

Busking to the Stars – Inspiring Young People Using Simple Physics

J. Carter (1), G. Guymer (1) and the Aberystwyth Physics Buskers

(1) Institute of Mathematical and Physical Science, Aberystwyth University, Aberystwyth, Ceredigion, SY23 3BZ (contact jac08@aber.ac.uk)

Abstract

A new outreach initiative based at Aberystwyth University is described – the Aberystwyth Physics Buskers. Some examples of the demonstrational tricks they perform are outlined, as well as the scientific lessons that can be taught using them. The Buskers have busked in a variety of settings, and have won an award for one of their performances.

1. Introduction

In October 2008 outreach training was organised for Aberystwyth University undergraduate physics students, resulting in a trained, CRB (criminal record background) checked troupe of enthusiastic, confident physics ambassadors. Styled “Physics Buskers”, they are now active in outreach, and have performed for groups of visiting schoolchildren, and have also visited schools.

The aim of the Aberystwyth Physics Buskers is to “first make you amazed, and then make you think”. They perform a range of simple physics tricks using mostly everyday materials, and then change the level of scientific detail in the explanation depending on the age of the target audience (which varies from session to session).

The coordinator of these activities (the Main Author) is a PhD student in Lunar Physics, so a lot of the basic science shown is explained in terms of how it can be used for space travel. Aberystwyth's Institute of Mathematical and Physical Sciences (IMAPS) puts a lot of emphasis on space physics, so this enthusiasm for space also shows in the other performers. Some principles relating to space that are taught through these exercises include rocket propulsion, gyroscopes, air pressure and vacuums, and sound as vibrations (or why “in space, no one can hear you scream”).

2. Activities

2.1 Example 1: “Whirly tubes”

A whirly tube is a meter long length of corrugated plastic which when swung around in the air emits a pleasant note (Figure 1). The speed the tube is rotated determines the pitch, with higher frequencies of sound at faster rotational speeds.

A typical demonstration would see children whirling the tubes to see who could get the highest note. They would be challenged to see if they could tell what makes the noise – is it the air inside or outside of the tube? How can we test this? Older children can then be told about resonant frequencies and harmonics.



Figure 1: Two “whirly tubes”. They are capable of producing up to four different notes, depending on the speed of rotation.

2.2 Example 2: “Rocket propulsion”

Rocket balloons are a quick, cheap and impressive way of demonstrating Newton's 3rd law, and of showing the basic principles behind rocketry (Figure 2). In the busking kits there are also balloon propelled cars (which the children involved can race against each other), and helicopters, which force the

expelled air out through the propellers, creating rotation and therefore upthrust.



Figure 2: A rocket balloon, inflated. When released, it shoots forward with a random curvature to its flight.

This unpredictability, coupled with the loud screeching noise, makes the audience jump!

There is lots of scope for interaction and participation with these activities. They can range from races of balloon cars, to competitions to see who can shoot rocket balloons the furthest. A discussion of the relatively simple principles behind rocket thrust can lead into more advanced topics. Why, if the principle is so simple, do we have the phrase “it's not rocket science”? How are real rockets propelled? What makes it so complicated, and so expensive, to get into space?

2.3 Example 3: “Vortex Machines”

Vortices are very impressive artifacts, and can produce wonder in an audience. One simple way is to join two bottles together, and spiral water from one to another. The addition of small objects (“boats”) and food colouring can make for an impressive whirlpool. The bottle connectors are very cheap to buy in bulk, and are given away by the Buskers as prizes for volunteers.



Figure 3: A Physics Busker demonstrating an “Airzooka”. This old, much repaired model was replaced using the money won at the Aberystwyth Science Week event.

Another way of producing a vortex is with a vortex cannon, or an “Airzooka” (Figure 3). These can provide cheap thrills by shooting the audience, or can be used by volunteers in shooting ranges, Mexican standoffs or duels. With the addition of a smoke machine, the fabulous toroid rings of air it produces can be seen, and these travel for up to 50 meters.

3. Activities undertaken and results

Each busking kit is easy to transport, and can be used by a single person or by a group of buskers. The Buskers have visited several schools with the kits, and these visits have varied in nature – in one, a talk was given and the busking kit was used to create a series of hour long sessions. In another visit, elements of the kit were used to create bridge-building and musical instrument challenges, while the rest of the kit was used to fill in time around these bigger, more structured activities.

The largest busking operation undertaken was at Aberystwyth University Science Week, a three-day long fair showcasing different areas of science. The Physics Busker’s stall won first prize for this event, and the prize money (£200) was donated back from the individual buskers into the equipment fund. This money will be used to buy consumables (balloons, kebab sticks, paper and card), and also for getting new equipment to demonstrate different principles. The latest acquisitions include bottle pumps for demonstration of air pressure, and a miniature smoke machine to show air vortices more clearly.

In time the hope is to build on these early successes, and build a student outreach team that will renew itself with each yearly intake, and continue to expand and grow in the future.

Acknowledgements

The mostly undergraduate students who make up the Aberystwyth Physics Buskers make the whole program possible, not only by donating their time but by supplying endless amounts of imagination and enthusiasm for communicating science.

Steven Ferne has been very helpful with advice and support, and by loaning us equipment from Infinity, the department’s outreach team. The late Tudor Jenkins also showed enthusiasm for Physics Buskers, and freely lent equipment and practical advice in the early days of the project.