

High-Performance CPR and Zoll AutoPulse Implementation

Entry Category: Clinical Outcome Project

Mark Corum
Hall Ambulance Service, Inc.
corumm@hallamb.com
1001 21st Street
Bakersfield, CA 93301

Hallamb.com

Number of Annual Service Requests: 100,000+
Number of Ambulances: 99

Privately-Held Corporation

Project Participants:

John Surface, Chief Operating Officer
surfacej@hallamb.com

Myron Smith, General Manager
smithm@hallamb.com

Chris Leone, Manager, Hall CCT
leonec@hallamb.com

Jennifer Att, QA Manager
attjm@hallamb.com

Nathan Kennedy, Training Coordinator, Harvey L. Hall EMS Academy
kennedyn@hallamb.com

Ryan Strange, Asst. Manager, Ambulance Division
stranges@hallamb.com

Situational Analysis (Background of project):

In 2013, the American Heart Association released new guidelines on a new technique referred to as high-quality CPR, in which providers focus on depth, rate, limited interruptions, and full chest release. In response, Hall Ambulance began evaluating its own CPR performance and methods for improvement through clinical review and a concentrated focus on education.

Project Goals:

The goal of this project is to improve sudden cardiac arrest survivability by educating our crews and other first responders in high-performance CPR, data analysis, and evaluation of new

technology to determine if the techniques are making a difference in positive outcomes for sudden cardiac arrest patients.

Planning & Implementation:

During the past four years, Hall Ambulance has made a major commitment to introducing and reinforcing these concepts to our Paramedics, EMTs, and RNs; as well as our partners at the city and county fire departments who respond to medical aid requests alongside us and provide additional assistance.

The following is a timeline which details training along with first responders, the implementation of See-Thru CPR, and the resulting decision to incorporate the Zoll AutoPulse into our standard level of care.

In 2015, the Company evaluated its CPR procedures and decided to incorporate Zoll's See Thru CPR technology along with the pit crew method of performing CPR. To increase efficiency, joint training on the new technology and technique was provided in concert with the Bakersfield Fire Department, where ambulance and fire crews trained side by side. This massive effort resulted in more than 400 first responders learning CPR and the beginnings of high-performance CPR in Kern County.

In October 2016, Myron Smith attended the Seattle Resuscitation Academy in Seattle to learn current techniques in the famed Seattle High-Performance CPR. The following October, the Kern County EMS Department brought the Seattle Resuscitation Academy to Kern County to provide training with all Kern County First Responders with Hall's own Myron Smith and Sam Swanson functioning as proctors.

Realizing there was still a need for improvement, in August 2018, Hall Ambulance conducted joint High-Performance CPR training with Hall Ambulance and Bakersfield Fire Department personnel. As a result of the training, a report card was developed for first responders to provide feedback on how well they were performing CPR. The report card was created from the data provided by the ZOLL See Thru CPR program. These report cards are given to ambulance crew members and firefighters that were involved in the response.

After detecting a decrease in 2018 for Time in Compression, additional training on High-Performance CPR was scheduled again for April 2019 with Hall Ambulance and Bakersfield Fire Department personnel. Once again, more than 400 first responders were trained in high-performance CPR.

After thorough research and evaluation, the Company selected the ZOLL AutoPulse as the preferred mechanical CPR device. Eighty of the devices were ordered for each Hall ALS and BLS unit in its 9-1-1 response area, which covers 88% of Kern County, California's population (over 800,000 people). The AutoPulse was also added to Hall Critical Care Transport's ground unit.

In preparation of an August 2019 implementation date, over 600 EMS workers and firefighters from Hall Ambulance, Bakersfield Fire Department, and Kern County Fire Department

completed intensive training. Over 67 sessions were held over the course of 10 days in July 2019.

On August 12, a news conference was held at the Harvey L. Hall EMS Academy to unveil the largest deployment of the Zoll AutoPulse in North America. Featured speakers included Kurt Sandstrom, Group V.P. of North American Sales for ZOLL Medical Corporation; Kern County Fire Chief David Witt, Bakersfield Fire Department Chief Anthony Galagaza, and Lavonne C. Hall, President & CEO of Hall Ambulance Service.

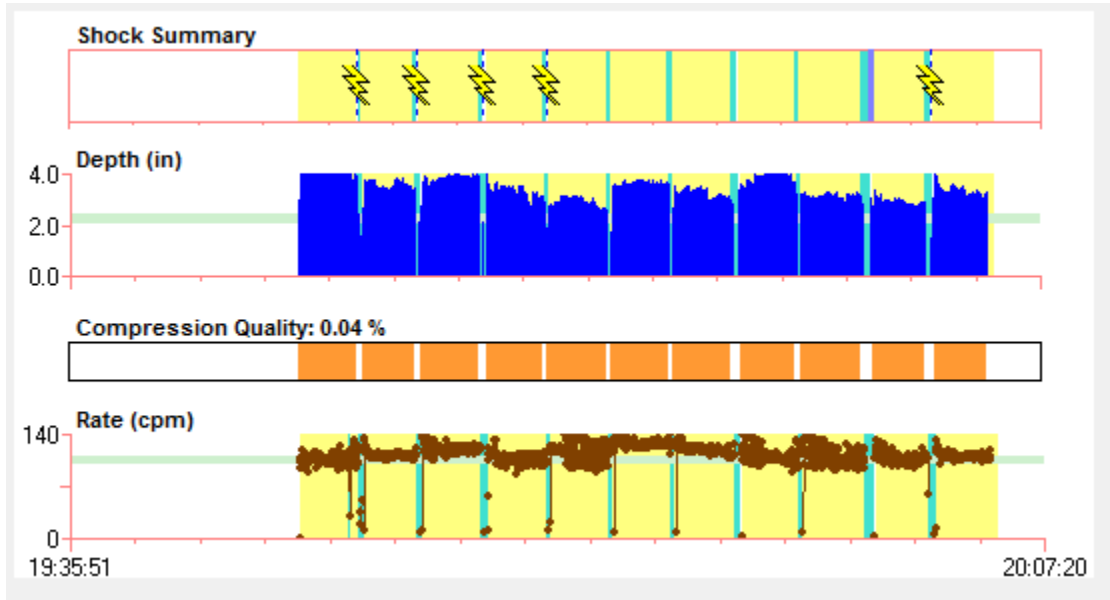
Results:

- Through data collection, it was revealed that Time in Compression improved from 2015 to 2019 YTD by 7.91%. Rate increased by 28.16% during that time period; however, Depth actually decreased by 27.11%. Compression Target, where both the Depth and Rate are correct, improved by 5.09%
- Average pauses in seconds from 2015 to 2019 was decreased from 52 seconds to 31 seconds.
- Significant accomplishment was made in Return of Spontaneous Circulation (ROSC) from 16% in 2015 to 34% in 2019YTD.
- Essentially, we discovered that a human delivering high-quality CPR over a period of time was difficult to maintain at the proper rate and depth. In light of this, Hall Ambulance began looking at more reliable and consistent options.

Impact:

Hall Ambulance's focus on high-performance CPR changed the mindset of the paramedics, EMTs, RNs, and firefighters. In 2015, our ROSC rate was 16%. CPR was looked at as something that had to be done but didn't really help the patient. Because of the concentrated training and information shared through the report cards, our crews and the firefighters see it as a tool that is useful and actually does save lives. Now our ROSC rates are 34% because we are just doing better!

Hall Ambulance's commitment to high-quality CPR did not end with the implementation of the AutoPulse. In August 2019, Hall Ambulance purchased new CPR mannequins that give real-time feedback to the first responders on rate and depth of compressions, as well as the quality of assisted ventilations. Using these mannequins, Hall Ambulance will be able to monitor the effectiveness of every compression and ventilation as it is provided to the mannequin. This will allow students to gain a better feel for correct CPR mechanics. Additionally, the equipment will be able to provide a report card to the student to verify their successful performance in class.



