Objective
Build a non-invasive monitoring system for detecting solid particle erosion in a steam turbine system within a combined cycle plant.

Data Communication
- Piezoelectric Sensor Readings
- Readout Equipment (Arduino)
- Compare and Analyze Natural Frequency
- Process and Graph Data

Electrical Circuit
- 18 to 30 VDC
- 2.5 - 3.5 VDC
- Connector
- Amplifier
- Shield
- Isolation Layer

Results and Analysis
This section of the graph shows a spike in voltage output meaning that it is reading a large amount of vibrations.

This section of the graph shows that the voltage output is very small meaning that it is not reading much vibration.

Cost Analysis
Current one cycle maintenance cost is $3,025, the teams prototype one time maintenance cost is $1,411.08, reducing the maintenance cost by $1,613.92 for a single cycle.

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Part</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td></td>
<td>$225.00</td>
</tr>
<tr>
<td>Valve</td>
<td></td>
<td>$1,600.00</td>
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<tr>
<td>Labor Rate/hour</td>
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<td>$100</td>
</tr>
<tr>
<td>X Number of Hours</td>
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<td>6</td>
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<tr>
<td>X Number of Workers</td>
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<tr>
<td>Subtotal</td>
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<td>$1,200.00</td>
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</tbody>
</table>

Prototype Maintenance Method
- Circuit Configuration: $41.77
- Sensor: $379
- Communication Device: $20.98
- Impact Hammer: $604
- Other Components: $265.33
- One hour of testing: $100
- Total: $1,411.08

Spindle Models
- Standard Spindle 2.25”
- Minimally Eroded 2.00”
- Eroded Spindle 1.75”
- Extremely Eroded spindle 1.50”

Future Development
- Test prototype on a functioning valve
- Development of a custom PCB board
- Explore applications of prototype on different valve bodies
- Develop wireless data communication

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