

EQUIPMENT

Ursa Major Space Station

Mel Lambert



There are several methods of obtaining echo – the repeating of an original signal after a short time delay – and reverberation – where a series of repeats of the original signal is heard, each repeat having a lower level than the one before as the time delay increases. Such methods include the use of an actual echo chamber complete with speaker and mics to produce reverb, or the use of a tape delay to provide repeats. But apart from the omnipresent EMT echo plate, which uses a steel sheet to simulate the reflection of sound waves in a room, there has until recently been little possibility of producing a compact reverberation unit that really 'sounds like a room'. The advent of digital technology made such units possible, but until now they've been very effective, but costly. Now a small American company, Ursa Major, has succeeded in producing a digital reverb/delay unit that sounds good and is within the reach of the smaller studio's budget – the *Space Station*.

At the heart of the *Space Station* is a digital 'random access memory' (RAM) which provides a maximum delay of 255ms. Because signals are stored and 'manipulated' in digital form, there is

very little degradation between the sound being fed into the RAM and its emerging a maximum of a quarter of a second later. However, the contents of the memory can be 'extracted' at a number of different points, referred to by the manufacturers as 'taps'. One set of delay taps is used to provide the signals that mimic the reflections of the simulated 'room' whose reverb pattern is being created. These delayed sounds are summed internally and fed back to the input of the memory to give a variable decay time from zero (no feedback) to around 3.5s. Alternatively, in the echo mode, a single tap can be taken at a variable delay time, and fed back in varying proportions to give a bizarre range of effects from flanging (short delay), to flutter-echo similar to that achieved with a long tape loop. Another, totally independent, set of eight 'audition' taps as they are known, allow the reverb or echo pattern circulating in the memory to be 'examined' in a large number of ways, dependent on the sort and size of room – or special effect – to be created. Or, just as useful, the feedback can be reduced to zero (no reverb pattern) and the various audition taps used as conventional delay lines, albeit with limited control over their individual delay times.

Because of a current patent applica-

tion, the *Space Station's* designer, Christopher Moore, is naturally reluctant to give away too many details of how he has randomised the output from the more than a dozen or so reverberation taps – necessary for a good sound – but the results are certainly very realistic. A wide range of 'stereophonic' reverberation patterns corresponding to different room 'sizes' can be synthesised using varying amounts of the audition taps, along with a selection of other delay-related effects. A brief rundown of the degree of control possible with the audition taps will give some idea of the elegant features that Chris Moore has incorporated in the *Space Station*.

It's all in the memory

The eight audition taps are arranged in four pairs, the output level from each pair being controlled by a single ganged potentiometer. (A glance at the photograph of the *Space Station's* front panel will give a good idea of the control layout.) Odd-numbered taps are summed and fed to the left output, while even-numbered taps go to the right output. A 'direct' control adds equal amounts of the input signal to both outputs. Thus, in a nutshell, the audition taps set up a way of 'listening' to the reverb or echo pattern within the memory, while the special reverberation or echo taps, when fed back, determine the kind of reverberant sound that exists in the random-access memory. By using varying mixes of the direct and four audition controls, different proportions of direct to reverberant sound can be set up, as well as combinations of early-arriving (low-numbered taps) to later-arriving reverberation (taps 7 and 8). The number of possible permutations is literally infinite.

Delay times of each audition tap are determined by a group of eight pushbuttons, giving a total of sixteen possible settings. These are arranged in four basic families of delay 'programmes': 1 **Rooms**. These four programmes – known as Room 1, 2, 3 and 4 – set the delay time of each tap to progressively longer and longer settings. For example,

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Room 1 sets taps 1 and 2 to around 20ms, 3 and 4 to 40ms, 5 and 6 to 60ms, and 7 and 8 to 80ms. A slight difference of a millisecond or two is also introduced between pairs of taps to give a different sound at each of the left and right outputs, and hence produce a pseudo-stereo – but nevertheless very realistic – effect. Altering the relative settings of each pair of taps enables different size rooms to be simulated: a ‘small’ room will give more early delays from taps 1 and 2, while ‘larger’ rooms contribute more later delays from taps 7 and 8. Rooms 2, 3 and 4 offer progressively longer maximum delays at each audition tap, resulting in even larger sounding rooms to be created. (For Room 4, the delay on taps 7 and 8 is set to the maximum delay of 225ms).

