

ANR Headsets

Do the numbers match the claims?

FLYER applies some real science in testing the leading active noise reduction headsets, finds one surprise low-cost contender for the crown and shows that the also-rans are no better than a good passive unit



Before Active Noise Reduction (ANR) we all chose headsets on subjective criteria: does this headset fit? Is it comfortable? Can I hear the comms clearly? Of course, there were always claims and counter-claims about noise attenuation efficacy but there is only so much, you would have thought, you can do with the design of sound-absorbing materials and ear-seal technology. For many of us, the personal decision was not so much based on acoustic performance, but what simply looked right...

With the arrival of ANR systems – branded with almost as many different names as there are headset manufacturers, and all using electronic circuitry to generate

an anti-phase speaker output to counter noise picked up by miniature microphones in the ear cups – came a step change in noise attenuation and a big premium in price. Now there was a difference you really could hear (or not).

Different philosophies

There are significant differences in design between the leading ANR headsets, early market leader Bose in particular taking full advantage of the technology to strip out the usual essentials for passive noise reduction, thick sound-insulating material and a weighty headband applying heavy clamping pressure to seal the ear cups, in order to produce a very light

and comfortable headset that cancels cockpit noise very effectively indeed.

Having established its reputation as the leading manufacturer of quality passive headsets on the back of past military contracts, US manufacturer

David Clark appeared to have been left behind by the new generation of ANR headsets, especially the Bose X. Now we've seen David Clark's response, the X11 – a fundamental redesign for ANR that followed Bose's

The actual numbers

	Active NR dB(A)	Passive NR dB(A)
Bose X	24	8
David Clark X11	16	10
Flightcom Denali ANR	14	10
Headsets Inc conv (DC 10.40)	23	10
LightSPEED Zulu	21	5
Sennheiser HMEC 460	25	14
Sennheiser HMEC 250	11*	12
Telex Stratus 50D	20	18

*unit appeared to be malfunctioning

How we tested them

We measured A-weighted noise levels averaged over roughly 20-30 seconds each time. The 'A-weighting' is an internationally standardised frequency weighting (essentially a sophisticated tone control) incorporated into sound level meters to approximate the response of the human ear to different sound frequencies.

The '(A)' in dB(A) indicates the A-weighting. A-weighted sound levels correlate very well with long-term hearing damage and consequently criteria for assessing risk to hearing are usually

specified in dB(A).

Dr Mike Lower reports, 'We used two miniature electret microphones with very thin cable so as not to affect the seal between the headset cushion and the head, with two Bruel & Kjaer (B&K) type 2231 sound-level meters. One of the microphones measured the noise level outside the headset and the other measured the noise level at the ear, inside the headset. Subtracting the noise inside from the noise outside shows the noise reduction given by the headset.'

'Although we measured to

0.1 dB, this was to avoid rounding errors in the subtraction, and we wouldn't normally quote measured values to better than the nearest half or nearest full decibel. The measurements were made with one sample of each headset, in one aircraft, on one person, and performance may differ slightly from person to person depending on fit, and in different aircraft. Consequently differences of one or two decibels when comparing headsets are probably not significant, but the larger differences will be important.

'We did not measure the noise levels under the headsets with radio or intercom messages. These will vary from person to person depending on volume control settings, and the maximum volume may vary from aircraft to aircraft, depending on the equipment fitted. Speech messages can add significantly to a person's noise exposure, but a headset which is effective in reducing the cabin noise reaching the ear will allow the radio volume to be turned down.'

Further info: www.isvr.co.uk/at_work/conawr.htm

lead in paring weight and improving comfort (and, some might say, shoving up price). Meanwhile, other manufacturers have developed a wide range of competing ANR headsets, some introducing novel design features of their own, others basing their concepts on proven ideas for passive sound attenuation.

While Bose X set the standard for ANR headsets, it was by no means undisputed champion even before the David Clark X11 appeared on the scene. There were early reports of the Bose headset not being sufficiently robust and suffering short battery life. We believe these issues have been remedied, but one complaint that won't go away – because it is a direct consequence of the design concept – is that the unit does not function well as a passive headset when the batteries finally do fail.

The X11 has also attracted a fair share of criticism, not least the suggestion that it simply isn't as good as the Bose X. At the same time, we've heard claims that other competing headsets – and even an after-market ANR conversion kit for passive headsets – could match the performance of the two big-price units.

The trouble is that any comparison made has been a subjective one... until now.

