Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Utilizing Rapidly Deployable Aerial Communications Architecture in Response to an Emergency	)	PS Docket No. 11-15

COMMENTS OF GLOBALSTAR, INC.

Globalstar, Inc. ("Globalstar") hereby comments on the Federal Communications Commission's ("Commission's") Notice of Inquiry in the above-captioned proceeding on deployable aerial communications architecture ("DACA") facilities.[1] Globalstar, a leading global provider of mobile satellite service ("MSS") in the Big LEO band, is committed to providing services to the public that yield substantial public safety benefits in the United States and internationally. Consistent with this public safety commitment, Globalstar has recently worked with a technology partner on the development of a ground-based emergency response communications system that utilizes Globalstar's MSS network for backhaul to the public switched telephone network ("PSTN"). While this system is not aerial, it represents a rapid, cost-efficient means of deploying reliable and interoperable communications to areas where terrestrial communications are disabled following a catastrophic event. Given the potential benefits of this innovative technology, it is critical that any new or amended rules that the Commission adopts in the instant proceeding be crafted to encompass not only the use of DACA facilities, but also the temporary operation of ground-based emergency response networks.

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[1] *Utilizing Rapidly Deployable Aerial Communications Architecture in Response to an Emergency*, Notice of Inquiry, 27 FCC Rcd 6402 (rel. May 24, 2012) (FCC 12-53) ("*NOI*").

I. Globalstar and Its Commitment to Public Safety Communications

Globalstar is a leading provider of mobile satellite voice and data services in the "Big LEO" band at 1610-1618.725/2483.5-2500 MHz. Since its inception, Globalstar has invested over $5 billion in the development of a global non-geostationary ("NGSO") MSS network, which today features a constellation of in-orbit satellites and 24 ground stations on six continents that, together, comprise the Globalstar System. The Globalstar System currently provides affordable, high-quality MSS to over 530,000 customers in over 120 countries around the world.

Since initiating commercial MSS in 2000, Globalstar has been dedicated to providing mission-critical, safety-of-life offerings to the public, including emergency services and connectivity in rural and remote areas. Public safety entities involved in relief efforts in the United States and around the world have relied on Globalstar's satellite services after earthquakes, hurricanes, and other disasters. In recent years, Globalstar has focused on the development of affordable, consumer-oriented devices and services with significant public safety benefits. Most notably, Globalstar's innovative "SPOT" family of MSS devices has played a critical role in the provision of emergency and safety-of-life services to individual consumers beyond terrestrial wireless reach. From any location in Globalstar's global MSS footprint, SPOT devices can transmit a user's GPS coordinates and status updates to any e-mail, handheld device, or smartphone address in the world. To date, Globalstar's SPOT products have been used to initiate more than 1900 rescues, in seventy countries and at sea. During 2012 alone, SPOT products have been used to initiate over 300 rescues involving over 650 individuals.

Globalstar expects that, by the end of this year, it will become the first global LEO MSS voice and data company to have launched a state-of-the-art, second-generation MSS constellation of satellites. Globalstar over the past two years has launched eighteen satellites of its second-generation MSS constellation, and plans to launch six additional satellites during the second half of

2012. Once operational, Globalstar's second-generation MSS network will support highly reliable, crystal-clear CDMA-quality voice and data satellite services to the more than five billion consumers, public safety personnel, and other customers located within its global footprint.

II. Development of the ERIC System

Globalstar commends the Commission for initiating this proceeding and making a determined effort to eliminate the communications gaps that occur "during the first 72 hours after a catastrophic event when communications may be disrupted or completely disabled due to damaged facilities, widespread power outages, and lack of access by restoration crews into the affected area."[2] Globalstar believes that MSS providers and other satellite operators will continue to serve as an important delivery mechanism for critical communications services immediately following such catastrophic events. Once fully deployed, Globalstar's second-generation MSS network will provide important post-disaster capabilities to public safety users around the United States and the world. Globalstar looks forward to continuing its critical partnership with the public safety community for years to come.

