RUAN

Electric Trucking and Automation

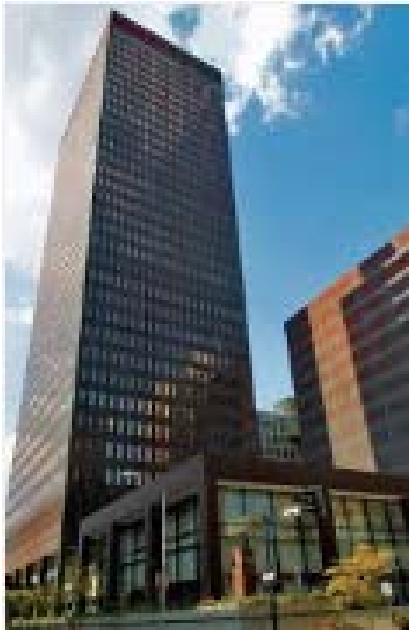
Northwestern University Transportation Center – Business Advisory Council

5/03/18

Ruan Transportation
VP of Fleet Services
James Cade

Ruan Introduction

+ Founded in 1932 by John Ruan in Des Moines, IA
+ National footprint with 270+ Operating Centers
+ Primary industries: Retail, Grocery, Industrial Gases, Dairy, Manufacturing, Food Processing, Chemicals & Metals
+ 3,700+ Class 8 tractors / 8,000+ trailers / 5,100 employees
+ # 40 2017 Industry ranking by Transport Topics “Top 100”
+ Sustainability
  - 3x Excellence Award recipient – EPA Smartway Partner
  - Member of DOE National Clean Fleets Partnership
  - Heavy Duty Trucking “Top 50 Green Fleets” award winner
  - Named annually to Food Logistics’ “Top Green Provider” list
  - Named annually to Inbound Logistics’ “Green Supply Chain Partner” list
  - Designated Carbon Disclosure Project (CDP) “Manager Level” in 2017
  - Member of CA SB1383 Subgroup #2 (Fostering Markets for Digester Projects)



Alternative Energy Interest

+ Ruan's asset business model is based on dedicated contract transportation
+ Multi-year contracts – very predictable energy consumption
  - Very predictable routes and/or routes under 250 miles one-way
  - Much of our volume is not weight sensitive (i.e. not at 80,000 lbs.)
  - Annual miles generally around 100K or more per tractor

Compressed Natural Gas Fleet (CNG and RNG)

+ Over 90 million miles with CNG equipment to date
+ CNG Fleet at a glance
  - 84 CNG 12L tractors
  - 40 RNG 12L tractors (Fair Oaks Farms)
+ Fleet domiciles: Iowa, Indiana, Minnesota, Texas, Wisconsin

Alternative Fuels / Energy – Ruan Experience

+ Equipment
  - Higher acquisition cost than diesel powered equipment
  - Heavier than diesel powered equipment
  - Higher downtime than diesel powered equipment

+ Operational Impact
  - Lower payloads
  - Increased driver training
  - Fueling complexity
  - Increased investment in infrastructure

+ Maintenance
  - More maintenance intensive than diesel
  - Reduced maintenance intervals (routine maintenance and inspections)
  - Increased technician training

Electrification Application

+ Yard trucks – for in-yard trailer shuttling
  - Vehicles are available, and demand seems strong
  - Grants are available
+ Future: On-board electrification – elimination of parasitic load to significantly reduce diesel consumption – 48 volt systems
  - Electrification of all gear and belt driven accessories (alternators, power steering, AC systems)

+ Future: Electric powertrains in class-8 vehicles
+ Ruan has Five Tesla class-8 electric semis on order
  - *“Ruan has always been a leader in efficient transport and logistics, so it makes perfect sense to explore what these trucks could do for us and our customers,"* James Cade, Vice President of Fleet Services

RUAN

Ahead of the Curve

Regional All Electric Trucks

Electric Yard Trucks

Long Haul Hybrid Electric Trucks

- Electric Standby Refrigeration Trailers
- Solar Powered Electric Refrigeration Units

Electrification Concerns

- Infrastructure
  - How long and where do I recharge my batteries?
  - What is the cost of a charging station?
  - What are the impacts of fast charge versus slow charge?
- Costs
  - How do the acquisition costs compare to diesel?
  - Are there operational savings to offset higher acquisition costs?
  - What is the cost of the electricity to recharge my batteries?
  - How long do batteries last?
- Range
  - How far can I go on a battery charge?
  - What impact does driver behavior have on range?
- Weight
  - Will battery weight impact my payload capacity?
  - Will weight distribution be affected?

There's a lot of automation that can happen that isn't a replacement of humans but of mind-numbing behavior.

-Stewart Butterfield