

Our unique design incorporates a contractile left ventricle (LV) with mitral and aortic valves that mimic realistic valve motion patterns and ejection fraction. This programmable phantom provides user control over; heart beat rates, LV contractile patterns, LV ejection fractions, and mitral valve pathologies. Contraction patterns, contraction rates and ejection fraction are controlled by a programmable micro-controller that actuates six individual pneumatic cylinders and a system of flow control valves.

Applications

This phantom is to be used with a Transesophageal echocardiography (TEE) probe for system development & validation studies for;

Image guided surgery simulation:

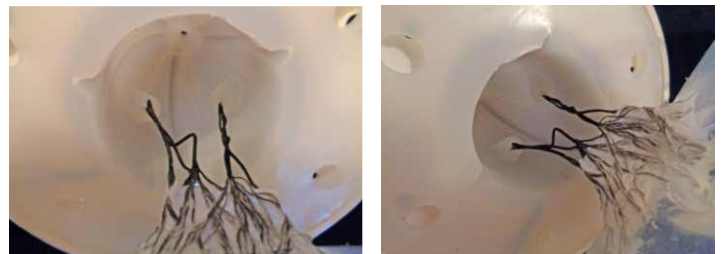
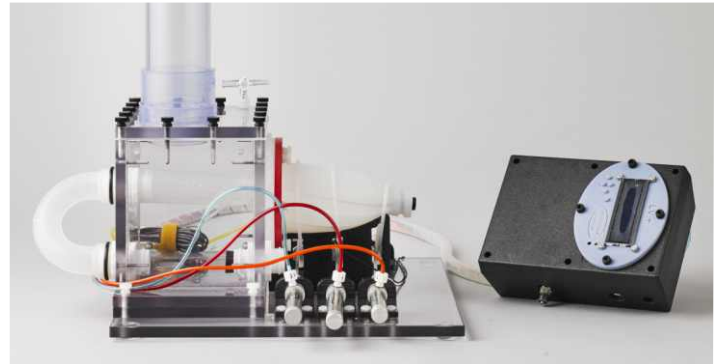
- Mitral valve repair or replacement
- Aortic valve replacement (TAVR)
- LV apical or retrograde aortic access

Image processing:

- Transesophageal Echocardiography training
- Ejection fraction measurement
- Image based valve tracking
- Flow analysis
- LV wall motion studies
- Mitral valve segmentation

Features

- TEE probe is positioned down the cylinder to image inside the enclosure
- Left ventricle material is silicone or polyvinyl alcohol cryogel (PVA-C)
- Adjustable nylon chordae tendineae integrated into mitral valve leaflets and extending through papillary muscles
- Mitral and aortic “valve sheet” with functional valves
- Apical access to simulate surgical procedures or for endoscopic viewing
- Retrograde access via descending aorta, plus access ports to simulate superior and inferior vena cava
- Six individually activated pneumatic cylinders to control LV contraction motion patterns and beat rates
- Compatible with many blood mimicking fluids
- Pre-programmed heart rates and activation patterns
- Programmable; user defined heart rates & activation patterns
- ECG gating output (5V square wave)



Sub valvular apparatus showing adjustable chordae connecting the mitral valve to papillary muscles inside the left ventricle.

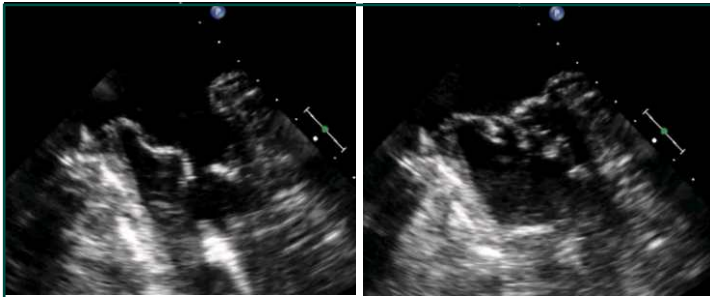




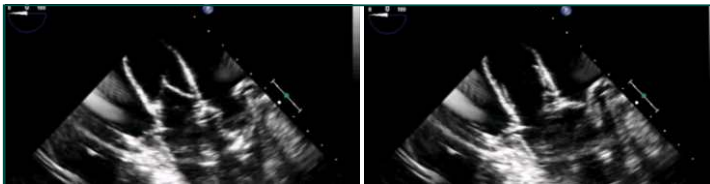
Ultrasound & Endoscopy

Diastole:

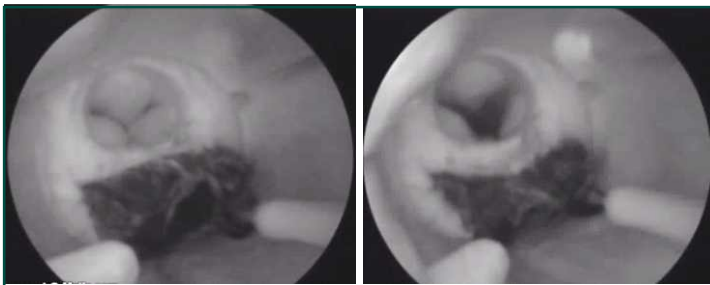
Systole:



Mitral Valve



Aortic Valve



Apical endoscopic view, MV & AV



Atrial endoscopic view, MV

Specifications

Heart Properties:

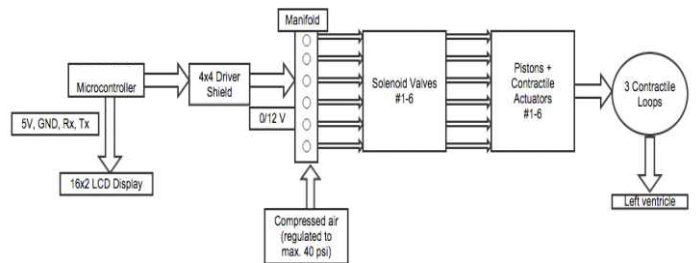
- Ejection fraction: up to 51%,
- diastolic volume 157mL,
- systolic volume 76mL
- Anterior-posterior MV 23mm
- Medial-lateral MV 37mm
- Ventricle height 130mm
- Silicone or PVA-C materials

Actuator System:

- Programmable micro-controller
- Six independent pneumatic cylinders for activation
- Individual flow control valves for each cylinder
- User-friendly interface
- 120V adapter (12V DC)
- 40 PSI input required
- NOTE: valves do not function at realistic human cardiac pressures

Customizable Design

- Micro-controller allows custom code development for control of heart rate and LV activation patterns to mimic mitral valve flail pathology



- Can be configured for trans-vascular access of the aortic valve or right/left atria

Manufactured by



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