In addition to satellite-only services, Globalstar is interested in the development of emergency communications architectures in which MSS technology plays a complementary role. Over the past several years, Globalstar has worked with a technology partner, Intelcomm Inc., on the development of a ground-based emergency communications system that relies on Globalstar's global MSS network for backhaul connectivity to the PSTN. The "Emergency Response Interoperable Communications" ("ERIC") system can be used to provide critical communications capabilities in affected areas in the first crucial hours after a catastrophic incident, with Globalstar's MSS constellation seamlessly linking this system to public networks. The ERIC system utilizes "drop-in" suitcases that can be deployed and utilized virtually immediately in areas where the

[2] *Id.* ¶ 2.

existing terrestrial infrastructure has been damaged or disrupted and rendered unavailable. This system represents a highly cost-efficient means of providing flexible, robust, interoperable communications services to first responders and other public safety personnel.

The specific technical and operational features of the ERIC system, reviewed here briefly, are fully described in Attachment A to these comments. The system's drop-in suitcase units serve as base stations for what are known as "Autonomous Radio Networks" ("ARNs"). ARNs are stand-alone, self-contained mobile communications systems that are completely independent of existing public mobile networks and require no connection to a central hub. ERIC base stations are software-defined, frequency-agile radios that can operate on any of the primary bands currently used or to be used in the future by commercial mobile, public safety, and private wireless licensees, including the 700 MHz band, the 800 MHz public safety frequencies, the 800 MHz and 900 MHz SMR bands, the 850 MHz cellular band, the Advanced Wireless Service ("AWS") bands, the Personal Communications Services ("PCS") band at 1.9 GHz, and the 2.5 GHz band. ERIC is compatible with most handsets currently in use in the United States, and, as indicated above, can be connected to the PSTN through Globalstar's MSS network. The system can operate from any fixed or mobile location, is transportable, and is designed to function in nearly all environmental conditions.

While the *NOI* focuses on deployable *aerial* communications facilities, the Commission asks whether there are "other technological solutions similar to DACA that are ground based, such as drop-in suitcase architectures, that would be equally adept at restoring commercial and public safety communications to an area."[3] In fact, following a catastrophic event, the ERIC system would restore communications capabilities at least as quickly and effectively as available DACA technologies, and the Commission's regulatory framework for emergency communications should

[3] *Id.* ¶ 9.

therefore account fully for this ground-based technology. As described below, the ERIC system provides particular advantages and benefits with respect to cost, coverage, and interoperability.

Cost. The ERIC system is a highly cost-effective means of restoring communications to affected areas following a disaster. The system utilizes GSM and/or 3G WCDMA wireless technology together with affordable, commercial off-the-shelf hardware, including standard handsets, batteries, chargers and other equipment widely available at retail outlets throughout the country. In addition, ERIC's ground-based architecture can be tailored to different disaster scenarios, thereby avoiding greater expenditures than necessary to restore communications.

Coverage. The ERIC system provides greater flexibility and precision with respect to signal coverage than many DACA systems. In contrast to aerial systems that transmit their signal over broad geographic areas, the ground-based ERIC system can provide highly localized, pinpoint coverage within areas affected by a disaster. (As with other wireless systems, the exact extent of this coverage will depend on the frequency bands used, local terrain, and other factors.) If coverage over larger areas is required, multiple ERIC base stations can be deployed and their coverage footprints "meshed" together. An ERIC base station can also be equipped with a telescopic mast extending to twenty feet in order to extend coverage. Significantly, the flexibility, scalability, and precision of coverage from the ground-based ERIC system reduces the risk of harmful interference both to adjacent-area terrestrial wireless operations and to existing wireless facilities that are restored to service within affected areas.[4]

Interoperability. As the *NOI* states, "[i]nteroperability is a central requirement of emergency response communications between multiple disciplines and agencies," and "it is critical