2 Combs. These four programmes are labelled 8, 10, 22 and 38, a number that refers to the delay setting in milliseconds between each set of audition taps. The resultant effect is one of comb-filtering (hence the name) as the outputs from combinations of taps cause cancellations at certain frequencies, and is similar to certain types of ‘static’ flanging. (It’s referred to as a ‘comb’ because of the pattern of periodic ‘nulls’ and ‘peaks’ it creates across the sound spectrum, spaced at frequencies related to the reciprocal of the delay time.) Since the delay times are defined accurately and are very stable, the nulls are particularly deep which, combined with the 5-way mixer (direct plus four audition controls), allows a wide range of effects to be set up.

3 Delay Clusters. These five programmes are based on a cluster of delays (hence the name) whose ‘nominal’ or centre delay time gradually gets longer. For the first programme, known as ‘Fatty’, the delay time of all audition taps

is set to within a millisecond or two of a nominal 30ms. At such short delay time differences it is virtually impossible to detect any audible separation between the input and repeats. However, the various contributions from each tap enhance the sound and make it appear ‘larger’ with more ‘depth’. Delay times have been chosen at pseudo-random intervals to prevent comb filtering occurring between pairs of taps. The second programme, ‘Cloud’, offers a group of delays centred around a longer setting, and are just about audible as repeats. Again various mixes between direct and the audition taps can be used to fill out and enhance the sound. ‘Slap 1’ and ‘Slap 2’ feature much longer nominal delay settings, and result in distinct ‘slap’ echoes but with a ‘fullness’ courtesy of the eight interleaved audition taps. ‘Echo’, the last programme in this family, produces a single repeat at about 250ms, again with eight delay settings based around this for added ‘impact’.

4 Space Repeat. This family comprises three related effects that provide for two, three or four repetitions of a sound, with even spacing from zero to 255ms. Each repeat is assigned to either left, right or ‘centre’ output in the following three sequences: left-right; left-centre-right; and left-right-left-right. All eight taps contribute to the effect, allowing extra fullness on each repeat.

Thus a reverberant or variable echo pattern can be set up in the memory by means of the multiple reverb or single echo tap and associated feedback control, and then ‘extracted’ with the audition taps. In addition, a pushbutton enables a long or medium reverb pattern to be pre-selected using different combinations of reverb taps. The ‘medium’ setting gives normal build-up and a smooth decay,

while ‘long’ gives a slower build-up and a longer decay time. Also a pair of low and high-frequency equalisation controls are situated in the signal path just before the *Space Station*’s memory. These enable a ‘lively’ reverb sound to be simulated by attenuating the bass frequencies or, at the other extreme, yield a ‘dead’ sound by cutting back the top frequencies.

The Acid Test

With so many possible combinations of reverb, echo and special effects that can be created by this remarkable device, it would be physically impossible to describe them all. Instead, I’ll confine my remarks to one or two that were particularly pleasing, and recommend that to really appreciate the staggering range of effects you must try it out for yourself.

Room effects, particularly Rooms 1 and 2, sound very realistic on vocal, acoustic guitar and piano, while Room 4 gives an *outrageous* effect with long decay time. Vocals almost become unintelligible, while slow lingering brass tracks pick up a lot of ambience and depth. Both Fatty and Cloud effects are very useful for fleshing out vocals as well as giving almost an ADT/chorus effect on long, slow electric guitar tracks. Comb programmes, especially the longer 22 and 38ms delays, sound very nice on drums because of the wide frequency range these instruments are capable of producing (and which show off the large number of nulls and peaks to good effect). Use of the shorter combs, on the other hand, results in a rather harsh ‘metallic’ sound that needs to be used carefully. Space Repeats are obviously more suitable only for occasional use. Since the repetition rate is fixed at one of three values, it would be easy to become bored with the effect rather quickly.

For all types of effect – but particularly the Room and shorter Cluster programmes – the stereo spread provided by the slight differences in delay time between taps feeding left and right outputs is *very* life-like. An obvious test is to listen to a single note as it dies away in the largest size room with a full 3.5s decay time. Under these somewhat extreme conditions, the decay is smooth and very natural – apart from some slight ringing at the end of the reverb pattern, just before the sound dies away completely. It's only noticeable on sharp, percussive notes or with pure tones (from a voice, for example) and would be lost in all but the most demanding mixes.

