Electromagnetic Acoustic Transducers (EMATs) are useful in Non-Destructive Testing as they can be used at lift-off on hot, moving, and rusted surfaces while being relatively inexpensive and robust. Generation of ultrasound using EMATs is relatively inefficient, however, the amplitude of the signal at a defect can be greatly improved with the use of focusing. A focused Rayleigh wave EMAT has been designed, characterized, and used to size a range of surface breaking defects in aluminum. The EMAT has improved spatial resolution compared to unfocused designs and generates a strong signal (giving up to 30 dB SNR) at the focal point, with a narrow beam width of 3.0 ± 0.5 mm. The new EMAT was used to detect and size a set of 1 mm width, 0.5 mm depth drilled slot defects, with lengths between 1 and 11 mm.

The aperture angle of the coil was found to change the focal depth, as expected, however, variation of the aperture angle also shifts the focal point. This can be used to design EMAT coils with specified focal points, beam widths, and length of focal region to allow scans to be done at a chosen resolution. The EMAT was fully studied experimentally and using finite element modelling, and the coil design was optimized.

References: