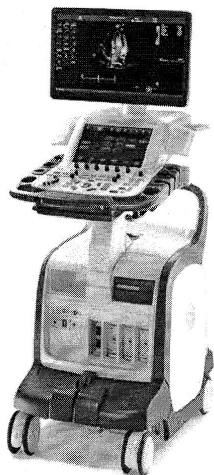




# Vivid E95



## Product Description

The Vivid™ E95 combines the proven breadth, quality and performance of the Vivid product line with a new and innovative software image processing platform: cSound™. The Vivid E95 is GE cardiovascular ultrasound's leadership scanner.

The system is designed to excel in adult 2D and 4D cardiac imaging, as well as in the following clinical application areas: pediatric cardiac, fetal/obstetrics, abdominal (including renal, GYN/pelvic), pediatrics, small organ (including breasts, testes and thyroid), adult and neonatal cephalic, peripheral vascular, musculoskeletal conventional, urology/prostate, transesophageal, transrectal, transvaginal and intraoperative (including vascular, thoracic/cardiac and abdominal).

Vivid E95 is delivered with a high-quality 22" high-resolution wide screen OLED monitor for optimal spatial and dynamic resolution.

## System Architecture

GE's exclusive, programmable and flexible beamforming technology, cSound, provides exceptional image quality and power compared to conventional GE hardware-based beamforming technology. In 2D, cSound offers true confocal imaging without the limitation of focal zones or sacrifice of frame rate and spatial resolution. In 4D, cSound delivers high spatial resolution at large volume sizes in full volume single-beat and multi-beat 4D acquisition. Using both coherent and harmonic image processing, the system provides computational power, ease of imaging, workflow flexibility and product upgradeability.

The Vivid E95 is designed to excel in the following areas:

**Exceptional image quality** is created through the use of True Confocal Imaging. The technique is enabled by the cSound platform taking advantage of advanced software image reconstruction and state-of-the-art graphics computer technology. The Vivid E95 combines Ultra Definition Clarity filtering, HD Imaging (optimal resolution, penetration and image uniformity), Adaptive Contrast Enhancement (ACE) and virtual apex (wide field-of-view) to deliver excellent cardiovascular ultrasound image quality.

**Probe Technology** – The XDclear™ series of probes are designed to help deliver powerful and efficient sound waves, with high bandwidth and efficiency. XDclear probe technology provides impressive deep penetration and high sensitivity while maintaining high spatial resolution. The combination of Single Crystal, Acoustic Amplifier and Cool Stack technologies is the core technology of the XDclear series of probes.

**Ease of use** for the operator in 2D imaging is provided by the cSound technology delivering auto optimized excellent image quality with minimal manipulation along with automated tools like 2D Auto EF, AFI Productivity Package, AFI Stress and Scan Assist Pro.

**Ergonomic** features include a highly portable user-adaptable design with electronic adjustable height and keyboard, articulating and height adjustable monitor, and lightweight transducers combining to make the Vivid E95 an ergonomic-friendly cardiovascular ultrasound system.

The cSound platform takes GE's **Raw Data** to a new level. For image processing and reconstruction, the Vivid E95 utilizes more than 100 times the data compared to its predecessor.

Additionally, the Vivid E95 uses an innovative data format technology that allows for advanced processing on archived images by applying many of the same scan controls and **advanced quantitative tools** as are available during the original exam.

## General Specifications

### Dimensions and Weight

- Width: 544 mm, 21 3/4"
- Depth: 844 mm, 33 1/4"
- Height: 1230 mm – 1670 mm, 48 3/8" – 65 3/4" (up/down mechanism + LCD arm)
- Weight: 126 kg , 278 lbs

### Electrical Power

- Nominal input voltage: 100-240 VAC, 50/60 Hz
- Typical power consumption: 500 W @ default cardiac preset With M5Se
- Rated power consumption: 700 W

## Operating System

- Windows® 7

## Console Design

- Five active probe ports
- ECG port
- Integrated HDD
- Multiple USB ports (front/back)
- Integrated DVD-R multi drive (optional)
- On-board storage for B/W thermal printer
- Integrated speakers for premium sound
- Integrated locking mechanism that provides rolling lock and caster swivel lock
- Integrated cable management
- Easily accessible removable air filters for cleaning
- Front and rear handles
- Side storage trays
- Rear storage trays/baskets
- Hand rest

## User Interface

### Operator Keyboard

- Floating keyboard adjustable in three dimensions:
  - Height
  - Rotation
  - Extension
- Touch keyboard with support for characters in 12 languages
- Drawer type, lit, A/N keyboard
- Support for European keyboard character sets (ISO 8859)
- Ergonomic hard key layout
- Interactive back lighting
- Integrated gel holders
- User-configurable probe holders
- Easy-to-learn user interface
- Dedicated rotary for overall gain for 2D-mode
- Dedicated gain rotary for M-mode, CFM or Doppler controlled by active mode

- Image manager on the touch screen for quick review of image clipboard contents

## Touch Screen

- 12" ultra-high-resolution, wide screen format, color, multi-touch LCD screen
- Interactive user-configurable dynamic software menu
- Backlight adjustment – automatic by light sensor or manual
- Touch-panel controls content can be set to routine or extended usage

## Monitor

- 22" wide screen High-Definition (HD) flicker-free OLED display
- 256 shades of gray and 16.7 million simultaneous colors available
- Articulated monitor arm
- Monitor translation (independent of console):
  - 350 mm horizontal bidirectional
  - 150 mm vertical height adjustment
  - Swivel to any viewing direction
- Fold down and rotation lock mechanism for transportation
- Horizontal viewing angle wider than 170°
- Resolution: 1920 x 1080 px
- Automatic or manual digital brightness and contrast adjustment for optimal viewing in different ambient light conditions (light-sensor)
- Tint and backlight adjustments
- Separate adjustment for external monitor brightness/contrast

## System Overview

### Probe Presets

- Cardiac
- Stress (incl. Exercise, QStress and LVO Stress) (optional)
- Abdominal (incl. renal)
- Vascular (incl. carotid, LEA, LEV, UEA, UEV, aorto-iliac)
- Fetal heart
- Pediatric
- Neonatal

- Neonatal head
- Small parts
- Thyroid
- Breast
- Musculoskeletal
- Intra Operative
- Transcranial
- Scrotal
- Urology (incl. pelvic)
- Rodent (incl. rats and mice for research)
- Transesophageal
- OB/GYN
- Coronary
- Contrast (optional)
- Contrast low MI (optional)
- LVO contrast

## Operating Modes

- 2D tissue
- 4D tissue
- 2D color flow
- 4D color flow
- 2D angio flow
- Color M-mode
- Tissue velocity M-mode
- Continuous wave Doppler
- Tissue M-mode
- Pulsed wave Doppler
- Anatomical M-mode
- Curved anatomical M-mode
- Tissue velocity imaging
- Tissue tracking
- Tissue synchronization imaging (optional)
- Strain imaging (optional)
- Strain rate imaging (optional)
- Tissue velocity Doppler
- Blood flow imaging
- Blood flow angio flow imaging
- B-flow
- 2D stress (optional)
- AFI Automated Function Imaging (optional)
- Auto EF (optional)

- 2D virtual apex imaging
- Bi-plane
- Tri-plane
- Bi- and tri-plane with color
- Coded phase inversion and power modulation contrast imaging
- Compound imaging
- Extended field-of-view (LOGIQView)
- 4D full volume scanning – single-beat and multi-beat
- 4D stress
- 4D strain imaging (optional)

#### Scanning Methods

- Electronic sector
- Electronic volume
- Electronic convex
- Electronic linear
- CW pencil

#### Transducer Types

- Sector phased array
- Convex array
- Linear array
- Single crystal matrix array
- 2D matrix array

#### Standard 4D Features

- Single, dual or multiple cycle volume acquisition
- Bi-plane acquisition includes tilt and rotate, and bi-plane prepare
- Tri-plane acquisition
- Multi-dimensional (bi-plane/tri-plane) color acquisition
- Dynamic multi-slice views
- Live multi-slice views
- FlexiSlice with depth mode
- 4D stress
- Multi-dimensional stress
- QuickRotate/Rotate
- Auto crop
- 2-click crop
- Flip crop
- View crop

- Dynamic view crop
- Measurement on render
- FlexiZoom
- Stereo vision
- Laser Lines
- Depth color render
- Automatic LV alignment
- 4D virtual apex
- Automated 4D left ventricular quantification (LV volume and EF)

#### Optional 4D Features

- 4D Auto AVQ: Automated 4D aortic annulus quantification (dimension, area, circumference)
- 4D Auto LVQ: Automated 4D left ventricular quantification (volume, ejection fraction)
- 4D strain
- 4D LV mass
- 4V enable (required to run 4V-D probe)
- HDlive
- MV assessment (Tomtec)
- RV volume (Tomtec)
- Polarized stereo vision

#### Peripheral Options

- Console protective cover

#### Internal peripherals

- USB B/W video printer with control from system (optional)

#### External peripherals

- Direct streaming DVR (Sony®HVO-550MD)
- Network printers
  - USB inkjet printer
  - Color laser printer
  - Color video printer with control from system
- 16 GB encrypted memory stick
- 2 TB USB hard drive (2 x 2 TB SATA II hard drives mirrored for data redundancy)
- Three-pedal configurable footswitch

- Optical isolation cable – DVI 104 fiber optic extender, required to connect the Sony 3D monitor for PolarVision (polarized stereo vision display)

#### External outputs

- DVI-D
- Ethernet – 10 Mbps, 100 Mbps, 1 Gbps
- Multiple USB 2.0 ports

#### Display Modes

- Live and stored display format: Full size and split screen, both with thumbnails, for still and cine
- Instant-review screen displays 12 simultaneous loops/images for a quick study review
- Selectable display configuration of duplex and triplex modes: side-by-side or top-bottom during live, digital replay and clipboard image recall
- Single, dual and quad-screen view
- Simultaneous capability
  - 2D+ PW/CW
  - 2D + CFM/TVI + PW
  - 2D + CFM + CW
  - 2D + CFM/Angio/TVI/SRI/TT/SI/TSI
  - 2D + M/AMM/CAMM
  - 2D+ CFM/Angio/TVI/SRI/TT/SI/TSI + M/AMM/CAMM
  - Real-time duplex or triplex mode
  - Compound + M/CFM/PW
  - 4D + CFM
  - 2D + bi-plane
  - 2D + bi-plane + CFM/TVI/SRI/TT/ SI/TSI/AMM/CAMM
  - 2D + tri-plane
  - 2D + tri-plane + CFM/TVI/SRI/TT/SI/TSI/AMM/CAMM
  - 2D + color split screen (simultaneous mode)
- Selectable alternating modes
  - 2D or compound + PW
  - 2D + CW
  - 2D or compound + CFM/PW
  - 2D + CFM + CW
- Multi-image (split/quad screen)
  - Live and/or frozen
  - Independent cine playback

- Timeline display
  - Independent 2D (or compound) + PW/CW/M display
  - A choice of display formats with various sizes of 2D + PW/CW/M
- Top/bottom selectable format
- Side/side selectable format
- 4D display
  - Two + one slice and render view
  - Quad view (three-slice and render)
  - Single render view
  - Slice-only view
  - Dynamic multi-slice
  - Live multi-slice
  - FlexiSlice (live and replay)
  - Bi-plane side/side view
  - Tri-plane view (quad including geometry viewer)
  - Crop view (three orthogonal slice + render)
  - Apical slice view (three 60 degrees view + render)
  - Cine rotate render view
  - Bi-plane prepare (two-slice + render)

#### Display Annotation

- Patient name: First, last and middle
- Patient ID
- Additional patient ID
- Age, sex and birth date
- Hospital name
- Date format: Two types selectable – MM/DD/YY, DD/MM/YY
- Time format: Two types selectable – 24 hours, 12 hours
- Gestational age from LMP/EDD/GA
- Probe name
- Map names
- Probe orientation
- Depth scale marker
- Image depth
- Zoom depth
- B-mode
  - Gain
  - Imaging frequency
  - Frame averaging

- M-mode
  - Gain
  - Frequency
  - Time scale
- Doppler mode
  - Gain
  - Angle
  - Sample volume size and position
  - Wall filter
  - Velocity and/or frequency scale
  - Spectrum inversion
- Time scale
  - PRF
  - Doppler frequency
- Color flow Doppler mode
  - Frame rate
  - Sample volume size
  - Color scale
  - Power
  - Color baseline
  - Color threshold marker
  - Color gain
- Spectrum inversion
- Acoustic frame rate
- CINE gauge, image number/frame number
- Bodymarks: Multiple human anatomical structures
- Application/preset name
- Measurement results
- Operator message
- Displayed acoustic output
  - TIS: Thermal Index Soft Tissue
  - TIC: Thermal Index Cranial (Bone)
  - TIB: Thermal Index Bone
- MI: Mechanical index
- Power output in dB
- Biopsy guide line and zone
- Heart rate
- Trackball-driven annotation arrows
- Active mode display
- Stress protocol parameters
- Parameter annotation follow ASE standard
- Free text with word library

- 4D slice intersection markers
- 4D gauge
- 4D viewing angle arrows
- 4D geometry viewer
- 4D number of cycles
- Scan plane position indicator and probe temperature are displayed with all TEE probes
- Image orientation marker

#### General System Parameters

##### System Setup

- Pre-programmable M&A and annotation categories
- User-programmable preset capability with administrator preset protection
- Factory default preset data, protected against modification
- User-defined annotations
- Body patterns
- Customized comment home position

#### Comprehensive User Manual Available on Board

Available through touch-panel utility page. User manual and service manual are included on a USB memory device with each system. A printed user manual is provided.

- User manual languages: English, French, German, Spanish, Italian, Portuguese (European and Brazilian), Swedish, Danish, Dutch, Norwegian, Japanese, Chinese, Polish, Finnish, Greek, Russian, Hungarian, Slovak, Romanian, Czech, Latvian, Lithuanian, Turkish, Estonian, Korean, Serbian, Bulgarian, Croatian, Indonesian, Kazakh, Ukraine

#### CINE Memory/Image Memory

- 8 GB of RAM (0.5 GB used for cine memory)
- Selectable cine sequence for cine review
- Measurements/calculations and annotations on cine playback
- Scrolling timeline memory



- Dual-image cine display
- Quad-image cine display
- CINE gauge and cine image number display
- CINE review loop
- CINE review speed

### Image Storage

- 4D virtual store for efficient 4D image management
- On-board database of patient information from past exams
- User-selectable ECG and time gated acquisition available on touch panel during live
- User-selectable prospective or retrospective capture in config
- Storage formats:
  - DICOM®-compressed or uncompressed, single/multi-frame, with/without raw data, storage via clipboard and/or seamlessly directly to destination device
  - Transfer/ "Save As" JPEG, MPEG, AVI, DICOM, Raw DICOM and VolDicom formats
- Storage devices:
  - USB memory stick: 16 GB
  - CD-RW storage: 700 MB (DVD option required)
  - DVD storage: -R (4.7 GB) (DVD option required)
  - Hard drive image storage: 0.5 TB
- Compare old images with current exam
- Reload of archived data sets
- Activation control of USB devices (for security)

### Connectivity and DICOM

- Ethernet network connection
- DICOM 3.0
- Verify
- Print
- Store
- Modality worklist
- Storage commitment
- Modality Performed Procedure Step (MPPS)

- Media exchange
- DICOM spooler
- DICOM query/retrieve
- Structured reporting – compatible with adult cardiac and vascular
- Media store of structured reporting
- InSite™ ExC capability for remote service/access
- Support of two patients' IDs in DICOM
- Separate DICOM SR and image storage destinations
- Simultaneous transfer of DICOM to multiple destinations

### Patient Archive

#### EchoPAC™/Patient Archive

- Integrated EchoPAC functionality adds connectivity and image analysis capability to scanner
- Data format fully compatible with offline EchoPAC review/reporting stations of same or newer vintage
- Instant access to ultrasound raw data provided by the system
- Advanced post-processing analysis
- Three user levels help organizing data security requirements
- E-signoff compatibility, with clear indications in patient management screens and report screen that a report was signed off, and by whom and at what time. The signed off report and exam cannot be changed. The "Diagnosing Physician" field is automatically assigned to the user that did the sign-off

### Image and Data Management

- Exceptional workflow with instant access data management
- DICOM 3.0 support – see DICOM conformance statement for details
- Support for transfer of the proprietary raw data files within the DICOM standard
- 2D, CFM or TVI data at maximum frame rate may be reviewed by scrolling or by running cine loops (can contain more than 1000 images for imaging modes)

- Image clipboard for stamp-size storage and review of stored images and loops
- Built-in patient archive with images/loops, patient information, measurements and reports
- DICOM-SR Standard structured reporting mechanism
- Structured findings report tools support efficient text entries with direct editing of findings text, usability improvements, new configuration options and conclusion section
- User can enter normal values which are then compared to actual measurements
- Configurable HTML-based report function
- Report templates can be customized on board
- ASE-based default text modules (English), user-customizable
- Internal archive data can be exported to removable image storage through DICOM media
- Internal hard disk – for storing programs, application defaults, ultrasound images and patient archive
- All data storage is based on ultrasound raw data, allowing to change gain, baseline, color maps, sweep speeds, etc., for recalled images and loops
- DICOM media – read/write images on DICOM format
- DICOM viewer embedded on media (optional and selectable in Config)
- Alphanumeric data can be exported in XML format
- JPEG export ("Save As" ) for still frames
- AVI and MPEG export ("Save As" ) for cineloops
- Specialized file format "Save As" VolDICOM feature to allow data import into TomTec Research Arena free-standing workstation

### **Insite™ Express Connection (ExC) Enables Remote Service and Training**

- Easy, flexible and secure connectivity configuration. The "Contact GE" on-screen button directly generates a real-time service request to the GE online engineering or application specialist. It takes a snapshot (e.g., error logs, setup files) of the system at the time of the service request to enable analysis of problem before customer contact
- Virtual Console Observation (VCO) enables the customer to allow desktop screens to be viewed and controlled remotely over the encrypted tunnel to enable real-time training, device configuration and clinical application support
- Operation of Insite Express Connection is dependent on the infrastructure being available – check with your local GE service representative
- File transfer enables the customer (biomed or clinician) to directly transfer system information (e.g., system logs, images, parametric data) to GE product engineering teams (no patient data transferred)
- Software reload provides remote application reconstruction and recovery capabilities in the event of system corruption

### **Scanning Parameters**

- Infinite number of effective channels
- Minimum field-of-view range (depth): 0 – 2 cm (zoom) (probe dependent)
- Maximum field-of-view range (depth): 0 – 50 cm (probe dependent)
- Width range: 10 – 120 degrees
- Continuous dynamic receive focus/continuous dynamic receive aperture
- Continuous dynamic transmit focus
- Adjustable dynamic range, infinite upper level
- Image reverse: Right/left
- Image rotation of 0°, 180°

### **Tissue Imaging General**

- Variable transmit frequencies for resolution/penetration optimization
- Display zoom with zoom area control
- High-Resolution (HR) zoom – concentrates all image acquisition power into selected Region of Interest (ROI)
- Variable contour filtering – for edge enhancement
- Depth range up to 36 cm – probe specific
- Selectable grayscale parameters: Gain, reject, DDP, clarity, dynamic range and compress – can be adjusted in live, digital replay and image clipboard recall (probe dependent)
- Automatically calculated TGC curves reduces operator interaction
- Automatically calculated lateral gain

### **2D Mode**

- Sector tilt and width control
- Frame rate in excess of 1000 fps, depending on probe, settings and applications
- Coded octave imaging with coded phase inversion – 3rd generation harmonic tissue imaging providing improved lateral and contrast resolution over conventional fundamental imaging. Features help reduce noise, improve wall definition, and axial resolution, making it well suited for a wide variety of patient groups
- True confocal imaging – ultra narrow focused two-way beam profile throughout the field-of-view, maintaining frame rate, no zone stitching, no multi-line acquisition artifacts and enhanced dynamic contrast resolution throughout field-of-view compared to conventional focal imaging
- Adaptive Contrast Enhancement (ACE) – emphasizing echoes from real structures while reducing noise/haze, resulting in enhanced signal-to-noise ratio

