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Home of the Resolution Awards and Line Up

Audio-Technica AT5047

A refinement of a unique diaphragm design — JON THORNTON tests a new flagship mic tailored for studio use.

Audio Technica's 50 series firmly occupy the upper echelon of the company's very extensive product range — and differentiate themselves in a number of ways. At a very pragmatic level there's the price, with the flagship microphones commanding prices at least double that of the most expensive models elsewhere in the range. And at a technical level, the 50 series all employ AT's rectangular capsule element.

Whilst the idea of a non-circular diaphragm is neither new nor unique — the benefits chiefly being the lack of a singular mode of resonance in the diaphragm's response — its implementation in the first of the 50 series was somewhat novel. The 5040, launched in 2012, employs no less than four of these elements whose outputs are summed together to effectively function as a single capsule. And whilst the technical challenges involved here were numerous, the thinking behind the approach was straightforward. In increasing the overall surface area of the 'capsule', improvements in signal to noise and dynamic range are there for the taking. But in keeping the individual diaphragms smaller, this doesn't come at the expense of transient response.

The same rectangular capsule — this time just the one — made an appearance in the AT5045 instrument microphone. A side addressed "stick" design, the AT5045 also utilised a transformer output stage, something that the AT5040 didn't have. And in essence, the new AT5047 is the quad-diaphragm 5040, but with a new, transformer based output stage. Of course, there's a certain historical precedent here for microphone designs to be offered with transformerless and transformer based output stage — think of the C414B TL and ULS variants for example. But it's also clear that the folks at Audio-Technica have been listening to their user base.

The 5040's design philosophy was very much one of facilitating the quietest, cleanest path from capsule to output — employing some clever thinking such as using two of the four elements to deliver the hot side of the differential output, and the other two the cold side. But this "straight-line" approach also resulted in a nominal output impedance of around 50 Ohms — low enough that some mic pre-amps would struggle in some conditions. Utilising a custom made transformer in the output stage instead (and they do mean custom made — apparently around 40 different variations were prototyped to find the best match) gives a more stable, consistent impedance of around 150 Ohms. As a result the overall sensitivity of the 5047 is lower than its stablemate — the 5040 ranks as one the hottest mic outputs I've ever tested at a frankly staggering 56 mV / Pa — but the 5047's 36 mV / Pa is still plenty healthy enough, and quoted noise ends up only slightly higher at 6 dBA.

Externally, the 5047 is differentiated from the 5040 by a change in colour — with a uniform silver finish as opposed to the two-tone scheme of the 5040. Other than that, it's indistinguishable from its sibling, and has the same overall feeling of solidity and quality. Supplied in a compact hard shell case, it also comes with the same beautifully engineered suspension mount introduced with the 5040. Looking and feeling vaguely like something from the 'Terminator' movies — the swivelling arcs and magnetic catches hold what is a fairly substantial microphone completely securely, yet take up very little space, and provide a good degree of isolation.

I didn't have access to a 5040 for a direct A/B, but did find my original test recordings to offer some degree of comparison — and it's fair to say that there is a subtle difference in tonality here, but most of the overall characteristics of the 5047 are very similar to the 5040. Listen closely, and there's just a hint of additional 'roundness' to the low registers in a male vocal — but still that real sense of digging into the detail and character of the mid-range. Off axis response sounds similar too — reasonably smooth overall, but with what seems to be a narrower on-axis working range than you might expect from a cardioid pattern. This does prove quite useful in softening sibilance a little, as there's a noticeable HF drop even 30 degrees or so off-axis.

Working both male and female vocals close also shows that there is also plenty of mileage in tuning the response of the microphone by varying the height of the capsule array relative to a singer, to favour the nose / mouth / chest. The even tighter directionality in the vertical plane exaggerates the differences in tonality a little more than a conventional large diaphragm condenser design might — but still manages to sound very natural in most cases. And it's these traits that make it, just like the 5040, a microphone that seems to match well with a wide range of vocalists.

