**Agency: Commerce, Community and Economic Development**

**Grants to Municipalities (AS 37.05.315)**

**Grant Recipient: Anchorage** **Federal Tax ID:** 92-0059987

**Project Title:** **Project Type:** Equipment and Materials

# Anchorage - Fire Department CPR Equipment

**State Funding Requested: $**140,000 **House District:** Anchorage Areawide (16-32)

One-Time Need

## Brief Project Description:

Replace nine CPR compression devices with the LUCAS Chest Compression System.

## Funding Plan:

| | |
|---|---|
| Total Project Cost: | $140,000 |
| Funding Already Secured: | ($0) |
| FY2012 State Funding Request: | ($140,000) |
| Project Deficit: | $0 |

*Funding Details:*

*Operating Funds*

## Detailed Project Description and Justification:

The Anchorage Fire Department currently operates seven Auto-Pulse CPR compression devices, deployed on fire engine companies, as well as two devices operated by the Chugiak Volunteer Fire and Rescue Company and Girdwood Fire and Rescue Inc. The fleet of nine Auto-Pulses are reaching the end of their service lives with increasing maintenance and operating costs, combined with decreasing operational reliability.

Today's rescuers most often manually perform much of the CPR protocol, compressing the chest with their arms and hands and providing ventilations via a bag valve mask. To be effective, chest compressions must be delivered quickly, forcefully and consistently.

When performed manually, compressions tend to vary in intensity and consistency. Further, rescuer endurance limits the effectiveness of manual chest compressions. Studies have found that rescuers began to lose effectiveness after about 1 minute and that after 4 minutes they achieved only about 30% of the chest compression deemed necessary.

The AFD will replace all nine Auto-Pulses with the LUCAS Chest Compression System, at an estimated cost of $15,000 per unit.

## Project Timeline:

Equipment will be purchased and delivered in FY2012

## Entity Responsible for the Ongoing Operation and Maintenance of this Project:

Anchorage Fire Department

*For use by Co-chair Staff Only:*

$140,000 Approved

10:28 AM 5/27/2011



**Contact Name:** Amory Lelake
**Contact Number:** 465-3704

## Grant Recipient Contact Information:

| | |
|---|---|
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Has this project been through a public review process at the local level and is it a community priority? [X] Yes [ ] No

*For use by Co-chair Staff Only:*

10:28 AM 5/27/2011



**Contact Name:** Amory Lelake
**Contact Number:** 465-3704

# LUCAS™ 2

## Chest Compression System

*Your Partner in Life Support*


ELECTRICALLY POWERED!

*Getting to the heart of resuscitation*

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Chest compressions according to guidelines... Every time.

**www.lucas-cpr.com** | a product by JOLIFE

# LUCAS™2
Chest Compression System

*Your Partne*

## Reduce chaos. Increase focus. Treat th


### AHA/ERC* guidelines compliant... Every time.

**LUCAS provides guidelines compliant compressions in the middle of the chest:**

- 100 per minute
- 4-5 cm depth
- 50/50 duty cycle for compression and decompression
- Allows for full chest recoil

*American Heart Association/European Resuscitation Council

er in Life Support

e cause.


## Never run out of power!

LUCAS™2 operates on battery or connected to wall or car electricity outlets. This provides a high operational flexibility as well as reliability whether the patient is treated by ambulance personnel in the field or in the hospital.

The modern and compact LiPo Battery, which does not require test cycling or reconditioning, typically provides 45 minutes of operation time. It is neatly integrated in the hood and can be exchanged easily.

## Compact and lightweight

LUCAS™2 is a compact and lightweight unit which is easy to store and carry in the practical Carrying Bag.

## Quick and easy to apply

LUCAS™2 can be applied within seconds and is designed to minimize interruptions of manual CPR during application. The small and lightweight Back Plate facilitates application also in confined spaces.

## Easy and intuitive to operate

The intuitive user interface allows for direct access to all operating modes, as simple as 1, 2, 3. There are two compression modes; 30:2 mode or a continuous mode with ventilation alerts.

## Smooth operation

LUCAS™2 has a quieter operation than ever and a Soft Start at initial adjustment to the chest. When compressions are secured, LUCAS allows for access to the patient's chest, e.g. to place defibrillation pads.