- Automatic tissue optimization – single keystroke optimizes immediately automatically and dynamically different grayscale settings with the goal of signal independent uniform gain and contrast distribution
- UD clarity and UD speckle reduce imaging – an advanced image processing technique to remove speckle in real-time examining the relative difference between neighboring pixel values and determining whether the grayscale variations have a sharp difference, follow a trend, or are random in nature
- HD imaging – real-time simultaneous acquisition at dual frequencies compounded to help reduce speckle and noise while enhancing resolution and contrast
- Multiple-angle compound imaging – multiple co-planar images from different angles combined into a single image in real-time to help enhance border definition and contrast resolution, as well as reduce angular dependence of border or edge as compared to no-compound imaging
- Elevation compounding (4D probes only)
- LOGIQView: provides the ability to construct and view a static 2D image with wider field-of-view of a given transducer. This allows viewing and measurements of anatomy that is larger than what would fit in a single image
- Virtual apex provides a wider field-of-view with phased array probes, effective at certain imaging views where a wide near field is preferred
- L/R and up/down invert, in live, digital replay or image clipboard recall
- Digital replay for retrospective review or automatic looping of images, allowing for adjustment of parameters such as gain, reject, anatomical M-mode, persistence and replay speed

- Data dependent processing performs temporal processing which helps reduce random noise but leaves motion of significant tissue structures largely unaffected – can be adjusted even in digital replay
- 256 shades of gray
- Colorized 2D-mode, user-selectable in real-time, digital replay
- Optimized presets for further 2D strain analysis on EchoPAC (separate option)

#### 4D Mode

- Flexi-volumes with customizable acquisition for volume size, volume rate or resolution
- Single-beat 4D scanning with real-time volume rendering display
- Multi-beat 4D scanning for high-resolution scanning
- Adjustable volume sizes for both single and multi-beat scanning
- Adjustable volume shape control
- Pre-defined volume sizes for quick volume setup
- Adjustable number of cycles for multi-beat scanning
- FlexiZoom for easy 4D visualization of structures of interest
- 4D scanning supporting variable octave and fundamental frequencies
- HDlive Imaging – acquisition and visualization providing enhanced display of anatomical structures using advanced shadowing techniques in combination with depth illuminating colors (optional)
- 4D clarity – user-selectable intelligent spatial filtering algorithm for noise reduction and smoothing both in 4D and in extracted 2D slices
- Coherent volume processing with motion compensation for seamless and artifact-free 4D and 2D slices
- Variable frame rate settings available
- Volume optimize control for volume rendering transparency and quality setting

- Flip crop available for changing 4D view direction 180 degrees with mirrored crop volume
- Dynamic multi-slice enables positioning of the multi-slice, short-axis cut-planes at same anatomical position throughout the heart cycle
- Live multi-slice layouts available during live 4D acquisition
- FlexiSlice for interactive slicing, cropping and navigation designed to provide the user with a flexible, yet intuitive way of extracting 2D slices from 4D data sets
- View-crop setting for toggle control of view plane vs. crop plane
- 2-click crop for quick and easy extraction of standard and non-standard views for visualization of 4D structures seen during or after the examination
- Stereo vision in 4D (option)
- Polarized stereo vision in 4D used together with dedicated Sony 3D monitor (option) may help improve depth perception of 4D image
- Laser lines to help improve the visual linkage between the 4D rendered view and the 2D slices
- Wide range of depth color rendering maps
- QuickRotate and Rotate for a flexible and easily accessible way of obtaining the desired single- or multi-plane, two-dimensional views
- 4D virtual apex enabling wider near field-of-view

#### Multi-Dimensional Mode

- Bi-plane scanning – two independent simultaneous scan planes where one of them can be rotated and tilted freely
- Bi-plane prepare mode for ease of obtaining biplane views from 4D render data sets
- Tri-plane – three independent simultaneous scan planes that can be rotated freely
- Both bi-plane and tri-plane scanning is possible in all color Doppler modes

#### M-mode

- Trackball steers M-mode line available with all imaging probes – max steering angle is probe dependent
- Simultaneous real-time 2D- and M-mode
- M-mode PRF 1 kHz – image data acquired is combined to give high-quality recording regardless of display scroll speed
- Digital replay for retrospective review of spectral data
- Several top-bottom formats, side-by-side format and time-motion-only format – can be adjusted in live or digital replay
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display
- Horizontal scroll can be adjusted in live or digital replay

#### Anatomical M-mode

- M-mode cursor can be adjusted at any plane
- Curved anatomical M-mode – free (curved) drawing of M-mode generated from the cursor independent from the axial plane
- Can be activated from live, digital replay or image clipboard recall
- Anatomical color and tissue velocity M-mode
- M&A capability

#### Color Doppler Imaging

##### General

- Steerable color Doppler available with all imaging probes – max steering angle is probe dependent
- Trackball-controlled ROI
- Removal of color map from the tissue during digital replay
- Digital replay for retrospective review of color or color M-mode data allowing for adjustment of parameters such as encoding principle, color priority and color gain even on stored data

