RYCOTE LYRE SUSPENSION

Studio microphone suspensions are often surprisingly costly affairs but Rycote's new 'lyres' look set to redefine the market. Hugh Robjohns MIBS reports.

For a great many years now Rycote has pioneered the windshielding and shock-mounting of microphones for film and TV location sound applications. Over the years, though, countless potential customers have asked the company to consider making suspensions for studio microphones – myself included! Of course, Rycote never has... until now. The change of heart is all down to a stunningly clever (and carefully patented) invention by Chris Woolf MIBS – Rycote's technical consultant and an exceedingly clever bloke.

Regular readers of *Line Up* will no doubt recall a review in the June/July 2007 issue (available on the *www.lineup.biz* website) of Rycote's latest location windshielding system, the S-Series. Among its many clever innovations, the S-series features a unique mic suspension design, referred to as a 'lyre web.' This is essentially a curved plastic 'W' shape which provides superb control of vibration and does so astonishingly cost-effectively. Being made of Hytrel (which Dupont describes as, 'a thermoplastic with polyester elastomers to provide the flexibility of rubbers, the strength of plastics, and the processability of thermoplastics'), these clips are virtually indestructible. Furthermore, there's no need to replace cracked rubber O-rings or stretched elastic cords! Like all the most brilliant ideas, the 'lyre' design appears to be incredibly simple and so obvious when you see it, that you wonder why no one has done it before!

Lyre, Lyre!

This basic lyre design lies at the heart of Rycote's new range of studio shock mounts. The initial offerings are designed to support the ever-growing number of miniature and compact studio microphones, but as the range expands over the coming months additional models will cater for larger mics, and hopefully even large diaphragm models eventually – the fundamental design is that flexible! Optimisation for microphones of different sizes and weights essentially comes down to altering the length, shape and thickness of the lyre's arms.

I was sent a box of beta test samples for this 'preview.' They are late prototypes and there may be a few detail changes in response to comments from Rycote's invaluable real-world testers – but production versions should be available almost as soon as you read this review. Initially, there will be two sizes of lyre, and two sizes of mounting bar. The smaller 'InVision' lyre measures 43mm wide by 40mm high, while the larger 'Standard' version is about 70mm wide to accommodate heavier mics. Additionally, there are several different sized clips moulded onto the two lyre sizes. The smallest is 9.5mm (although this can be reduced further with a plastic sleeve), and there are also 20mm and 30mm clips. A more flexible universal design accommodates diameters between 19 and 25mm.

The lyres are mounted on a Hytrel bar, the end of which couples to a compact 3/8-inch threaded stand mount adapter. A clever curved clamp arrangement is built into the stand adapter, holding the mic cable absolutely solidly to isolate vibration. It can accept cables between about 2.5 and 8mm; I didn't believe it would stretch to 8mm, but it did without any trouble. After removing the big cable, I slipped in a lavalier mic cable and it clamped that just as firmly.

Rycote has combined these components – the stand adapter, the mounting bars, and the lyres – to create eight distinct variations, and at a startlingly low price (see box). The first three models use the smaller InVision lyres and are intended for static stand mounted applications. The INV-1 provides a pair of 9.5mm clips with the reducing sleeve, mounted on a standard bar. This arrangement will accommodate mics like the AKG C747, DPA's 4000 series miniatures, and Schoeps CCM and CMC models. The INV-2 uses a 20mm clip at the front with a 9.5mm version at the back to support remote cabled mics like the Røde NT6 and Sennheiser MKH8000. The INV-3 version has two 20mm clips to accept mics like the DPA4021, Neumann's KM100/180 series, Sennheiser's MKH8000 (with XLR module), and so on.

The next three models employ the larger standard lyres mounted on a short bar, and are intended for either static or indoor pole/boom applications – the larger lyre accommodating greater movement. The INV-4 set provides dual 9.5mm clips again, while the INV-5 version has the 9.5 and 20mm combination. Instead of a dual 20mm version, the INV-6 uses a pair of more versatile 19-25mm clips. These will obviously accommodate a wide range of small diaphragm mics, but the short bar length means that mics longer than about 120mm become rather unstable.

The INV-7 model addresses that by mounting the same standard lyres with 19-25mm clips on a longer bar, giving more spacing between the clips and thus better support for longer mics. Finally, the INV-8 model uses a pair of 30mm clips on the long bar for the more rotund and lengthy mics!

Prices

All the InVision mounts are priced at £30 +VAT in the UK.

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Impressions

The InVision suspensions are very clever, very elegant, and extremely effective. Simple comparisons with conventional mic manufacturers' O-ring and elastic shockmounts quickly revealed one of two outcomes. In some cases there was an astonishing improvement in isolation from cable and stand vibrations, and in others the isolation was at least as good. The Lyre's performance is very impressive for the former, and the cost-advantage is equally satisfying for the latter!

Despite looking fragile, these InVision suspensions are roadie-proof – I twisted the lyres inside out and stretched them ridiculously, yet they just reformed in seconds without any sign of stress or damage.

