

# BBC, University of Salford

## Examining the best way to incorporate 3D audio in broadcast

### About the Project

It started with mono sound. Then came stereo, and following on from that, surround sound. What comes next is the subject of the PhD project by the BBC and University of Salford.

The trend in the broadcast industry over several decades has been towards improving sound quality and providing a more immersive sound experience. Early radio broadcasts were in mono, attempting to reproduce complex sound-fields from a single loudspeaker. Contrast that with today's high definition television (HDTV) broadcasts, which with a correctly configured 5-channel speaker array are capable of surrounding the listener with sound in the horizontal plane.

With television screen sizes increasing dramatically, the overall sense of viewer immersion is improved by extending the audio element of broadcast to provide 3D sound, where sound can arrive at the viewer from any direction. The challenge is how to record, store and deliver audio signals in order to reproduce an immersive and engaging three-dimensional sound experience for the maximum number of listeners.

One way is using ambisonics, a technique originally developed by UK researchers in the 1970s. By recording sound using a complex microphone array, 3D sound can be transmitted using as few as four channels, allowing low complexity and cost effective delivery. While

ambisonics has a number of benefits, existing systems need refining before they are suitable for broadcast applications, and this PhD project aims to analyse and optimise ambisonic solutions for broadcast. Additionally, ambisonics needs to be carefully compared with alternative approaches to delivering 3D sound, such as NHK's 22.2 extended surround system.

**“Indications are it's going to be a successful relationship, with more publications and solutions to the problems we're looking at.”**

Chris Dunn, Senior Technologist,  
Research & Development, BBC Future Media

Historically, research and development has been a key component of the BBC's work, and an audio research partnership has recently been established between BBC R&D and five UK universities.

One of those partners is Salford University, who have specialised in audio and acoustics research for many years. Given the BBC's recent move to MediaCity UK in Salford, Salford University is an ideal partner both geographically and academically.

### Fast Facts

**Sector:** Radio and TV

**Funding Source:** EPSRC ICASE

Awards

**Total Project Value:** £91,838

**Duration:** October 2011 – April 2015

**Market Impact:** The goal of the PhD is to make strong recommendations about the future of sound broadcast.

**Creative Industries KTN input:**

CIKTN was allocated studentships by EPSRC, and shortlisted the six successful applications.

### Benefits of Funding

The project funding was arranged by BBC R&D and, although small in terms of industrial research budgets, substantially improves financial aspects of the PhD studentship.

The additional funding provided by the BBC removes financial barriers common to PhD-level research - for example, by allowing the student the freedom to travel to important international conferences, and to acquire experimental equipment as needed. The partnership also

allows the student to gain valuable experience working at the BBC research laboratory in Salford Quays.

### Results

Just seven months in and the PhD student's first publication has already been presented at a major conference in China, detailing a simulation model developed to obtain insights into the behaviour of ambisonic reproduction. Ultimately it is hoped the project will help answer a set of key questions regarding ambisonics for broadcast applications, and provide understanding of requirements and capabilities of immersive audio technology from the audience perspective.

Even though practical 3D audio systems might not be seen in large numbers until the next decade, the aim is to be in a position to make recommendations about the future of sound broadcasting, something relevant to anyone with a radio, television or games console. BBC R&D is confident this work will help provide answers to some of the problems they are working on in the field of 3D spatial audio.



**An Eigen Mic, a spherical microphone that can be used for recording spatial audio signal.**