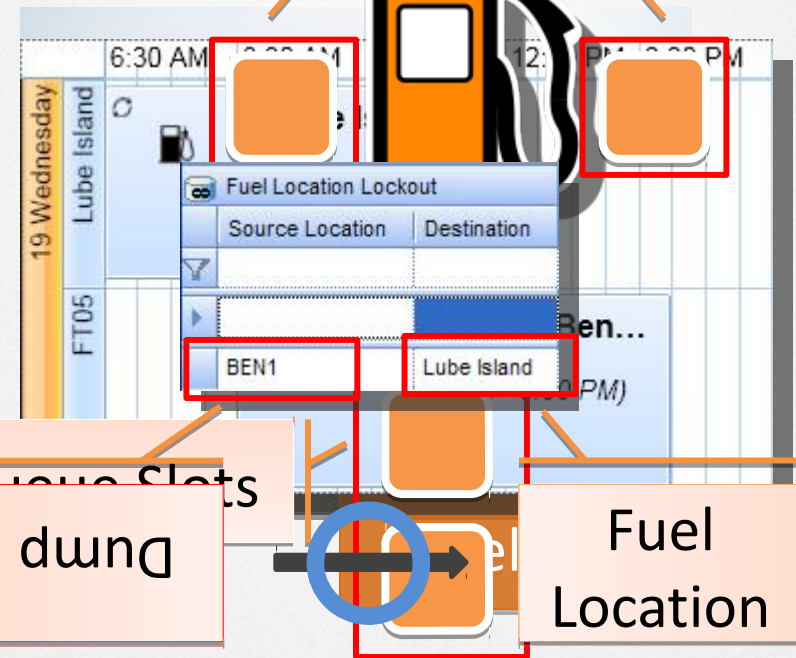B. Inferred using fuel consumption properties

Finding Fuel Locations

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Locations as Candidates for Dispatch

