# MEEN GREEN Design Day

## Department of Mechanical & Energy Engineering University of North Texas

*Nov 20 2015*

DEPARTMENT OF MECHANICAL & ENERGY ENGINEERING
College of Engineering
UNT

# PROGRAM

## Poster Presentations
### 11:30 AM -12:30 PM
***Discovery Park Foyer***

## Project Presentations
### 1:30 PM – 5:30 PM
***Room: B140***

## *Projects*
*(in the order of presentation. Each team has 30 min. presentation and Q&A)*

- **Seat Suspension – Peterbilt**
- **Sleeper Cab Amenities – Peterbilt**
- **Convertible Bed – Peterbilt**
- **Microclimate System for ZOE Lab**
- **Smart Water Meter for ZOE Lab**
- **Quad Lift**
- **Rear-Mounted Variable-Speed Wind Turbine**
- ***Novel Air Revitalization for Deep Space Habitats***

# POSTER LAYOUT

Microclimate System for ZOE Lab

Smart Water Meter for ZOE Lab

Quad Lift

Rear-Mounted Variable-Speed Wind Turbine

Novel Air Revitalization for Deep Space Habitats

Seat Suspension - Peterbilt

Sleeper Cab Amenities - Peterbilt

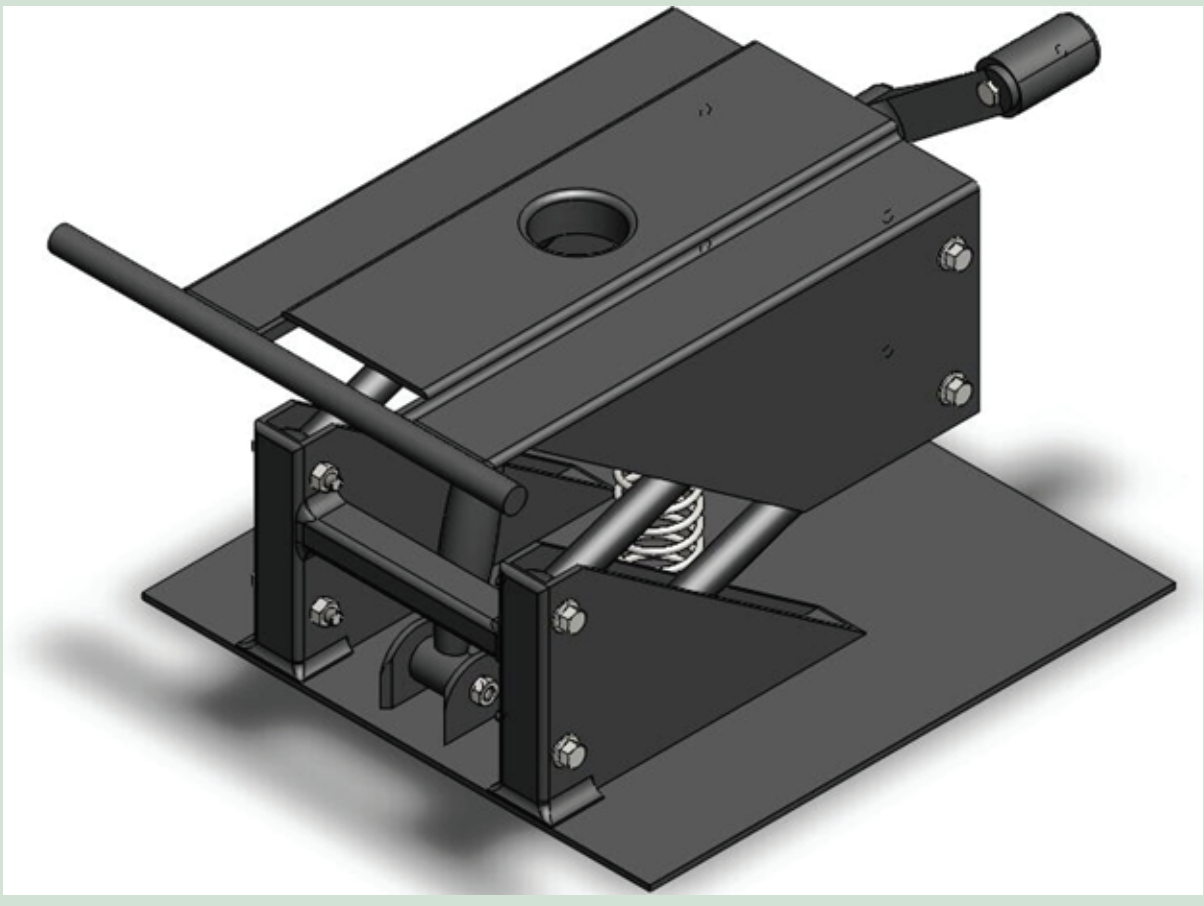
Convertible Bed - Peterbilt

MEE Department

# PETERBILT SEAT SUSPENSION

*Team Members: Hussain Alfareed, Andy Ofori, and Pravin Giri*