Bandwidth at *all* delay settings is a very reasonable 7.5kHz; a figure that could only be bettered by digital reverb units costing many times more than the *Space Station*. Obviously certain instruments suffer from this somewhat restricted bandwidth – mainly cymbals, female vocals and certain string sounds – but this isn't too noticeable after the reverb and echo is added to the overall stereo mixdown.

Layout of controls on the front panel is very good indeed, making it easy to find the required knob or pushbutton. An input level control and associated series of peak-reading LEDs ensure that the digital memory isn't overloaded, and is followed by a pair of EQ shelving controls offering up to 10dB of cut at 20Hz and 7kHz (to tailor the feedback pattern for 'dry' or 'bright' rooms). Delay time in the echo mode (selectable by a single 'reverb/echo' pushbutton) is set with a control calibrated from zero to 255ms, plus a 'push-to-set' button. This arrangement means that echo delay time cannot be varied continuously in the normal sense of the word, but it isn't a severe limitation. A 'mixed/dry' pushbutton enables instant checks to be made between the input signal and the direct-plus-reverb/echo pattern.

God's imperfection

As Christopher Moore points out in the *Space Station* manual, remarking that American Indian craftsmen are said to have always left a defect in their

handiwork – whether a bead of the wrong colour in a bracelet, or a miswoven section of a basket – 'in order not to encroach upon God's perfection', there are one or two effects that do have their faults. In particular, he acknowledges the presence of the 'ringing' effect at very long reverb decay times, and a little flutter or noise, occasionally audible on pure tone, or acoustic piano, but again only with long decay times. With no feedback – pure delay – these anomalies are totally absent.

Comments from Others

At my invitation, Chris Moore gathered the following field comments from three studios owning a *Space Station*:

GlenSound, a 24-track Stockholm studio, use their *Station* as the main reverb for electric keyboards. The studio also uses it as the pre-reverb delay and equaliser for an EMT 140 plate, with the *Station's* own reverb adjusted to lengthen the apparent reverb time of the EMT. Comb programmes are used with and without feedback for 'unique and very stereo' signal processing. On the negative side, GlenSound note 'occasional flutter occurring near the end of some of the longer patterns, when the reverb is in the clear; but this is not a serious problem when mixed into a track.'

Productions by Tree, a radio programme and commercial production studio based in Southern California, find a variety of exciting uses for the *Station*. It creates a space around announcers and voice-overs: the Fatty delay programme is their standard way to process an announcer's voice for added punch and presence, using the built-in EQ to high-pass the delays. For stereo mixes, Tree use short patterns of early reflections from the audition delay taps to create a wider stereo image and depth, balancing and panning the delays inward of the stereo reverb. The echo feedback feature is an 'easy way to set up tape slap, with very clean multiple repeats superior to tape.' Special effects are used at times for sequences within programmes.

A major 24-track Los Angeles studio, which doesn't lend its name in print to specific products, has just begun work with its *Station*, and finds that 'when used in conjunction with an EMT plate or live rooms it can enhance the psychoacoustic

impression of the depth present in the reverb signal'. Another studio uses a *Station* set for Space Repeats in conjunction with an Audio & Design S23 stereo panner on its outputs to create moving, ricocheting pseudo-stereo sounds that are 'truly awesome on strings and percussion'. The same set up can create a separate moving space on background voices and distant tracks.

Ursa Major

They describe themselves as 'a new company, dedicated to producing useful, lasting products of superior value for professional audio users, and to building a satisfying, equitable workplace for its people. To this end, control and ownership of the company will be kept internal, among the workforce, and growth will be financed through loans, strict credit terms and sweat. We have our heads and hearts in the clouds, and our feet firmly on the ground. By daring to turn our dreams into realities, we strive to grow and prosper.'

I can do no more than give you their address: Box 18, Belmont, Ma 02178, USA, Tel: (617) 489-2039. The *Space Station* is available in the UK through Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH, Tel: 01-580 4314.

Technical Specifications

Input: active differential, 10kohm high pin, 20kohm low pin; XLR connector

Output: Single-ended, source resistance 47 ohm; left and right on XLRs.

Frequency response*: 20-7.5kHz, ref 1kHz at -3dB.

Dynamic range*: 80dB minimum, 20Hz-20kHz bandwidth.

Total harmonic distortion and noise* 0.1% typical, p.2% max at 1kHz.

Size: 19 x 5½ x 9in.

Weight: approx 10lbs.

*Measured from input to output, any single audition delay tap; delay-mode only. ■