FLYER decided it was time to introduce some science to the debate, and contacted one of the country's leading consultancy organisations, the Southampton-based Institute of Sound and Vibration Research (ISVR). Having surveyed cockpit noise levels and determined the noise exposure for both commercial pilots flying for a major airline and instructors employed by one of the UK's leading flight training organisations, ISVR consultant Dr Mike Lower was well placed to put some numbers on the noise attenuation performance of aviation headsets. Late in November we loaded Mike, his noise meters and our eight candidate headsets into **FLYER's** C182 (see 'How we tested them,' opposite).

While Mike covered the science for us, subjective opinion and field experience still count. No two human heads are exactly alike and there are any number of combinations of cockpit audio and radio systems out there in use – so we launched a survey on the **FLYER** forums at www.flyer.co.uk. Reader feedback provided valuable extra information, reproduced alongside the test ratings.

Bose X

£700

Active Noise Reduction ★★★★★

Passive NR ★★ Comfort ★★★★★

The Bose X headset comes in a carrying case with a Velcro-attached internal compartment that separates the in-line battery box/volume control from the headset (incidentally making this one of the quickest units to stow away). We appreciated the chic 'hi-fi' design and found, in terms of comfort, the Bose X is the closest thing to not wearing a headset at all.

ANR performance is top-drawer, although our noise measurements showed that Sennheiser is even better and the Headsets Inc conversion kit can be right up there with the Bose X.

However, you wouldn't want to fly for long with ANR inactive – the Bose X is at the bottom end of the league in passive operation, giving noise attenuation of around 8 dB(A).

Our survey showed that there was universal agreement about the excellent ANR performance and general reservations about the degree of noise when the



power fails (usually on final, one person complained). Several respondents reported compatibility problems with other headsets, but the general feeling is nicely summed up by Dave Ridley: 'I believe it's the best headset I've ever worn. In my opinion, it is more comfy than the David Clark X11. The ear pads feel better and they seal better around my glasses. The clamping force seems to be less; at the end of the flight I never feel relieved to get the headset off my head. The audio quality is excellent and the ANR is fantastic.'

Headsets Inc conversion

£140/£188 (kit/supplier fitted)

ANR ★★★★★ Passive NR ★★ Comfort ★

Headsets Inc manufacture an ANR conversion kit that they claim can be fitted in a couple of hours. The kit is very complete – but fitting it is a fiddly job, best done by somebody who is already a dab hand with a soldering iron.

We put the conversion to a severe test in that we used an old-model David Clark 10.40 headset, albeit one fitted with DC's optional gel ear seals. The one-star comfort rating reflects the progress made in even passive headset design since the 10.40's inception, but the stonking five-star ANR performance puts the inexpensive Headsets Inc conversion kit on a par with the best units available. Perhaps we should not have



been surprised at this finding – lots of **FLYER** forumites have claimed their modified headsets match the ANR performance of the best factory units. Keef's comment is typical: 'I don't have one of those fine ANR-from-the-ground-up headsets, because I already had a DC 13.4 that I liked. I had Richard Holder (richard.holder@avnet.co.uk) convert it to ANR instead, and I reckon that's the best money I ever spent on anything in aviation.'

David Clark X11

£500

ANR ★★★ Passive NR ★★ Comfort ★★★★★

Although the in-line battery box is clumsy and has a cheap and nasty-looking on/off switch, our first impression of the David Clark X11 was favourable. The unit folds down to a compact size, sports very soft and thick gel ear seals, is nice and light, and there feels to be very little pressure on the ear cups, promising comfort in extended wear.

However, our noise measurements revealed that this expensive unit offers disappointing ANR performance, on a level with the lower-cost opposition.

We didn't quite believe this result, but careful adjustment for fit and repeated testing gave no



improvement in sound attenuation. Passive sound attenuation was no more than average.

It seems that users out there share our impression. Several reported problems with the ANR malfunctioning, either resulting in a low-frequency 'buffer' or whistling sound heard in the ear cups.

Flightcom Denali ANR

£380

ANR ★★ Passive NR ★★★ Comfort ★★★

Coming in a well-padded carrying case, stylish and blessed with very soft, stitched-leather ear seals, the Denali looks the business - but it isn't as comfortable as it looks and our tests showed that it doesn't really deliver in terms of noise attenuation. ANR performance was the second poorest of the bunch, being on a level with the impressive Sennheiser HMEC 460 operating with ANR switched off, and some 4 dB(A) down on the impressive passive performance of the Telex Stratus 50D.