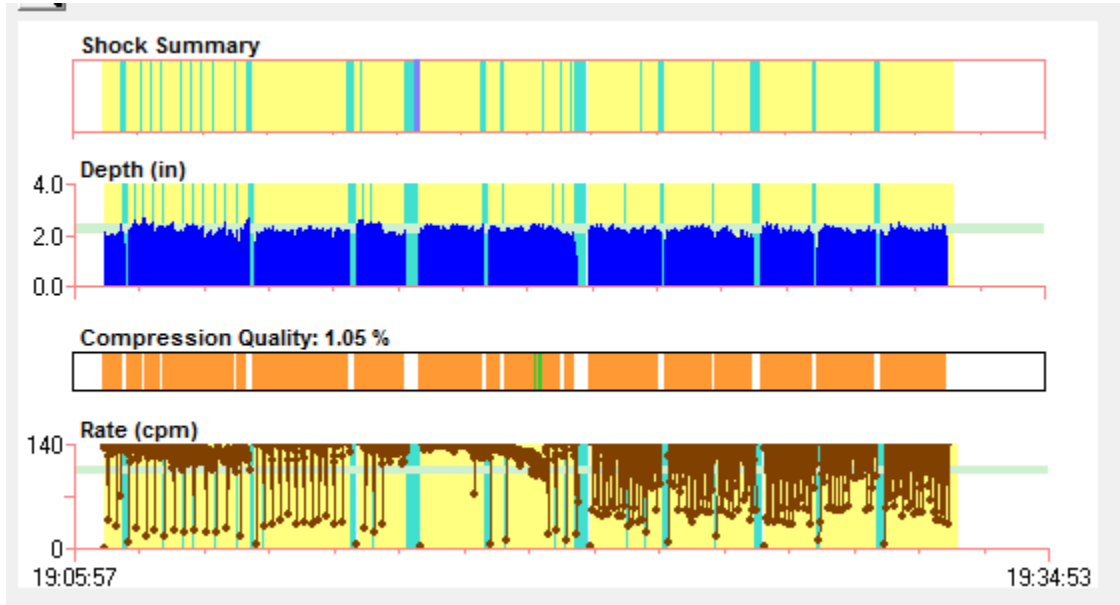
Longest Pause = 20 seconds
No pauses should be greater than 10 seconds.

Time in compression = 92.09%
The goal is 90%. This measures the time that CPR is being performed throughout the time the monitor is on.

Depth = .31%
The goal is 90%. This measures how often the compression depth is at least 2 inches and no greater than 2.5 inches

Rate = 43.79%
The goal is 90%. This measures how often the compression rate is between 100 and 120 compression per minute.

Compression Quality = .04%
The goal is 90%. This measures how often the compression depth and rate are achieved at the same time. This is represented as green on the compression quality graph.



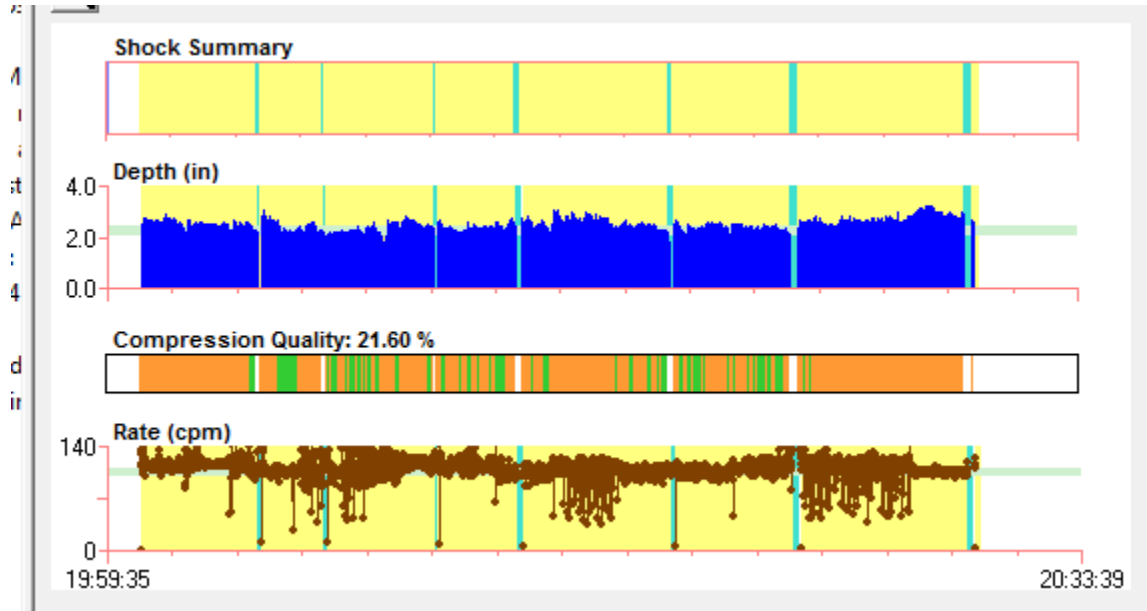
Longest Pause = 23 seconds
No pauses should be greater than 10 seconds.

