



Responding to the Needs of Community Paramedicinesm

EMS Mobile Healthcare Systems
LifeBot[®] Technology Design Guide Kit
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advanced telemedicine with continuity of care.tm



LifeBot, LLC 2303 North 44th Street, Phoenix, AZ 85008-2442 USA
telephone: 877-466-1422 website: www.lifebot.us.com email: info@lifebot.us.com

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The Promise of EMS Mobile Healthcare

By Roger Lee Heath

Historically, general practitioners provided first-contact care in the United States. Today, however, only 42 percent of the 354 million annual visits for acute care—treatment for newly arising health problems—are made to patients' personal physicians. The rest are made to emergency departments (28 percent), specialists (20 percent), or outpatient departments (7 percent). Although fewer than 5 percent of doctors are emergency physicians, they handle a quarter of all acute care encounters and more than half of such visits by the uninsured. Health reform provisions in the Patient Protection and Affordable Care Act that advance patient-centered medical homes and accountable care organizations are intended to improve access to acute care. The challenge for reform will be to succeed in the current, complex acute care landscape.¹

Nearly a third of these visits take place in the emergency room (ER). The ER is of course the right place for bleeding wounds, crushing chest pain, and motor-vehicle accidents, but an enormous amount of these visits are not actually emergencies, 30% according to one study.² Some concede it is more, maybe as high as 60% in some regions.³

Most of these visits more properly belong in the category of "urgent care" — rashes, mild-moderate pains, urinary infections, coughs, fever, and so on. The type of things that are easily and routinely handled by outpatient primary-care doctors or new Emergency Medical Services (EMS) Mobile Healthcare.

Some of this misuse of the ER falls under the rubric of access: patients have primary-care doctors, but are unable to obtain timely appointments. But most of this is attributed to patients who do not have primary care doctors, usually because they don't have insurance.³

Who's Caught in the Middle? EMS...

The simple convenience of dialing 911 puts Emergency Medical Services (EMS) right in the middle of this crisis. There is no choice but to respond regardless if the call is a real emergency (emergent) or one that is not an emergency (non-emergent). This means dedicating multiple layers of the most costly public assets in responding to these urgent needs.

The magnitude of this problem for EMS cannot be overstated. According to the most recent information there are over 81,000 emergency medical vehicles in the U.S. They are now responding to more than 36 million calls each year.⁴

Why does it cost EMS so much?

When American EMS systems respond to most of these calls they utilize a ton of assets. This includes dispatch centers, highly trained personnel and advanced ambulance systems. Sometimes this includes the additional cost to dispatch a second ambulance for transport of the patient independently by private providers.

It is not uncommon, after the costs of managing dispatch, to send out on a call an ambulance, an engine company (fire engine), and law enforcement. An engine company is often sent to keep response times low should a delay of an ambulance occur. Many engine companies have on board EMTs or paramedics who may respond to emergencies sooner because of a closer location. Law enforcement is sent to mitigate potential legal issues.



How much does this cost? In a recent interview with the medical director of a large city, he estimated that just to send an ambulance could cost more than \$1000. He agreed that to send both an engine company and police could cost more than another \$1000. If this is true, and one looks at projecting this upon 36 million calls, then is this costing our nation \$72 billion annually? While it is likely less cost, due to some efficiency, there is no question this is one massive burden for EMS systems nationally to try and maintain.

The medical director was then asked what the savings would be if he only had to respond to real emergencies. He stated that this regional metropolitan system has more than 310,000 calls each year. So the **annual** savings would be \$30 to \$50 million. But, how can this be done? How do we mitigate 911 calls safely, promptly and intelligently to realize this savings?

The Door-Step.

The problem for hospitals is even more demanding. Emergency rooms are really the front door for most hospitals with sometimes 80% of admissions occurring there. All of this, and more, arrives at their door-step. One study estimates \$4.4 billion annually could be saved by redirecting unnecessary ER visits to less expensive clinics and urgent care centers.⁵

The problems and their costs are growing. The new healthcare law will pack 32 million newly insured people into emergency rooms already crammed beyond capacity, according to experts on healthcare facilities. The Academy of Architecture for Health predicts hospitals will need at least \$2 trillion over the next 20 years to meet the coming demand.⁶

"We don't have the primary care infrastructure in place in America to cover the need. Our clients are looking at and preparing for more emergency department volume, not less," says Rich Dallam, a healthcare partner at the architectural firm NBBJ, which designs healthcare facilities.⁶

And, who picks up the bill for all of this? Ultimately, the total cost is laid at the door-step of all of us. It's simply unavoidable within the existing structure of, "the way things are done".

The Sky-Rocketing Costs of Medical Errors.

First and foremost we have a far more litigious nation than most others. How do we minimize errors and risks for both providers and patients? How do we make fast accurate clinical and field decisions and at the same time document the quality and proficiency of delivered care? How do we do this in an era of such change and demand for accountability?

The Institute of Medicine's (IOM) 1999 report, *To Err is Human*, reveals that 44,000- 98,000 Americans die annually as the result of medical errors. The national costs of medical errors resulting in injury are estimated to be between \$17-29 billion annually. The costs to the U.S. health care system represent over 50 percent of these additional expenses.⁶

These expenditures burden not only health plans and insurers, but also employers who are already reeling with escalating premiums as well as individuals who must dig deeper to cover co-pays. The United States healthcare system has lagged behind most other industries regarding the attention paid to ensuring safety. The costs to healthcare provider's, Local, State and Federal budgets can be overwhelming.

Navigating Healthcare Reform.

When Administration officials tell you that we must adopt some European healthcare methods for reform, they are completely right. Granted, some methods will not work within an American model, but undoubtedly some will. How do we adopt what works for us? What is the formula for affecting healthcare costs without compromising care? Can we increase the quality of care delivery and at the same time implement these changes?

The Role of Tele-Nursing at Dispatch Centers.

One prime example of such a method comes from a European model now in use for over a decade in the United Kingdom. They have mastered the art of determining if a call is emergent or non-emergent and then matching the level of response to the level of care needed by the caller. This is an important first step.

This "smart response" model involves the use of tele-nursing and decision support software (DSS) to intelligently triage patients, at the outset; in calls for help to dispatch centers. One service alone, East Midlands Ambulance, is now saving over \$11 million annually and has evolved the system for over ten years. The DSS, called Odyssey, has now handled over 18 million patient calls in the UK without any major issues. So Odyssey has enabled the service to prioritize and tier its services and responses and lower both errors and risks at the same time⁷

Odyssey has now been "Americanized" so it is available for use in the US for the first time. But, how does one integrate this life-saving revenue-saving system into an American model? How can the nation quickly realize the benefits of such a system?

Some major cities in the U.S. have been experimenting in "nurse tele-triage", but none have approached the substantial savings documented by the Odyssey system in the UK. Odyssey is truly the most tested and proven decision support system for EMS and it has the data to prove it from over a decade of use.



An East Midlands Ambulance Service (EMAS) dispatch nurse assesses a patient caller using Odyssey Decision Support Software (DSS).

The Controller for the City of Philadelphia has produced a detailed proposal for the use of tele-nursing in EMS. In it he states, "The diversion of non-emergency calls to a qualified nurse will save the Philadelphia Fire Department (PFD) as much as \$2.5 million annually by increasing productivity and reducing the wear-and-tear on vehicles and equipment, as well as reducing stress on personnel."⁸

Imagine if those benefits were to be projected over most major EMS systems and pre-hospital facilities across the nation. The savings would be immense. With the use of EMS Mobile Healthcare those savings may be multiplied.⁹

Why Decision Support Software?

The Odyssey DSS performs real-time patient assessments referencing over one million words of clinical data. The human brain simply cannot perform this function. But Odyssey can, and it can do this in just a few minutes. It provides a vivid list of differential diagnoses in just seconds.

For some General Practitioners (GP) services in the UK, it has reduced assessments significantly to an average of about 5 minutes. Odyssey is used by 60% of the GPs services using DSS in the UK, again proving its viability to get the job done saving millions in the process. Costly "Over-Triaging" is reduced.

Pre-Hospital Decision Support.

Fast accurate pre-hospital patient assessments are also required in the design of an EMS Mobile Healthcare System. So Odyssey is not just for use in dispatch tele-nursing. The use of DSS at both the dispatch and on-board pre-hospital vehicles provides for an early alert system for discerning whether one is dealing with an emergent or non-emergent situation. Errors and risk may be significantly reduced in both areas of use.

Odyssey is the first integral component for forging a pathway to millions in healthcare delivery savings in the EMS Mobile Healthcare model; to demonstrate significant savings similar to those already produced in the UK over many years.

It's What Inside that Counts:

The fact is, many patients may appear quite healthy on the outside, when on the inside there may be the most serious of health issues. EMS telemedicine "looks inside" and transmits to the hospital what is most important, physiological data; ECG or heart waveforms, blood pressure, 12-lead ECG, oxygen levels and a host of vital sign parameters to ascertain the true health status on the "inside". This is often the only way an informed decision can be made under these circumstances. This substantially reduces errors and associated risks.¹⁰

The Role of EMS Telemedicine.

Remote telemedicine, with home patient monitoring and management, is now demonstrating some savings that may reduce healthcare costs. But, the truth is, this is doing almost nothing to affect real savings in emergency management, EMS, and hospital ERs. This is the mission of EMS Telemedicine.

Pre-hospital EMS Telemedicine provides for "care at a distance" during ambulance transport operations. The value of this in both saving lives and significantly lowering healthcare costs is already being demonstrated in 12-lead ECG programs to treat STEMI patients and in regional tele-stroke programs. But, these are only two of the applications involving the potential of EMS Telemedicine.

With true EMS Telemedicine saving lives in real-time becomes possible through the use of live transmission of voice, video, physiological parameters and waveforms. Suddenly, the opportunities of increasing both the quality of care and saving healthcare costs are even more enhanced.

To quote a prominent EMS medical director, "Perhaps a picture is worth a thousand words, but a video is worth a million." This is not always readily apparent to pre-hospital field personnel, but it is clinically. Just as a 12-lead ECG is valuable to a Cath-Lab STEMI Alert Team and an interventional cardiologist, additional information transmitted early can save lives and reduce costs for other clinical specialists.

For example, for an emergency physician or trauma surgeon seeing a video revealing the method of injury is priceless in preparing to receive that patient for surgery. He or she knows who to call to surgery or trauma, not simply "everyone". In this instance alone, costs may be substantially reduced.

A neurologist may use video teleconferencing to score a stroke victim, to determine what kind of stroke has occurred, and to determine what kind of Stroke Center that patient needs immediate transport to that is necessary for survival.

Video and Risk Management.

Use of ambulance video not only produces clinical advantages, but it protects pre-hospital field personnel. So use of video lowers the risks not only to the patient, but also to EMS providers. Nowhere has this lesson been learned more than in modern law enforcement who now utilizes it almost universally. Playback of videos in law enforcement has caused major lawsuits to be simply thrown out, saving millions. With this alone, these systems may pay for themselves overnight.

Intelligent Care = Cost Effective Care.

EMS Telemedicine brings to EMS Mobile Healthcare the opportunity to increase the quality of care while, at the same time, reducing overall healthcare costs. It makes any EMS response vehicle into a "virtual hospital" where **intelligent informed** clinical decisions may be made on a **timely** basis. It will also save lives in the most critical instances and especially during disaster management and the demands of mass casualty operations.

