



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Elizabeth L. Llanes	Project Number S0799
Project Title Assessing the Performance of the Viterbi Decoding Algorithm Using Convolutionally Encoded L2C GPS Data	
Abstract Objectives/Goals The objective of this project is to assess the performance of the Viterbi decoder used in the transmission of L2C GPS civil navigation messages when the link is corrupted by noise. It was hypothesized that if the input bit error rate into the Viterbi decoder is 1×10^{-6} , then the Viterbi decoder will correct all bit errors and recover all of the original civil navigation messages. If the input bit error rate into the Viterbi decoder is 0.1, then the Viterbi decoder will be unable to correct any bit errors or recover any of the original civil navigation messages. Methods/Materials A program was created in Visual Basic which simulates the link, including the convolutional encoder, the addition of noise, and the Viterbi decoder. The program was executed with varying input bit error rates, and the results were written out to an Excel spreadsheet. Results The input BER was plotted against the output BER and the percentage of civil navigation messages that were rejected. In the graphs, the data was terminated once the percentage of rejected messages reached 100%. Logarithmic scales were used to generate the above mentioned plots because the magnitude of the numerical results spanned several decades, and logarithmic scales are useful for comparing values that are very small to values that are very large. Conclusions/Discussion The hypothesis was proven to be too conservative. The Viterbi decoder performed better than expected. For small values of input bit error rate, the output bit error rate was 0, up to an input bit error rate of 1×10^{-5} , which was an order of magnitude better in performance than was expected. For large values of input bit error rate, the percentage of rejected civil navigation messages did not reach 1 (or 100%) as soon as expected, occurring at an input bit error rate of 0.14 instead of 0.1.	
Summary Statement This project assessed the performance of the Viterbi decoder used in the transmission of L2C GPS civil navigation messages when the link was corrupted by noise.	
Help Received L2C GPS navigation data was obtained from an ITT owned Spirent simulator. Father taught Boolean algebra and Viterbi decoding basics.	