The fundamental pulse-echo data acquisition mode in modern ultrasound imagers is the same as those used in the 1960's. However, today's imager is radically different in its data acquisition and signal processing methods as well as in the image quality it presents. This presentation will outline some of the exciting breakthroughs in ultrasound technology that have occurred during the past 3 years.

One of the most important equipment modifications is the nearly exclusive transfer of array beam forming technology from analog to digital. After a brief description of the role of a "beam former" we will describe beam forming, including concepts such as advantages of digital beam forming channel density and how this influences the image and a newer method called "coherent beam formation" by one manufacturer.

In addition, recent work has produced substantial improvements in transducer technology, resulting in so-called broad bandwidth transducers with high sensitivity, and enabling "multi-frequency" operation from the same probe. The expanded bandwidth and improved sensitivity of today=s transducers has led to an exciting new approach to ultrasound imaging, "tissue harmonic imaging." This modality originally was developed for use with contrast agents, but recent work demonstrates that nonlinear wave distortions in tissues are of sufficient magnitude that "native tissue harmonic" imaging is possible. Native harmonic imaging provides substantial improvement in image contrast because 2nd harmonic signals are less susceptible to beam distortions by the patient body wall than signals at the fundamental frequency.

Manufacturers who provide high-level digital signal processing have gone to other measures that improve image quality. Significant here is the demonstration that "coded excitation" pulses applied to the transducer, along with deconvolution of the received signals, can vastly improves the system sensitivity, enabling higher frequency probes with better resolution to be used where output limits have previously restricted uses to lower frequencies.

1 **2** dimensional arrays enable electronic focusing to be applied in the elevational (slice thickness) direction, significantly improving the spatial resolution of ultrasonic systems. 3-d imaging enables complex structures to be viewed in orientations other than those applying during the acquisition.