

Similar to the paradigm change of the 1980's, when ultrasound labs shifted from large, manual scanner to cart-based, real-time scanners, we now see a move in the industry towards small, portable ultrasound units (PUU) having sophisticated imaging capabilities. Unlike their predecessors, however, the cart-based scan consoles are likely to continue to play an important role in medical imaging, with PUU's significantly expanding the tasks carried out by this modality. This presentation highlights these anticipated changes.

Ultrasound machines continue to use sequential, line-by-line echo acquisition and traditional array beamforming. This limits frame rates because of the sound propagation speed in tissue, a significant problem as 2D arrays producing 3D datasets are developed. One manufacturer has developed a "zone" transmission method with synthetic aperture processing of element data. This improves frame rate and offers new capabilities, such as adaptive means of speed corrections.

Operator controls, even on very basic machines, are numerous and encompass many echo acquisition and signal processing functions. Although applications specific presets simplify the task of precise adjustment of these controls, there is a growing trend to develop machines that allow a wide range of traditional operator adjustments and automatically set important functions, such as overall gain, TGC, and transmit focus.

Echo amplitude information continues to serve as the primary data presented to users in non-Doppler operating modes. This now is being supplemented by elastography, where tissue stiffness images are reformatted and displayed, and may soon be extended further by displays of tissue properties that are not evident in conventional B-mode, such as scatter size estimation.

Much development activity is taking place in PUU's, with varying capabilities and intended uses. Full featured portable machines allow sonographers to access patients not easily scanned with larger cart-based machines. Inexpensive, special purpose PUU's are being directed to new users, such as emergency room physicians, and anesthesiologists.

#### Learning Objectives

1. Understand how current ultrasound machines operate and appreciate limitations of these devices.
2. Understand tradeoffs when choosing high-end vs. portable ultrasound machines.
3. Understand sources of new information from ultrasound scanners.