The Smart Restart function allows for an immediate resumption of compression after change of Battery as it remembers the patient settings during 60 seconds.

## Compatible with resuscitation therapies

Most tasks and therapies can be undertaken while LUCAS compressions maximizes circulation and minimizes interruptions, such as: defibrillation, ventilation, medication, patient movement, transportation as well as coronary interventions in the catheterization laboratory.

In addition, LUCAS increases the safety of the personnel while maintaining patient circulation.

# LUCAS™2
Chest Compression System

jolife

## Technical information

### Chest compressions as defined in AHA/ERC guidelines:

- Rate: 100 per minute
- Depth: 4-5 cm
- Equal compression/ decompression duty cycle
- Allows for full chest recoil

**Patients eligible for treatment**

- Sternum height of 17.0-30.3 cm
- Maximum chest width of 44.9 cm
- The use of LUCAS is not restricted by patient weight

### Power source and operation

- Electrical operation with rechargeable Lithium Ion Polymer (LiPo) Battery alone or together with External Power Supply (12-24V DC car outlet or 100-240V, 50/60Hz AC wall outlet).
- Battery run time: 45 minutes (typical)
- Operating temperature: 0-40°C
- Battery recharge time in external charger <4 hours at room temperature
- Battery expected service life: 200 uses or 3 years
- Battery classification: IP44

### Physical characteristics

- Weight of device including Battery: 7.8 kg
- Dimensions of assembled device (H×W×D): 57×52×24 cm
- Dimensions of device in Carrying Bag (H×W×D): 65×33×25 cm

*All specifications are valid for LUCAS™2 and at 25°C unless otherwise stated. Technical data are subject to changes without prior notice.*

*LUCAS is available also in an air-powered version; LUCAS™1. Visit www.lucas-cpr.com for more information.*


LUCAS™2 is stored and carried in a padded Carrying Bag.

The device consists of an Upper Part and a lightweight Back Plate.


The Stabilization Strap helps secure the position over the patient's chest.

LUCAS™2 has a disposable Suction Cup which can be easily exchanged.

It is recommended to have an extra Battery.

The Battery may be charged in the External Battery Charger.

The External Power Supply (100-240V 50/60Hz AC) supports prolonged operation as well as charging of the Battery in the device.

The Car Cable (12-24V DC) supports prolonged operation as well as charging of the Battery in the device.

**For an overview of LUCAS clinical data, please turn to lucas-cpr.com or your local sales representative.**

Train on LUCAS at our LUCAS Web Training Center; **www.lucas-cpr.com**

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900 097-00 RevA

LUCAS CPR facilitates circulation and supply of oxygen to vital organs by:

- Performing chest compressions at a rate of 100/min. at a force of roughly 50kg—the level needed to achieve effective chest compression (4 to 5cm) in an average adult patient. (As a safeguard, it is designed so it cannot be used on children, for whom the force applied would be too great.)
- Maintaining maximum compression depth for 50% of the time, which provides the best possible coronary perfusion pressure and blood flow. [15] This rate is nearly impossible to achieve with manual compressions.
- Enabling caregivers to focus on other aspects of patient care (patient assessment, ventilations and treatments such as IV medications and intubation)
- Performing safely during transport with patients on stretchers and in ambulances
- Making it possible for ALS clinicians to defibrillate while compressions are ongoing, because it is made of a composite material which does not conduct electricity
- Eliminating the need to interrupt CPR while caregivers swap places to alternate ventilation and compression

With proper training, LUCAS CPR can be applied to the patient in less than 20 seconds. Simple, intuitive and safe to use, LUCAS CPR speeds treatment when every second counts.


References:

1. Wik, L., Hansen, T., Fylling, F., Steen, T., Vaagenes, P., Auestad, B., Steen, P., Delaying defibrillation to give basic cardiopulmonary resuscitation to patients with out-of-hospital ventricular fibrillation. A randomised trial. *JAMA* (2003) vol 289, No 11, 1389-1395

2. Kern, K.B., Limiting interruptions of chest compressions during cardiopulmonary resuscitation. *Resuscitation* 58 (2003) 273-274

3. Steen, S., Liao, Q., Pierre, L., Paskevicius, A., Sjöberg, T., The critical importance of minimal delay between chest compressions and subsequent defibrillation: a hemodynamic explanation. *Resuscitation* 58 (2003) 249-258.