Truck drivers spends long hours in their seat and consider safety and comfort a priority. Even though current seat suspension systems provide comfort and safety, they are really expensive and the lower cost designs are not comfortable and have very low adjustability. Thus many truck manufacturers are looking for alternative designs to provide same level of comfort and safety and still be competitive with prices. Peterbilt is known for their legendary service and they asked us to come up with a quality design that is cost effective, safe and comfortable. We designed a seat suspension, which replaces the traditional air suspension system with a combination of compression spring and two torsion springs. New design is cheaper, has fewer components, reliable, easier manufacturability and has variable spring constant for driver adjustability. Cross frame design and position of torsion spring makes the design more stable and is able to achieve close to ideal natural frequency.



# PETERBILT SLEEPER CAB AMENITIES

*Team Members: RoseMarie Hernandez, Jeremy Kinney, Trevor Lopes, and Omar Padilla*

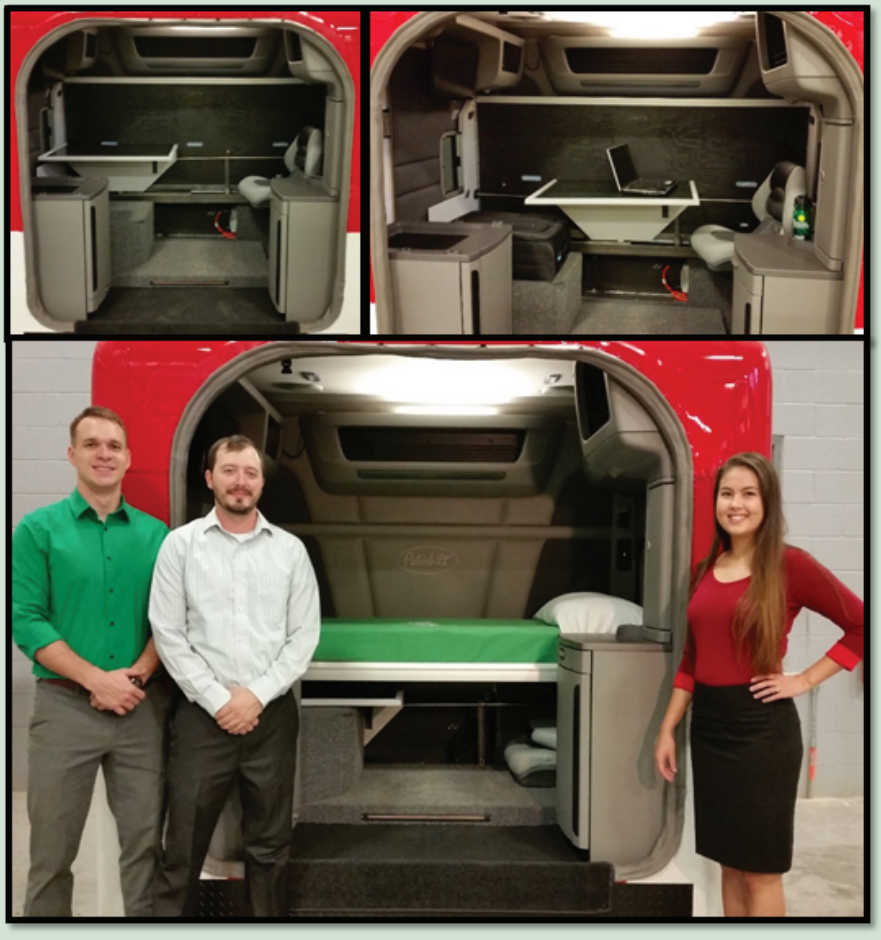
Purpose: Peterbilt Motors Company conducted a focus group involving female truck drivers. During this focus group, the primary concern by these drivers was for their safety. Many of the female truck drivers felt unsafe using truck stop restrooms at night. To address this concern we have designed an on-board toilet facility.

