

**EMERGENCY ULTRASOUND:  
Essential Machine Features**  
Updated for 2014

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## 1. COMPACT & EASILY MOBILE

- Fits into patient rooms, limited spaces
- Width and depth kept to a minimum
- Wheels are high quality, multi-directional
- Light weight, easy maneuverability
- Most ED applications best served by a compact cart-based system
- Storage options (e.g. for extra gel, cleaning agents, probe covers, angiocaths, etc.)

## 2. IMAGE QUALITY & VERSATILITY

- 2-D image quality is essential
- Maximize in difficult/obese patients
- Capabilities for multiple applications
  - General/abdominal (wide footprint curvilinear probe)
  - Cardiac (phased array probe)
  - Vascular, soft tissue, procedural (high frequency linear probe)
  - Pelvic, obstetrical (endocavitary/transvaginal probe)
- Midline mark on linear, curvilinear probes to facilitate procedural applications
- Multiple (at least 3, ideally 4) probe ports, easy switching between transducers
- Large, bright screen, broad viewing angles
- Monitor easily articulates in all directions
- Needle localization/guidance technologies highly desirable

## 3. EASE-OF-USE & SIMPLIFICATION

- Quick boot-up time (including “cold boot”)
- Battery powered sleep mode
- Maximal battery life (at least 2-3 hours battery powered scanning)
- Rapid battery recharging
- Reminders (visual and auditory) when battery level low
- Simplified control panel with essential functions
  - On/Off
  - Start/End exam
  - Exam type
  - Depth
  - Gain
  - Optimize
  - Zoom
  - Freeze
  - Measure
  - Calculations
  - Still image
  - Video
- Backlit, large print, large buttons
- Sealed control panel surface for easy cleaning
- Keyboard best if sealed (not easily penetrated by liquids) or pull-out
- Should be as intuitive as possible (users of varying skill levels)
- Retain ability to pull up more advanced features
- Touch screen panel on cart (not monitor) ideal for this purpose
  - Allow for maximal customization (i.e. which functions to include/exclude)
  - Default to basic functions, with option to access more advanced modes
- Start exam screen fields
  - Patient name
  - Medical record number
  - Accession number
  - Examiner name(s) (two fields to allow for trainee/supervisor)

- Probe selection
- Exam type preset

#### 4. DURABILITY & SERVICE

- ED is a harsh environment, demands 24/7 uptime
- Machine, probes, cords need to be rugged
  - Probes may be dropped onto the ground
  - Probe cords, power cords may be run over by the machine wheels
  - Probes, machine may be exposed to bodily fluids (blood, pus, etc.)
- Machine cord management commonly under-appreciated
- Probe cords must be durable (protected), cart designed to minimize cords tangling or being run over by machine wheels
- Probe holders should be stable, strong, easily cleaned
- Power cord ideally retractable, otherwise easily stowed and should not originate from bottom of cart, which promotes tangling in cart wheels
- Service needs to be prompt and accessible 24/7
  - Need availability beyond Monday-Friday 9am-5pm business hours
  - ED required to be in full operation nights, weekends, and holidays
- Affordable service plan options, either included plan (5 years) or contract paid yearly
- Commonly broken parts should be separate (modular) and easily replaceable
- Ability to export and import machine system settings (i.e. for loaner machines in case primary machine is out of service for repairs)
- Software failures (freezes, reboots) unacceptable

#### 5. IMAGE ARCHIVAL & WORKFLOW

- Record as still images and cine loops to internal storage
- Internal storage capacity upgradeable (not fixed in size)
- DICOM capabilities should be standard on all machines
- Widely used export formats for still images (JPEG) and cine loops (MOV, AVI, MP4)
- Export options should include USB, CD/DVD, and (less commonly) thermal print
- Integrated Wi-Fi capabilities essential for all future machines models
- Wi-Fi adapter housed within a secured location on machine cart (not attached externally)
- Support for IEEE 802.11 standards, security protocols commonly used in healthcare IT
- Workflow should be designed using standardized, non-proprietary formats
- Front-end workflow: getting information into the machine (i.e. patient information, sonographer name(s), exam type, indication for scan)
- Optimize front-end workflow via barcode scanners, DICOM modality worklists
- Separate diagnostic studies from those performed for educational purposes
- Ultrasound interpretation (“worksheets”) filled out directly on machines
- Worksheets should include indication, views, findings, interpretation based on ACEP Standard Reporting Guidelines, but essential that they are fully user customizable
- Back-end workflow: getting information out of the machine (i.e. transfer ultrasound images and interpretations to the PACS and EMR)
- Ideal workflow to obtain images and document findings directly on the machine, then wireless transfer of ultrasound images and report from machine to the PACS and EMR

## **6. FUTURE INNOVATIONS**

- Wireless probe technologies highly desirable for the ED setting
- Consider incorporation of basic controls (e.g. image capture, depth, gain) onto the ultrasound probe
- Ability to pull up teaching images (standard views, probe placement, pathologic images) directly on machines