



California Science Center
CALIFORNIA STATE SCIENCE FAIR
2001 PROJECT SUMMARY

Your Name (List all student names if multiple authors.) Kelsey A. Jones	Science Fair Use Only <h1 style="margin: 0;">J0617</h1>
Project Title (Limit: 120 characters. Those beyond 120 will be ignored. See pg. 9) Can GPS Accuracy Be Improved by Repeated Measurements?	Division <input checked="" type="checkbox"/> Junior (6-8) <input type="checkbox"/> Senior (9-12)
Preferred Category (See page 5 for descriptions.) 6 - Electricity & Electronics	
Abstract (Include Objective, Methods, Results, Conclusion. See samples on page 14.) Use no attachments. Only text inside these boxes will be used for category assignment or given to your judges.	
<p>Problem & Hypothesis: A Global Positioning System (GPS) receiver can be used to find your location on earth at any given time. Unfortunately, errors can be present when recording one's location with a GPS receiver. What causes these errors? Can they be filtered out? There are two types of errors in the GPS system. Random "noise" errors are caused by disturbances in the ionosphere and troposphere layers of the atmosphere, and by other random-type disturbances. Bias errors are caused by equipment limitations, and other factors such as atomic clock errors in the GPS satellites. It was hypothesized that if a significant portion of the error was due to random "noise" type errors, then repeated measurements averaged over time would result in greater accuracy of location.</p> <p>Materials and Methods: To test this hypothesis, a GPS receiver and a known location were needed. The procedure for this greater accuracy experiment is as follows:</p> <ol style="list-style-type: none"> 1) Obtain coordinates of an easily accessible survey marker 2) Place GPS receiver on survey marker. Record approximately one hundred measurements over multiple days. 3) Find the average of all the recorded measurements and compare it with the known location's coordinates. <p>Main Results & Conclusions: After recording 102 measurements, the average measurement had an error of 11.678 meters. The data recorded has shown that measurements taken on any one day have had an error as small as six meters, but also as large as eighty meters. From this, it has been proven that by recording measurements over time, the majority of the errors have been filtered out. This result indicates that the majority of GPS errors are due to random "noise" errors.</p>	
Summary Statement (In one sentence, state what your project is about.) My project will determine if averaging the results of many GPS measurements over time would produce greater accuracy of location.	
Help Received in Doing Project (e.g. Mother helped type report; Neighbor helped wire board; Used lab equipment at university X under the supervision of Dr. Y; Participant in NSF Young Scholars Program) See Display Regulation #8 on page 4. Father helped develop graphs, City of San Diego Field Engineering (specifically Chris Rogers) gave coordinates of known position, Craig Williams lent GPS receiver	