Design: The design of a toilet facility inside of a sleeper cab truck needs to be lightweight and space efficient. Due to the lack of waste handling infrastructure, it also needs a way to dispose of waste. Our design utilizes an existing cabinet within the sleeper cab to store the toilet. The toilet slides out like a drawer for easy access. Water is supplied from a six-liter pressurized water tank that can be refilled using the water hose hookup. Waste is then stored in a nine-liter removable tank below the toilet. This tank can be accessed from the outside of the truck by a small luggage door. The waste tank can then be emptied into standard toilet facilities at a place and time the trucker sees fit. To improve efficiency, this toilet uses one liter of water per flush.

# PETERBILT CONVERTIBLE BED

*Team Members: Sylvia Byre, Richard Roberts, and Alex Reese*

Truck drivers can spend weeks to months living out of the sleeper cab while driving all over the country. During off hours, truck drivers are currently limited to the bedroom space that exists in the sleeper cab. Sitting on the side of a bed, trying to do paperwork, or make a video call to those at home, can be quite uncomfortable. Truck drivers have asked for a more useful and comfortable space that can be used in multiple ways. We have designed three functional spaces, the bedroom, the office, and the living room, all into the same factory built sleeper cab. Drivers now have the option of using the desk to do paperwork, the living room to relax and kick feet up while watching a movie, eat a meal at the table, and finally the original bedroom to get rest. The multiple use space was designed to maintain all the current packaged options that come standard with a Peterbilt 80 inch sleeper cab.



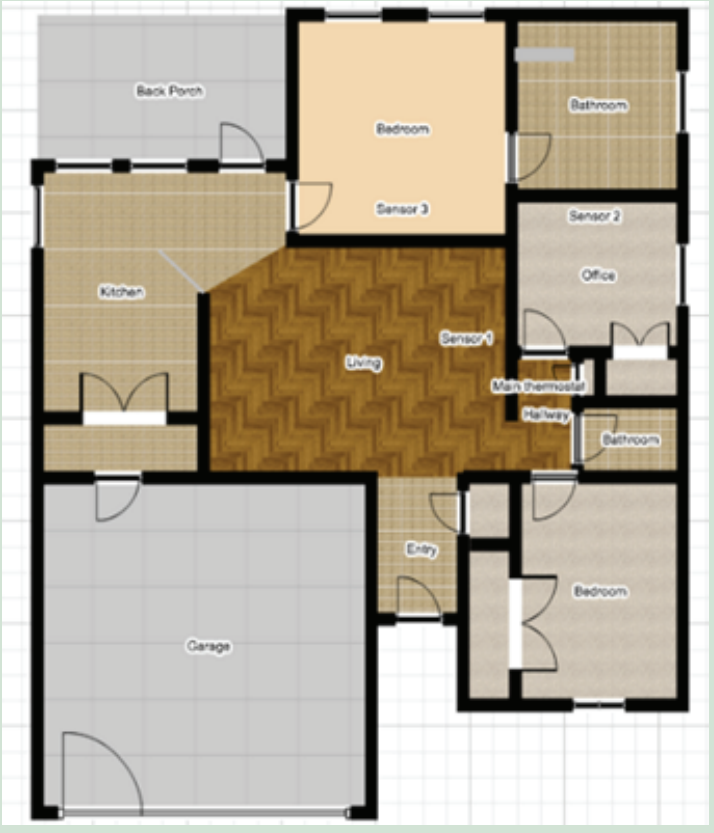
# MICROCLIMATE SYSTEM FOR ZOE LAB

*Team Members: Jody Riojas, Bradly Walker, and Philip Martin*

The microclimate team has been tasked to focus on energy efficiencies and human comfort in both a home and lab setting. The project implemented two phases of study: (1) A conventional single set temperature thermostat vs. a nonconventional smart thermostat coupled with room sensors in a residential home and (2) how alliesthesia, or perceived human comfort, affects power consumption in the Miniature Energy Lab.

