Reducing Sidelobes of SRF10

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The price to pay for the SRF10's tiny transducers is that the system is now very sensitive to objects way off boresight (boresight is the angle where the sonar is aimed, that is, straight ahead). In fact the sonar will respond continuously to the ground if aimed horizontally and mounted at a height of 3 feet or less. The published curves show the response pattern in dB, but what is more practical for my purposes is a plot of the distance an object will be detected vs. its angle from boresight. The SRF10 responds to a narrow object 30 inches away at an angle of 60 degrees below boresight, even with drastically reduced gain! This is certainly a false alarm for most applications (including mine).

Reducing the gain cuts down the sidelobes somewhat, but not enough.

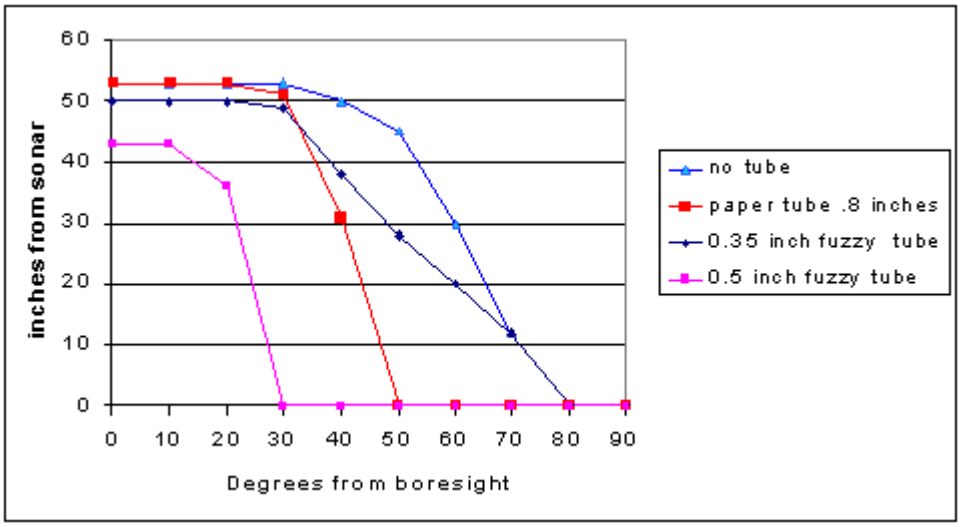
The pattern up and down (relative to the picture in the book – looking at the component side with wires on left) is not symmetrical. The sonar is much more sensitive to objects below boresight. So if you are mounting your sonar vertically (not side-by-side), mount it up-side-down. And in any case, aim the sensor UP about 30 degrees or more to avoid the ground. Probably the mounting supplied can be bent.

I did some experiments to try to reduce the sensitivity off boresight. I first installed a paper tube around both aluminum cans on the sensor. I tried lengths of 0.8" and 0.5" (measured from the PC board) with very similar results. I also tried 3/8"ID shrink tubing (without shrinking it) with similar results. But I also tried fuzzy velvet ribbon, in 2 lengths, with dramatic results.

These extensions form a tube a couple of wavelengths (0.339"=8.6mm) long from the transducer, so there is some combination of open-tube resonance, diffraction, absorption, and collimation happening. But it seems to be mostly absorption, because the fuzzy ribbon works much better. In every case, the sensitivity off boresight is reduced markedly.