With EMS Telemedicine new efficiencies of care may be applied to both the most simple of calls and to the most serious of calls. Care given is matched to the level of care required. In the simplest of calls the patient may be treated and then released without transport at all. This is termed simply "**treat and release**". The prospects for savings in this scenario are even greater.

When any serious question about the patient arises, any medical specialist or physician, appropriately equipped, may login into the system and be "virtually" on the scene. He or she may render an informed and intelligent assessment of what to do in the most adverse of circumstances while viewing almost all pertinent detailed information about the patient and the assessment.

EMS Telemedicine Technologies.

The most advanced systems for EMS Telemedicine were developed for the U.S. Military and are now available for use commercially. The system is known as the **LifeBot® DREAMS™** system. DREAMS™ stands for "Disaster Relief and Emergency Medical Services". This system is the most tested and proven in six years of actual use, even during the hurricanes Katrina and Rita disasters. Research on this, **one-of-a-kind system**, was funded by U.S. Army Medical Research and Materiel Command (USARMMC) and the Telemedicine and Technology Research Center (TATRC); both Department of Defense agencies.

The system was the brain child of famed Texas trauma surgeon, Dr. James "Red" Duke, Jr. Others involved with the design included S. Ward Cassells, M.D., former Assistant Secretary of Defense (Health Affairs), Texas A&M, and the University of Texas Health Science Center at Houston.

The EMS Ambulance or EMS Mobile Healthcare side:



Above is the DREAMS™ ambulance telemedicine system proven in use for over six years at Liberty County Texas EMS. DREAMS™ was also tested and proven in the Katria and Rita hurricane disasters.

Generally, ambulances and EMS Mobile Healthcare vehicles are enabled through installation of computers with graphical displays, mobile connectivity and management systems (for cellular 3G and 4G, WiMAX or LTE, Wi-Fi, etc.), multiple cameras, and microphones. Cameras may be placed on the exterior of the vehicle for situational awareness, for example, revealing what assets are still on the scene, or to view extrication “live”, and for “battlefield” over-sight of disaster or mass casualty events.

Acquiring of patient data, and transmission of parameters and waveforms, is accomplished by interfacing the DREAMS™ telemedicine system with patient connected physiological monitors. Physiological monitors typically acquire live clinical waveforms; single, 12 and 15 lead ECG, HR, NIBP, dual invasive BP, SpO2 with plethysmogram, etCO2 with capnogram, tpCO2, dual temperatures.

Other data that may be acquired and exchanged includes that from examination cameras, e.g. video laryngoscopes, otoscopes (ear), eyescopes, polarizing dermoscopes, etc., as well as ultrasound, electronic stethoscopes, blood analyzers, etc.

These systems may be installed using fixed PC based systems or may utilize ruggedized laptops or tablets. Patient connected EMS Telemedicine systems should be generally thought of as “servers” since they are connected to both acquire and securely send significant amounts of critical information.

The Weakest Link – Wireless Mobile Connectivity.

Most often the weakest link in the chain is the ability of a pre-hospital vehicle to maintain reliable wireless data connectivity, particularly if a vehicle is moving at high speed. Conventional Wi-Fi Mesh systems utilizing old protocols are typically inadequate for such situations. Also, one moment cellular from Verizon may not work, but Sprint will. Such is the challenge presented.

The LifeBot® DREAMS™ Digital Ambulance System, funded with \$14 million in military research grants, has a unique solution to effectively combat these problems. It is called the **Intelligent Communications Manager™ (ICM™)**.



The DREAMS™ Intelligent Communications Manager (ICM™).

The ICM™ system may utilize multiple cellular providers, e.g. Sprint, Verizon, AT&T, etc., but also integrate Wi-Fi, WiMAX, and LTE. It automatically manages and aggregates connectivity and bandwidth in totally transparent fashion. At any one time the system analyzes what works and uses it automatically.

The ICM™ is unlike most other so called “wireless gateways” presently in use because it manages so many critical aspects necessary to making pre-hospital telemedicine and mobile healthcare communications work.

For example, the ICM™ is also the only system that marries connectivity with data management functions. It tags data so one patient’s call data does not get mixed with another’s. This is a very important feature to make certain patient medical records remain true and clinically usable. Thus, this is connectivity and data management that also lowers errors and risks.

If connectivity is compromised, important data may be saved and the “intelligence” of the ICM™ includes a feature to send the most important life-saving information first, once reconnected. It prioritizes the most important data and then makes sure it is sent immediately.

Patient data with the ICM™ is securely transmitted, for HIPAA compliance, using AES encryption. This also makes voice and video communications more secure. This is even more secure than most radio and cellular communications, because no one may easily “listen in”. With the LifeBot® DREAMS™ system, even secure text messaging may be used to send highly specific or sensitive information “silently”.

Data Must be Immediately Usable.

With LifeBot® DREAMS™, no separate servers or fees are required and data is securely shared only with the parties involved. It is immediately transmitted and **instantly usable**. In an urgent situation, the last thing a clinical specialist should have to do is login to a separate server to “try and find” life-saving information. Such delays could cost a life much less “tie up” a specialist which increases overall healthcare costs.

Data-Flow = Reduced Work-Load + Quality Patient Care.

The super-efficiencies of EMS Telemedicine are not always immediately apparent. The cumulative effect is very important if the primary objective is to lower overall healthcare costs in scale. This should not be minimized or underestimated.

First, the DREAMS™ “standardized” computer user interface simplifies interactions to significantly reduce the requirements of training and use by all involved. But, this is just the beginning.

Normally, field personnel use a radio or cellphone to verbalize all sorts of patient information to the hospital. This is a costly time consuming process for both. With DREAMS™ most of this information is transmitted “live”. This makes almost everything “hands-free” so patient care may properly become the focus.

Physicians and nurses may communicate with everyone “face-to-face” and in real-time while field professionals expedite the most important tasks. Body language and the smallest gestures may convey the most important and revealing information about the true state of the patient and the nature of all concerned.