[4] Globalstar's second-generation MSS constellation will provide seamless two-way coverage throughout the United States, and ERIC base stations will therefore enjoy backhaul connectivity to the PSTN at virtually any location in the U.S. with a clear view of the sky.

to ensure that they preserve interoperability for emergency responders."[5] Flexible, interoperable communications are at the core of the ERIC system, which includes a unique "smart" routing capability that enables direct contact between teams of first responders and other emergency service personnel and disaster victims. To promote interoperability, ERIC allocates numbers to handsets based on the service/function that the user is performing rather than the user's location; thus, the Police Team in a given disaster scenario could immediately contact the Fire Team by dialing three digits or by pushing a speed dial button. System users can be pre-registered into a particular ERIC system database, or can be flexibly added into the system database during the disaster response. With these features, the system will enhance coordination between disparate federal, state, and local agencies and emergency personnel.

The ERIC system can also be used to send a special type of "General Broadcast Alert" message that automatically appears on all users' phones. Such broad-area announcements will facilitate fast and reliable communications across different agencies regarding any threats, responses, and updates. In addition, while the system in normal mode is operational only for authorized users (such as public safety personnel), the system can switch to a mode that enables communications with any mobile handset within a given coverage area. In this mode, a General Broadcast Alert can be transmitted to all handsets within an ERIC coverage area following a disaster, and emergency response personnel can call all handsets receiving the alert in order to coordinate any necessary rescues.

III. Regulatory Issues

In the *NOI*, the Commission requests comment on how it could incorporate the use of DACA systems into its existing regulatory framework for wireless services. The Commission seeks comment on how it could authorize the temporary operations of DACA systems, and asks whether

[5] *NOI* ¶ 33.

such authority should be assigned to existing wireless licensees or to third parties that actually control and operate these systems.[6] The Commission further asks whether any federal, state, or local agency should be responsible for deploying and operating DACA technologies and solutions during emergencies.[7] The Commission also seeks comment on whether it should authorize a third party to manage coordination among and between DACA systems and terrestrial wireless operations, including by developing frequency assignments and/or a database for this purpose.[8]

In Globalstar's view, all of these licensing and regulatory issues are relevant not only to DACA technology, but also to the operation of *ground-based* emergency communications facilities like the ERIC system. Accordingly, any new or amended Commission rules for emergency communications systems should apply to the temporary operation of the ERIC system and other similar ground-based networks.[9] With respect to the specific licensing and regulatory issues raised in the *NOI*, Globalstar believes that any DACA or similar ground-based system should be licensed and operated only with the full approval and cooperation of the existing commercial, public safety, and private wireless licensees whose bands will be utilized by these temporary operations. If the Commission decides to issue the necessary grants of special temporary authority ("STA") to third parties rather than to the existing wireless licensees in the utilized bands, those third-party grantees should have to obtain express consent from the relevant spectrum licensees, either at the time of the emergency or potentially earlier during a required, preliminary coordination process. Certainly, coordination of these emergency systems with licensed operations – whether via direct discussions or through a certified third-party frequency coordinator – is an appropriate prerequisite to the

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6 *Id.* ¶ 21.

7 *Id.* ¶ 16.

8 *Id.* ¶ 25.

9 With the ERIC system, there are no issues relating to compliance with Federal Aviation Administration ("FAA") rules or the regulatory and operational constraints of the U.S. airspace system. *See NOI* ¶ 17.

deployment of DACA and similar ground-based systems. The Commission should address these licensing and regulatory processes in greater detail in a future Notice of Proposed Rulemaking in this proceeding.

IV. Conclusion

Globalstar appreciates the Commission's commitment to eliminating the communications gaps that have occurred immediately following catastrophic events in affected areas of the United States. In adopting new or amended rules for the operation of temporary, emergency communications networks during and after such disasters, the Commission should craft a regulatory framework that encompasses not only DACA facilities, but also ground-based deployments like the ERIC system that offer similar benefits and potentially some advantages over aerial operations.

