**Rationale:** To provide guidance and perspective on how the LUCAS™ Mechanical CPR device will be integrated into our Pit Crew model.

**Background:** Our pit crew cardiac arrest process has been very successful in producing improved patient outcomes in our system. While we do not wish to tamper with what is clearly a successful model, safety of providers is also a high priority, as is availability of first response resources within their service area. Sedgwick County EMS has purchased several LUCAS™ mechanical CPR devices which will be carried on Division Leader vehicles. There are some limitations to the LUCAS™ devices, including patient size and inability to modify compression rate. Studies in other systems have shown that these devices can produce acceptable compression ratios but rates that are slightly below the target of 100-120 compressions / minute including pauses. Our human pit crews routinely give our patients ideal compression rates, as well as acceptable compression ratios. As a result, LUCAS™ use should be limited to patients who meet indications below who are transported, either post-ROSC or in ongoing arrest. Our standard pit crew approach should continue to be used on scene. Division Leader will be responsible for correct placement and ongoing operation of LUCAS™ device.

**Indications:**
- Post-ROSC patients
- Ongoing arrest patients who are being transported, either trauma or medical
- Patient size appropriate for machine (see below for contraindications). Approximate guidelines include:
  - Sternum height of 6.7 – 11.9 inches
  - Chest width of < 17.7 inches
  - The device may be used in pediatric patients if the patient is not too small as noted in the contraindications section.

**Contraindications:**
- Pregnancy
- Patient body size incorrect:
  - Too small: LUCAS™ alerts with 3 fast signals when lowering suction cup, you cannot enter PAUSE or ACTIVE mode, signals patient is too small for correct placement
  - Too large: upper part and legs cannot be locked to the back plate without compressing patient
- LUCAS™ is not to be applied unless the patient is being transported in cardiac arrest or post-ROSC, and compressions are not to be activated unless patient is in cardiac arrest.

**Necessary Equipment**
- LUCAS™ Device
- Spare battery for long transport
- Backboard or soft patient mover to assist in moving patient once LUCAS™ is applied

**Procedure:**
- An SCEMS provider trained on the LUCAS™ must remain with the patient at all times until the LUCAS™ is removed. That person shall be responsible for the proper application of and operation of the device.
- Remove device from case. Push on/off button to power up and initiate self-test. Green LED next to ADJUST key will light when ready for use.
The LUCAS™ 2 has push-button settings
- **ADJUST** - for initial sizing to patient.
- **PAUSE** - stops compressions if needed for rhythm check, repositioning the patient or changing batteries.
- **ACTIVE** - compresses the chest at a rate of 100 compressions per minute. Select the *continuous compressions button* (top button).

The LUCAS™ should never be paused for BVM ventilations or airway management.
• If patient has an invasive airway, position 3 is to anchor the airway, even if a holder is in place and support the patient’s head throughout LUCAS™ application and patient movement.
• Be sure defib pads will not interfere with proper placement of suction cup. Suction cup cannot be on top defib pads. See CARDIAC ARREST MANAGEMENT (P-30) for placement options. Move defib pads if necessary.
• In patients with ongoing cardiac arrest, Pit Crew resuscitation should be in process. Division Leader directs application of the LUCAS™ over the course of two planned pauses between 220 compression cycles. The pause should still not be longer than the usual length of 15 metronome beeps. Maximizing compressions remains the priority.

1. First pause: Division Leader directs placement of the LUCAS™ back plate with the assistance of the person who just finished compressions. The back plate can be placed in one of two ways:
   • Lift the patient’s shoulders and slide plate in under patient’s head until the top of the plate is below patient’s armpits.
   • Roll the patient side to side and work the plate down behind patient.
2. Resume manual compressions after no more than 15-beat pause.
3. Prepare upper part of device by pulling up on both release rings on legs to assure that claw locks are open.
4. Attach claw to back plate on side opposite to compressor while manual compressions continue.
5. Pivot the machine’s upper part over the patient’s torso, bringing the top/hood carefully toward the manual compressor, threading it between his/her arms and stopping manual compressions only at the moment prior to locking the near side claw at the end of that compression cycle.
6. Second pause:
   • Position the suction cup so that the lower edge is just proximal to the inferior sternum (see diagram). Be sure you are above the xiphoid process. Assure that defib pads and wires are not under or interfering with suction cup.
   • Adjust the suction cup height as follows: Press ADJ UST button, push suction cup down with two fingers until pressure pad touches the patient’s chest without compressing the chest.
   • Press PAUSE button to lock the start position.