- PRF settings – user-selectable
- Advanced regression wall filter gives efficient suppression of wall clutter
- For each encoding principle, multiple color maps can be selected in live and digital replay – variance maps available
- More than 65,000 simultaneous colors processed, providing a smooth display two-dimensional color maps containing a multitude of color hues
- Simultaneous display of grayscale 2D and 2D with color flow
- Color invert – user-selectable in live and digital replay
- Variable color baseline – user-selectable in live and digital replay
- Multi-variate color priority function gives delineation of disturbed flows even across bright areas of the 2D-mode image
- Color Doppler frequency can be changed independently from 2D

#### Color Flow Imaging

- The cSound platform with its parallel beamformer architecture allows a combination of ultra high frame rate and increased lateral resolution compared to previous generation GE scanners
- Ultra-high digital signal processing power, maintaining high frame rates with large ROI's even for very low PRF settings
- Frame rate in excess of 150 fps, depending on probe and settings
- Variable ROI size in width and depth
- User-selectable radial and lateral averaging to help reduce statistical uncertainty in the color velocity and variance estimates
- Data Dependent Processing (DDP) performs temporal processing and display smoothing to help reduce loss of transient events of hemo-dynamic significance

- Digital replay for retrospective review or automatic looping of color images, allowing for adjustment of parameters such as DDP, encoding principle, baseline shift, color maps, color priority and color gain even on frozen/recalled data
- Application-dependent, multi-variate motion discriminator helps reduce flash artifacts
- Dedicated coronary flow application
- Multiple-angle compound imaging in 2D mode is maintained while in color Doppler mode

#### 4D Color Doppler Imaging

- Single-beat 4D color flow scanning
- Volume size control to change the size of the color ROI
- Multi-beat 4D color flow scanning using ECG stitching for increased volume rate
- Pre-defined volume sizes for quick volume setup
- Adjustable number of cycles for multi-beat scanning
- Variable volume rate settings available
- Flip crop available for changing 4D view direction 180 degrees with mirrored crop volume
- View-crop setting for toggle control of view plane vs. crop plane
- Stereo vision in 4D color
- Tissue transparency control
- Flow transparency control

#### Multi-Dimensional Color Mode

- Bi-plane and tri-plane scanning with all color Doppler and tissue velocity modes

#### Color Angio

- Angle-independent mode for visualization of small vessels with increased sensitivity compared to standard color flow of previous GE products

#### Color M-mode

- Variable ROI length and position – user-selectable
- User-selectable radial averaging to help reduce statistical uncertainty in the color velocity and variance estimates
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted during live, digital replay or image clipboard recall
- Real-time 2D image while in color M-mode
- Same controls and functions available as in standard 2D color Doppler

#### Anatomical Color M-mode

- GE-patented, any plane color M-mode display derived from color Doppler cine loop
- Also applicable to tissue velocity imaging
- M&A capability

#### B-flow

- B-flow is a digital imaging technique that provides real-time visualization of vascular hemodynamics by directly visualizing blood reflectors and presenting this information in a grayscale display
- Use of GE-patented techniques to boost blood echoes, and to help preferentially suppress non-moving tissue signals
- B-flow is available for most vascular and shared service applications

#### Blood Flow Imaging

- Combines color Doppler with grayscale speckle imaging
- Helps improve delineation of blood flow without bleeding into tissue or vessel wall

#### Blood Flow Angio Imaging

- Combines angio with grayscale speckle imaging

## Tissue Velocity Imaging

### Tissue Velocity Imaging Mode

- Myocardial Doppler imaging with color overlay on tissue image
- Tissue Doppler data can be acquired in background during regular 2D imaging
- The velocity of myocardial segments after entire heart cycle can be displayed in one single image
- Tissue color overlay can be removed to show just the 2D image, still retaining the tissue velocity information
- Quantitative profiles for TVI, tissue tracking, strain and strain rate can be derived
- Time markers for valve events derived from any TM mode help simplify understanding of signals in velocity traces or curved anatomical M-mode

### Tissue Tracking Mode

- Real-time display of the time integral of TVI for quantitative display of myocardial systolic displacement
- Myocardial displacement is calculated and displayed as a color-coded overlay on the grayscale and M-mode image – different colors represent different displacement ranges

### Tissue Synchronization Imaging Mode (option, enabled by Advanced QScan)

- Parametric imaging which gives information about synchronicity of myocardial motion
- Myocardial segments colored according to time to peak velocity, green for early and red for late peak
- Waveform trace available to obtain quantitative time to peak measurement from TSI Image
- Available in live scanning, as well as an offline calculation derived from tissue Doppler data
- Additional features in combination with multi-dimensional imaging option
- Simultaneous acquisition of tri-plane TSI images covering all standard in apical views

- Efficient segment specific TSI time measurements
- Immediate bulls-eye report
- Automatic calculated TSI synchrony indexes
- TSI surface mapping
- LV synchronization report template
- CRT programming protocol