Automatic Live Electronic Health Record (EHR + ePCR).

The system also makes the Electronic Patient Care Reporting (ePCR) fully **automatic** for the first time. Once a nurse triages the caller at the dispatch level, **complete** patient information may be securely transmitted to the paramedics or care giver en route. They arrive with an ePCR already “filled out”. Not only do providers have this information, but a complete Odyssey full tele-triage patient assessment on-board too.

When the pre-hospital provider then connects to a physician or specialist, the same patient's medical or call data is automatically securely transferred, shared, and displayed "live". This results in safer and more expedient care for all involved.

The **Hospital Clinical** or **Dispatch** side:



Shown above is famed trauma surgeon Dr. "Red" Duke triaging Hurricane Katrina victims in New Orleans 375 miles away.

Physicians, emergency professionals, or intensivists may communicate with ambulances and EMS Mobile Healthcare vehicles in a variety of ways. This involves the use of both desktop workstations and lightweight tablet PCs.

In dispatch, a hospital department, or in a specialist's home, a desktop workstation is ideal. If the person is mobile, then they may use a lightweight tablet PC to "login" at almost any time from almost any place. During a major event or disaster many physicians and specialists may be virtually "on the scene" in a few minutes with each using a small Slate tablet PC system.



Shown above is the LifeBot® Communications Workstation with DREAMS™ and Odyssey DSS tele-triage systems. The system may also integrate radio and telephone communications.

The fully integrated LifeBot® workstation can perform both DREAMS™ EMS Telemedicine and Odyssey DSS. In addition, it may include radio and telephone communications for use by clinical specialists and nurse tele-triage dispatch personnel.



Shown above is the 1.5 pound LifeBot® Slate tablet PC that may be used by any medical specialist anywhere at any time to quickly access pre-hospital ambulances and mobile healthcare units.

Who Is or What Is a LifeBot?

The basic concept of a "LifeBot" involves the reducing of work-load for medical professionals using robotics designs, or automating as many important processes as possible so that the patient and quality of care can become the central goals.

The more medical professionals have to attend to equipment, fill out forms, worry about managing connectivity, etc. that becomes the focus, not the patient. Put very honestly, this is just wrong. Properly designed systems should reduce work-load, not add to it. They should make life safer and easier for everyone. They should reduce healthcare costs.

The trademark LifeBot® also refers to a company in Phoenix, Arizona that is building these systems. It is headed by Roger Lee Heath, who is best known as the inventor of "hands-free" defib or combo pads making possible the modern Automatic External Defibrillator (AED) and non-invasive heart pacing.

This company is the **only one** exclusively integrating this unique combination of DREAMS™, Odyssey, and a host of exclusively patented technologies to make all of this, and more, possible.

Nowhere is this more important than in advanced pre-hospital EMS Telemedicine, EMS Mobile Healthcare; or in the delivery of **Community Paramedicine**^{18,19}. In both acute and urgent care this will not only reduce costs, escalate the quality of care, but it will also save lives. Everyone has an early understanding of "what's coming in the door" and exactly "what are we dealing with".

What is EMS Mobile Healthcare?

EMS Mobile Healthcare is a no nonsense approach to solving the problems of primary care nation-wide and doing this quickly.

It says, we do not have to construct \$2 trillion in new facilities or even deploy additional expensive ambulances. This will only cause the costs of healthcare delivery to continue to sky-rocket. It says, we have a cost effective alternative. It says, we now have the technologies and the expertise to accomplish this, and fast.

With the implementation of primary care delivery by pre-hospital providers, a new vehicle shows up on the scene, the "**Mobile Primary Care Unit**" or "**MPCU**". It is specifically designed to still respond, but to the non-emergency caller and at much lower costs. It is staffed by a qualified nurse or paramedic that can use advanced technologies to provide the appropriate level of care relative to the urgency or precise needs of the caller.



ALS MICU continues to respond to emergencies with necessary advanced care, but faster.



MPCU responds to non-emergencies and delivers primary care at much less cost.

This frees up the ALS or MICU ambulances to attend to real emergencies. In this light, EMS Mobile Healthcare may save millions by reducing the costs of deploying more costly vehicles. It also enhances the ability of pre-hospital services to **lower response times and save lives** where this is urgently needed. Not only are the calls prioritized, but so are responder assets.

With LifeBot® systems Odyssey is integrated into DREAMS™ to become one powerful combination of unique technologies. This enables EMS Mobile Healthcare. These systems are deployed in the MPCU. They may be optionally deployed in ALS-MICU ambulances to escalate their level of care as well for cardiac arrest, trauma, stroke, 12-lead STEMI, etc.

Callers to 911 dispatches are screened by qualified nurses. As Dr. Jeff Clawson has stated, "...the nurse screening approach is the 'Cadillac' of selective dispatch philosophies."¹¹ With the MPCU response model, patients are "double screened" for determining the urgency of their needs. The MPCU may still call upon an ALS responder; if it is more clearly determined there is a valid need.

Stick with the Model That Works: Affects Cost the Most.

NAED® Medical Priority Dispatch System (MPDS) remains the primary choice for initial call screening at the dispatch level. Odyssey tele-nursing DSS functions as a "safety net" for those calls where expressed symptoms and needs remain somewhat obscure and present a risk to the provider. The dispatch or tele-triage nurse service may still hand a caller back for 911 dispatch if the DSS software quickly determines that this is appropriate.

This is the exact model used in the UK that is so successful. It is important to stick with what works; to use what is proven to substantially lower both costs and risks in over a decade of use.

The Nurse Call Center Services Role.

Can EMS Mobile Healthcare be integrated with existing nonemergency nurse call centers? Absolutely. This is a matter of properly "wiring" them into the 911 dispatch system. This gives to them a distinct advantage. At any time they encounter a genuine emergency, they may "**stay online**" with the person, while patching in the 911 emergency response system.