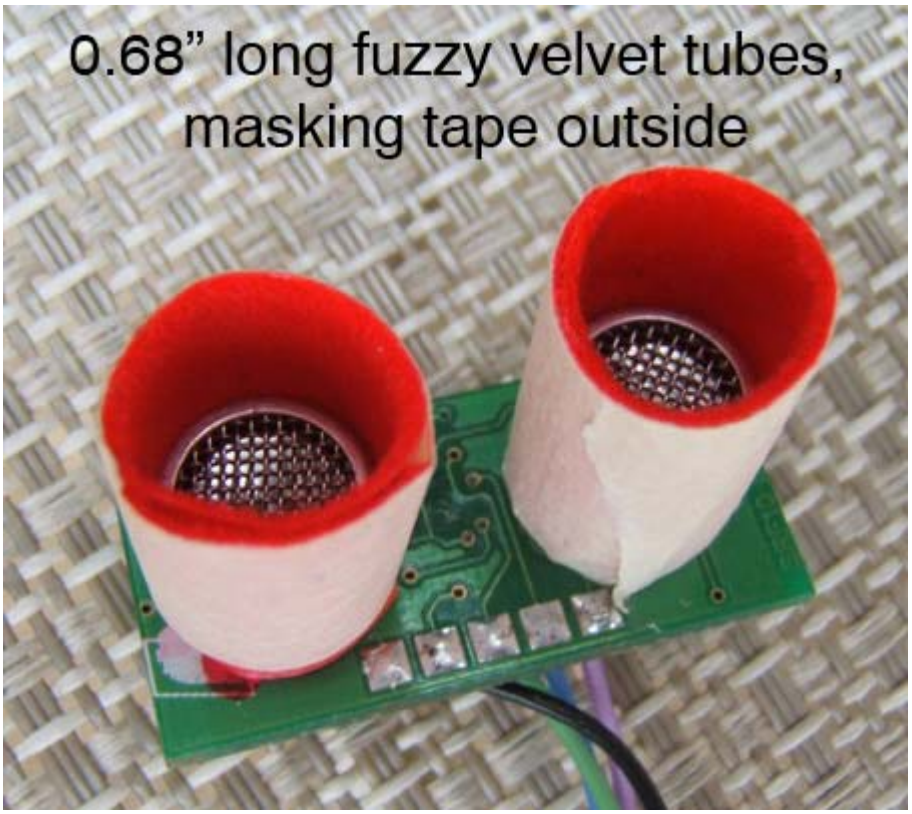
My experiment setup was to tape the sensor (aimed horizontally, with transducers side-by-side) onto a horizontal turntable that could rotate in azimuth. The turntable was mounted 5' above the ground to avoid ground effects. I worked outside so there would be no interference from room reflections. I used a paper template to measure the rotation angle every 10 degrees (you could print the template below). I laid out a tape measure on the ground, with zero directly under the sonar. The target was a long ½"-diameter pole held vertically (using a wider target would be hard to determine its azimuth). I rotated the sensor to each 10 degree angle, moved the pole along the tape measure from distant to closer, and recorded the distance where is sonar responded. I also checked to be sure that there was no dead spot at that angle. The sonar is operated by a PIC16F870, with the gain reduced to 100 (setting of 6 in the register, which just barely detects the target at 53"), and max range reduced to 55" (setting of

