

# CNG FUEL PUMP MODIFICATION

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# AGENDA

- Bio
- Overview
- Project Methods
- Results
- Final Thoughts



# Brock Baker



**Current Position: Package IE Intern**

**Hometown: Allen, TX**

**School: Auburn University**

**Hobbies: Film, Sports, Traveling, Music**

**Fun Fact: Graduated from the largest high school in the country**



## Overview



# Project Overview

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## Problem

- Traffic congestion at CNG pumps during fueling time

## Original Project Goal

- Provide analysis to support the addition of a 6<sup>th</sup> CNG fuel pump at Lone Star fueling bay

## Project Methods

- Data collection
- Simulation (Python)
- Data consolidation
- Results and justification





## Data Collection



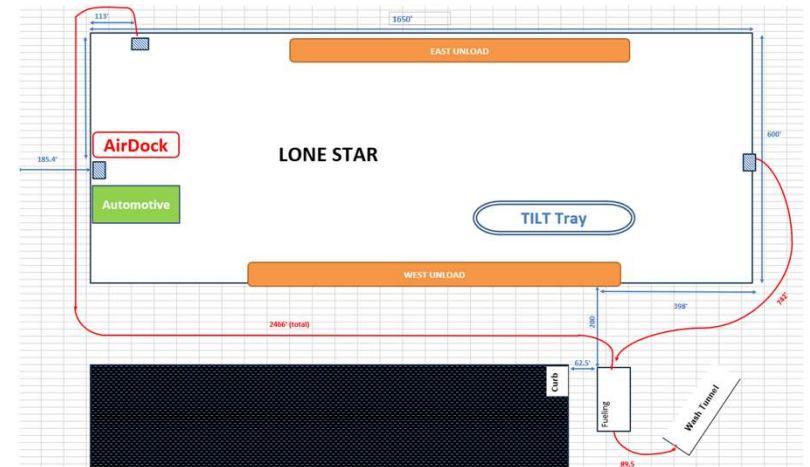
# Data

## Data Needed

- Measurements of Lone Star
- Basic time values
- Package car fuel data:
  - Avg miles driven per day
  - Number of trips per week
  - Number of cars fueled per day
  - Range of package car
  - Fuel types for each car

## Data Collection Methods

- iGate
- PKG
- Measuring Wheel
- DIR



# Project Adjustment

## Project Financials

- Cost of pump modification
- Amount saved per hour saved

## Adjusted Goal

- Shift from addition of 6<sup>th</sup> pump to modification of current pumps' hoses and nozzles
- Currently have 3 of 5 CNG pumps available for package car refueling
- 3 large nozzles, 3 small nozzles
- Goal is to have 6 small nozzles





## CNG Fuel Pumps



Only current pump with two hoses



Large nozzle as seen currently on three pumps (3 total larges)



Small nozzle as seen currently on two pumps (3 total smalls)



# Simulation



# Simulation Overview



## Function

- Use Python to run simulations for 3, 4, 5 and 6 nozzle scenarios
- Utilize relevant packages for queuing functions and plotting data

## Simulation Steps

- Initialize functions for queue
- Data collected used to establish fixed variables in script
- Script was built to run for 75000 fueling simulations
- Returns total fueling time for all vehicles

```
24 # Simulation of the refueling queue
25 def simulate_queue(num_pumps, num_vehicles, time_after, weights):
26     # Adjust refuel time based on the number of pumps
27     if num_pumps == 3:
28         vehicles = [Vehicle(1.019 + (.409 * random.uniform(18, 30))) for _ in range(num_vehicles)]
29     elif num_pumps == 4:
30         vehicles = [Vehicle(1.019 + (.459 * random.uniform(18, 30))) for _ in range(num_vehicles)]
31     elif num_pumps == 5:
32         vehicles = [Vehicle(1.019 + (.489 * random.uniform(18, 30))) for _ in range(num_vehicles)]
33     elif num_pumps == 6:
34         vehicles = [Vehicle(1.019 + (.579 * random.uniform(18, 30))) for _ in range(num_vehicles)]
35
36     pumps = [Pump() for _ in range(num_pumps)]
37     current_time = 0
38     vehicle_index = 0
39     remaining_times = [0] * num_pumps
40
41     while vehicle_index < num_vehicles:
42         min_remaining_time = min(remaining_times)
43         current_time += min_remaining_time
44
45         for i in range(num_pumps):
46             remaining_times[i] -= min_remaining_time
47             if remaining_times[i] == 0 and vehicle_index < num_vehicles:
48                 pump = pumps[i]
49                 vehicle = vehicles[vehicle_index]
50                 pump.start_refueling(vehicle, current_time)
51                 remaining_times[i] = vehicle.refuel_time
```