4. Steen, S., Liao, Q., Pierre, L., Paskevicius, A., Sjöberg, T., Evaluation of LUCAS, a new device for automatic mechanical compression and active decompression resuscitation. *Resuscitation* 55 (2002) 285-299

5. Holmberg, S., Holmberg, M., National register for cardiac arrest outside hospital, annual report 2002. (http://www.sos.se)

6. Frenneaux, M., Cardiopulmonary resuscitation – some physiological considerations. *Resuscitation* 58 (2003) 259-265

7. Cobb, L., Fahrenbruch, C., Lt Walsh, T., Copass, M., Olsufka, M., Breskin, M., Hallstrom, A., Influence of cardiopulmonary resuscitation prior to defibrillation in patients with out-of-hospital ventricular fibrillation. *JAMA* (1999) vol 281, No 13, 1182-1188

8. Herlitz, J., Eek, M., Engdahl, J., Holmberg, M., Holmberg, S., Factors at resuscitation and outcome among patients suffering from out of hospital cardiac arrest in relation to age. *Resuscitation* 58 (2003) 309-317

9. Wik, L., Rediscovering the importance of chest compressions to improve the outcome from cardiac arrest. *Resuscitation* 58 (2003) 267-269

10. Hightower, D., Thomas, S., H., Stone, C., K., Dunn, K., March, J., A., Decay in quality of closed-chest compressions over time. *Annals of Emergency Medicine* 26:3 (September 1995) 300-303

11. Ashton A, McCluskey A, Gwinnutt C, Keenan A. Effect of rescuer fatigue on performance of continuous external chest compressions over 3 min. *Resuscitation* (2002) 55:151-155

12. Stone, CK, Thomas SH., Can correct closed-chest compressions be performed during prehospital transport? *Prehospital Disaster Med.* 1995 Apr-Jun:10(2):121-3

13. Editorial: Time for a change? *Resuscitation* 58 (2003) 237-247

14. Rubertsson, S., Karlsten, R., Increased cortical cerebral blood flow with LUCAS: a new device for mechanical chest compressions compared to standard external compressions during experimental cardiopulmonary resuscitation. *Resuscitation* 65 (2005) 357-363.

15. Guidelines 2000 for Cardiovascular Resuscitation and Emergency Cardiovascular Care. 2000. *Circulation* 102 (8) 11-384.


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# Sudden Cardiac Arrest and LUCAS® CPR Chest Compression System: *Getting to the Heart of Resuscitation*

Increasingly, the resuscitation community is focusing on the importance of CPR—particularly chest compressions—for patients with sudden cardiac arrest. A growing body of research indicates that effective, consistent chest compressions are critical to patient survival and avoiding neurological damage—especially in cases where treatment is delayed by 5 minutes or more.[1,2,3]

Effective compressions circulate blood, oxygenate the brain and other vital organs, and prevent pooling of blood in the heart, helping to prepare it for delivery of a defibrillating shock. The most effective CPR is administered quickly, with forceful, consistent chest compressions.

But many challenges hinder EMS teams in delivering optimal CPR:

- Delays in reaching patients
- Difficulty of delivering sustained, forceful chest compressions
- Challenges of performing CPR in tight quarters and during transport
- Interruptions caused by the need for patient assessment, hands-off periods during shocking and patient analysis by automated defibrillators, and administration of IV drugs and other interventions

This paper briefly discusses the current situation and why evolving research is spurring a renewed focus on the role of chest compressions in sudden cardiac arrest treatment. It also describes how LUCAS CPR—a portable, mechanical device that provides hands-free, high-quality chest compressions—helps EMS responders safely deliver uninterrupted patient care, whether on the scene of an emergency or during transport.

## TODAY'S CHALLENGE: GRIM OUTLOOK FOR PREHOSPITAL CARDIAC ARREST PATIENTS

Sudden cardiac arrest (SCA) remains a leading cause of death, in spite of cutting-edge improvements in defibrillation technology, treatments such as IV medications and intubation, and improved training for emergency medical services (EMS) providers.