The initial phase was conducted utilizing one of the team member's 1362 sq. ft. residential home. It was first tested with a single set thermostat, commonly used in typical residential homes. It was later equipped and tested with an Ecobee Smart Thermostat with wireless sensors. In the second phase of the study, the team performed testing using the Miniature Energy Lab which was constructed by student teams in the Construction Engineering program. The test was done in the 96 sq. ft. lab using an LG window air condition unit, P3 electricity usage monitor, temperature sensors, and two test subjects.

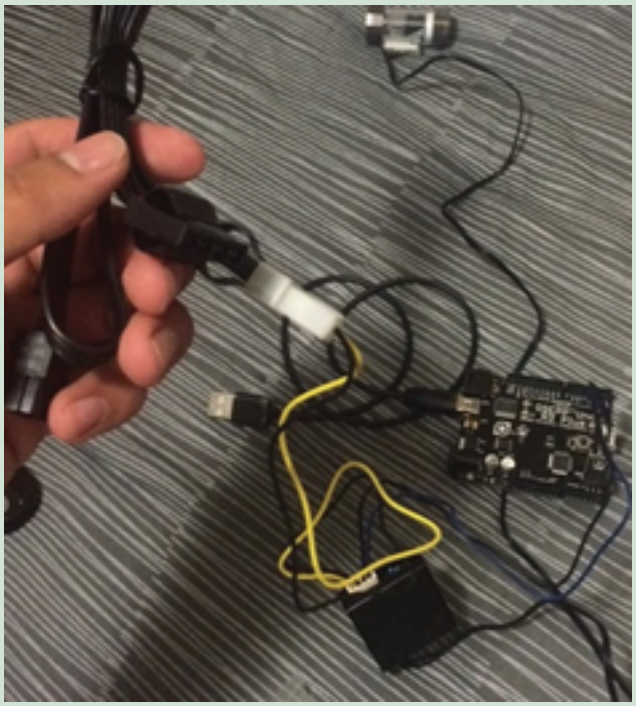
At the conclusion of the two phases were completed, the team used the results to determine which thermostat conserves power while maintaining human comfort and the how the perceived human comfort affects power consumption in multiple scenarios.