This is a patented feature within LifeBot® designs enabling any medical call support center to handle remote emergency situations. The answer is not the classic response, "*Hang up and dial 911.*" If the caller becomes incapacitated; he or she may be unable to do so. The caller should remain connected to the medical expertise **on-hand**, and the tele-nurse should make the call to 911. Disconnecting the caller could be life threatening.

The Most Important Component: People.

In constructing EMS Mobile Healthcare systems there is simply no substitute for dedicated qualified healthcare professionals. The concept of Mobile Healthcare opens a whole new area of tremendous need for the qualified nurse or field professional.

The renowned visionary in this area is Ms. Sheila Wheeler. In 2006, she has described the future tele-triage nurse as having the following job description, "*Positions open in high volume high tech, 24 hour, integrated telemedicine call center. RN or NP with minimum of ten years nursing and five or more year's telephone triage experience. Eligible candidates must be computer literate, culturally sensitive and possess excellent communication skills. Requires expert level decision-making, communications and negotiating skills. Experience with telemedicine and/or telemetry required. 80-Hour full-time orientation required. Bilingual nurses (esp. Spanish) highly desired. BS/MS in Psychology or Sociology a plus. Desired specialties: Pediatric, Adult/Geriatric, OB/GYN, Crisis Intervention, Behavioral Health, or Case Management.*"¹²

In the same article, she described the future call center as, "...in the future, many will practice from large national call centers. In these "mega call centers", nurses may serve as the coordinator from the "hub" of an integrated computer and phone system -- a network of phone-based health care services, calls ranging from crisis level to information-based and from telemedicine and internet based service to "POTs" -- "plain old telephone" lines."¹² Ms. Wheeler was the first to foresee the Telemedicine Hub.

The Future: The Dispatch Telemedicine Hub.

In telemedicine, callers cannot "magically" connect to the right physicians or medical expertise when needed. This is the job of the **Telemedicine Hub**. A Telemedicine Hub acts as a telemedicine dispatch center. Should this be connected into the emergency dispatch similar to the Nurse Call Centers mentioned above? Yes. This gives them a similar advantage in that they also become able to handle emergencies without "hanging up". If complications emerge, patients will benefit. The ability to respond in a timely way will lower risks, lower costs and save lives.

The most advanced telemedicine hub has been constructed at the University of California San Francisco. At any time a provider can immediately connect to the specific medical specialist in dispatch fashion to fifteen separate telemedicine suites.¹³



Shown above is the University of California San Francisco Telemedicine Hub design connecting 15 remote facilities.

A Telemedicine Hub may not only connect providers to telemedicine facilities at hospitals or clinics, but also be used for home remote monitoring, school nurses, nursing home and extended care facilities, outpatient facilities, and much more.

Weill Cornell Medical School has also evolved a model for using the Telemedicine Hub specifically for **Medical Emergency Response** to major events or disasters.^{14, 15} Healthcare experts at Centura Health consider it the next generation model in the new approach to ambulatory care all together. They also consider it as a model for delivery of “patient-directed” primary care systems.¹⁶

Exclusive patented LifeBot® technologies now enable the structure required to build complete Telemedicine Hubs today that are geared to respond fully to acute, urgent and primary care, as well as to respond to both individual isolated emergencies and major events such as disasters or even battlefield operations.

The central unifying concept here is “**Multi-Function**”. Almost all systems deployed today have only bits and pieces; they are “cobbled together”. Most so called “telemedicine systems” are largely constructed by audio visual suppliers with experience in video teleconferencing, but little or no experience in medical applications. Similarly, dispatch centers are being constructed with the best expertise in modern radio, telephone and wireless designs. But, once again, little understanding exists regarding the needed integration of medical devices and their data. **Multi-Function** means that the system is designed to meet all of the basic essential clinical data needs, even for an emergency.

Mobile Healthcare Inside the Hospital?

Since it is now possible to construct systems to properly respond to both the needs of both routine pre-hospital primary care and emergencies, then is this possible in the hospital and clinic itself? Can physicians, intensivists, and other medical specialists still utilize the same desktop PC and lightweight tablet PCs to “login” to assist in emergencies inside a healthcare facility as well?

The American Heart and Stroke Association recommends wide-spread use of “hub and spoke” tele-stroke cart systems to accelerate care in much the same way it is already assisting communities to speed life-saving care for STEMI heart patients with 12-lead ECG programs for priority transport to cath-labs.

Can such a cart be made for tele-stroke, but be designed with “**multi-function**” capabilities so it may also respond to the needs for tele-trauma, tele-psychiatry, e-ICU, etc. and respond to an emergency? The answer is yes with the deployment of the Multi-Function Crash Cart system. This is an “**all-in-one**” cart design.



Shown above is the LifeBot® Multi-Function Crash Cart, an in-hospital mobile healthcare solution for both routine care and emergencies.

The Multi-Function Crash Cart enables physicians and other specialists to use the same DREAMS™ desktop and lightweight tablet PCs to “login” to **both** pre-hospital and in-hospital systems. In minutes, they may be “on-the-scene” to assist in critical care from almost any location at any time for almost any situation.

This cart may be used as a “**virtual mobile ambulance**” within any healthcare facility, no matter what the size. The system has a flashing light system to clear the hallways, similar to the way an ambulance clears the street when in route.

How does this relate to pre-hospital mobile healthcare? Carts may be used by pre-hospital providers to extend their services to in-facility use. Here are just a few examples where carts may be used as “**virtual ambulances**”:

- **Schools and Universities:** On-site qualified nurses may deliver primary care and respond to emergencies. Schools are also prime locations to support and manage disasters.
- **Public Event Facilities:** Sports and concert stadiums and convention halls; any where large groups congregate publically and individuals undergo excitement or stress.
- **Prisons and Jails:** MPCUs may respond to prisons to deliver primary care or use carts with on-site personnel. *The State of California now projects \$1 billion in annual savings accomplished by eliminating costly high-security transports state-wide using remote telemedicine.*
- **Nursing Homes and Extended Care:** May provide for priceless support to on-site healthcare specialists.

