

**The Aberystwyth Physics Buskers: An ongoing public outreach scheme.** J. A. Carter<sup>1</sup> and M. J. Vickers<sup>1</sup>,  
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**Introduction:** In October 2008 outreach training was organized 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 in the local area.

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 scheme therefore increases the level on enthusiasm for science in the audience members, and also benefits the undergraduate performers by allowing them to develop their communication skills.

The coordinator of these activities (the first author) is a PhD student in Lunar Physics, so much 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”).

**Funding and Organization:** The initial training was organized by IOP:Wales, and was paid for by HEFCW as part of the Stimulating Physics in Wales initiative. Money for new equipment and a further training session was later received after a successful bid for a Beacon for Wales funding grant, with the assistance of the West and Mid Wales Widening Access Partnership, which is led by Aberystwyth University's Centre for Widening Participation and Social Inclusion. The scheme is supported by STEMNET, which supplies the CRB checks and insurance for the buskers.

Initially the scheme was coordinated by the lead author, but to ensure continuity a new system was implemented. The Physics Society at Aberystwyth arranged for the election of two new committee members (outreach officers) to organize busking visits and trips, and to maintain the equipment. The aim is that this arrangement will be passed on from year to year, keeping the busking scheme alive long after the original organizers have left.

**Activities:** *Example 1: “Sound tubes”.*

A sound 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: A busker demonstrating a sound tube. They are capable of producing up to four different notes, depending on the speed of rotation.

*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 being launched by a busker and a volunteer “rocketeer”.

There are many opportunities 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?

*Example 3: “Vortex Engines”*

Vortices are very impressive artifacts, and can produce wonder in an audience. A simple way to produce one 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” to a group of excited children. There is often competition amongst the audience as to who gets “shot” the most.

Another way of producing a vortex is with a vortex cannon, or an “Airzooka” (Figure 3). These can provide 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 toroid rings of air it produces can clearly be seen, and these travel for up to 50 meters.

**Sessions 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 many schools (secondary and primary) 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 Buskers’ 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 was used to buy consumables (balloons, kebab sticks, paper and card), and also for purchasing 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.

The program is growing, with a recent new intake of enthusiastic undergraduates. The demand for visits from local schools is growing as word of mouth spreads, and the buskers are also branching out into community groups, such as Scouts, Guides and home schooling collectives. The buskers have also performed at larger local events, such as summer play-schemes, the Wrexham Science Festival and the Urdd Eisteddfod (a local cultural festival).

Physics busking has received consistently high approval ratings from both the children and their teachers/leaders. It has also helped to develop the communication skills of undergraduate physicists, and promote responsibility and personal growth.

**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.

**Links:**

<http://www.iopwales.org/>

<http://www.hefcw.ac.uk/>

<http://www.stimulatingphysics.org/wales.htm>

<http://www.engagingwales.org/>

<http://www.aber.ac.uk/en/widening-participation/>

<http://www.stemnet.org.uk/>