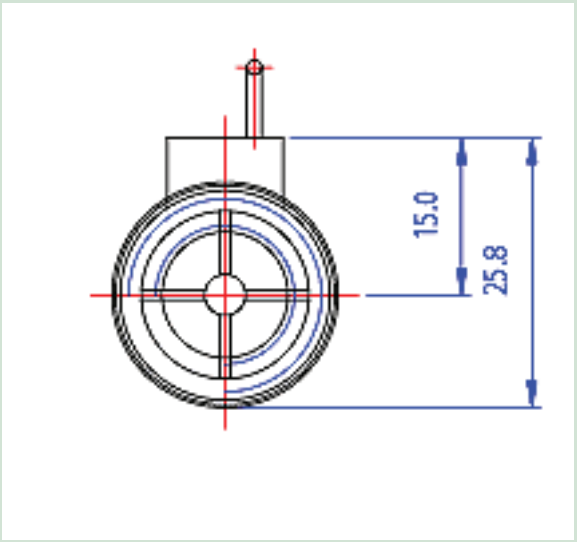



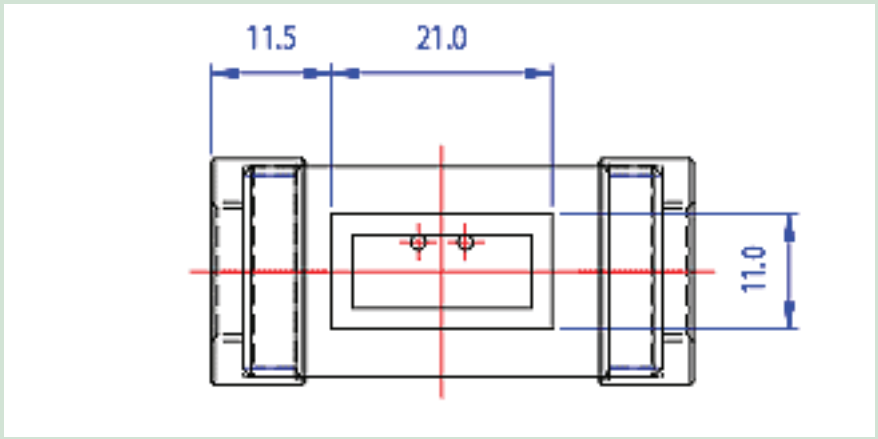
# SMART WATER METER FOR ZOE LAB

*Team Members: Timothy Kee and Joshua Daniel*

The goal of this project is to create a water monitoring system to be used in the University of North Texas Zero Energy Labs for consumption feedback. The purpose of the system is minimize municipal water usage and maximize use of on-site collected water to make the labs as self-sufficient as possible. The device created is an in-line flow sensor which will be implemented into the water lines of the lab. The data collected by the sensor will be used to guide and demonstrate where water is allocated, thereby causing changes to the consumption habits within the lab.





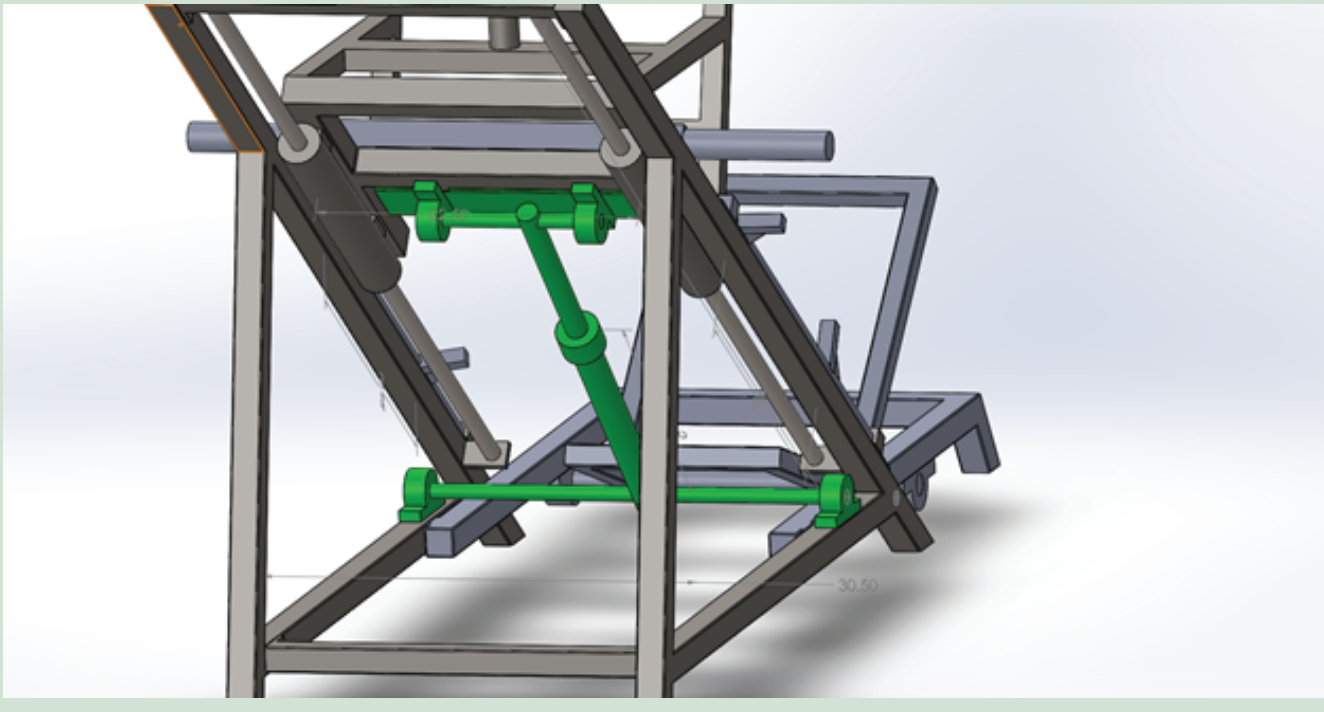
# QUADLIFT

*Team Members: Matthew Cummins, Brad Fullman, and Joshua Page*

Team Quadlift's goal is to provide a unique mechanism to allow consistent, isolated eccentric (downward) repetitions on a leg press machine while providing lift assistance on cocentric (upward) repetitions. Dr. Brian McFarlin of UNT's Kinesiology department is conducting research on the effects of isolated concentric leg muscle damage during lifting exercises.

