Shotgun roundup

Looking down the barrel of Sennheiser's MKH8060 and MKH8070, Shure's VP82 and three lengths of VP89, and Rode's NTG8, PATRICK MORVLYTH checks out the latest audio weaponry among shotgun and rifle microphones.

I'll challenge anyone to be able to distinguish a hypocardioid from a hypercardioid microphone at three paces, and only the sharp-eyed can separate those two from a pressure omni, but almost anyone can recognise the gun-barrel of an 'interference tube' microphone — revolver-like in the case of a 'short-rifle'; closer to a 12-bore for the 'shotgun'. You will rarely find them in studios but they are the mainstay of TV and film location work, and also frequently used in theatres where their extended pick-up range is valuable.

They are something of a Johnny-come-lately to the microphone family, with the first one appearing barely 50 years ago. First-order directional microphones — that's the basic range of cardioid variants — were fine for music and radio work, but film and particularly TV (which had no time for dialogue replacement) wanted microphones well out of the picture. That meant that the microphone had to be further away than ideal, and recordists soon found they needed what is delightfully (and indelicately) termed more 'suck'.

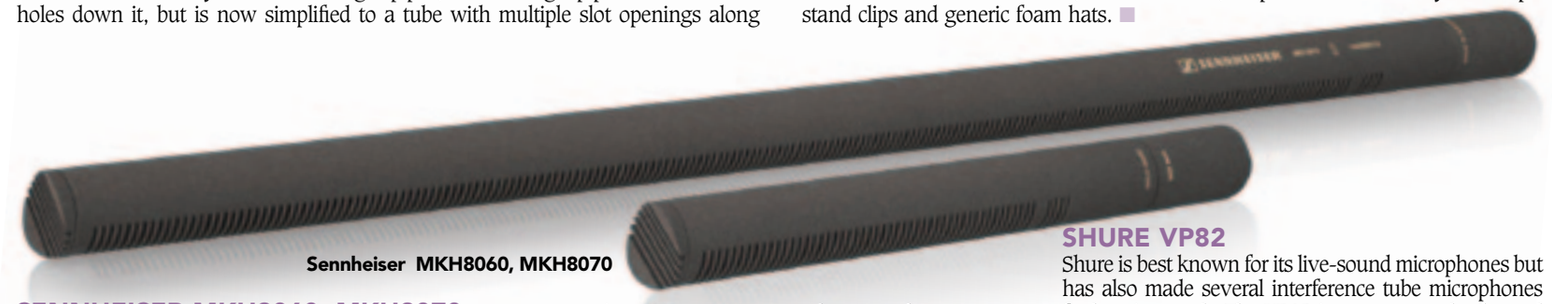
The simple phase cancellation technique used with a cardioid-style pressure-gradient capsule can only yield a maximum Directivity Index of 6dB (an omni is 0dB). That is for a hypercardioid (defined as having a rear null at 110°), or 5.7dB for a supercardioid (rear null at 126°). In everyday language these microphones allow you to double the pick-up distance and still get approximately the same level of forward sound as you would with an omni. To move further away and get a reasonable balance between direct sound and ambience needs something cleverer.

There have been some interesting developments using digital techniques such as the early Audio-Technica AT895 and the more recent Schoeps Super CMIT, but by far the most usual method is the interference tube, which was originally conceived as an array of different length pipes, or as a single pipe with a series of holes down it, but is now simplified to a tube with multiple slot openings along its length. Sound from directly in front (0°) goes straight down the tube to the capsule at the far end. Off-axis sound hits each slot at an angle with a slightly different timing and thus experiences a degree of cancellation on its way down the tube. This is totally dependent on the angle of incidence and the wavelength of the sound, so the results vary greatly across the audio spectrum. Above the critical length where the tube can have any useful effect the Directivity Index increases by about 3dB/octave. For practical microphones the DI can reach as high as 15dB, but only for very high frequencies. Interference tubes are most often added to a hyper- or super-cardioid capsule with its underlying DI of ~6dB so a 200mm tube doesn't have any useful effect until >2500Hz, and even a massive 800mm one doesn't do much below 1kHz. Thus Directivity Indexes in the speech range only improve to 7-9dBs at best — useful but not as startling as some would imagine.