Then remove your fingers from the suction cup.
• Verify that position on sternum is correct. If not, push ADJ UST button, pull up suction cup, and repeat positioning as above.
• Verify that the claws on the support legs lock without compressing the patient’s chest. If the patient’s chest is compressed, the patient is too large.
• If LUCAS™ alerts with 3 fast signals when suction cup is lowered, the patient is too small.
• If patient too large or small, remove device and restart manual compressions as soon as possible.
7. Activate compressions by pushing CONTINUOUS button.
8. Secure patient’s arms with Patient Straps on upper part of LUCAS™ unless a humeral IO has been placed. If humeral IO has been placed, secure wrists together over umbilicus or secure arm with IO under the buttock on that side to prevent IO dislodgement. Do not attempt to lift patient by Patient Straps.

9. Position patient on backboard or patient mover for movement to cot. Backboard may be left in place for patients in ongoing arrest. Other patients should be transferred to soft cot, ideally by removing backboard from the foot of the cot with appropriate securing of airway, patient, and LUCAS™.

   o In patients post-ROSC: After transport decision has been made, and patient has had several minutes to begin equilibrating physiologically post-ROSC, gently place the LUCAS™ on the patient as follows: Division Leader directs placement of the LUCAS™ back plate in one of two ways:
      ▪ Lift the patient's shoulders and slide plate in under patient's head until the top of the plate is below patient's armpits.
      ▪ Roll the patient side to side and work the plate down behind patient.
   o Continue with Steps 3-6, 8, and 9 above.
   o If patient re-arrests, activate compressions by pushing CONTINUOUS button.

   • If patient is moved with the device only, press PAUSE for the movement period, which should be as brief as possible. Re-verify correct suction cup position before restarting compressions. Assure that upper part of device is perpendicular to patient's chest.
   • Be certain you change battery and recharge after every use so device is ready for next use.

   Considerations
   • Manpower for transport with LUCAS™
      o 2-3 providers is an appropriate number. If the patient re-arrests and the device does not function, two providers are enough to begin Pit Crew CPR as the driver calls for additional manpower.
      o One of the providers should be the Division Leader responsible for operating the device.
      o No more than 4 EMS providers should be in the rear of the ambulance for transport.
      o Division Leaders may choose to allow the ED to continue use of LUCAS™ for a brief period of time after ED arrival to allow safe removal of the device and an orderly transition to hospital care. The Division Leader will continue to be responsible for safe operation of the device.
   • Operation/Placement:
      o Only use continuous compression mode, never 30:2 mode.
      o LUCAS™ compressions interfere with ECG analysis. Therefore, cardiac rhythm should only be evaluated between cycles when PAUSE is pushed.
      o If the pressure pad is incorrectly positioned in relation to the sternum, there is an increased risk of damage to the rib cage and the internal organs, and the cardiac output is further decreased.
      o If the position of the Suction Cup changes during operation or during defibrillation, immediately push ADJUST and adjust the position. Always use the LUCAS™ Stabilization Strap to help secure the correct position.
      o Cardiac output is further compromised if the pressure pad presses down too heavily or too lightly on the chest. Push the ADJUST key and adjust the height of the Suction Cup immediately.
      o If safe and correct positioning of the LUCAS™ on the patient's chest is not possible, start Pit Crew CPR again.
Troubleshooting:

- Monitor for movement of the device, both the tower and the suction cup. The neck strap and wrist straps should be used and will help avoid this.
- The upper part / tower must remain vertical relative to the patient's chest at all times. Reposition if the device goes off-axis. If there is a device malfunction, immediately remove the arm of the device and resume Pit Crew CPR. Consider reapplying device only after the problem has been addressed.
- A red alarm LED will illuminate and a high priority alarm will sound if there is any malfunction during operation.
- If there are interruptions, or the compressions are not sufficient, or something unusual occurs during operation: Push ON/OFF for 1 second to stop LUCAS™ and remove the device. Start manual chest compressions.

Device cautions:

- Use with caution in oxygen-enriched environment – use ventilation fan in rear of ambulance when LUCAS™ in use.
- Do not block the vent holes under the hood since this can cause overheating. The temperatures of the hood and battery may rise above 118 °F / 48 °C. If hot, avoid prolonged contact to prevent skin burns.
- Do not use the straps for lifting. The straps are only to fixate the patient to LUCAS™.