Chicago is the third largest intermodal freight hub in the world. Joliet, being so close, makes a great place as a depot to intercept much of Chicago’s goods. It is also far enough away to avoid further congestion in the city. Currently one hub exists in Joliet (Elwood BNSF), another is being developed (Centerpoint), and one is being proposed off of Lorenzo road. Our sponsor, Mi-Jack, has asked us to determine the difference in efficiency between a regular wide span gantry system and their new Pathfinder system.
3 PROBLEMS - 3 GROUPS - 3 SOLUTIONS

GROUP 1, PATHFINDER TECHNOLOGY
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  MATTHEW WIESE, COMPUTER SCIENCE
  JOEL ZOOK, ARCHITECTURE

GROUP 2, EXISTING FACILITIES
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  JOHN BOUIKIDIS, MECHANICAL ENGINEERING
  DAVID DZIUBA, ARCHITECTURE
  BRYAN SLONSKI, ARCHITECTURE

GROUP 3, ALTERNATIVE FUELS
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  MATTHEW KEHOE, INFORMATION TECHNOLOGY AND MANAGEMENT
  MELAT TESFAYE, BIO-MEDICAL ENGINEERING
  CHRISTOPHER WISEMAN, CHEMICAL ENGINEERING
USING JAVA, WE WILL CREATE SIMULATIONS FOR AN INTERMODAL FACILITY
CREATE A SPREAD SHEET INDICATING SCALE AND TIMING OF ALTERNATIVE FUEL INTERVENTION
GENERATE INFORMATION FOR VOLUME OF TRUCK AND CONTAINER TRAFFIC FOR JOLIET AREA
Truck Processes: Conventional Terminal

Truck Arrives: Queues to Gate

Entry Gate: Paperwork Check and Instructions

- Dropping Off Container; Leaving with Empty Chassis
  - Storage Area by Tracks
    - Drop Off Container
    - Pick Up Chassis
  - Remote Storage
    - Drop Off Container
    - Pick Up Container and Chassis

- Dropping Off Container; Leaving Bobtail
  - Storage Area by Tracks
    - Drop Off Container
    - Drop Off Chassis
  - Remote Storage
    - Drop Off Container
    - Pick Up Chassis

- Dropping Off and Picking Up Container
  - Storage Area by Tracks
    - Drop Off Container
    - Drop Off Chassis
  - Remote Storage
    - Drop Off Container
    - Pick Up Chassis

- Arriving Bobtail
  - Pick Up Chassis
  - Pick Up Container at Storage Area

- Arriving with Empty Chassis
  - Pick Up Container and Chassis at Storage Area
  - Chassis Flip

Exit Gate: Paperwork Check and Exit
Truck Processes: Terminal with Pathfinders

All tractors using the Pathfinders will have RFID tags to open the automated gate and record time of arrival and departure from the exit gate.

**Truck Arrives**

Pathfinder Traffic Uses Automated Gate

- **Drop Off Container at Pathfinder**
- **Pick Up Container at Pathfinder**

Outbound containers are delivered to designated corridor. Pathfinder bays, identified by numbers, ensures no mis-parked containers. Driver operates Pathfinder to load the container into designated Pathfinder. Blocking is automatic.

**Pick Up Container at Pathfinder**

Exit Gate: Automated; Truck Departs

For inbound pickup, Container/Pathfinder identification sent by communication software to truck line carrier the moment the container is set in the Pathfinder.
Intermodal Systems Simulator

- Driver
  - Train/Truck
  - Terminal
    - Standard Pathfinder
    - Lift
      - Crane
      - Gantry Crane Pathfinder
    - Connection
      - Road Track Gate
    - Vehicle
      - Truck
      - Train
    - Container
      - Container