Team Quadlift decided that the best, most cost efficient, solution for this study was to engineer a hydraulic system meeting the following constraints: safety, lifting a maximum loading of 1200 lbs, consistency in functionality, and simplicity of design.

In doing so, Team Quadlift decided the best, cost efficient, solution was to create a hydraulic lifting system shown in the following diagram:



# REAR-MOUNTED VARIABLE-SPEED WIND TURBINE

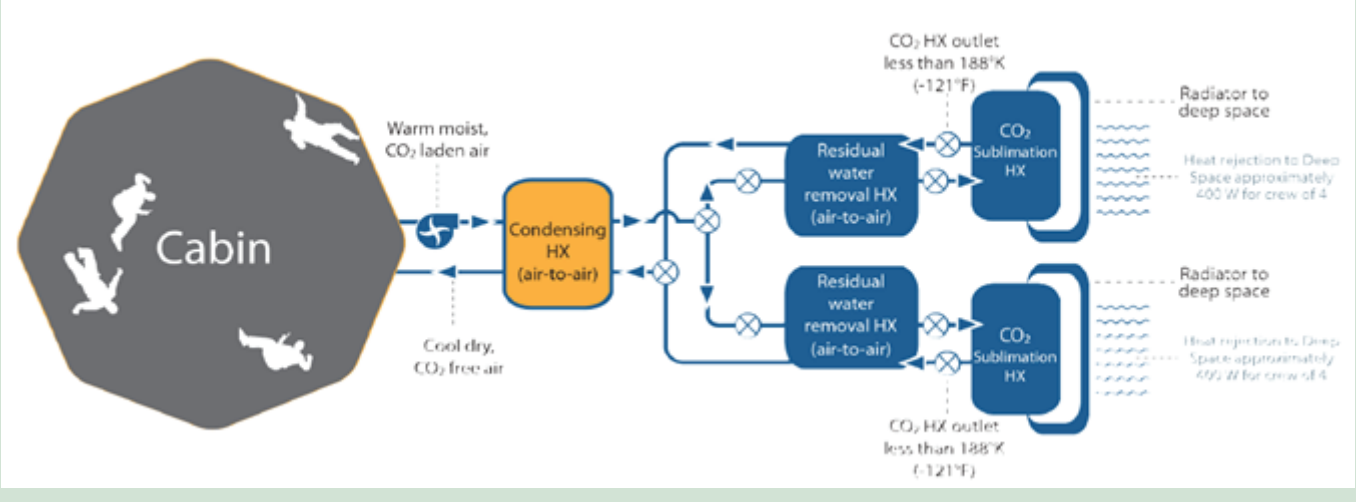
*Team Members: Jyramie Cooper and Kyle Hilliard*

For every glance you take outside your home or workplace you may have noticed thousands of platforms bare of the necessary means to harness the winds abundant energy. Platforms such as power line poles, street light poles, traffic light assemblies, and many others reaching into the winds above. The idea of a rear-mounted variable-speed wind turbine (Ventus-1) is to create a cost efficient, mass manufactured, and efficient wind turbine that can function in a wide variety of environments. Ventus-1 is created using 3D printing technology to further explore efficient means of production and analysis.

# NOVEL AIR REVITALIZATION FOR DEEP SPACE HABITATS

*Team Members: Jordan Essman, Andrew Carr, Sarah Hagerman, Rudy Nagasimha, Lawson Taris, and Ahmad Shabbar*

Air in deep space habitats must be treated to control the concentrations of carbon dioxide, humidity, and other contaminants. UNT Ad Astra's goal is to establish an alternative air revitalization technique for removing CO2 and humidity from cabin air using the cryogenic cooling of deep space. Deep space temperatures sink as low 4 Kelvin, providing a perfect temperature range to condense CO2 and other atmospheric contaminants cryogenically. System design includes taking an airstream through a condensing heat exchanger surrounded by cryogenic fluid to mimic deep space cooling. The temperature, humidity and CO2 levels will all be monitored at the inlet and outlet of the schematic. This concept is simpler, less massive, and less power intensive than the current air revitalization system, and allows for the recovery of CO2 which could potentially feed other processes.



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