Time in compression = 88.21%
The goal is 90%. This measures the time that CPR is being performed throughout the time the monitor is on.

Depth = 74.14%
The goal is 90%. This measures how often the compression depth is at least 2 inches and no greater than 2.5 inches

Rate = 1.72%
The goal is 90%. This measures how often the compression rate is between 100 and 120 compression per minute.

Compression Quality = 1.05%
The goal is 90%. This measures how often the compression depth and rate are achieved at the same time. This is represented as green on the compression quality graph.



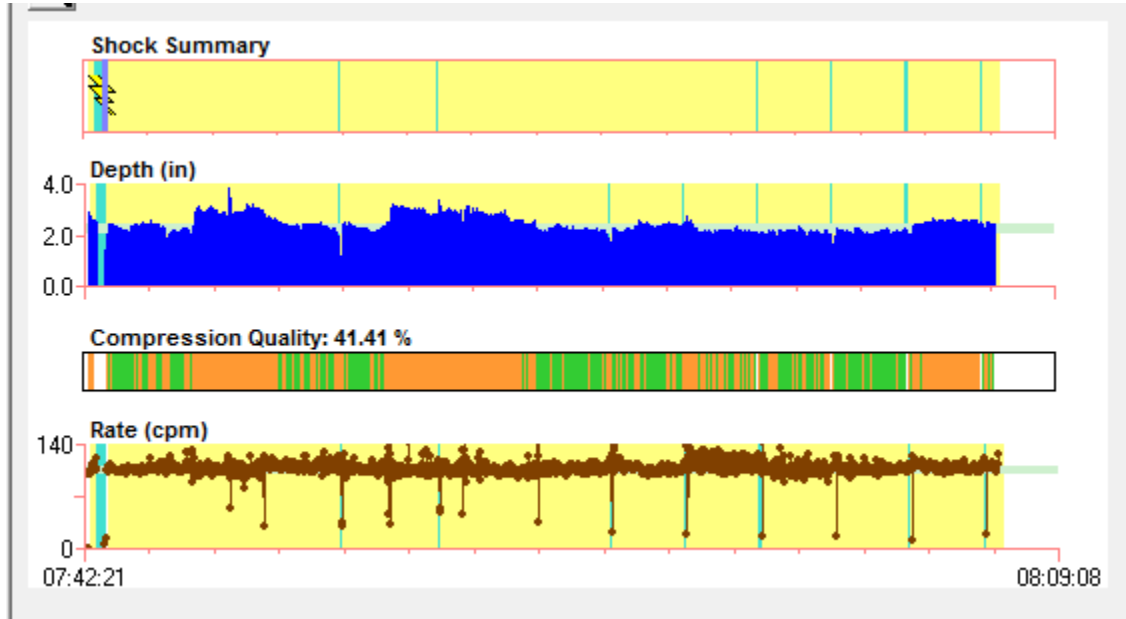
Longest Pause = 17 seconds
No pauses should be greater than 10 seconds.

Time in compression = 95.26%
The goal is 90%. This measures the time that CPR is being performed throughout the time the monitor is on.

Depth = 43.54%
The goal is 90%. This measures how often the compression depth is at least 2 inches and no greater than 2.5 inches

Rate = 46.26%
The goal is 90%. This measures how often the compression rate is between 100 and 120 compression per minute.

Compression Quality = 21.60%
The goal is 90%. This measures how often the compression depth and rate are achieved at the same time. This is represented as green on the compression quality graph.



Longest Pause = 17 seconds
No pauses should be greater than 10 seconds.

Time in compression = 97.27%
The goal is 90%. This measures the time that CPR is being performed throughout the time the monitor is on.

Depth = 55.28%
The goal is 90%. This measures how often the compression depth is at least 2 inches and no greater than 2.5 inches

Rate = 76.68%
The goal is 90%. This measures how often the compression rate is between 100 and 120 compression per minute.