Respectfully submitted,

/s/ Regina M. Keeney
Regina M. Keeney
Stephen J. Berman
Lawler, Metzger, Keeney & Logan, LLC
2001 K Street NW, Suite 802
Washington, DC 20006
(202) 777-7700

Counsel for Globalstar, Inc.

L. Barbee Ponder IV
General Counsel & Vice President
Regulatory Affairs
Globalstar, Inc.
300 Holiday Square Blvd
Covington, LA 70433

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Attachment A

Emergency Response Interoperable Communications

Table of Contents

1 Introduction

1.1 Objective

To provide a robust, scalable and highly interoperable communications umbrella that combines the use of readably available, low cost user hardware with a unique ‘smart’ routing capability that enables direct contact between teams of first responders, search and rescue teams, emergency services and victims.

2 Overview

During a crisis, natural disaster or terrorist attack a robust and effective command and control structure is crucial to stabilizing an affected area. Organizations such as FEMA, DOT, DOD, DIA and others are key elements in the complex function to restore order. Communication with and between all these organizations is essential to understand and visualize the needs of the plan in operation. Real time situational awareness is vital to monitor, evaluate, map and execute a successful plan to ensure effective disposition of emergency resources. A reliable and flexible communication network is key to rapidly focus crisis response teams to expedite rescue operations. Some organizations already have their own bespoke emergency communications system but lack the ability to effectively interconnect with each others’. This severely hampers the ability of unrelated teams to work together to maximize the rescue effort. There is an increasing need for a common platform that can be quickly and easily deploy to enable access by all suitably authorized personnel without the use of expensive specialist hardware.

Having common hardware to meet theses requirement is only part of the solution, in a fast developing situation the ability to enable any team member to directly contact any other related or unrelated team member is of critical importance.

The Emergence Response Interoperable Communications (ERIC) system is built around the highly reliable ARN (Autonomous Radio Network) architecture. ARNs are stand alone mobile phone networks that provide interoperable assured access to

subscribers while maintaining links to legacy communication infrastructures (e.g. land lines, cellular and web-enabled communications). Although ARNs operate completely independently of public mobile networks they are totally compatible with users' handsets. They can also leverage global position system technology and streaming video to characterize events unfolds to provide users exquisite situational clarity. In addition to voice, the ERIC system can send General Broadcast Message alerts, Individual or CUG Short Message Service (SMS) texting and also automatic user position updates. All of these features are available in a private and secure network. The ERIC system uses Groupe Special Mobile (GSM) and/or 3G WCDMA cell phone technology together with commercial COTS hardware compliant with applicable federal and civil laws, and their governing guidance. In general the diverse features inherent in this system provide a comprehensive command suite for control, oversight and direct management of precious resources during crisis response.

The system is compatible with the National Incident Management System (NIMS) Guide and the Incident Command System (ICS) with key concepts woven into the core of this system of systems approach to include:

- Scalable Architecture – Each ERIC system is a self-sufficient stand-alone network with tailorable, reconfigurable networks able to grow as requirements dictate (e.g. new teams formed) simply by adding additional stand-alone networks which then automatically "mesh" together. The open architecture simplifies network operations and allows the seamless integration into the Unified Command Network.
- Common Terminology – most people today are confident in understanding the terminology and capabilities (phone calls, numbers, texting, GPS, etc.) associated with mobile phone networks. It might be difficult to find a more Integrated Communications capability than that of a controllable and intelligent mobile phone and data network. Low cost spares such as handset, batteries, chargers, etc. are very readably available throughout

the country. Personnel and Resource accountability metrics are easy to identify when the intelligent database keeps a near real-time accounting of all.

- Intuitive Interface – Standardized Operational Toolset fuses responder and tactical command and control elements on common backbone without the need for extensive training or complex procedures. Ensures unity of effort from tactical, municipal and federal echelons of command.

