



**CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY**

Name(s) Gabe Klapman; Peter Lee	Project Number S0711
Project Title Big Array System: A New Low-Cost Technology for Directional Hearing Aids	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Hearing loss inhibits millions of people around the world from enjoying normal social group interactions. To counter this problem, a new directional hearing aid system is proposed which uses a large two-dimensional non-linear microphone array processed with a digital delay-and-sum beamforming algorithm to maximize the user's ability to understand sound in a noisy environment.</p> <p>Methods/Materials A prototype hearing aid array was built as a proof of concept of this technology. Its directionality was tested at various frequencies of the human voice. A computer physics model was created to analyze different array designs, to verify that the prototype was functioning properly, and to evaluate the capabilities of this technology.</p> <p>Results The array significantly attenuated noises from non-target angles. Results show that an SNR improvement of 6 to 8 dB could be achieved with this technology. Measured results followed the model's predictions closely.</p> <p>Conclusions/Discussion Current top-of-the-line directional hearing aids, delicate and finicky because of their small size, frequently go out of tune and become ineffective. The new technology, however, is robust and does not need to be tuned up. The cost of a hearing aid using this new technology would be only a small fraction of the cost of a current directional hearing aid. If this inexpensive and durable technology were made available, millions of hearing impaired people could benefit.</p>	
Summary Statement An inexpensive and robust technology for directional hearing aids which uses a digitally implemented delay-and-sum beamforming algorithm was developed to help the hearing impaired.	
Help Received Mentored by Michael Lee, Used digital oscilloscope from Semifusion, used parts from Lee Innovations	