In most published reports, the one-year survival rate for out-of-hospital cardiac arrest is less than 5%.[4]

The dismal survival rate for SCA patients outside of hospitals is illustrated in Fig. 1, from the Swedish National Register.[5]

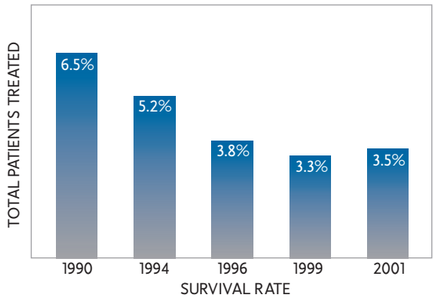


Fig 1. Illustration created with data from the National Register for Cardiac Arrest Outside Hospital Annual Report 2002: S. Holmberg, M. Holmberg

While declining survival rates may, to a certain extent, be attributed to the overall increase in population age and prevalence of home care for terminal illnesses, the downward trend in survival is still significant, and disturbing.

## CAUSES OF SUDDEN CARDIAC ARREST

Sudden cardiac arrest is caused by three basic types of electrical malfunctions of the heart:

- Ventricular Fibrillation (VF)
- Pulseless Electrical Activity (PEA)
- Asystole (lack of electrical activity)

In ventricular fibrillation—the leading cause of SCA— defibrillation is most effective within the first 5 minutes and often restores pulse-generating rhythm if administered quickly.[6,15]

While early defibrillation programs have improved survival rates for VF patients, the majority are not treated within the five-minute window. Most sudden cardiac arrests are not directly witnessed, and EMS response time is often longer than 5 minutes. In the interim, patients frequently receive no CPR or ineffective CPR. As their condition deteriorates, so does their chance for successful resuscitation.

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In addition, defibrillation is not advised in all cases. When SCA results from PEA or asystole or if SCA remains untreated for longer periods of time, chest compressions are the treatment of choice.

These factors have sparked clinical and animal research that increasingly points to the important role of CPR in improving patient survival.[1,7]

### Why CPR Is So Important

Oxygen is continually needed to keep the body alive. Without the circulatory system pumping blood, oxygen does not get to vital organs such as the brain. CPR assists both in providing oxygen to the body via ventilations, and in circulating that oxygen through chest compressions.

Even in successful resuscitations, there is a high risk of neurological impairment due to oxygen deficits during SCA. CPR has been shown to reduce the risk for permanent neurological damage due to SCA.[3]

In addition, good CPR increases the chances of successful defibrillation. Chest compressions increase coronary artery perfusion pressure, keeping the heart muscle from suffering ischemia. Oxygen supplied via chest compressions makes the heart more receptive to an electrical shock.

Effective CPR helps force blood out of the heart, preparing it for a shock. Recent experimental work has shown that since blood is not being pumped out of the heart during the first few minutes of an SCA, it continues to collect there.[8] This leaves the heart distended and reduces the effectiveness of shocks on patients with shockable VF rhythms.

After longer periods of ventricular fibrillation (VF), electrical shocks are needed simply to relax the heart muscle.[6] Because effective chest compressions prevent the heart from filling with blood, any shocks delivered can work more toward return of spontaneous circulation (ROSC) than relaxing heart muscle.

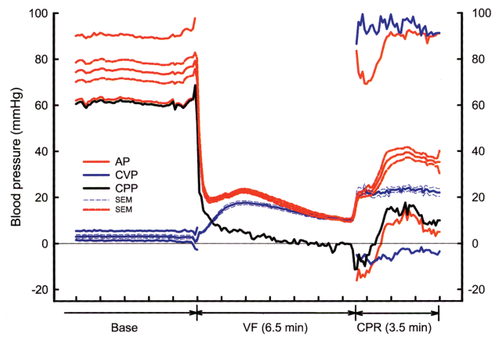


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Fig 2. During ventricular fibrillation blood accumulates in the heart as a consequence of a leveling out of the pressure gradient which exists between the heart's two chambers (red and blue lines).
Stig Steen et al, *Resuscitation*, 58 (2003) 249-258.

### Qualities of Effective Chest Compressions

Today's rescuers most often manually perform much of the CPR protocol, compressing the chest with their arms and hands and providing ventilations via a bag valve mask. To be effective, chest compressions must be delivered quickly, forcefully and consistently.

#### Administered Quickly

As time elapses from the original SCA, the importance of effective CPR increases. CPR eclipses defibrillation as a first response to an SCA after about 5 minutes.[1,9] With EMS response times well over 6 minutes in the United States, often the critical early defibrillation stage has been missed, thus augmenting the importance of CPR.

