Alternative Design 1: Horizontal Fixture Setup

The main difference of this design from the other alternatives is that the testing will be done in a horizontal configuration as opposed to a vertical setup. This would require completely different bases, clamps, load cells, and simulated body fluid chambers. The Bose Testbench device would have to be tilted 90 degrees from its current configuration and lowered closer to the base.

The clamps would have to be attached on their sides to the platforms so the tissue specimens will be held parallel to the base and along the axis of the applied force. This will be done by building two platforms that will each hold 12 clamps facing each other. The platform positioned further from the Bose device will be stationary, while the platform closer will be moved by the Bose device. The load cells will be attached to the stationary platform as in the primary design, but will need to be kept out of the solution.

A horizontal setup would provide a much less difficult specimen setup. Nothing would be over positioned the tissue clamps as with the vertical designs, so it would be much easier to reach the clamps. All of the clamps would be in one row, so the entire device would not have to be rotated to reach any of the clamps. In the vertical designs, only six clamps can be reached at a time; the device must be rotated to reach and setup the others. A horizontal design also eliminates the frustration of clamping the tissue in the proper spot while fighting gravity. The tissue can simply be placed on the clamp in the proper spot, and the clamp can be tightened. The vertical setup requires that the tissue be placed in the upper clamp, then carefully held while the clamp is closed and secured. If the tissue happens to slip down due to gravity, the setup will have to be repeated.

The chamber that will hold the tissue specimens in the simulated body fluid will also be quite different than in the primary design. The arm that connects the movable base to the Bose Testbench device will have to go through one of the walls of the chamber. We will need to design a seal that would go around this arm that would allow it to move back and forth for millions of cycles while remaining water tight. This would be a significant complication and is one of the reasons why a horizontal setup is the primary design.

Another complication is the implementation of the load cells in a horizontal setup. The strain gauges must remain dry during the experimentation in order to function properly. The horizontal setup requires that both platforms be completely submerged in simulated body fluid, so the strain gauges will have to be orientated in a way that keeps them above the solution. This could be done by installing thin
strips of metal that would connect the two platforms together. These strips would have to be raised enough so they remain out of the solution. The strain gauges could then be installed on these metal strips. This strain gauge setup would create a lot of issues with recording accurate data. In the vertical setups, the strain gauges are installed right to the connecting arm of each upper clamp, so they will be directly exposed to the forces experienced by the individual tissue specimen in that particular clamp. In this horizontal setup, the strain gauges would not be attached directly to the clamps, but to the supports that keep the strain gauges raised out of the solution. This separation could reduce the accuracy of any data recorded.