Of course, with such a system, hospital **Crash Cart Teams** may now deploy the most advanced care with telemedicine capabilities onto general floors across a whole facility and within both nearby or remote clinics and in medical specialist’s offices anywhere.

A “Front-End” for All of Healthcare.

When **multi-function connected care** (smart telemedicine) becomes integrated with **intelligent care** (DSS decision supported triage), the more healthcare providers can look forward to reduced work-load with substantial reductions in the costs of healthcare delivery.

When these technologies are properly combined they form a “front-end” for all of healthcare. Nowhere does a broader opportunity exist to both elevate the level of care, the quality of life, while at the same time, substantially reducing overall healthcare costs for everyone.

The Ideal Accountable Care Organization (ACO) Model:

This consolidation becomes the ideal model for the Accountable Care Organizations (ACO) to enhance the prospects for reimbursement. **With LifeBot® systems medical and call data-flow follows the logical pathway of the patient-flow.** Then the data may be easily ported to all modern clinical Electronic Health Record (EHR) systems across the board.

The Need is Real. The Time is Now.

The promise of Mobile Healthcare is real. The opportunity to elevate EMS and Community Paramedicine exists today. The sooner it is put to use, the sooner one may elevate the quality of care and, at the same time, significantly reduce healthcare delivery costs.

About Roger Lee Heath:

*Best known as the inventor making possible the Automatic External Defibrillator (AED) through his invention of noninvasive defib combo pads, Mr. Heath is Chairman & CEO and founder of LifeBot, LLC, a company based in Phoenix, Arizona. LifeBot is the **sole source** for the EMS Mobile Healthcare combined technologies offered by the DREAMS™ telemedicine systems with the Odyssey DSS. He was just awarded his 33rd patent which covers additional exclusive technologies that compliment the above advanced healthcare delivery technologies.*

Recommended Support Contacts:

The following are the recommended contacts for systems design and deployment of EMS Mobile Healthcare and Community Paramedicine systems:

LifeBot® Mobile Technologies Support:

Roger Lee Heath
LifeBot, LLC
Email: heath@lifebot.us.com
Telephone: 877-466-1422 extension 3
Website: www.lifebot.us.com

MHN Logistical and Grants Support:

Chief Dennis Murphy
Mobile Healthcare Network, LLC
Email: dennis@mhn.us.com
Telephone: 541-726-4840
Website: www.mhn.us.com

Important Considerations in Systems Design:

Not all EMS pre-hospital monitor-defibrillators are created equal.

Many modern EMS defibrillators are not designed send “live” physiological data for telemedicine applications. Some do.

Simply fill out the form on the next page and we will contact you and inform you if yours does.

In the event that yours cannot, LifeBot® will furnish you with technologies that enable this functionality.

Can incoming calls play Ring-Tones?

Yes, absolutely. Just tell us to quote which music or tones you wish to use to alert ED or Call Center staff. These systems may also activate lights and alarms as well.

What about FDA Compliance?

LifeBot® systems are compliant under premarket notification procedures.

Compatibility with Modern Radio and Telephone Technologies.

The LifeBot® Communications workstation may integrate not only telephone systems, but the most modern radio communications as well.

It is the first ED communications system utilizing VOIP (Voice Over IP) based system with full compatibility and interoperability with digital radio systems including 700MHz P25, 800 MHz trunked, UHF, VHF, TETRA, and all Phone/PSTN systems.

If replacement of older communications systems is needed, LifeBot® may quote complete systems to compliment new telemedicine systems deployments.

Can large overhead video displays be utilized for an individual call scene?

Yes, just like most major dispatch centers, this may be done. At any one time a communications or nurses station can switch the “live” video for simultaneous display.

The World-Wide One Source for Building Telemedicine Hubs.

LifeBot® is the only company in the world that stands ready to build Telemedicine Hubs or full dispatch and call centers integrating these systems.

Cellular Data for Mobile Pre-Hospital Ambulance and MPCU Systems.

LifeBot® quotations do not include the cellular modems for our products. This is because most providers have contracts that may supply this at much lower cost. These may be added into our systems after they are delivered.

LifeBot® systems are generally already compatible with Public Safety WiMAX, Wi-Fi Mesh, and LTE wireless data network systems. To confirm this compatibility please contact us.

The Features of LifeBot® DREAMS™

Examination Camera Systems:



LifeBot® has available a complete product line of examination cameras to capture either high resolution images or videos for retransmission to remote facilities using DREAMS™.

Included are cameras for general exam, otoscopes (ear), eyescopes, dermoscopes and dentoscopes. Some contain polarizing magnification features.

SonoSite® Ultra-Sound Systems:

LifeBot® DREAMS™ systems are compatible with Sonosite® ultrasound systems that are the most popular in many military and pre-hospital ambulance, and Emergency Department applications.

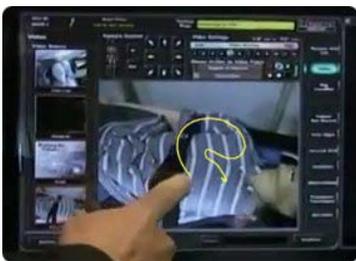


Pictured at left is the M-Turbo® model lightweight versatile portable ultrasound system that is certified to transmit its images using LifeBot® DREAMS™. The system is ideal for telemedicine cart use and renders striking image quality with sharp contrast resolution and clear tissue delineation. This ultrasound

equipment lets you visualize detail, improving your ability to differentiate structures, vessels and pathology.