There are also, inevitably, downsides too. Since the cancellation effects are extremely sensitive to frequency and angle of incidence the off-axis high frequency response of the microphone can be messy. A polar plot usually shows a number of narrow 'starfish' lobes around the main frontal one, and these vary depending upon frequency. Another way of describing that is 'colouration' — interference tube microphones may produce sweet sound on axis but the ambience can be significantly coloured, and this can change very obviously when moving the microphone [see sidebar]. A short-rifle held on a boom in the open can sound good but moving that scene indoors and adding a low ceiling may produce strange, honky results from the reflected sound.

Long tube microphones tend to display the colouration effects at lower frequencies and their characteristic sound is sometimes more obvious as a result, though that isn't a universal rule. They are also unwieldy so they have become less widely used than they once were. However, short-rifles have increased in popularity with the democratisation of video. At the top-end of the range of both successful efforts have been made to smooth the polar response.

Since interference tube microphones are used in awkward locations, and are frequently waved on poles or fitted to wobbling video cameras, they need protection from wind and handling noise to function successfully. Indeed they can be virtually worthless unless proper provision is made. Many manufacturers are aware of this and now include, or at least offer, bespoke accessories beyond simple stand clips and generic foam hats. ■



Sennheiser MKH8060, MKH8070

SENNHEISER MKH8060, MKH8070

Sennheiser has had a very long association with shotgun microphones. The MKH416 has been by far the most widely used short rifle microphone in history, and being not far off 40 has lived longer than most workhorses. The MKH8060 could well be construed as its replacement. It follows in the tradition of being an RF capacitor microphone, which uses the capsule in a low impedance mode. The great benefit of this, for location recordists, is an inherent immunity to humidity — an environmental headache that DC capacitor microphones can never quite avoid. Unlike the 416 the 8060 also makes use of Sennheiser's symmetrical capsule design, which places the diaphragm between two backplates — a technique that minimises distortion. The MKH8070 is essentially the same, but with a much longer interference tube to give greater directionality.

Both microphones are fitted with MZX8000 XLR adapters, which screw onto the body of the microphone, but these can be swapped for remote cable adapters, MZD digital output sections, or allow the insertion of an MZF filter unit.

The MKH8060 is very short — a mere 178mm even with the XLR adapter — and slim (19mm) but quite weighty at 112g. That's significantly more than the 89g of the 251mm Schoeps CMIT or the 71g of the 210mm DPA 4015, both plausible competitors. For use on a boom pole — mass multiplied by extension equals arm ache. The slotted length is 115mm, which leaves just 60mm to hold the microphone by if you want to be able to slide the foam windshield on. Modern suspension systems such as Rycote's lyres can just cope with that, but even they would be floored by the MKH8070 with its total length of 465mm. Holding 332g by the tail-end 60mm can only be done using a beefy, rigid clamp, which Sennheiser does provide. For shockmounting the only option is a clip suspension that holds the tube part way down its length, together with a full basket windshield.

Both microphones sound excellent on-axis, as one would expect. At 180° the 8060 has noticeably less rejection than the 8070 but at intermediate angles is somewhat sweeter, without undue colouration. However, for sheer suck the 8070 is most impressive with an extremely narrow pick-up angle and good gain. Both microphones have excellently low self-noise (11dB A) but both are very hot mics in terms of sensitivity. The 8060 is 63mV/Pa and the 8070 is 112mV/Pa — coupled to a max SPL of 129dB and 124dB respectively that means that these mics can generate >+13dBu maximum output. You might well need the 10dB pad in the (optional) MZF8000 filter to tame these beasts. P48 current consumption to provide all this power is 3.3mA.

