

| <b>Element</b>    | <b>Issue</b>   | <b>Possible Delay</b>  | <b>Solutions</b>   | <b>Critical Path</b> |  |
|-------------------|--|--|--|----------------------|--|
| Programming       | Optimizations affect the speed and accuracy of at which the ECU will operate. Timing tolerances must be met under these conditions. Calculations will determine if we meet these requirements. | Compiler lead time 3 days, funding issues will also cause delay  | Purchase of full size complier (\$1000 and week delay for delivery). This Also causes a budget issue for us and is not the recommended solution.   | X                    |  |
|                   | <b>Risk Level - Moderate</b>   | <b>Delay Length - Long</b>   |  |                      |  |
|                   | Code Size - Code is currently at 11K using optimizations and is over the 16K limit without.  | Compiler lead time 3 days, funding issues will also cause delay  | Purchase of full size complier (as above.)   | X                    |  |
|                   | <b>Risk Level - Moderate</b>   | <b>Delay Length - Long</b>   |  |                      |  |
|                   |  | MIN 0.5 Days, MAX 3 Days   | Reduction of lookup tables library to minimize the size of the tables. This has limited capability in the amount that it can reduce the code size. It is inexpensive but requires man hours (estimated 5 hours.)   | X                    |  |
|                   | <b>Risk Level - Moderate</b>   | <b>Delay Length - Short</b>  |  |                      |  |
|                   | Code De-bugging Time Forecasting Difficulties due to our teams' lack of experience with the code being used.   | MIN 2 Days, MAX 1 Quarter  | Contact Chris Fueurstein for assistance and explanation  | X                    |  |
|                   | <b>Risk Level - High</b>   | <b>Delay Length - Long</b>   |  |                      |  |
|                   | Redesign of code if problems cannot be solved  | MIN 1 Week, MAX 1 Quarter  | Contact Chris Fueurstein for assistance and explanation  | X                    |  |
|                   | <b>Risk Level - High</b>   | <b>Delay Length - Long</b>   |  |                      |  |
| Simulation Models | De-bugging Time Forecasting Difficulties - The majority of the simulation has now been completed with the injectors now to be tested.  | MIN One Day, MAX One week  | Trouble-shooting is necessary since the problem can not always be pin pointed and these models will have to be created by our group, not from other models.  | X                    |  |
|                   | <b>Risk Level - Low</b>  | <b>Delay Length - Long</b>   |  |                      |  |
|                   | Pspice Models Not Available  | This risk was planned on in the group's schedule and the proto board testing is currently being completed. | Models will have to be tested using proto boards.  | X                    |  |
|                   | <b>Risk Level - Moderate</b>   | <b>Delay Length - Long</b>   |  |                      |  |
|                   | Pspice Not Capable of Modelling Components   | This risk was planned on in the group's schedule and the proto board testing is currently being completed. |  | X                    |  |
|                   | <b>Risk Level - High</b>   | <b>Delay Length - No Delay For Parts which were planned for testing.</b>                                   |  |                      |  |
| PCB Board         | Error in PCB Design  | 1 week + time to notice +cost  | Error in design of ordered PCB board is a monetary and time issue. There is a balance between money and lead time that would have to be decided on in this situation. Our original plan is to purchase with one week lead time. Purchase during winter and being testing to discover any errors. |                      |  |

|                                     |   |                                    |  |   |
|-------------------------------------|---|------------------------------------|--|---|
|                                     | <b>Risk Level - High</b>  | <b>Delay Length - Long</b>         |  |   |
|                                     | Destruction of PCB all PCB boards Printed                                     | 1 week + time to notice +cost      | Purchase of multiple boards will reduce the risk of this occurring. The incremental cost of the boards is low enough to reason for purchase of extra boards.   | X |
|                                     | <b>Risk Level - Low</b>   | <b>Delay Length - Long</b>         |  |   |
| Lab Testing                         | Destruction of Board  |                                    | PCB Board leadtime based on our budget will be one week. As a result we will be ordering extra boards with the initial order since the set up cost is high and the incremental cost for additional boards is relatively small. Populating additional boards will prevent this. |   |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Short</b>        |  |   |
|                                     | Evidence to prove theoretical calculations wrong                              |                                    | Problem diagnosis required and repairs made to PCB design and re-order.  | X |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Long</b>         |  |   |
|                                     | Destruction of Case   | 5 days                             | Diagnosis would be required at this point and evaluation of the current design. Lead time for materials to rebuild is  |   |
|                                     | <b>Risk Level - Low</b>   | <b>Delay Length - Moderate</b>     |  |   |
| Field Testing                       | Insufficient testing  | Customer satisfaction              | Though testing can be reduced in the case that other tasks take longer to complete, this will most definitely result in the product not being used. This result would not qualify as a success for our team.   | X |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Incompletion</b> |  |   |
|                                     | Destruction of Board  | 1/2 week                           | See Above.   | X |
|                                     | <b>Risk Level - Low</b>   | <b>Delay Length - Long</b>         |  |   |
|                                     | Destruction of Case   | 1 week                             | See Above  | X |
|                                     | <b>Risk Level - Low</b>   | <b>Delay Length - Moderate</b>     |  |   |
| O2 Sensor Development/ Verification | Measurements of Oxygen Sensor Inputs/Outputs while under operating conditions | 1 week                             | Further investigation would be needed into determining the input/output waveforms between the Oxygen sensor on the engine and the ECU circuitry.   | X |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Long</b>         |  |   |
| Case                                | Case waterproofing not sufficient   | 3 days                             | Re-apply water sealant and possibility of damage to board. Additional boards being populated.  | X |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Short</b>        |  |   |
|                                     | Overheating of internal components  | 1 day to 2 weeks                   | Revise thermal analysis and increase amount of thermal interface material or alternative solutions to dissipate heat.  | X |
|                                     | <b>Risk Level - Moderate</b>  | <b>Delay Length - Long</b>         |  |   |