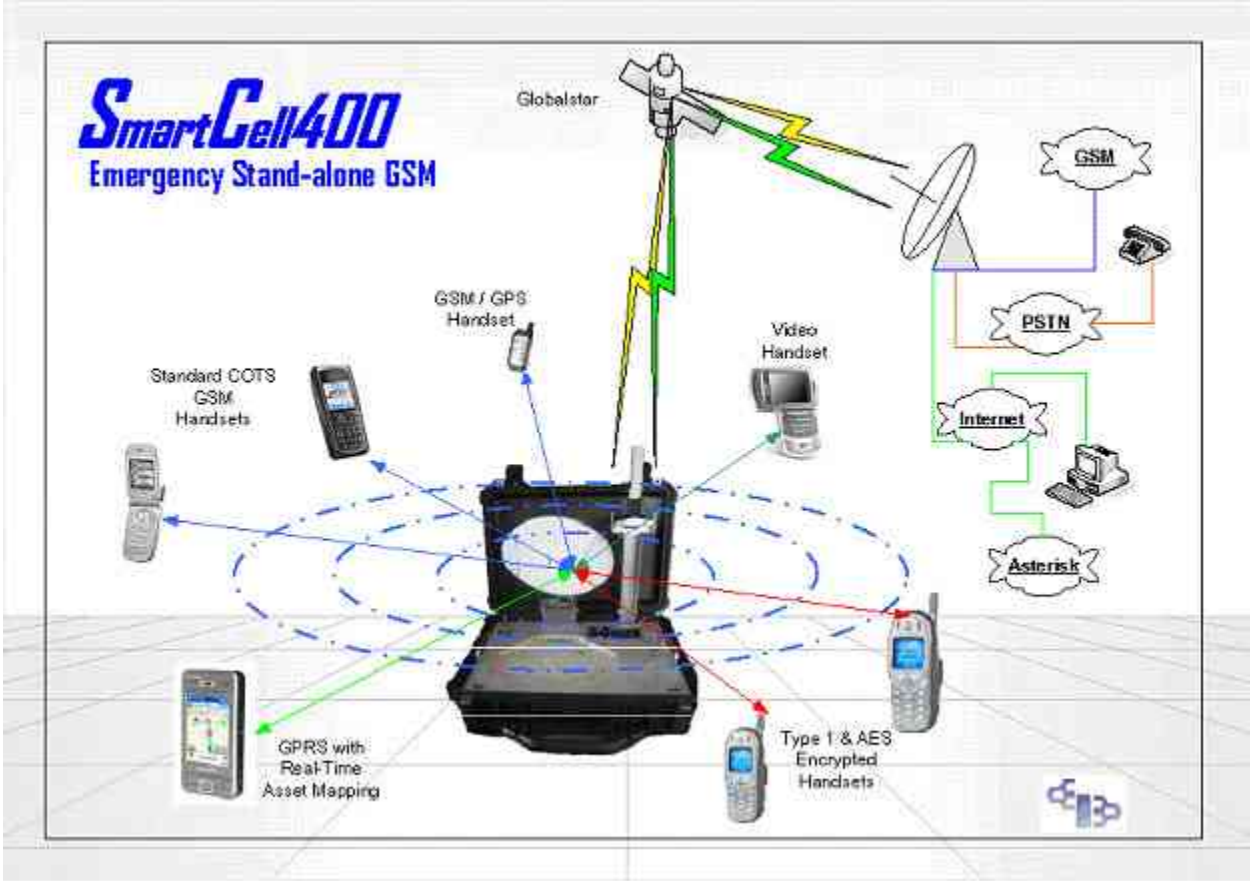

Figure 1

Notional operational view with diverse candidate platforms supported or leveraged as a dynamic communication infrastructure

3 Technical Description

3.1 Robustness

The ERIC system is a completely self-contained, mobile network (Fig. 3 and Fig. 4). It requires no connection to a central Hub and can operate from any fixed or mobile location. It is transportable with its own power source and although not hardened for an electro-magnetic pulse (EMP) event, this system is designed to function in nearly all environmental conditions/events (e.g. adverse terrestrial weather, seasonal temperature changes and naturally occurring phenomenon, etc.). Backward compatible to existing cellular networks, terrestrial land lines (e.g. Public Switch Telephone Network) and Internet protocol is an added feature offering users maximum utility in diverse circumstances.