Compression Quality = 41.41%
The goal is 90%. This measures how often the compression depth and rate are achieved at the same time. This is represented as green on the compression quality graph.



THE CALIFORNIAN

Hall paramedics and EMTs perform a demonstration using AutoPulse, a new piece of equipment the company is using in all of its ambulances.

New CPR device technology serves as another set of hands for Hall paramedics

BY MAUREEN STRODE

mstrode@bakersfield.com

A new piece of equipment has been introduced to Hall Ambulance paramedics that serves as essentially another person on scene — and provides continuous compressions while implementing improved blood flow at the same time.

AutoPulse, a ZOLL Medical Corp. invention, provides high-quality CPR to victims of sudden cardiac arrest. The “unique device” will allow Hall Ambulance paramedics to give treatment quickly while also continuing compressions consistently — which increases one’s likelihood of surviving, said Bryan Pank, senior EMS account executive for ZOLL.

The new piece of equipment was introduced at a press conference Monday afternoon.

Here’s how it works: The machine itself consists of a board and a “lifeband,” which actually gives compressions. First responders will put a person experiencing sudden cardiac arrest on the board and place the lifeband around their chest, which will then tighten based on the circumference of the person’s chest. From there, “the magic of the blood-

flow really occurs,” Pank said — the lifeband begins to give compressions.

This can be especially useful when paramedics are called to a scene with unfavorable conditions such as a stairwell, a hallway with sharp corners, or a cramped elevator. Paramedics can utilize AutoPulse to continue compressions as they are moving the person into a more stable area, said Chris Leone, manager for Hall Critical Care Transport.

With the AutoPulse, paramedics are able to administer compressions much more efficiently as compared to using just their hands — AutoPulse allows fewer pauses between compressions.

More than 600 paramedics and EMTs from Hall Ambulance and firefighters from the Kern County Fire Department and the Bakersfield Fire Department have been trained on how to use the device over the past two weeks, Leone said.

Eighty of the AutoPulse devices will be placed in each Hall Advanced Life Support and Basic Life Support ambulance within the next few days, Leone said. Hall Critical Care Transport will also be using the device on its ground unit.

Hall unveils new life-saving technology

By Maureen Strode
The Bakersfield Californian
mstrode@bakersfield.com

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Hall Ambulance paramedics and EMTs perform a demonstration using AutoPulse, a new piece of equipment the company is using in all of its ambulances. THE BAKERSFIELD CALIFORNIAN

New CPR technology serves as another set of hands for Hall paramedics

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mstrode@bakersfield.com

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Hall Ambulance rolls out largest deployment of the ZOLL AutoPulse in North America

Hall Ambulance Service, Inc. announced details this week of its massive implementation of the ZOLL AutoPulse making it the largest deployment in North America. The device will give the Company's Paramedics, EMTs, and Critical Care RNs, the upper hand in responding to sudden cardiac arrest.

Eighty AutoPulse units have been placed into service on each Hall Advanced Life Support (ALS) and Basic Life Support (BLS) ambulance in its 9-1-1 response area, which covers 88% of Kern

County's population (over 800,000 people). The device will also be carried on-board Hall Critical Care Transport's ground unit.

The ZOLL AutoPulse Resuscitation System helps to improve blood flow to the heart and brain during SCA because of the unique, high-quality chest compression it generates compared to manual CPR. Compared with manual CPR, the AutoPulse has been shown to reduce interruptions in compressions during transport by more than 85% and was applied in as little as 14 seconds. "Historically, when we do CPR, our hands are allowed to push about 30% of blood flow to the brain in an ideal situation," said Bryan Pank, Senior EMS Account Executive with ZOLL Medical Corporation. "With the AutoPulse deployed, using the LifeBand, you're going to be able to push near-normal blood flow very quickly. It's consistent, and it's constant!"

Over 600 EMS workers and first responders including Hall Ambulance Paramedics, EMTs, and Critical Care RNs; as well as, firefighters from the Kern County Fire Department and Bakersfield Fire Department took part in one of the 67 comprehensive training sessions which took place over 10 days in July. "We wanted to bring in the fire departments so that we are a cohesive team as we work together on scene of a cardiac arrest patient," said Chris Leone, manager of Hall Critical Care Transport.