SHURE VP82

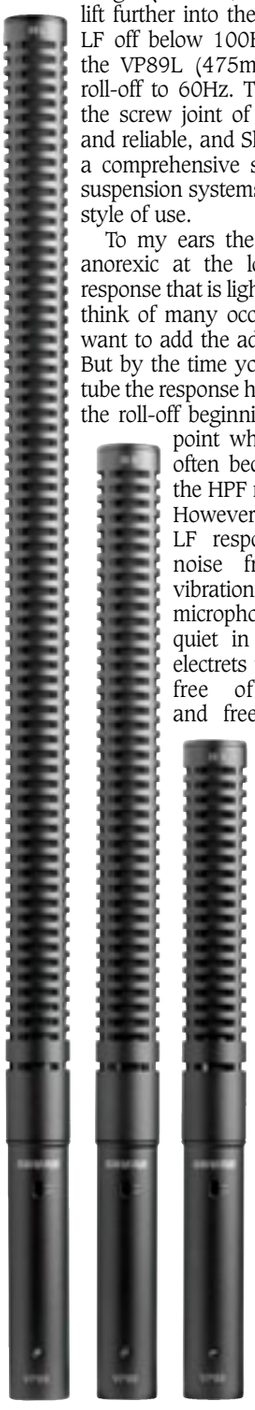
Shure is best known for its live-sound microphones but has also made several interference tube microphones for location work. The VP82 is a permanently charged (electret) short rifle with an aluminium body. At 22mm diameter and 195mm long it is light (76g) and small. Shure provides various Rycote lyre mount options to support the microphone on poles, pistol grips, hot-shoes or camera adapters. These give excellent isolation against handling noise, which makes it a little strange that the microphone has been rolled-off (12dB/oct) from 150Hz. This undoubtedly gives it insensitivity to handling noise and also to wind but does leave the microphone sounding a little thin. The polar diagram suggests that off-axis sound is evenly controlled up to 2.5kHz but becomes a little ragged above that — listening tests do reveal some colouration — but this is a microphone designed for down-and-dirty location work. As such these compromises are reasonable, as is the powering marked as P48 (which it needs for full spec performance), it will deliver sound across the P12-48 powering range.

Sensitivity is on the low side for an electret (2.11mV/Pa) but there is no risk of the microphone overloading the inputs of video cameras possessed of underwhelming preamplifiers. Self-noise is a respectable 15dBA.

SHURE VP89

The technical specifications for the VP89 follow those of the VP82 in respect of sensitivity, noise and powering, but the design concept is very different. Instead of being a one-piece microphone it is a modular one with three different length interference tubes incorporating integrated capsules, and if you use the optional A89U it can even be 'folded' in half.

The preamplifier section is 90mm long (excluding its screw connector), 22mm in diameter, and has a biro-tip switchable 12dB/oct high pass filter. The nominal knee frequency is 200Hz but the actual response is modified by the interference tube/capsule it is attached to. With the shortest version (VP89S – which makes a 227mm, 117g microphone) the flat LF rolls off almost as steeply as the VP82, being 3dB down at 140Hz, and it has a slight presence lift. The medium length (330mm, 138g) VP89M extends the lift further into the HF region and rolls the LF off below 100Hz. The longest version, the VP89L (475mm, 174g) drops the LF roll-off to 60Hz. The VP89 is solidly built, the screw joint of the capsule feels secure and reliable, and Shure has wisely provided a comprehensive suite of windshields and suspension systems that should cover every style of use.



To my ears the short version is a little anorexic at the lower end, with a bass response that is lighter than ideal, and I can't think of many occasions when you would want to add the additional HPF into circuit. But by the time you get to the long VP89L tube the response has improved greatly, with the roll-off beginning to be effective at the point where suspension isolation often becomes less reliable. Here the HPF makes much more sense. However, the upside of a restricted LF response is that infrasonic noise from wind or camera vibration has little effect — these microphones are easy to keep quiet in adverse conditions. As electrets they should be relatively free of humidity problems, and freezing them to promote condensation displayed no ill effects *(So, can cook from frozen. Ed)*.

The VP89L, contrary to expectation, has the least colouration, but the VP89S and its shorter VP82 cousin will be of greater interest to the video world. The A89U is a fascinating (and unique) approach to making microphones ever more compact for videographers. It is a U-adapter that reduces the length of the VP89S to a mere 155mm (and ups the mass to 155g) — shorter even than the VP82. With the VP89M it reduces the microphone length to 257mm, which could well make it possible to fit many cameras to give better performance at a distance.