Frequency:	GSM-850, GSM-900, GSM-1800, GSM-1900
Protocol:	GSM, GPRS, IP, SIP
Power:	110-240VAC / 12-48VDC
Weight:	12Kg-16Kg
Simultaneous Channels	7 up to 23 (3 x TRX)
Capacity (concurrent handsets):	1280 subs per Cell
Speedy Cell(SENS)	127 (16 x TRX). Max simultaneous logged users 3800 per cell.
Operating temp:	Standard 0/+40C (max -28 /+70C with Peltier)
Interconnect Options	POTS, PSTN, PBX, & ISDN
Reachback Options:	GLOBALSTAR

Figure 2

GSM System Specifications

A small, ready to deploy configuration, similar to an airline carry-on suitcase, is available to support at least 50 users with between 6 to 23 simultaneous voice channels (Figure 4). Additional handsets can be easily added in a stand-alone or linked configuration to support thousands of individual users while maintaining sufficient bandwidth to accomplish the tasks (Figure 5). The ERIC system operates on 12-48VDC or 110-240 VAC and is easily sustainable through various power sources such as an automobile's power supply, batteries, gas, wind and solar powered generators.

Standard GSM offers moderate over the air security. Many of the inherent weaknesses of a commercial network are not accessible to an eavesdropper of the system due to the BSC and MSC residing on the same platform. Additional security (commercial grade AES256 up to and including USG Type 1 encryption) is available using COTS handsets (both standard and PDA form factor).

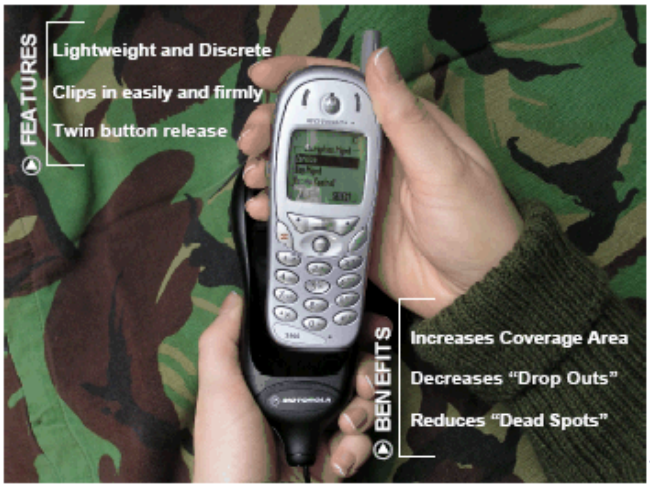

Figure 3-Small Handset

Figure 4- The ERIC system

Compatibility to both existing and emerging technologies is an inherent capability within this system. The system can interconnect with any communications technology that has an existing POTS, PSTN, PBX, VOIP (ASTERISK compliant) and/or ISDN interface. However, the ERIC system has been specifically designed to reach-back to

existing federal, state, local and/or public or private networks via the GLOBALSTAR satellite network. It is intrinsically backwardly compatible with existing GSM G2 & G2.5 technologies and will also support the later EDGE, GPRS and G3 technologies.

