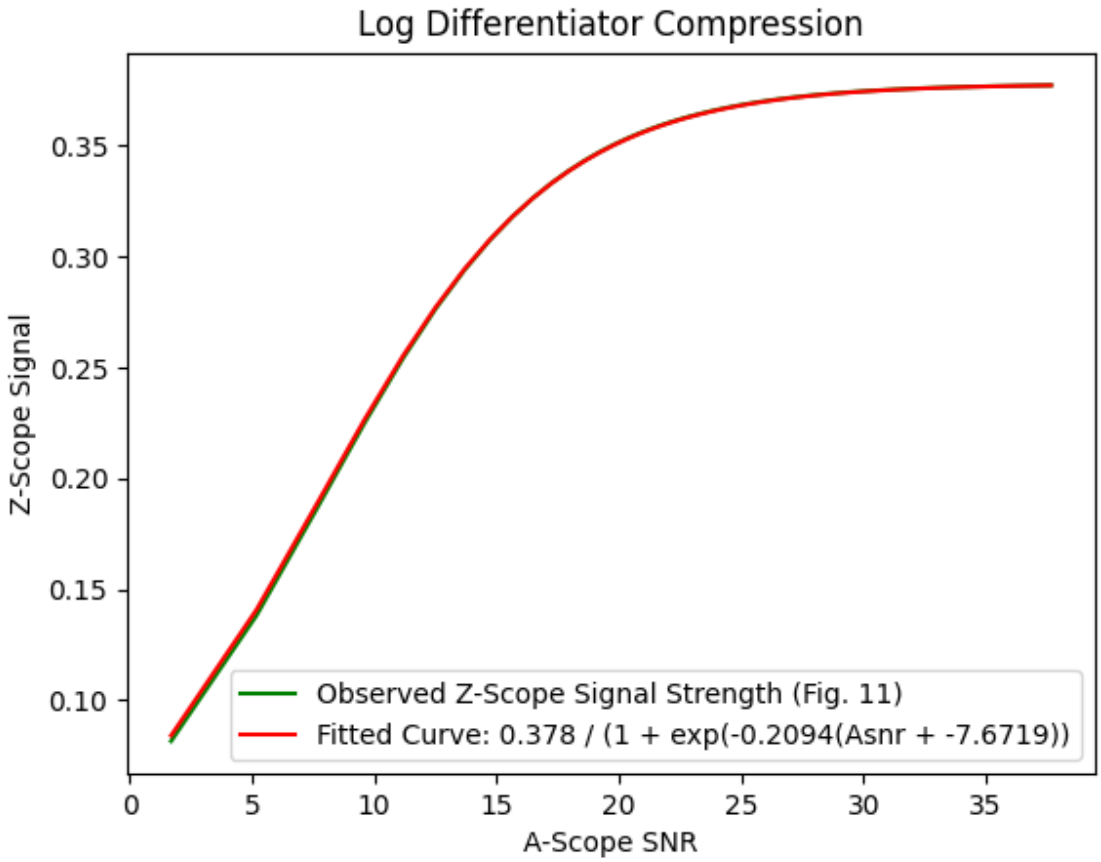
This model was created from Fig. 30 (Christensen, 1970) using LTspice, an analog circuit simulation software (cite). We used specific LTspice models for components given by Christensen 1970, otherwise using the idealized component models from the built-in LTspice library. Expected performance of the circuit was verified using a transient simulation. The input signal was modeled as the summation of two independent sources, both a Gaussian white noise simulation with a standard deviation of 1.24x10^-3 and a 60 MHz sine wave. The standard deviation of the noise was found by assuming the A- and Z-scope saturate at the same power level, then finding the noise level that gives a 70 dB dynamic range for the A-scope (see Fig. 6 of main paper). The standard deviation in the PWL file read into the circuit has a standard deviation of 1.5x10^-3, but manual measurements of the noise entering the circuit gives the lower standard deviation of 1.24x10^-3. The amplitude of the 60 MHz sine wave is swept from 0.051V to 6V in 0.05V increments. The gain is set by changing the value of R57 or changing the location of the ground, based on the settings in Fig. 30 (Christensen, 1970), though no setting significantly affected the shape of the fitted curve. After running the simulation the RMS voltage for the A- and Z-scopes, labeled Vrms_a and Vrms_z, respectively, are exported as a function of input voltage. An optimized curve fit for the A- and Z-scope RMS voltages as a function of input voltage is computed. The scale on the Z-scope signal axis is linearly adjusted to fit the scaling in Fig. 11.

This method gives a logarithmic function for the A-scope SNR to Z-scope signal, shown in Fig. S1, with an RMS error of 0.0021% between the optimized fitted curve and the predicted values from Equation 3. This strongly suggests a logarithmic relationship of the form suggested between the A-scope SNR and Z-scope signal, but additional factors such as the limited film dynamic range and unknown variations in the chemical processing of the film make one to one comparisons ill-advised. Likewise, this circuit was based on the 60 MHz radar in the 1970 expedition, yet it should be noted that the hardware was updated between expeditions and specific gain and capture settings may have been changed between and/or within flights.


Log Differentiator Compression
Z-Scope Signal
A-Scope SNR
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25
30
35
Observed Z-Scope Signal Strength (Fig. 11)
Fitted Curve: 0.378 / (1 + exp(-0.2094(Asnr + -7.6719))