Fuel Bays

❖ Open & Close Times

❖ Fueling & Queue Slots

❖ Lockout Restrictions

Fueling Slots

Fuel Location Lockout

Source Location	Destination
BEN1	Lube Island

Queue Slots

Dump

Fuel Location

⚠ **Critical trucks may violate queue limits**

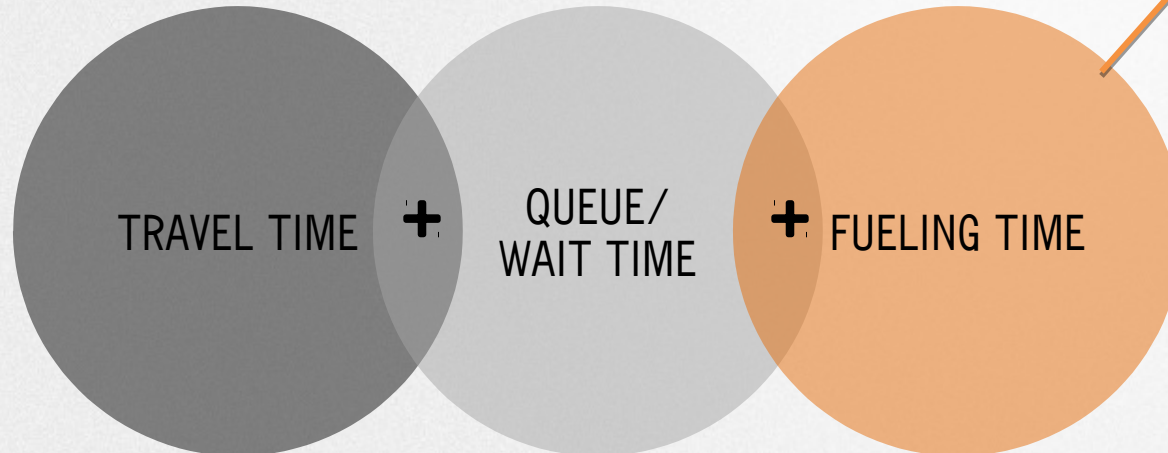# Minimize Time until Fueled

Dispatch Tactic

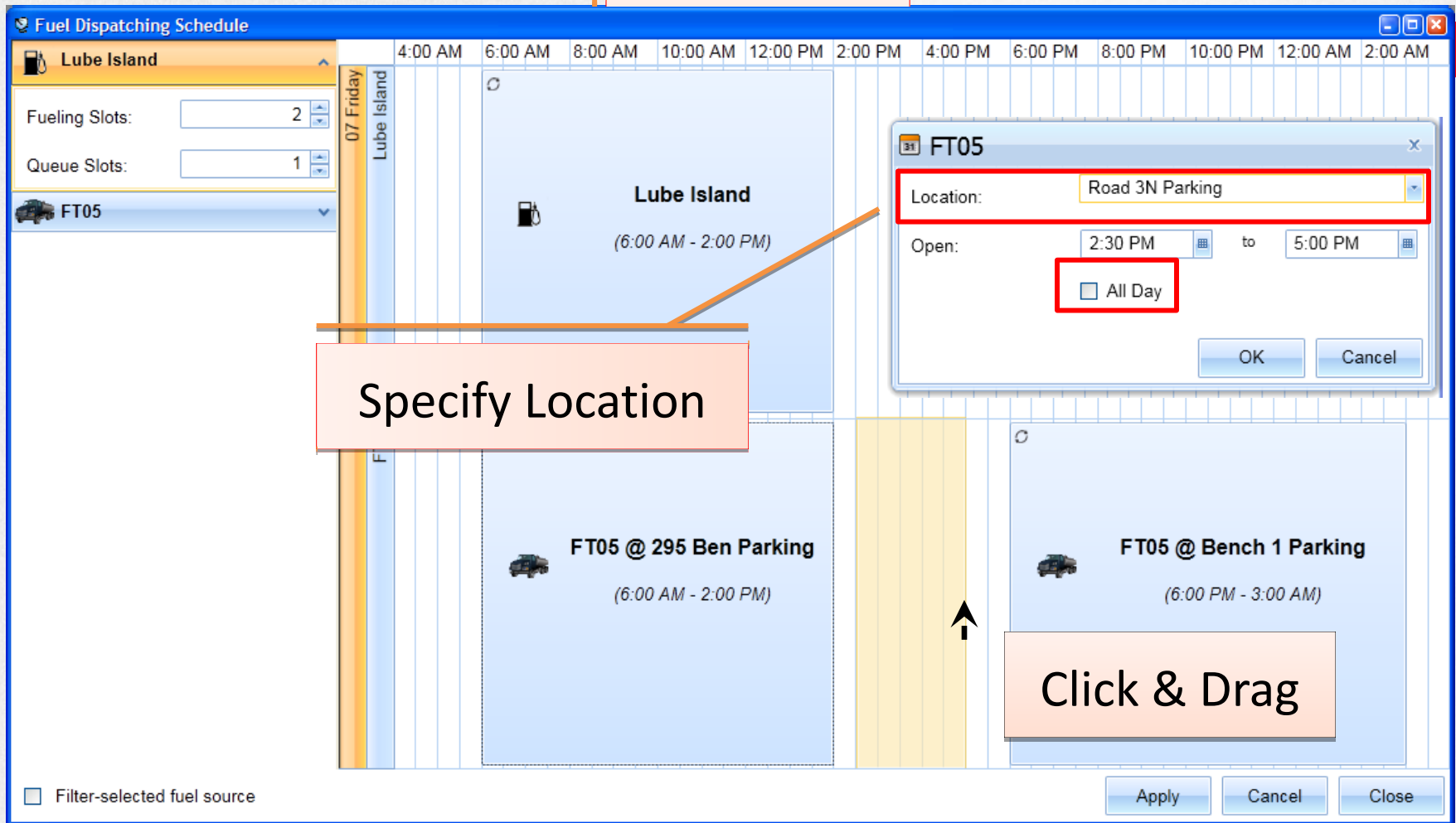**Truck dispatched to fuel source that will allow it to fuel the soonest**