Timer
<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Availability</th>
<th>Cost of fuel (gal)</th>
<th>Vehicle Alterations Required</th>
<th>Processed on site?</th>
<th>Efficiency</th>
<th>Emmissions</th>
<th>Pros</th>
<th>Cons</th>
<th>Possible Roll-out Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetable Oil</td>
<td>Local greasy food restaurants and factories. As of 2000 the United States was producing in excess of 2.9 billion gallons of waste vegetable oil annually. WVO, SVO, PPO.</td>
<td>Free other than initial cost for filtration system</td>
<td>Diesel car with separate tank for vegetable oil containing heating element and a three way valve.</td>
<td>Settling tanks.</td>
<td>85-95% efficient compared with petroleum based diesel fuel</td>
<td>Less carbon dioxide and sulfur. More nitrous oxides</td>
<td>From current production 1% of US oil consumption could be offset. Not very difficult or costly.</td>
<td>The EPA clearly states it is illegal to burn SVO.</td>
<td>Viable as a fuel today. Small systems with a centrifuge can handle 5-7 gallons per hour. Larger systems are feasible</td>
</tr>
<tr>
<td>Biodiesel</td>
<td>Same as vegetable oil</td>
<td>Initial investment in reactor required. Costs are dependent on cost of methanol and catalyst used to create fuel</td>
<td>None for newer cars. Older cars require replacing rubber fuel lines with biodiesel compatible lines.</td>
<td>Yes</td>
<td>90-95% efficient compared with petroleum based diesel fuel</td>
<td>Could offset 1% of US oil consumption. No vehicle modification necessary</td>
<td></td>
<td>Dangerous chemicals need to be used in production</td>
<td>Viable as a fuel today. 100 gallon per day reactors can be acquired easily</td>
</tr>
<tr>
<td>Algae Fuel</td>
<td>Can be grown on ocean or wastewater. Yields claims cover a vast range from 5,000 to 150,000 US gallons of oil per acre per year. Algae can produce 15-300 times more oil per acre than conventional crops.</td>
<td>Biodiesel (B100) can be run in any diesel engine. In most gasoline engines, biobutanol can be used in place of gasoline with no modifications.</td>
<td></td>
<td>No. Expensive process of converting algal to biodiesel or biobutanol. PhotoBioreactors, Closed loop system, Open pond, Fermentation tanks.</td>
<td>Biobutanol has an energy density 10% less than gasoline, and greater than that of either ethanol or methanol.</td>
<td>Depends on the production process. Systems have been made to recycle CO2 emissions from power plants.</td>
<td>The United States Department of Energy estimates that if algae fuel replaced all the petroleum fuel in the United States, it would require 15,000 square miles</td>
<td>Energy losses due to converting the algae lipids into fuels.</td>
<td></td>
</tr>
<tr>
<td>Hydrogen fuel cell</td>
<td>Hard to acquire. Moving and storing mass quantities is unpractical and costly. Non-existent infrastructure.</td>
<td>With renewable energy produced on site, gas only costs initial installation of equipment + maintenance.</td>
<td>Basically an electric car with hydrogen tank, a fuel cell stack, and an air compressor.</td>
<td>Production on site makes for less distribution costs, but higher production costs.</td>
<td>The energy in 2.2 lb (1 kg) of hydrogen gas is about the same as the energy in 1 gallon of gasoline.</td>
<td>Depends on type of production (hydrogen and oxygen (renewable energy)?)</td>
<td>Potential for near-zero greenhouse gas. Doesn’t need to be imported. Low noise.</td>
<td>Low volumetric energy density calls for a large tank. Moving and storing mass quantities is unpractical. Lack of infrastructure. Cost.</td>
<td>Fueling stations already exist in southern California. Fuel cost is comparable to gasoline.</td>
</tr>
<tr>
<td>Propane</td>
<td></td>
<td>Extremely explosive</td>
<td></td>
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</tr>
<tr>
<td>Ethanol</td>
<td></td>
<td>In the US, takes 1 gallon of fossil fuel to produce 1.3 gallons of ethanol. Less efficient than gasoline</td>
<td>Already available at many gas stations around the country</td>
<td></td>
<td>Only slightly “greener” than petroleum based fuels</td>
<td></td>
<td></td>
<td>Not currently available at gas stations. Home fueling stations are available</td>
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<tr>
<td>CNG</td>
<td></td>
<td>Most abundant natural resource in the US (could lessen dependence on foreign countries)</td>
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</tbody>
</table>
NARROW BROAD FOCUS DOWN TO KEY FOCUS POINTS

ONLY ONE GROUP MEMBER WITH JAVA EXPERIENCE

OBTAINING DATA FROM FUELING STATIONS AND FREIGHT YARDS
COMPLETING PROGRAM USING JAVA

SENSITIVITY OF ANALYZING FUTURE USE OF ALTERNATIVE FUELS