### Strain/Strain Rate Mode

#### (option, enabled by Advanced QScan)

- Tissue deformation (strain) and rate of deformation (strain rate) are calculated and displayed as real-time, color-coded overlay on the 2D image
- Cine compound calculates and displays cineloops generated from a temporal averaging of multiple consecutive heart cycles
- Anatomical M-mode and curved anatomical M-mode displays (SI and SRI)

## Spectral Doppler

### General

- Operates in PW, HPRF and CW modes
- Trackball steerable Doppler available with all imaging probes – max steering angle is probe dependent
- Selectable Doppler frequency for enhanced optimization
- High-quality, real-time duplex or triplex operation in all Doppler modes, CW and PW, and for all velocity settings
- Frame rate control for optimized use of acquisition power between spectrum, 2D and color Doppler modes in duplex or triplex modes
- Very fast and flexible spectrum analysis with an equivalent DFT rate of 0.2 ms
- Automatic Spectrum Optimization (ASO) provides a single push, automatic, real-time optimization of PW or CW spectrum scale and baseline display
- Dynamic gain compensation for display of flows with varying signal strengths over the cardiac cycle to help improve ease of use

- Dynamic reject gives consistent suppression of background – user-selectable in real-time, digital replay or image clipboard recall
- Digital replay for retrospective review of spectral Doppler data
- Several top-bottom formats, side-by-side format and time-motion-only format – can be adjusted in live or digital replay
- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted in live or digital replay
- Adjustable spectral Doppler display parameters: Gain, reject, compress, color maps – can be adjusted in live or digital replay
- User-adjustable baseline shift – in live, digital replay and image clipboard recall
- Adjustable velocity scale
- Wall filters with range 10-2000 Hz (velocity scale dependent)
- Angle correction with automatic adjustment of velocity scale – in live, digital replay and image clipboard recall
- Auto Doppler angle
- Stereo speakers mounted in the front panel
- Display annotations of frequency, mode, scales, Nyquist limit, wall filter setting, angle correction, acoustic power indices
- Compound in duplex

### PW/HPRF Doppler

- Automatic HPRF Doppler maintains its sensitivity even for shallow depths and with the highest PRF's
- Digital velocity tracking Doppler employs processing in range and time for high-quality spectral displays
- Adjustable sample volume size of 1-16 mm (probe dependent)
- Maximum sample volume depth 30 cm

### CW Doppler

- Highly sensitive steerable CW available with all phased array probes
- Tissue velocity Doppler

### Contrast Imaging

#### LVO Contrast (standard)

- Enables contrast applications intended for imaging of the left ventricle
- LV contrast (4V-D, M5Sc-D, 6VT-D) enhances delineation of the LV border in combination with ultrasound contrast agents. The implementation of GE's Coded Phase Inversion (CPI) provides high-resolution detection of contrast in the LV cavity and excellent suppression of myocardial tissue signals. Furthermore, tri-plane imaging with 4V-D using LV contrast enables apical views within one cardiac cycle
- LVO stress (M5Sc-D) provides enhanced delineation of the LV border when contrast is used as part of an exercise stress exam, preserving an adequately long continuous capture buffer length

#### Contrast Low MI (option)<sup>1,2</sup>

Contrast Low MI imaging enabled by the Advanced Contrast option.

- With improved resolution, tissue suppression and higher contrast sensitivity, obtained by utilizing the new Coded Phase Inversion mode (B-mode) intended for low power real-time myocardial contrast imaging. Destruction wash-in studies are possible online or offline using "flash" and Q-analysis features. Offline ECG triggering (acquire the full cine loop) is yet another useful tool of the Contrast Low MI application

#### Vascular/Abdominal Contrast (option)<sup>1,2</sup>

Vascular Contrast – enables contrast applications intended for vascular (9L-D) and abdominal (C1-5) contrast imaging.

- Vascular Contrast (9L-D) – coded phase inversion enables excellent detection and resolution of vascular contrast imaging

#### Physiological Traces

- Integrated three-lead ECG module
- Automatic QRS complex detection
- External ECG lead input
- Up to three traces display simultaneously
- Internally generated respiratory trace using ECG leads
- ECG trigger
- ECG lead selection
- High-resolution display of the following traces: ECG, respiration, phono, and pressure/AUX
- Adjustable ECG QRS markers

#### Automatic Optimization

- Dynamic optimization of B-mode image to improve contrast resolution, TGC and grayscale (soft or sharp, user-selectable)
- Auto-spectral optimize – dynamic adjustments of baseline, and PRF (on live image) and angle correction

#### Measurement and Analysis (M&A)

- Personalized measurement protocols allow individual set and order of M&A items
- Measurements can be labeled seamlessly by using protocols or post assignments
- Measurements assignable to protocol capability

- Parameter annotation follow ASE standard
- Seamless data storage and report creation
- User-assignable parameters
- Comprehensive set of cardiac measurements and calculations to help assess dimensions, flow properties and other functional parameters of the heart
- Comprehensive set of shared service measurements and calculations covering vascular, abdominal, obstetrics and other application areas
- Configuration package to set up a customized set and sequence of measurements to use, defining user-defined measurements and changing settings for the factory-defined measurements
- Stress echo support allowing wall motion scoring and automatic stress level labeling of measurements
- Support for measuring on DVR recordings and DICOM images
- Automatic Doppler trace functionality for use in non-cardiac applications in both live and replay
- Worksheet for review, edit and deletion of performed measurements
- Reporting support allowing a configurable set of measurements to be shown in the exam report
- DICOM SR export of measurement data