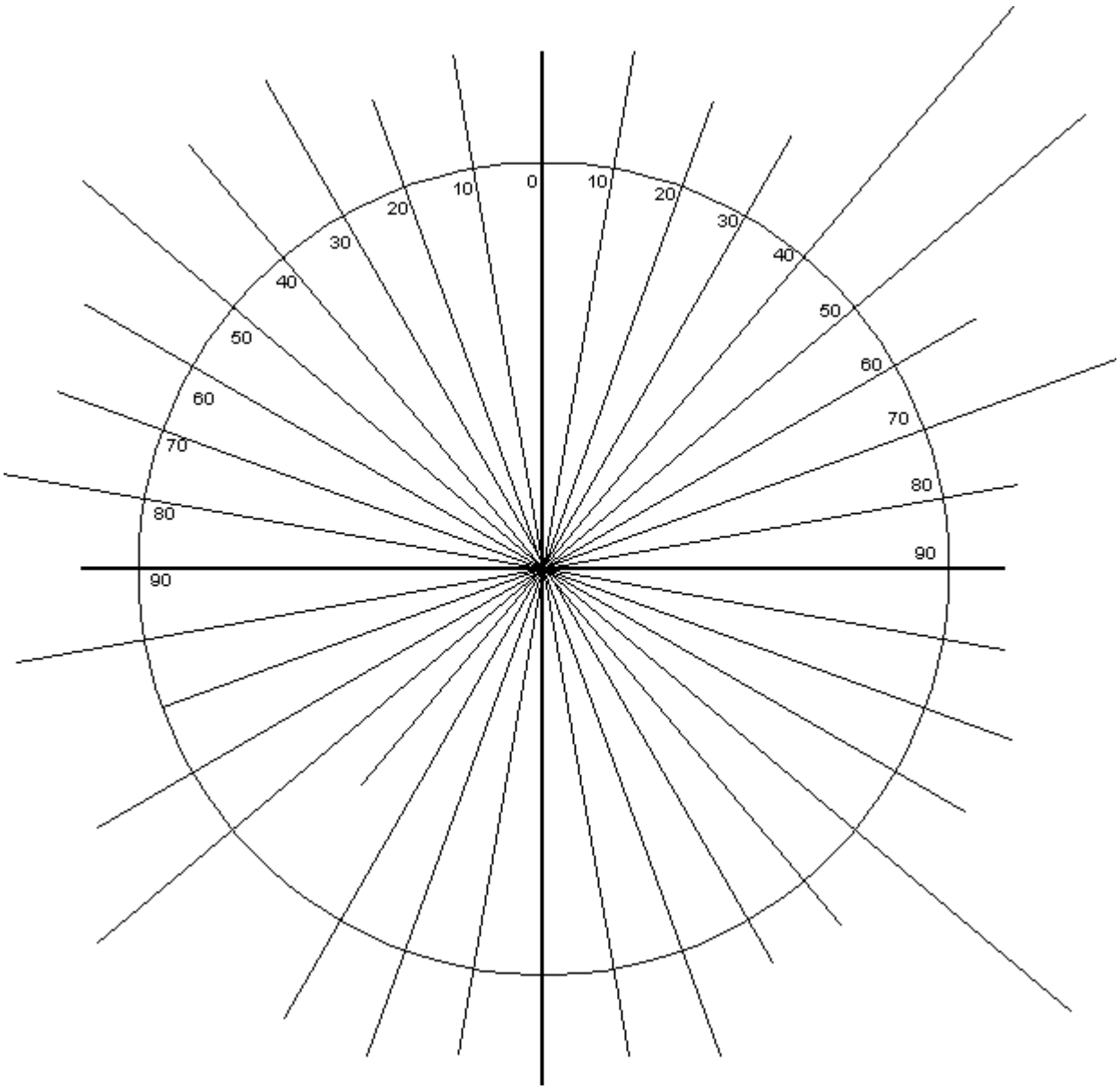
33 in the register). My results as follows:



The 0.35" fuzzy tube was too short to be very effective at wide angles. The 0.5" fuzzy tube was slightly too long, because it affected the boresight sensitivity, but of course the max gain could be increased to compensate for that. The boresight sensitivity was unchanged by the paper tube and short fuzzy tube, but it was limited by the set max distance. At 50 degrees, adding the paper tube reduced the detected distance for 45" to zero. The 0.5" fuzzy tube made the sonar into a truly narrow-beam device, with no sidelobes beyond 30 degrees! There are no dead spots in the pattern like you might expect from diffraction effects. The tubes helped in the up direction also, but not as dramatically.

You might want to experiment with different lengths of tube, to see if sidelobes can be reduced further. Maybe Velcro thicker fuzz or upholstery velvet would be a better absorber. Maybe a flare like a trombone would be better. Maybe a long tube with a slight taper would not affect the center sensitivity, but still kill off-axis sidelobes. Maybe just a horizontal flat surface would absorb the ground clutter.


0.68” long fuzzy velvet tubes,
masking tape outside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