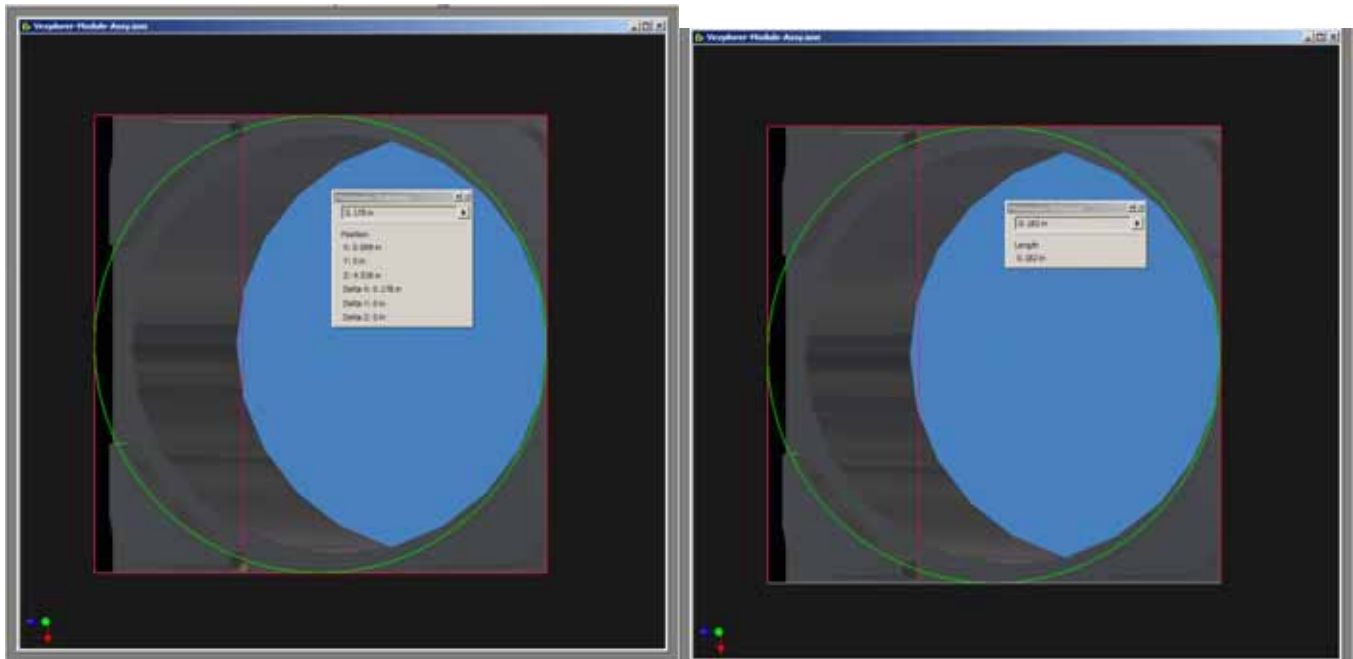


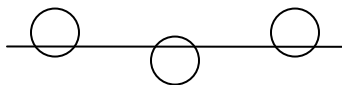
Thank you for this opportunity in participating in this design competition.

If I were to design a combat robot, I'd reuse the VEXplorer's drive train modules and slightly change the height of the wheels.

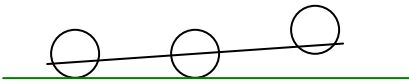
The parts files show that the flat bearings fit with somewhat loosely in the square holes of the chassis frame:



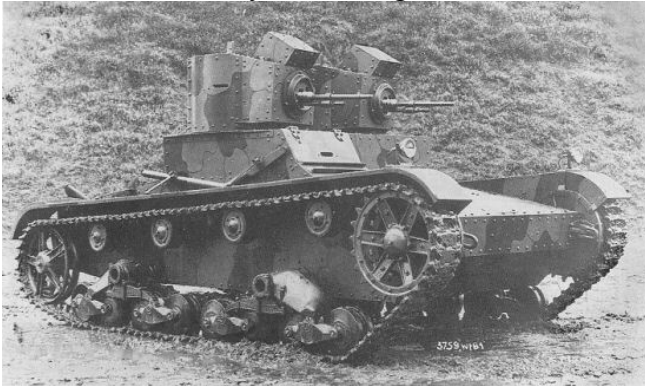
The hole has a width of $.182''$ and the bearing's mounts are spaced $.178''$, a difference of $.004''$. This means that each bearing can be moved up or down $.002''$. I propose to experiment moving the two outside wheels (of one side of the six-wheel-drive) up $.002''$ and moving the middle wheels down by $.002''$. The diagram below shows an exaggeration of this:



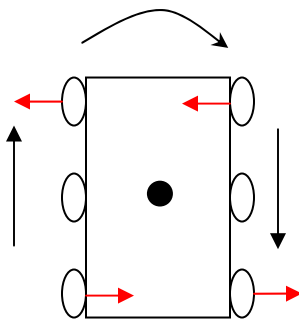
The line represents where the wheels would be located if the bearings were centered in the holes, and the circles represent the wheel. The robot would be significantly heavier on the back (with motors, battery, receiver, and camera) so more often than not, the robot would be oriented like this: (The green line tangent to the two back wheels represents the ground)



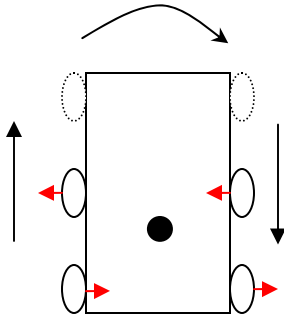
Notice the similarity this configuration has to an efficient tank tread arrangement:



An advantage to this is the increased ground clearance of .004'', but this distance is negligible and would probably be barely noticeable. The greater advantage that I see to this is that the robot drives with the stability of a 6-wheeled design, but it has the maneuverability of a 4-wheeled design. What I mean by this is that only 4 wheels are ever in contact with the ground, so when the robot turns, it turns about a point in between those four wheels. This greatly reduces the drag caused by the lateral friction acting on the wheels: (The straight lines on either side of the base represent the direction the wheels are being driven; the curved line on top represents the direction the robot will be turning, and the middle point represents the point which the robot is turning about.



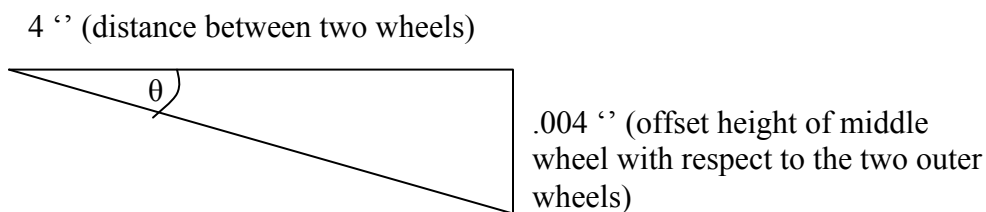
The red lines represent the forces of friction acting perpendicularly to the wheels' direction of travel. These forces are a big reason why robots with long (and not wide) bases have difficulty turning. Below is the diagram of the configuration I would like to try: (The dotted wheel on top represents a wheel that is slightly raised, and is thus making little contact with the ground, notice that the point about which the robot turns has changed.



The frictional forces are smaller because the turn radius is smaller. For the same angular displacement, the arc length is now much shorter.

One may argue that the advantages over the longer design are more stability and traction. Although some traction is being lost, I feel it is a decent compromise to attain better maneuverability. The stability has remained virtually unchanged—should the robot decelerate, shift its center of mass (e.g. due to the arm), or get pushed, it will just slightly tip forward (trigonometry says that it should tip less than 1 degree) and the four front most wheels will come in contact.

Trig Calculation: (not to scale)



$$\tan \theta = \frac{.004}{4}$$

$$\theta = \tan^{-1} \frac{.004}{4} \approx .01^\circ$$

The gears should continue to mesh because they will only be a very tiny fraction of an inch more apart.

Another modification I'd like to try is mounting the gripper perpendicularly to how it comes mounted in the kit. If the robot is to be used in combat, this would allow the robot to grasp the other robot around things like chassis frames, something that would not be feasible with the gripper in the current configuration. I'd also decrease the length of the arm to increase the force acting at the end point (since the torque output of the motors is the same, decreasing the distance increases the force, $\tau = F \times d$). To disable a robot, I'd

be able to grab a chassis rail (with the rotated gripper) and slightly lift one side up. This should be enough to dramatically decrease the traction the robot has on the floor, thus disabling it.

I also have in mind some other useful applications, not involving robotic battles. I'd like to make a much smaller robot, possibly mounting the chassis rails vertically up and make a card-dealing robot. Two wheels would provide motility to the robot, allowing it to rotate and approach game players. Another motor would then be used to index and serve the cards. I'd probably need to fit a wheel to this motor so that it can serve the cards, and this wheel and motor assembly would probably be on a pivoting mechanism so that it can maintain constant traction on the top card of the deck even when less and less cards are in the deck, and thus its height is changing.

I think what I'll most enjoy about using the VEXplorer kit is that I'll be able to try out all these ideas! From my understanding, the kit can be assembled and reassembled over and over again. This will allow me, as I am manifesting these ideas, to make modifications in the design. What attracts me most to the kit, for this reason, is its versatility.

Thank you for your time. I hope you have enjoyed my descriptions on using the VEXplorer kit in an innovative manner! Please let me know if I can answer any questions.