By Equipment Model

TRAVEL TIME **+** QUEUE/ WAIT TIME **+** FUELING TIME

"Traveling for Fuel"

Fuel Dispatching Schedule

Fuel Dispatching Schedule

Lube Island

Fueling Slots: 2
Queue Slots: 1

FT05

07 Friday | Lube Island

4:00 AM | 6:00 AM | 8:00 AM | 10:00 AM | 12:00 PM | 2:00 PM | 4:00 PM | 6:00 PM | 8:00 PM | 10:00 PM | 12:00 AM | 2:00 AM

Lube Island
(6:00 AM - 2:00 PM)

FT05

Location: Road 3N Parking

Open: 2:30 PM to 5:00 PM

☐ All Day

OK   Cancel

Specify Location

FT05 @ 295 Ben Parking
(6:00 AM - 2:00 PM)

FT05 @ Bench 1 Parking
(6:00 PM - 3:00 AM)

Click & Drag

☐ Filter-selected fuel source

Apply   Cancel   Close

The site closes its fuel bays for two hours, twice a day, thresholds remain in order to prevent a truck running out of fuel while the fuel bay is closed.

- Initial setup of Fuel Dispatch, the system was configured with a Suggested fuel threshold of five hours and a Critical fuel threshold of three hours.

- Since then, dispatchers have lowered those thresholds; Suggested now sits at 3.5 hours and Critical at two hours.

The operation actually projects times of 2.5 hour Suggested and 1.5 Critical if it were to keep its fuel locations open 24 hours a day. Given these thresholds, trucks still receive fuel dispatches with 15% to 18% of their fuel tanks remaining — about 1,000 litres for the Caterpillar 797s, more than enough to perform several haul cycles. Even with these restrictions, though, the producer has extended the time between fueling sessions to 16 hours. Every three runs for fuel, they have gained an additional free fueling session.
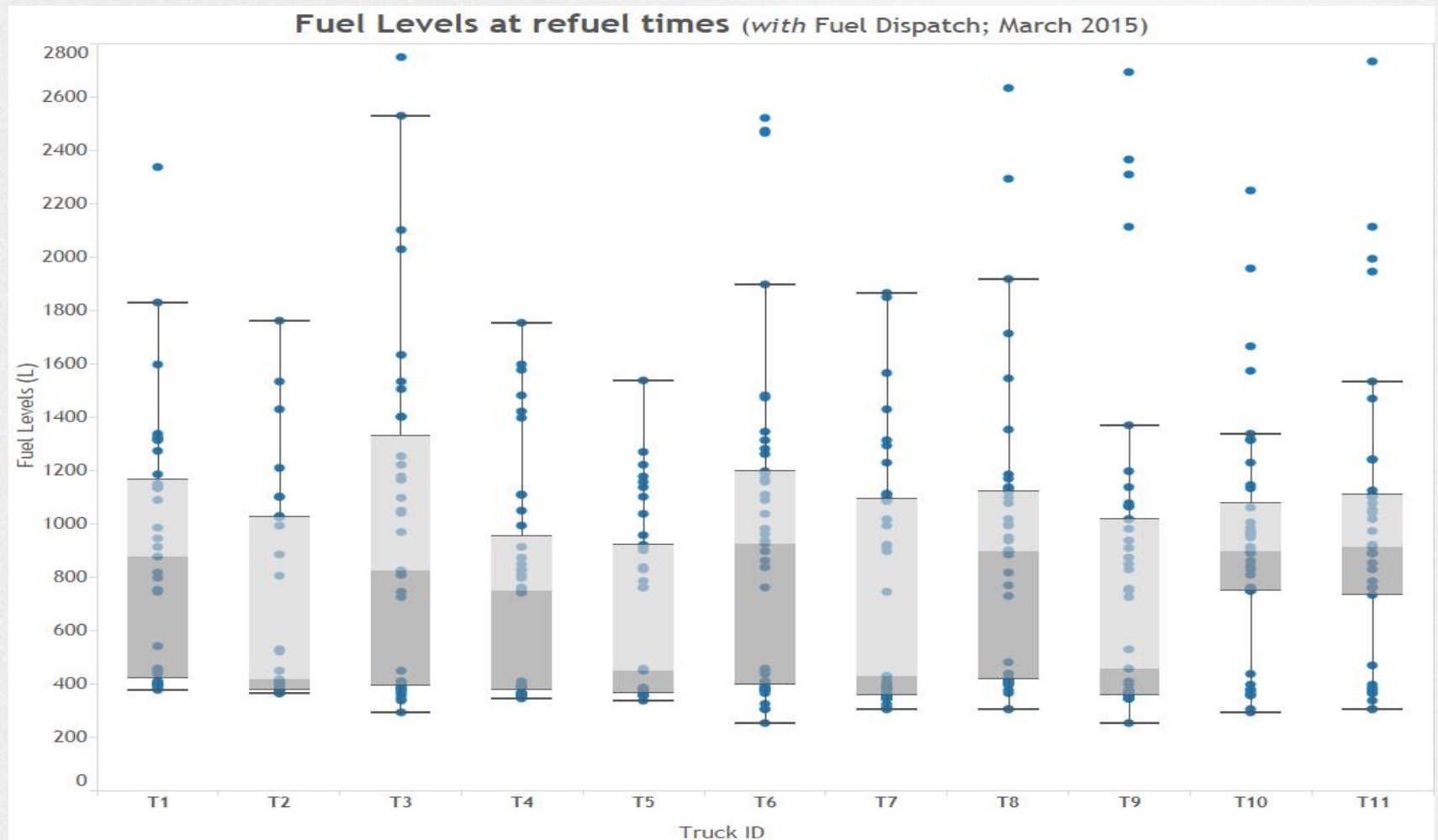
Results - Fueling Operations