RESPONSE — A surface plot to show the response of a microphone is unusual but can allow you to see colouration effects that are not visible in polar diagrams. This example is a real-world measurement of a well-designed short-rifle microphone.

At low frequencies the classic hypercardioid response with a rear null of ~120° is easy to see. Above about 2500Hz the response starts to narrow as the interference tube becomes active, until the pick-up is <40° at 20kHz. However, at the same time, the off-axis response ceases to be the relatively smooth hypercardioid one and grows a family of hillocks and crags (far right in Figure 1). These are the starfish lobes of a polar plot.

Rotating the plot so that you look down on it from above (Figure 2) you can see that the off-axis HF response forms curved grooves. As you turn the microphone to follow on-axis sound the different frequencies of off-axis sound passes through these response grooves at different moments, producing the typical colouration effects of interference tube microphones

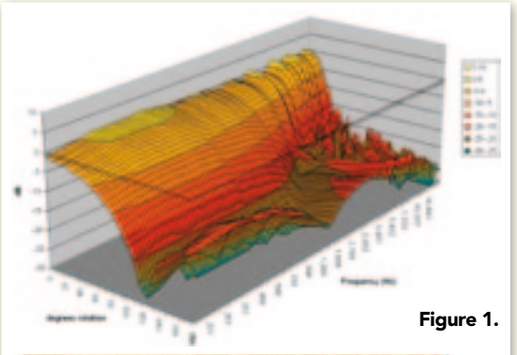


Figure 1.

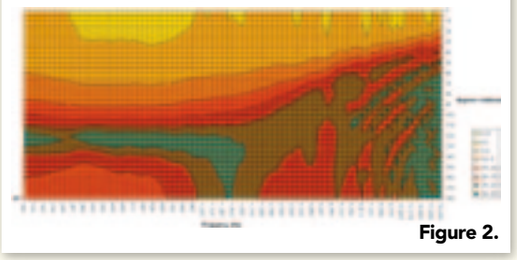


Figure 2.

RØDE NTG8

A few years ago Røde introduced the NTG3, a short rifle using the RF capacitor technique that has been Sennheiser's realm for so many years. The NTG8 is the long shotgun sibling — half a metre (560mm) of slim 19mm pipe in an exotic aluminium storage tube. The microphone weighs in at a considerable 345g. This needs a substantial isolation mount and the SM8 provided is a doubled-up rubber cage version that adds another (somewhat unwelcome) 215g. This makes a secure and solid arrangement, but one that is perhaps more suited for static set-ups unless you hate your boom-op. The NTG8 has a good LF response that doesn't start to roll off till 80Hz, though you will have to tailor the bass bandwidth externally to prevent infrasonic overloads. A 50Hz HPF is ideal, leaving excellent clean bass, but if the SM8 mount is being used you'll need to lift that to nearer 150Hz since the LF isolation is ineffective below 100Hz.

If the NTG8 is a heavyweight physically it is also powerful on performance. It is very quiet (–8dBA is claimed) but also on the hot side in terms of sensitivity at 97.5mV/Pa. The maximum output is 8.2dBu, which would risk overloading most mic preamps unless fitted with input pads. As a microphone it sounds sweet, with a gentle HF lift centred around 10kHz, characteristic of the classic shotguns. It will inevitably be compared with the obsolete (but still popular) Sennheiser MKH816 and I think it sounds cleaner and less coloured off-axis. On-axis pickup is very narrow at +/- 15°. Røde now uses the laudable technique of swaged-pin grounding to improve RF immunity. This continues the metal case across the floor of the XLR connector, with pin 1 directly fixed into it and the audio pins 2 & 3 poking though insulated ports. This reduces to a minimum the risk of RF interference being coupled into (or out of) the microphone. ■

Contact

SENNHEISER, GERMANY:
Web: www.sennheiser.com

SHURE, US:
Web: www.shure.co.uk

RØDE, AUSTRALIA:
Web: www.rodemic.com