The relationship between Hall Ambulance and the fire departments is very amicable, which ultimately results in greater patient care. "I can tell you that we're pretty lucky in Kern County. When you go nationwide you won't find many locations where a private ambulance company and the city or the county [fire departments] work together," said John Surface, chief operating officer of Hall Ambulance. "We started this high-quality CPR project three years ago. Our original partner was the Bakersfield Fire Department. We've done joint training now three times—starting in 2018, in May of this year, and now with the AutoPulse, we've just done it again. We had the County join us this time so that everybody throughout Kern County in the areas that Hall Ambulance serves can be trained."

The local fire departments were



Hall Ambulance and Bakersfield Fire Department crews train on the AutoPulse. Photo provided.

equally excited to get on board with the training of high-performance CPR and now with the AutoPulse. "As the Bakersfield City Fire Chief, I find it absolutely critical that we can train anytime with Kern County Fire Department and at any time with Hall Ambulance," said Chief Anthony Galagaza. "It's so important that we come together collectively when it is something lifesaving such as the AutoPulse. To have that continuous high-performance CPR and this joint training is critical for the simple fact that this is just better for the citizens of Bakersfield and the citizens of Kern County."

Kern County Fire Department Chief David Witt echoed the sentiment by saying, "It's a great opportunity to be a part of assisting with technology - technology for the future, technology for the people within Bakersfield city and as far out as Boron or Lost Hills."

Sudden cardiac arrest is a substantial health problem killing approximately 350,000 persons each year in the U.S. and Canada alone, and as many as a million worldwide. It is the leading cause of unexpected death in the world and strikes without warning. Survival is poor in most communities at less than 10 percent, and improvements in resuscitation practices could save as many as half of these victims.

Through the years, Hall Ambulance has incorporated several ZOLL products which has supported the Company in its goal to provide exemplary patient care. "Today marks the completion of three implementations started by our founder, my husband," said Lavonne C. Hall, president and CEO of Hall Ambulance. "This includes the ZOLL X Series Cardiac Monitors, Road Safety, and now the AutoPulse."

Participating in the news conference was Kurt Sandstrom, Group V.P. of North American Sales for ZOLL Medical Corporation. On entering the foyer of the Harvey L. Hall EMS Academy, he noticed the Founder's Era Timeline highlighting 47 years of Hall Ambulance milestones which includes several ZOLL products. "As I walked into the building, it was not lost on me, looking at the photos of the company and the long history and partnership between Hall and ZOLL. We've enjoyed the spirit of collaboration, and I would like to thank you all with deploying the largest amount of AutoPulse in North America."

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PRESS RELEASE

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ASSOCIATION OF HALL AMBULANCE SERVICE, INC.

May/June 2015

Evolving the CPR Paradigm



Paramedic Nathan Kline and EMT/
Paramedic Intern Aaron Orozco,
practicing high-quality CPR
technique.

Hall Ambulance Changes CPR Approach Infusing Technology with Instantaneous Feedback

by Mark Corum, Director of Media Services



Hall CCT Manager Myron Smith narrates a demonstration of the new high-quality CPR techniques as EMT Everett Sutton delivers the proper rate and depth of compressions during a news conference on April 21, 2015.

Hall Ambulance Service is putting into practice a new approach, paired with technology, aimed at performing more effective cardio pulmonary resuscitation (CPR) in the field—and saving lives.

To present the new procedures to the community, Hall Ambulance hosted a news conference on April 21 which included presentations from Hall Ambulance Medical Director Ron Ostrom, M.D. and Brian Pank, Zoll Medical's Senior Account Manager.

Known as high-quality CPR, paramedics and EMTs will focus their attention on four critical components that can greatly improve patient outcome. The guidelines were initially identified in the *2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*.

On-scene of a medical aid call for someone in cardiac arrest, Hall Paramedics will combine Zoll's See-Thru CPR Technology with a cardiac monitor to track the patient's heart rhythm, rate, and depth of CPR compressions.

See-Thru CPR filters out compression artifact on the

ECG monitor so that paramedics can see the underlying heart rhythm during CPR, thereby reducing the duration of pauses in compression.