What is Tele-Stration?

Tele-Stration or **tele-demonstration** is a feature of the LifeBot® DREAMS™ telemedicine system. Using this feature a physician, intensivist, or other medical specialist using the LifeBot® Slate tablet PC or Desktop PC may draw directly upon the screen of transmitted videos “live”. Those



instructive drawings appear “live” at the patient end rendering real-time clinical care instruction.

Physicians may illustrate “**play-by-play**” where pertinent and important

information exists and use this method to instruct those treating the patient with precise critical observations.

This is just one of the many valuable features inherent in the LifeBot® DREAMS™ telemedicine system. For a complete list of features please visit the website at www.lifebot.us.com.

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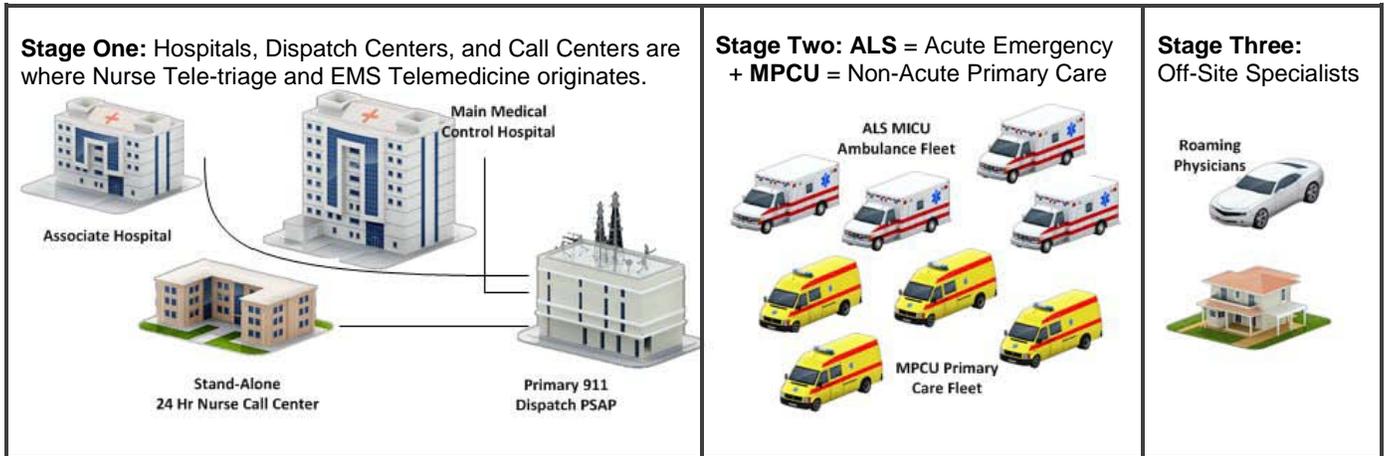
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LifeBot® Mobile Healthcare Design Guide Survey

Please answer the initial questions below for us to research and quote your technology needs.



LifeBot® Nurse Tele-Triage Operator's Positions: Typically located at call centers, 911 dispatch these may also be installed into a call center adjoining an Emergency Room (this may reduce costs). Designed to triage non-emergency calls and retain the ability to handle calls determined to be emergent back to 911 dispatch for ALS response.

LifeBot® EMS Pre-Hospital Telemedicine:

On-Site + Off-Site:

Stage 3: Specialists may carry a lightweight tablet PC to support care. How many are needed?

Specialists may use a desktop at home or in off-site locations to support care. How many are needed?

Stage One: Please indicate total nurse tele-triage positions quantity required for all above facilities:

LifeBot® DREAMS™ Telemedicine Operator's Client Positions:

Typically located in the Emergency Department and other select hospital departments to provide direct telemedicine communications with both ALS ambulances and MPCUs Primary Care vehicles by physicians, intensivists, and other EMS specialists. May be used for tele-trauma, 12-lead STEMI, etc.

Stage One: Please indicate total telemedicine workstations quantity required for all above facilities:

Do you wish to also deploy **LifeBot® Crash Carts**? Yes ___ No ___

Please indicate how many vehicles are to be equipped with telemedicine systems:

Please indicate how many vehicles are to have the following options installed:

What monitor-defibrillator systems are used in pre-hospital care?

Please enter the following contact information:

Name: _____

Facility: _____

City, State: _____

Phone number: _____

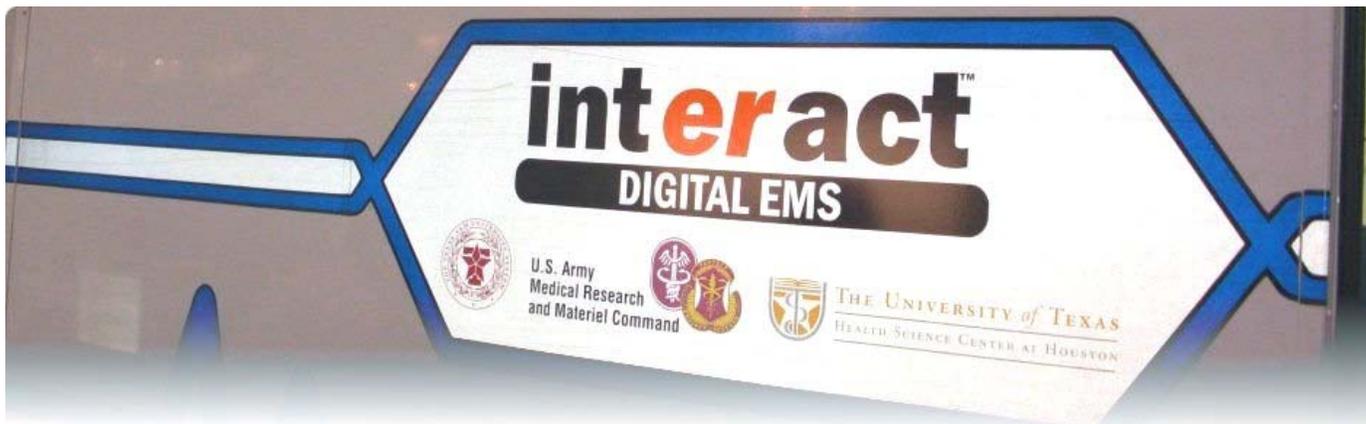
E-mail address: _____

What monitor-defibrillator systems are used in pre-hospital care?

