

“Autonomous Gyroscopic Ocean-Wave-Powered Generator: Invention of a New Energy Conversion Technology”

Aaron Goldin, San Dieguito High School Academy, Encinitas, CA – 2004-05 National Individual Winner

Abstract: Oceans cover over 70% of the earth’s surface and are its largest energy storage system. Efforts to tap the 2000TWh/yr of available wave energy encounter serious engineering obstacles. If an autonomous wave energy converter (WEC) could be designed to directly convert the power in ocean waves (of varying frequencies and amplitudes), it might overcome difficulties in current WEC technologies.

A prototype WEC, incorporating a gyroscope and electric generator (“Gyro-Gen”), was designed, built and tested. Trials recorded output power versus gyro angular velocity, generator electrical load, and slope frequency. Sea tests were performed. Data show a direct relationship between gyro rate, output power and electrical load. The small prototype autonomously powered the gyro while delivering 0.817W into an auxiliary load. A theoretical model of power output and efficiency was developed that accurately predicted experimental results. This novel configuration applies gyroscopic precessional torque to directly convert the periodic kinetic energy of surface waves into continuous torque that drives a rotary electric generator. Gyro-Gen requires no transfer system used in existing WECs, avoids corrosion and rough-sea-damage, and is scalable to much greater power outputs. This design offers a new approach to a practical, alternative, renewable energy generation technology.

“The American Sign Language Translator”

Ryan Patterson, Central High School, Grand Junction, Colorado – 2001-02 National Individual Winner

Abstract: Many people in the world cannot speak because of problems such as hearing impairment, abnormalities affecting mouth, throat, larynx, or vocal cords, or from psychological or mental causes¹. The majority of these people use American Sign Language to communicate, which makes it very difficult to speak to people who don’t know the language. This paper presents a hardware system to electronically translate the American Sign Language alphabet to text characters, which are displayed visibly for reading.

The prototype translator consists of a modified golf glove and translator/display unit. The glove has ten strain gauges, all of which are read by a microcontroller. The glove transmits this data over a RF link to the portable translator/receiver device, which uses mathematical analysis to translate the hand sign to a written character, which is then printed to the display.

Once the device was finished, it was taught the American Sign Language alphabet. The alphabet was then exercised, while wearing the device, to test its interpretation accuracy. This test proved the device to be a successful sign language translator.

Mentor: John McConnell