-14
dB(A)

LightSPEED Zulu

£550

ANR ★★★★★ Passive NR ★ Comfort ★★★★★

The LightSPEED Zulu is a newcomer to the UK market. This headset appears to be very well made and looks robust, while remaining relatively light. We found the Zulus to be very comfortable and tester Ian Seager, who wore the Zulu headset for the entire day's flight-testing, judged the ANR to work better than his usual, wired-in Sennheiser 350. Certainly, the measured attenuation of 21 dB(A) put it near the top level.

The Zulus also have the further advantage of a built-in Bluetooth module, but beware what happens when the batteries go flat – the passive noise attenuation performance came out at the bottom of the league, a rather surprising 5 dB(A).



-21
dB(A)

Sennheiser HMEC 460

£600

ANR ★★★★★ Passive NR ★★★★★

Comfort ★★★★★

'Coo, these are nice,' we thought when we unpacked Sennheiser's latest, the HMEC 460. We found them immediately very comfortable on the head – Sennheiser claims the damping pressure has been reduced by thirty percent compared with its past models – and our noise tests showed them to have an outstanding active and passive performance – we are talking about 25 dB(A) active/14 dB(A) passive, which is quite stunning.



TOP
PERFORMER

-25
dB(A)

Sennheiser HMEC 250

£380

ANR ★ Passive NR ★★★ Comfort ★★★

Sennheiser went from champions to relegation fodder when we tested their newest model, the very compact folding HMEC 250. Swivelling ear cups allow the 250 to drop snugly into the smallest carrying case of the lot, the design and construction of the headset suggests real quality, yet all this appears to flatter to deceive when it comes to ANR performance.

We spend some time poring over the manual, working out which was the correct ear-cup-mounted button to press (there's a confusing 'TalkThrough' function that allows you to 'communicate with

people around you while wearing the headset') and repeating our noise measurements; subjectively, the ANR system seemed to actually raise background noise – suggesting we had been supplied a faulty unit – and the 11 dB(A) attenuation put the 260 firmly at the bottom of the table.



Telex Stratus 50D

£500

ANR ★★★★★ Passive NR ★★★★★

Comfort ★★★

The Telex Stratus won our prize for being the most cussed headset to get back in its carrying case, its stiff leads and clunky battery box proving reluctant to return to confinement. We did, however, appreciate the general quality of the unit and its super-soft and deep ear seals. ANR performance was very good, if not top tier, but the 50D knocked all the competition into a cocked hat when it came to passive noise attenuation – an outstanding 18 dB(A), which bettered the ANR performance of the David Clark X11! 'Very

comfortable, very quiet, moderately heavy. Doesn't squish your head in a vice like some, good noise reduction both active and passive... Batteries last 5 hours,' Eric Whitehead told us.

Further endorsement came from Aiden Grimley: 'I couldn't get a sensible combination of headset and earplugs that made the noise bearable and still allowed me to hear the radio. Then I got the Telex 50s. It revolutionised flying my Laser: quiet, comfy and perfect reception. The only problems are securing the battery pack while doing aerobics and tying up that absurdly long lead so that it didn't fly all over the cockpit... and



replacing the batteries (I know you can wire it into the aircraft but it was a syndicate plane and we all used different headsets). I never timed the battery life but I replaced them very often. At least the passive noise attenuation was good so if the batteries died in-flight it was no big deal!

And the winners are...

As you might have expected, our tests showed the most expensive ANR headset, the £700 Bose X, to be one of the top performers – and as to comfort, our reader feedback confirmed that this unit was just about the best on the market.

We also found that rival manufacturers are matching Bose's ANR performance, not least Sennheiser with the new £600 HMEC 460, which offers a very impressive all-round performance, albeit at a price not that far behind Bose's.

So much for the expected. What we were surprised at was the

very average performance of David Clark's £500 contender and what really rocked us on our feet was the outstanding active noise cancelling performance of the £140 Headsets Inc ANR conversion kit when fitted to an old-model David Clark headset.

If you take the Cessna 182 to be fairly typical of the fleet, our cabin noise measurements showed quite how high the noise level can be in the GA aircraft cabin. A good passive headset can block this out to marked degree, typically reducing

noise by 10 dB(A) or more, but the best ANR systems will cut it by getting on for 25 dB(A).

The good news is that one of the cheapest options, self-fitting the Headsets Inc conversion kit, may give your old passive headset much the same ANR capability as the best dedicated units out there on the market, for a quarter to a third of the price.

The bad news is that some of the worst ANR headsets only offer noise protection at a level you might expect from a good passive unit ■



Bose X: top comfort, superb ANR



Headsets Inc-converted DCs