Diamagnetic Suspension Seismometer

by

LEAD HEADS

Seis•mom•e•ter (*n*): an apparatus to measure and record actual movement of the ground.

Our team was faced with the challenge to design and construct a seismometer at the beginning of the school term. We received a letter from John Lahr of the US Geologic Survey, and Thomas Boyd of the Department of Geophysics at the Colorado School of Mines wishing for us to design a simple seismometer for public school use within certain constraints. This task developed into a full-scale project requiring hours of research, development, construction, and testing. After fifteen weeks of intensive effort, team Lead Heads has produced a superior seismometer, exceeding expectations.

Outlined in the letter from our clients were numerous constraints placed upon the design and construction of the seismometer. Most importantly was cost. The project could not exceed $150; intended for school use this cost was appropriate to fit into an average school budget. Second, capabilities of the seismometer are crucial. It must detect an earthquake of magnitude six or greater from any distance on the surface of the earth with a period from one to twenty seconds. Another major constraint placed on the design is recording data. The seismometer must be able to transfer an analog signal through an AD converter, filter, and amplifier to any PC with the appropriate software. Other less important specifications necessary for the design of the seismometer were construction and safety. The Globe program intends to use the design for schools across the nation and world from kindergarten through college. Therefore it is necessity that any school teacher or student with little or no mechanical ability be able to construct the entire apparatus from singular components. Safety also becomes an issue if the seismometer is placed in a school where small children will have access to it. Following these constraints, the Lead Heads have created a top-quality, affordable solution.

Named the diamagnetic suspension seismometer, this design offers affordability, accuracy, originality, and sheer interest. Total cost for the diamagnetic suspension seismometer is approximately $75.00 depending on local costs and alternative sources. The most common alternative to the diamagnetic model is known as the Lehman model. This simple contraption of pipes and beams will cost in excess of $100. Schools are never looking to spend more money than they must. The diamagnetic suspension seismometer also offers the accuracy and sensitivity of the higher priced seismometers. For a fraction of the cost, this design detects very light movements of the earth. It can then transfer the data quickly to any PC with Amaseis software by measuring small differences in voltage output.

The Lead Heads' diamagnetic suspension seismometer also offers that which few other teams do: originality. The basic Lehman model has been replicated numerous times by other teams to yield continual results. The price and sensitivity of the Lehman is unable to rival that of the diamagnetic seismometer. The sheer interest in the design doubles this effect. The Lehman model is a system of pipes and beams that swing over a magnet producing a measurable difference in voltage. Unfortunately this model produces much friction and loses sensitivity. The diamagnetic suspension model on the other hand produces excellent results. As the title indicates, this model utilizes the diamagnetic

properties of common pencil graphite with a few powerful magnets. The magnets are known as Neodymium Iron Boron (NIB) magnets and are some of the strongest produced. These aligned in two columns produces a large enough repelling magnetic field that a rod of graphite will actually levitate above them. Simply observing a "magically" floating object is enough to spark the interest of any person. This system also has little if no friction to disrupt data. Coupling this levitating piece of graphite with an LED and photo resistor on separate circuits minute differences in voltage are converted into a digital signal and read on any PC. The entire design can operate safely around small children needing little maintenance and is built easily in little time.

Cost and sensitivity, the two major constraints on the design of a school seismometer, have been achieved with the diamagnetic suspension seismometer. This system designed and built by the Lead Heads overtakes the competition. No Lehman model can reproduce the cost and sensitivity of which a diamagnetic seismometer is capable. Each team member completed his or her subsystem to assist the overall design and functionality of the project. Clearly our project is superior and we've enjoyed working together to produce this.

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