It's not an exaggeration to suggest these InVision mounts are truly revolutionary, and I forecast that in five years' time studio engineers around the world will be talking about putting mics in 'Rycotes' with the same assumed familiarity that location sound recordists have enjoyed for the last twenty years.

Designer's Notes

Microphones are almost as efficient at detecting acceleration as they are at picking up audio, so suspensions aim to allow a capsule to stay still while the support moves. Obviously, if that happened for extreme low frequencies or vast movements it would be impossible to swing a mic on a boom, so suspensions only isolate down to a particular frequency and are optimised for amplitudes in the vibration and minor shock range.

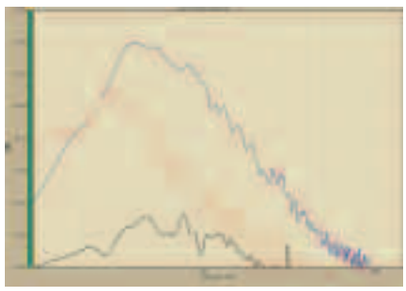
Suspensions all use a springy arrangement that allows the microphone to be displaced, and then exerts a restoring force to return it to the rest point. It will inevitably overshoot and bounce around, but the system should be damped to minimise this. Physics tells us that as the frequency drops the displacement wavelength increases – the suspension has to move further to do as good a job. It also tells us that for any particular mass of microphone and compliance (wobbliness) of suspension there will be a low frequency point at which resonance occurs. At this point the suspension amplifies movement rather than suppresses it; not until about three times the resonant frequency does the system start to isolate properly.

The axis along which a microphone diaphragm moves is the one most sensitive to disturbances. This means that ideal suspensions are most compliant along this (Z) axis but should give firmer control on the horizontal (X) and vertical (Y) axes to stop the mic slopping around.

Diaphragm and 'doughnut' suspensions can work well, but tend to have acoustically solid structures that affect the microphone's polar response. Silicone rubber bands, shock-cord cats' cradles, and metal springs are thinner and more acoustically transparent, but struggle to maintain a low tension (and therefore a low resonant frequency) at the same time as providing good X-Y control and reliable damping. The restraining force also rises very steeply with displacement, which limits LF performance.

X, Y and Z

The Rycote 'lyre' webs rely primarily on their shape to give different performance on each axis. Typically, a 100g force will barely move a microphone 1mm along the (up and down) Y axis, whereas it will move about four times that on the (sideways) X axis. In the critical Z axis, it will move something like 10 times as far.



With a very low inherent tension the resonant frequency can be very low too, and the Z displacement can be vast. Even with small-mass compact microphones, a resonance of <8Hz is possible, which means that microphones can be well-isolated across almost their entire frequency range.

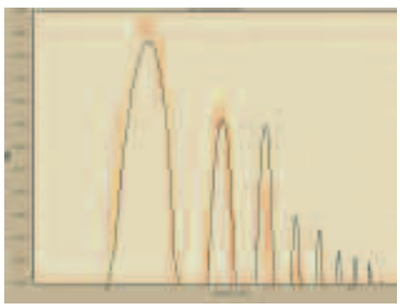
Damping has to be added to metal spring suspensions, and although integral to rubber band versions, is not very easy to control. With the lyre webs, damping can be selected almost independently by choosing a suitable plastic. The Hytrel that Rycote uses not only damps smoothly but maintains its characteristics even down to arctic temperatures. It also has a 'shape memory' that allows it to be tied in eye-watering knots without developing a permanent 'set' – or snapping!

Plotting

Most suspension systems are difficult to 'scale.' Springs and elastic bands become thin and fragile, and the range of softness for rubber and foam is limited. However this does not apply to lyre webs. The tiny InVision suspensions, which are visually unobtrusive, isolate compact and similar sized microphones down to <30Hz, yet are tough enough to be dropped on the floor without risk. A research version has even been built for cigarette-sized microphones using 25mm wide webs without sacrificing performance.

The two graphs show the actual measured performance of InVision lyre mounts. The first shows the transfer function for a Schoeps CCM4 microphone being shaken with pink noise in an InVision mount. The black trace shows the output from the microphone with the shaker operating but not touching the mic at all, and reveals the inherent coupling through air and the building itself.

The blue trace is with the shaker directly coupled to the microphone body to reveal the actual level of vibration input. Finally, the red trace shows the microphone's output with the shaker knocking the bar of the mount – and thus demonstrating the effectiveness of the suspension.



The second graph shows the damping of three different types of suspension (which share roughly the same resonant frequency) after being excited by a 15Hz sine wave. The black trace is a rubber diaphragm mount – seven harmonics (extending beyond 100Hz) are undamped. The yellow trace is a rubber band type of mount with five harmonics apparent (and the lower ones are relatively poorly damped). The red trace is a lyre mount, showing well-controlled damping with only three harmonics detectable.

Chris Woolf