But it does sound different — and not just that slightly rounded low end. The best way to describe it would be "tamed". One of the things I clearly remember about the 5040 was the way it could generate some surprises from an engineering perspective. A combination of that high output level and a large diaphragm surface area meant a susceptibility to plosives, and some peak transients that could catch you unawares from behind a console. Whether it's the added iron, or the associated change in electrical sensitivity I don't know. But whilst a good pop shield is still very much needed, the 5047 seems much more controlled in this regard. But it's definitely tamed, not subdued. It still sounds incredibly open and detailed, and opens up a vocal without ever sounding hyped.

Of course, like the 5040, these qualities come with a fairly hefty price tag attached. The level of manufacturing effort required to tune, match and align those four capsules doesn't come cheap — in this case a RRP of £3499 including VAT. Which means that it would probably be a case of either the 5040 or the 5047, rather than the luxury of both. And if faced with that choice, I'd probably come down in favour of the 5047. Both are extremely fine microphones, but the 5047 seems just that little bit easier to live with — and not only in terms of mating it to a mic pre-amplifier.

PROS	**Extremely quiet; impressive dynamic range; makes a good match to a wide range of vocalists and styles; characterful without sounding hyped; a better match to some mic pre-amps than the 5040.**
CONS	**Quality doesn't come cheap.**

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Audio-Technica

We head to Real World for an insight into some real engineering.

A select group of studio professionals, distributors and technology press from across Europe were recently invited to Audio-Technica's 50 Series event, held at Peter Gabriel's Real World Studios near Bath. We attended a series of presentations, held in the well-known, capacious control room (The Big Room), detailing the development of the new AT5047 condenser microphone, as reviewed by Jon Thornton on page 14.

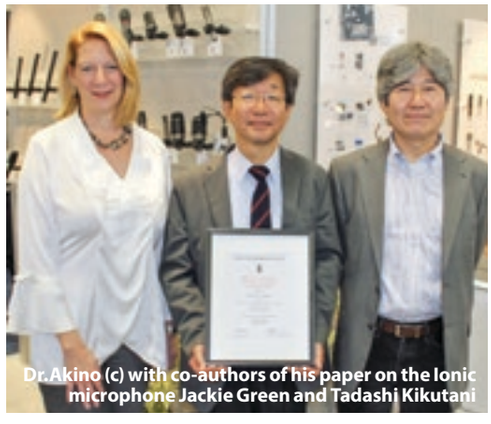
As product expert Alex Lepges explained, the 50 series concept started with designer Shioto Okita being given the brief: 'Do whatever you like, price does not matter, take the best of the best and make something no-compromise and pure!'

Okita started work on the 50 series in 2006, but it took 3 years before the first AT5040 prototype was completed. The rectangular diaphragm concept was chosen in order to improve the signal-to-noise ratio over the existing 8040 series. The larger the surface the better the signal-to-noise ratio. On the other hand, a large surface is not so good for transient signals such as acoustic guitars or percussion, hence the design choice of four small rectangular diaphragms, summed together. The aim was to have the best of both worlds, by combining small diaphragms to improve signal-to-noise, whilst retaining a good transient response.

Rectangular diaphragms: with one diameter on a circular diaphragm, there is one resonant frequency (like a guitar string). The audio to be recorded stops, but the mic diaphragm may continue resonating — the slight overhang is visible on a waterfall plot — and may cause an element of smearing to the sound. Shioto Okita aimed to eliminate this with the rectangular diaphragm, where there is no single dominant resonance.

Chris Woods Groove Orchestra

50 Series designer Shioto Okita



Dr.Akino (c) with co-authors of his paper on the Ionic microphone Jackie Green and Tadashi Kikutani

Although the 5047 resembles the original 5040, there is quite a significant difference electronically, it was not simply a case of sticking a transformer on the output, the summing of the elements in the transformer-coupled mic is quite different. Basically, in the 5047 the signal of one diaphragm element is taken and used as a reference for the next element — it's like taking two batteries, putting them in circuit together — and doubling the voltage. On the 5040, there is actually an amplifier in-between the elements, to boost the signal to the levels specified. The summing principal might be the same, but the implementation is different.