LifePak Medtronic total:	Zoll Medical: total:	Philips MRx: total:
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Date: _____ Time: _____

Instructions: Please print this form and fill it out as accurately as possible. Scan it and e-mail it to support@lifebot.us.com. It may also be faxed to: **602-840-3024**. A LifeBot® telemedicine systems design engineer will contact you for further details and to supply a quotation.



While now under revision, the LifeBot® DREAMS™ exterior vehicular moniker, shown above, may be displayed on Advanced Life Support Ambulances and EMS Mobile Healthcare units that deploy and use these advanced telemedicine systems. To request permissions to utilize this display contact us.

The LifeBot® Technologies Team

These technologies were either funded, developed or are supported by this extraordinary group of LifeBot® technology partners:

Telemedicine and Technology Research Center (TATRC)

The Telemedicine & Advanced Technology Research Center (TATRC) performs medical reconnaissance and special operations to address critical gaps that are underrepresented in Department of Defense medical research programs. TATRC is an office of the headquarters of the US Army Medical Research and Materiel Command (USAMRMC).

Hewlett Packard Company

A Fortune 10 company with over \$139 billion in annual revenues HP provides one of the tech world's most comprehensive portfolios of hardware, software, and services.

The strategic and tactical challenges of healthcare IT are complex and far-reaching. Systems must support quality patient care, facilitate cost reductions and help secure critical medical information. With HP on your side, you'll have the technologies your organization needs to provide exceptional care today and going forward.

LifeBot® products are supported by the HP Elite Healthcare Partners and associated corporate groups.

Vesalius Ventures

A "technology accelerator" based in Houston, Texas. The company was founded by former astronaut Dr. Bernard Harris. Dr. Harris is also the President of the American Telemedicine Association (ATA). Ms. Marsha Lamb, Vice President of Strategic Initiatives, has joined LifeBot as an advisor.

United States Army Medical Research and Materiel Command (USAMRMC)

The U.S. Army Medical Research and Materiel Command is the Army's medical materiel developer, with responsibility for medical research, development, and acquisition and medical logistics management. The USAMRMC's expertise in these critical areas helps establish and maintain the capabilities the Army needs to fight and win on the battlefield.

Avia, PLC

Avia produces outstanding clinical decision support systems that are the standard for General Practitioners services and Emergency Care throughout the United Kingdom.

The Odyssey system has been highly developed for over 15 years while in use in numerous critical applications.

Now with over 18 million patient assessments the software represents a new standard for use in the U.S. It may aid in quickly, clearly and safely determining whether calls are emergent or non-emergent in nature giving healthcare providers the edge in prioritizing services and significantly reducing healthcare costs.

Bosch

Robert Bosch was established the company in Stuttgart, Germany in 1886. In North America, the Bosch Group employs approximately 25,000 associates in more than 80 locations throughout the U.S., Canada and Mexico. The company also offers advanced healthcare and communications security systems.

Texas A&M University

Primary DREAMS™ development is performed at Texas A&M University, Academy for Advanced Telecommunications and Learning Technology who is charged with developing consortia and collaborative opportunities for Texas A&M and the people of Texas in areas of distance learning, telemedicine, advanced telecommunications, and supercomputing. The Academy houses the test-bed for Next Generation 911 (NG911).

University of Texas Health Sciences Center at Houston

As a comprehensive health science university, the mission of The University of Texas Health Science Center at Houston is to educate health science professionals, discover and translate advances in the biomedical and social sciences, and model the best practices in clinical care and public health.

Texas Engineering Experiment Station (TEES)

For nearly 100 years, the Texas Engineering Experiment Station (TEES) has served the citizens of Texas through engineering and technology-oriented research and educational collaborations. Their research has made significant impact on the health, safety and quality of life of Texas citizens and has contributed to the state's economic growth and development.

Mobile Healthcare Network, LLC

MHN is the leading development company for EMS Mobile Healthcare Networks.

Founder and industry veteran Chief Dennis Murphy is a past committee chair for the International Association of Fire Chiefs (IAFC). His work in the field of rapid treatment for heart attacks and cardiac arrest has made a significant contribution to the national advancement of emergency medical services. In 1987, he initiated and chaired the IAFC nationwide RapidZap project, which resulted in equipping the nation's fire apparatus with Automated External Defibrillators.

In 1996, he received the International Fire Chiefs EMS Section James O. Page Award of Excellence.

LifeBot, LLC

Now with 33 patent awards, LifeBot was founded by renowned inventor Roger Lee Heath to deploy his new exclusively patented telemedicine technologies.

Mr. Heath is best known as the inventor making possible the Automatic External Defibrillator (AED) through his invention of "hands-free" multifunction defibrillator and external pacing combo pads. Mr. Heath was recommended for the Lemelson MIT Prize by American Heart Association officials and others.

His new technologies compliment the DREAMS™, Odyssey DSS and additional advanced technologies for Advanced Life Support, EMS Mobile Healthcare and Disaster Management with a view towards increasing the quality of care, lowering user work-load and significantly reducing overall healthcare delivery costs.



advanced telemedicine with continuity of care.™



LifeBot, LLC 2303 North 44th Street, Phoenix, AZ 85008-2442 USA
 telephone: 877-466-1422 website: www.lifebot.us.com email: info@lifebot.us.com