#### Intima Media Thickness (IMT) Measurements (optional)

- Automatic measurements (patent pending) of carotid artery Intima-Media Thickness (IMT) on any acquired frame
- On-board IMT package facilitates non-interrupted workflow – fully integrated with M&A, worksheet, archiving and reporting functions
- Algorithm provides robust, quick, reliable measurements which can be stored to the on-board archive for review and reporting

<sup>1</sup> Schering developed harmonic imaging for supporting contrast agent imaging.

<sup>2</sup> GE Healthcare's Vivid scanner is designed for compatibility with commercially available contrast agents. Because the availability of these agents is subject to government regulation and approval, product features intended for use with these agents may not be commercially marketed nor made available before the contrast agent is approved for use. Advanced contrast features are only enabled on systems for delivery in countries or regions where the agents are approved for use or for investigational or research use.

- IMT measurement can be made from frozen images or images retrieved from archive
- IMT package supports measurements of different regions of the intima in the carotid vessel (e.g., Lt./Rt./CCA/ICA etc.)
- Frame for IMT measurement can be selected in relation to the ECG waveform

#### Z-Scores

- Limited implementation of z-scores for a set of predefined pediatric dimension measurements

#### 4D Auto LVQ

- Automated measurement of LV volume and EF from volumetric data
- Automated identification of LV long-axis and standard views
- Automated initialization of measurement ROI
- Validation of detected boundaries
- LV volume waveform for entire cardiac cycle
- ED and ES automatically selected from volume waveform (max/min)
- Editing by point and click
- User approval of final results
- Fully integrated into M&A system with results in worksheet

#### 4D LV Mass (optional) and 4D Strain (optional)

- LV Mass with Sphericity Index (SI)
- 4D Strain with support for the following parameters: Area, longitudinal, circumferential, radial, twist and torsion. All global and/or segmental
- Retrospective editing available in 4D Strain
- Strain bulls-eyes and graphs supported in addition to LV surface model with strain color overlay
- 4D Strain export available in HDF format
- User approval of final results

- Fully integrated into M&A system with results in worksheet

#### 4D Auto AVQ (optional)

- Automated alignment, segmentation and measurement of aortic annulus from volumetric data sets
- Editing by point and click
- User approval of final results
- Fully integrated in M&A system with results in worksheet

#### Mitral Valve Assessment (optional)

- The semi-automated MV assessment tool from Tomtec provides the ability to include quantitative results for the mitral valve apparatus, into the patient exam

#### 4D RV Volume (optional)

- The second generation 4D Right Ventricle (RV) volume tool from Tomtec provides volumes, ejection fraction, TAPSE and RV strain values from volumetric data sets
- The analysis tool provides the ability to include results (both alpha-numeric values and screen captures) into the patient exam

#### Quantitative Analysis Package (Q-Analysis)

- Traces for velocity or derived parameters (strain rate, strain, displacement) inside defined regions of interest as function of time
- Contrast analysis with traces for grayscale intensity or angio power inside defined regions of interest as function of time, including post processing ECG triggering and curve fitting for wash in/wash out analysis
- Curved anatomical M-mode display allowing an M-mode along an arbitrary curve in a 2D image
- Sample-area points may be dynamically anchored to move with the tissue when running the cineloop
- Cine compound displays cineloops generated from a temporal averaging of multiple consecutive heart cycles

#### Automated Function Imaging (AFI) (optional)

- Parametric imaging tool which gives quantitative data for global and segmental wall motion
- Allows comprehensive assessment at a glance by combining three longitudinal views into one comprehensive bulls-eye view
- Integrated into M&A package with specialized report templates
- 2D strain based data moves into clinical practice
- Simplified workflow with fully automated ROI tracing (if configured), quick tips and combined display of traces from all segments
- Peak Strain Dispersion (PSD) (included in AFI and 2D Strain [EchoPAC]). Index, as well as bulls-eye displaying variability in time to peak longitudinal strain. The index is the standard deviation from the average (of all segments) over the whole heart cycle, while the bulls-eye displays the PSD in a color scheme where green color indicates normal contraction with a peak at or around AVC, blue color indicates early contraction and yellow to red indicates late contraction

#### AFI Stress (optional)

- Dedicated protocol and workflow integrating AFI as part of a stress exam (pharmacological, as well as exercise) – see Stress Echo section

#### Automated Ejection-Fraction Calculation (AutoEF) (optional)

- Automated EF measurement tool based on 2D-speckle tracking algorithm and on Simpson
- Integrated into M&A package with worksheet summary

#### Generic Measurements

- BSA (Body Surface Area)
- MaxPG (Maximum Pressure Gradient)
- MeanPG (Mean Pressure Gradient)
- % Stenosis (Stenosis Ratio)
- PI (Pulsatility Index)