Audio-Technica was one of the first companies to use electret elements in studio microphones with the 40 series. The A-T thinking is that, if you have to charge your microphone element over 48v phantom power, and you have to build up a charge on the diaphragm of 100V or so, electronic circuitry is required, and a DC-DC converter is needed to increase the voltage. With any DC-DC converter there's always going to be some form of spurious signal generation: A-T's purist approach was to avoid any possibility of signal generation within their microphones, and to save the P48 current to drive their amplifier electronics. It is typical of A-T's iconoclastic approach to electronics that they took what was once considered an inferior option (electret) and improved the design to exceed convention.

Audio-Technica only employ 8 engineers for wired microphone development. Most unusually, one microphone is designed by one engineer exclusively, meaning the engineer is responsible for every component from electrical and acoustic components to assembly hardware. This follows the design ethos of Audio-Technica that every single component is somehow related to sound quality. Each microphone model is thus very much a "personal" product. It also means A-T have built a team with very specialist in-depth knowledge of particular acoustic fields. Unusually, the engineers are not only

Ionic microphone prototype

Noriko Matsui

responsible for 3D CAM and design, but are also responsible for soldering, prototype assembly, testing and documentation. It could be said that "integrated technical skills" are the strongest suite of AT's boffins!

Many microphones in A-T's range were developed by senior engineer Dr. Hiroshi Akino, who also designed many of the tools and machines for microphone manufacture. His first product was a shotgun microphone, designed in 1985. Since then, Dr. Akino has worked on an incredible 1,200 products for the company. Audio-Technica engineers, and in particular Dr. Akino, are held in very high regard within the company. Product planner Noriko Matsui, a former microphone engineer herself with 16 patents to her name, revealed that Dr. Akino holds 550 Japanese patents and more than 200 US patents.

Kweku Mainoo

Some audio professionals may regard microphones as mature technology, whose development was basically completed decades ago. It's heartening to discover that the culture within Audio-Technica is very much one of pushing boundaries, searching for the next innovation to deliver an incremental improvement in audio quality. Dr. Akino masterminded a science-fiction-sounding project to develop a diaphragm-less ionic microphone, using high-temperature plasma. An ionic microphone was tested in which the frequency response level using high-temperature plasma increased as the sound wave frequency decreased. The only comfortable thing about the plasma microphone seems to be the XLR connector sticking out of the side of the machine — I'm certainly glad not to be the recording engineer tasked with mic-ing up using the equivalent of St. Elmo's Fire! Nevertheless, it is somehow reassuring to think that, somewhere in a laboratory in Tokyo's downtown, no element is too interstellar ... if it could somehow increase the realism of our recordings.

Our day at Real World was completed by a musical demonstration of the 50 series, with African kora player Kweku Mainoo and the Chris Woods Groove Orchestra. Hearing the acoustic instruments in the recording room, and then returning immediately to the control room, one aspect of the A-T flagship microphone range was striking: the dynamics and room ambience were uncannily faithfully reproduced. If it sounded a little boxy in the room, it sounded boxy over the control room monitors; if a particular tone on a hang drum or kora resonated in the live room, we heard it replayed. The choice of acoustic instruments for the demo — featuring Hang Drum from Matt Calder, Tabla from Harkiret Singh Bahra and Double Bass from Lukas Drinkwater — served to illustrate the detail and depth of tone possible from the flagship Audio-Technica range.

'Real World Studios proved the perfect setting to highlight the natural, dynamic nature of the new AT5047,' said Audio-Technica marketing manager, professional audio, Tim Page. 'It was a great opportunity to get up close and personal with the 50 Series and fully experience their capabilities in one of the most prestigious recording spaces in the world.' Sometimes, it's a good idea to get "close and personal" with the engineers who actually design the equipment we use: our take-away from the event was the unusual esprit de corps of the A-T design team, and their admirable determination to continue pushing the boundaries of sound.

Purity Transformed

AT5047 Premier Studio Condenser Microphone

Building on the AT5040's breathtaking purity of sound, the new AT5047 combines the four-part rectangular element of its predecessor with a transformer-coupled output to create a mic with exceptionally wide dynamic range and remarkable versatility. This is purity transformed. **audio-technica.com**

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