Sophisticated software on the cardiac monitor provides audio and visual cues to confirm the EMS professional is pressing onto the sternum at least two inches deep; delivering compressions at a rate of at least 100/per minute; minimizing interruptions in CPR to no more than 10 seconds; and, completely releasing on the upstroke to allow the heart to fill with blood for the next compression.

What does all of this mean? For the first time, monitoring of CPR quality has become a reality, which supports the adage, "if you don't measure it, you can't improve it." After the call, Hall Ambulance's Quality Assurance Division can download data for post-event review, analysis and debriefing. As a result,

the paramedic and EMT's performance is measurable, ensuring proficiency in the four critical areas during every resuscitation attempt.

As the 9-1-1 paramedic provider for 87% of Kern County, Hall Ambulance Paramedics and EMTs performed CPR as a part of their treatment on approximately 600 requests for medical aid in 2014—the potential impact is significant. *



CPR goes high-tech incorporating the principles of high-quality CPR into a sensor that measures the rate and depth of compressions. Zoll Medical's See-thru CPR technology minimizes the need to stop compressions to re-assess the patient. The pertinent information is now visible on the defibrillator's monitor.



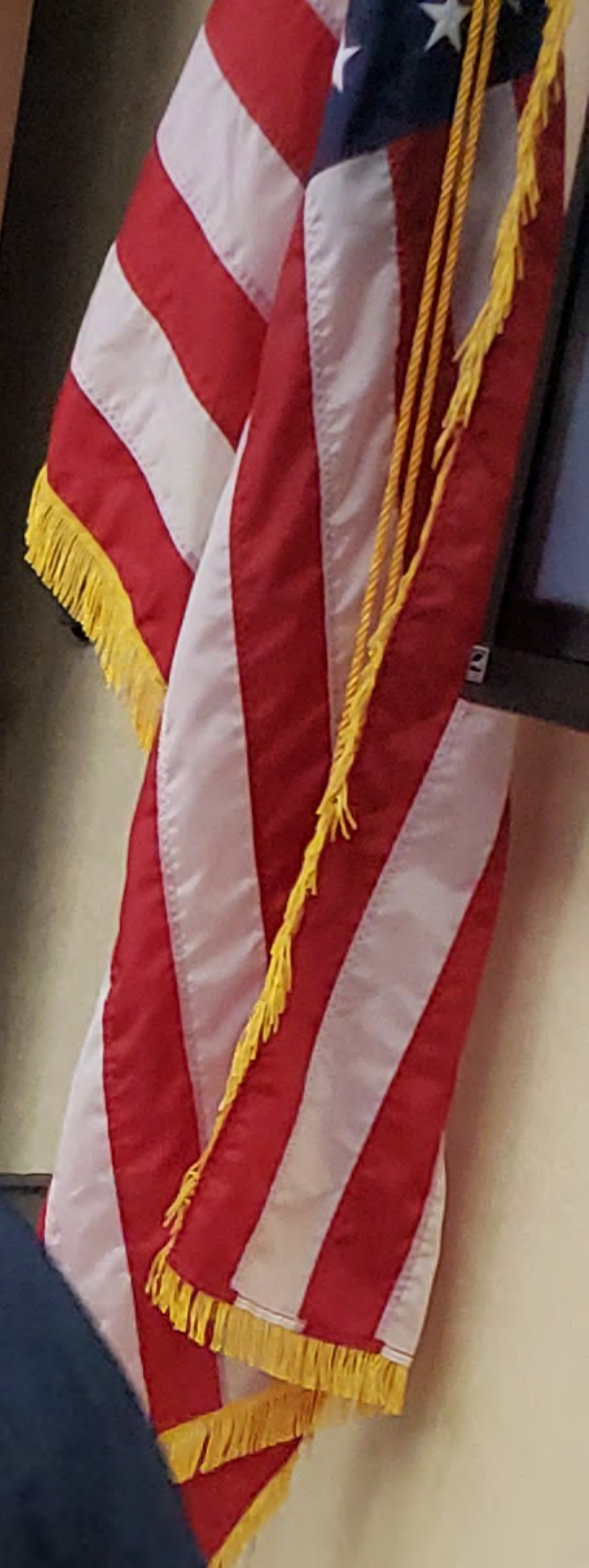
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