**The Song for Lighthouse Bill**

**Compositional Methods**

**Biomusic** is a form of experimental music which deals with sounds created or performed by non-humans. The definition is also sometimes extended to included sounds made by humans in a directly biological way.

Biomusic can be divided into two basic categories: music that is created solely by the synthetic animal (or in some cases plant), and music which is based upon synthetic animal noises but which is arranged by a human composer. Some forms of music use recorded sounds of nature as part of the music, for example New Age music uses the nature sounds as backgrounds for various musical soundscapes, and ambient music sometimes uses nature sounds modified with reverbs and delay units to make spacey versions of the nature sounds as part of the ambience.

The music for Lighthouse Bill is a combination of ambient in situ recordings enhanced with tuned synthesis. This provides each programme a musical bed which will be manipulated by the more traditional compositions and instruments from the musicians.

**Convolution Reverb**

In audio signal processing, convolution reverb is a process used for digitally simulating the reverberation of a physical or virtual space. It is based on the mathematical convolution operation, and uses a pre-recorded audio sample of the impulse response of the space being modelled. To apply the reverberation effect, the impulse-response recording is first stored in a digital signal-processing system. This is then convolved with the incoming audio signal to be processed. The process of convolution multiplies each sample of the audio to be processed (reverberated) with the samples in the impulse response file.

Real space simulation**:** The primary goal of a convolution reverb is to sample real spaces, in order to simulate the acoustics of the sampled space. A straightforward and simple mono example of capturing an impulse response would be to set up a microphone in a concert hall and to place the microphone in the centre of the auditorium. Next, produce a very brief pulse (often an electric spark) of sound, and record everything that the microphone picks up, which includes both the original sound and the response of the room to it. The recorded take would then be cleanly edited and loaded into the convolution processor. This convolution can be applied as part of a signal processing chain.

The convolved reverb used in Lighthouse Bill was recorded at Ardnamurchan Lighthouse and comprised both sweep impulses (ideal for surround sound) and pistol shot ( stereo).They were used to place the excerpts from Tony Parker’s “Lighthouse”.

**Hydrophonics**

Just as microphones are used to listen to sound in air, devices called hydrophones are used to listen to sound underwater. Microphones convert sound in air into electrical signals. The electrical signals can then be amplified, recorded, played back over loudspeakers, and transmitted over telephone lines. The electrical signals can also be used to measure the characteristics of the sound, such as amplitude and frequency. Similarly, hydrophones convert sound in water into electrical signals that can be amplified, recorded, played back over loudspeakers, and used to measure the characteristics of the sound. Hydrophones listen to sound, but do not transmit any sound.

Humans were listening to underwater sounds with air tubes as early as 1490, when Leonardo da Vinci wrote about it. It wasn't until the mid to late 1800's that the technology was developed to convert acoustic signals into electrical signals, however. This technology advanced enough that by World War II, British, French, and American scientists were using echo-ranging to locate icebergs and submarines. The ability to locate submarines was invaluable against the German U-Boats.

Most hydrophones are made from a piezoelectric material. This material has a special property that allows it to produce small electrical signals when squeezed, that is, when it is exposed to pressure changes. Because sound is a pressure wave, it can be detected by a piezoelectric element. Under the pressure of a sound wave, the piezoelectric element flexes and gives off electrical signals. These electrical signals can be recorded and later analysed with computer programs to determine the properties of the sound wave, including amplitude a Some hydrophones, called omnidirectional hydrophones, record sounds from all directions with equal sensitivity.

Other hydrophones, called directional hydrophones, have a higher sensitivity to signals from a particular direction. Directional receivers are most often constructed using a number of omnidirectional hydrophones combined in what is called an array. Directional hydrophones are typically used in systems for locating and tracking objects and frequency.

Hydrophones are specially designed for underwater use. They are normally encased in a rubber boot to provide protection from seawater. The Hydrophones for Lighthouse Bill were mounted on a purpose built floating rig and lowered from the support vessel.