## Results and Analysis



# Results

## Raw Data

- **Average total time to refuel all vehicles (3 pumps): 283.95 minutes or 4.73 hours**
- **Average total time to refuel all vehicles (4 pumps): 234.79 minutes or 3.91 hours**
- **Average total time to refuel all vehicles (5 pumps): 198.11 minutes or 3.30 hours**
- **Average total time to refuel all vehicles (6 pumps): 179.97 minutes or 3.00 hours**
- **Average time saved with 4 pumps: 49.17 minutes or 0.82 hours**
- **Average time saved with 5 pumps: 85.85 minutes or 1.43 hours**
- **Average time saved with 6 pumps: 103.99 minutes or 1.73 hours**
- **Maximum break-even time (6 pumps): 7.17 days**

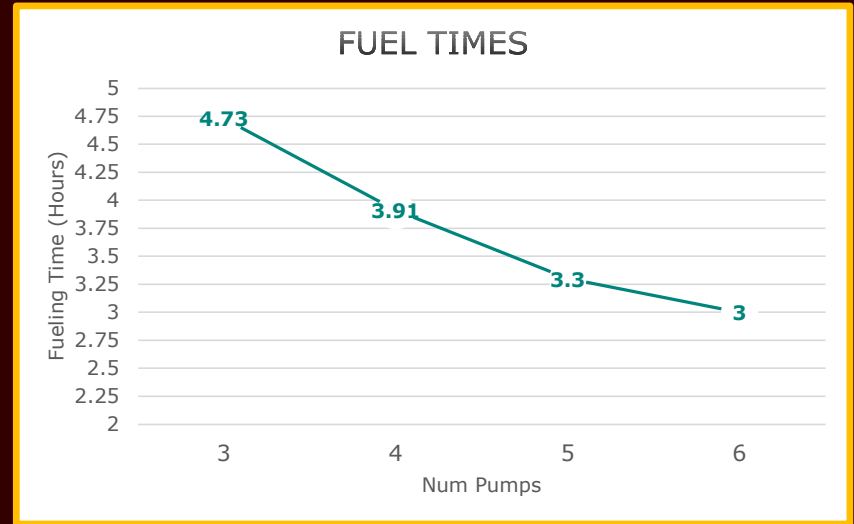
# Analysis

## Results Breakdown

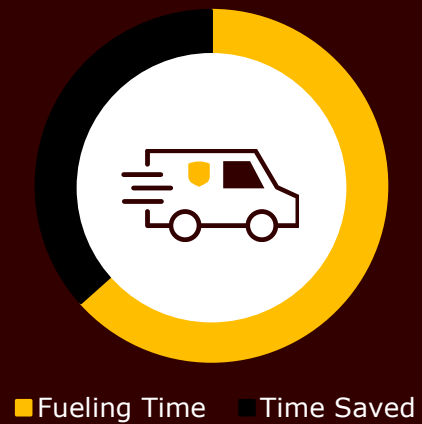
- 4.73 working hours while using 3 small nozzles (current)
- 3.00 working hours while using 6 small nozzles (proposed modification)
- 1.73 working hours saved while using 6 small nozzles
- 36.6% decrease in fueling time per day using 6 small nozzles

## Verdict

- Fuel pump modification to all pumps is a viable option for UPS to consider pursuing



## Saved Time



## Savings!

Year	Annual Savings
2024	\$ 91,287.29
2025	\$ 94,025.91
2026	\$ 96,846.69
2027	\$ 99,752.09
2028	\$ 102,744.65

### Savings Factors

- Wages
- Inflation
- Time saved = Money saved



## Final Thoughts





## Other Tasks

### Projects

- Bonus audits
- Work measurements
- Small sort operations
- Mesquite automation

### Opportunities

- Shadowed various positions
- Attended preloads
- Rode along with driver
- Worked in 5 different hub buildings

**Total Savings**

**\$ 100,020.99**



# Takeaways

## Accomplished Goals

- Translate skills from classroom to professional practice
- Be slow to speak and quick to listen to all those who have been here before me
- Grow technically through real conflicts and solutions
- Don't be afraid to ask ANY question

## Final thoughts

- Best Sponsor (Elijah Williams) and team
- Impressed with depth of work for UPS
- Prepared for the future





**THANK YOU**