At a refueling rate of every 16.5 hours, trucks spend approximately 221 hours a year fueling. (The oil sands producer provided an average of 25 minutes per fueling session.)

- Previously, the site's Caterpillar fleet spent approximately 279 hours a year fueling — a total time savings per truck of 58 hours, almost 2.5 days of production per truck per year.

- The Komatsu 930E trucks gained even more uptime — an estimated increase of 164 hours per year, or almost a week per truck.

Results - Fuel Management

Fuel Levels at refuel times (*with* Fuel Dispatch; March 2015)

Net Operating Hours

Net Operating Hours per Fueling Session
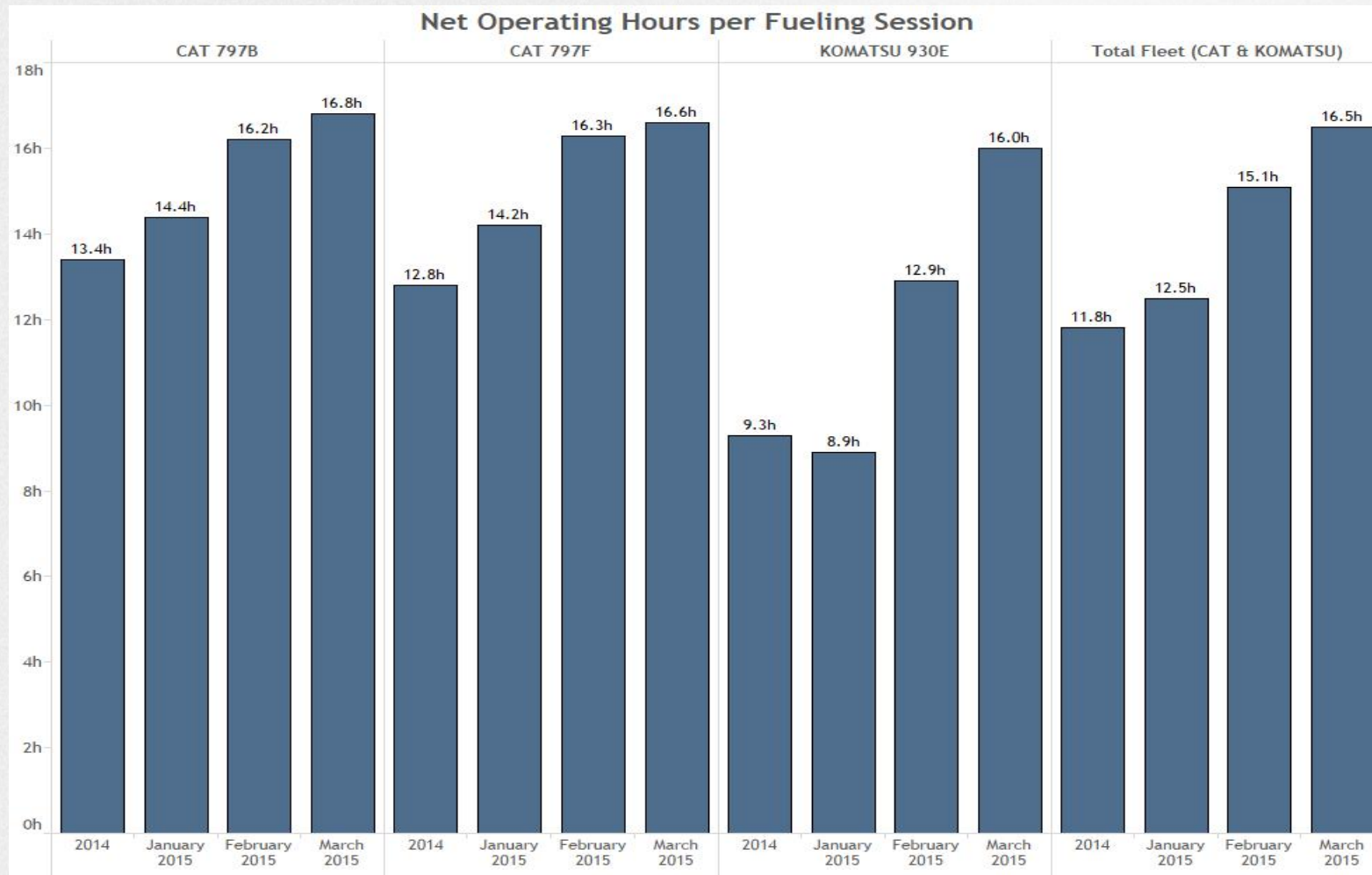
Fuel Management

Truck Model	Time Period	NOH per Fueling Session
Caterpillar 797B	2014	13.4
Caterpillar 797F	2014	12.8
Komatsu 930E	2014	9.3
Total Fleet	2014	11.8
Caterpillar 797B	January 2015	14.4
Caterpillar 797F	January 2015	14.2
Komatsu 930E	January 2015	8.9
Total Fleet	January 2015	12.5
Caterpillar 797B	February 2015	16.2
Caterpillar 797F	February 2015	16.3
Komatsu 930E	February 2015	12.9
Total Fleet	February 2015	15.1
Caterpillar 797B	March 2015	16.8
Caterpillar 797F	March 2015	16.6
Komatsu 930E	March 2015	16.0
Total Fleet	March 2015	16.5

Additional Benefits

The mine site experienced an additional benefit from the system due to its data collection capabilities.

- Fuel Dispatch system has provided the operation with accurate data on fueling times and travel times based on status switching

- Mine managers have been able to quantify important metrics for fueling efficiency and use them to model scenarios for improved fueling processes.

- Performed studies to determine whether or not it proves cost efficient to move fuel bays or how to reduce wasted time due to personnel delays.