The International Liaison Committee on Resuscitation (ILCOR) continually reviews new CPR research, exploring both the effectiveness of automatic CPR (A-CPR) and conditions that might warrant CPR as a first-line treatment of SCA. This is leading to new guidelines expected to place CPR as the primary initial treatment of SCA in patients who have not received defibrillation within 5 minutes.

#### Performed Forcefully

To achieve adequate compression on an average patient requires a compression force equivalent to about 50kg. Studies show that over a 3-minute period, the maximum compression achieved by a rescuer corresponds to approximately 70% of his or her body weight. This means that a rescuer weighing 50-60kg cannot achieve the force of compression required to provide adequate chest compressions.

For optimal results, compressions should be performed in such a way that the rib cage is held down for 50% of the time, and subsequently released for the remaining 50% of the time. When performed manually, compressions tend to vary in intensity and the chest is compressed for significantly less than 50% of the time.[15]

Rescuer endurance limits the effectiveness of manual chest compressions. Studies have found that rescuers began to lose effectiveness after about 1 minute and that after 4 minutes they achieved only about 30% of the chest compression deemed necessary.[10]

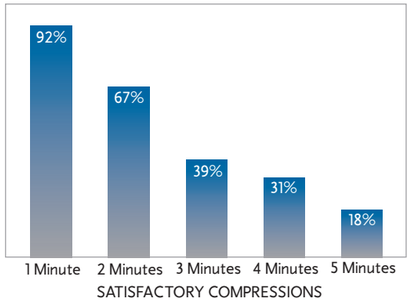


Fig 3. The diagram illustrates the declining quality of compressions during CPR. The person carrying out compressions is not aware of the reduction in quality of the compressions during this time.
Hightower D: *Annals of Emerg. Medicine* 1995 Sept 26: 3.

In the most extreme case, CPR quality begins to deteriorate significantly after one minute of care provision, although it may appear to be adequate.[11]

#### Provided Consistently

To build the proper pressure gradient to allow for the flow of blood requires consistent chest compressions. Any lapse in chest compressions causes perfusion pressure to drop dramatically, stopping the flow of blood. Resuming compressions slowly rebuilds this pressure, increasing the time a patient goes without oxygenation.[3] The consequences are dire: Interruptions in chest compressions during standard CPR are associated with decreased survival rates.[2]

However, achieving consistency in compression depth and rate without interruption is often quite difficult—especially considering that CPR is sometimes performed in moving vehicles[12] and that rescuers often switch responsibilities of chest compression and ventilation.

Consistency is made more difficult by the need for caregivers to stop to re-assess the patient or administer other treatments such as IV medications, tracheal intubation, and defibrillation. Interruptions to CPR are further increased by protocols of automated defibrillators that require hands-off time during patient analysis, shocking, charging, and re-analysis.

### Automatic CPR: The LUCAS CPR System

Concern over current SCA survival rates and increased recognition of the importance of chest compressions to improved survival have spurred the search for better alternatives. With its editorial "Time for change," the journal *Resuscitation* emphasized the renewed focus on CPR and explored the possibility of using automatic CPR.[13]

Considerable promise is offered by automatic mechanical devices such as LUCAS CPR, a pneumatic CPR device that performs consistent cardiac compressions throughout a save.

The compact, lightweight device is easy to carry from the ambulance to the patient. Requiring no electric or battery supply, it is entirely pneumatically driven by oxygen or air from a central gas supply or bottle with a specific regulator.

A recent animal study published in Resuscitation indicates that LUCAS CPR increases survival significantly in cases of VF compared with manual compressions.[4]

Studies comparing manual chest compressions to those provided by the LUCAS CPR device yielded the following results:

- End tidal carbon dioxide was significantly higher in the LUCAS CPR group, indicating that a higher minute volume was attained.
- In the LUCAS CPR group, spontaneous circulation was restored after 15 minutes of compressions following defibrillation in 100% of the animals, while none survived in the manual compressions group.[4]

  Note: Cardiac arrest was induced in animals and allowed to persist for over 6 minutes before ventilations and chest compressions were initiated.

Experimental studies also have shown that compared to manual chest compressions, LUCAS CPR provides higher cerebral blood flow and cardiac output.[14]