One of the key elements of a GSM network is the use of a Subscriber Identity Module (SIM) card. These cards enable the user to swap physical handsets while maintaining connectivity within a network. The SIM card holds the International Mobile Subscriber Identity (IMSI) number or telephone number, which is used by the network to identify the individual user. This feature is beneficial to track the resources so as to ensure uninterrupted span of control. This versatile technology allows you to program various SIMs for different users/applications. In addition, it could register another network SIM onto the ERIC system's so that commercial phones can also use the network if the need arises.

The ERIC system has the ability to support the use of a Unified Incident Command structure during emergencies by providing priority communications to the Unified Command Center as well as the "Incident Commanders" of all major organizations involved in the incident. The system has a unique "smart call routing" capability which will allow the incident commanders to effectively coordinate and carry out their own jurisdictional responsibilities concurrently under the umbrella of the unified command structure while each individual responder works together providing an integrated response to the incident.

3.2 Services Based Numbering Scheme

When an emergency arises every second counts. There is no time to deal with lost papers or with an extensive list with phone numbers. One of the most powerful attribute offered by the ERIC system is the ability for a user to contact another user without having to know the other user's individual number. This is of particular value where

emergency teams are from different cities, districts and States who are called upon to support the incident.
Public GSM operators allocate their numbers according to the user's home location (area codes). The ERIC system however, being a self-contained system, is able to allocate numbers based upon the service/job that the user is performing rather than their location.

Example:
The ERIC system would allocate a standard ten digit long number to a user but instead of the first three digits depicting an area code the Services Number (SN) would depict the user's function.

Example:

First Response	SN = 990.xxx.xxxx
Police teams	SN = 999.xxx.xxxx
Fire teams	SN = 989.xxx.xxxx
Water teams	SN = 979.xxx.xxxx
Electrical teams	SN = 969.xxx.xxxx
Rescue teams	SN = 959.xxx.xxxx

With just the Service Number (SN) already installed under 'contacts' in the telephone, the Police Team immediately can call the Fire team by dialing just the first three digits or by pushing a speed dial button. Since the ERIC system works with a dynamic database, once the user is logged, their number would be added to the database and the ERIC system would be able to automatically route the call to the most appropriate response element based on their function/job, availability and distance. Immediate communications are available without having access to numerous and potentially outdated phone rosters – greatly reducing confusion by breaking down organizational stovepipes and establishing standardized and enduring functional relationships.

The next three digits could possibly depict another attribute from within the Police team. The phone call could go to the most senior officer or someone with special skills like linguistics. It is also possible for a user to call a specific individual by dialing their full number. The ERIC system can be programmed in many different ways based on the needs of the user.

3.3 Capacity and Services Texting

It is unlikely that there would be a “typical” incident; therefore, it’s difficult to predict the number of potential users of the system. Any type of radio based system will have a finite number of simultaneous channels it can provide. GSM is no exception; however there are a number of techniques that can be used to maximize the ways of communicating between users. The most obvious is to use SMS texting.

Texting not only takes up a fraction of the capacity of a voice message, it also uses a sequential collection/delivery system for message trafficking. In many instances text messages are very useful with the potential to reach a broader audience in less time it would take to initiate voice communications, especially if a user is particularly busy and is unable to answer a phone call.

Individual text messages can be sent to large groups of users but the ERIC system can also send a special type of “General Broadcast Alert” message which automatically appears on all users’ phones without them having to retrieve it from their inbox; broad area announcements. This valuable service will facilitate fast and reliable communications force wide for immediate notices for threats, responses and updates.

The system comes equipped with call waiting, three-way calling and conference/general broadcast calling features similar to what the commercial telecommunications market offers to its customers. These enhancements allow users to determine who and how to communicate through an intuitive interface they are already familiar with.

3.4 Nav/Com

Many new COTS GSM handsets (ie: iPhone, Android) are equipped with built in GPS. There are also many small GSM/GPS units currently available at low-cost. All these type of devices are able to send a SMS text giving their current position. It is also possible to send a SMS to these devices which trigger an automatic reply with its position. Assuming some (or all) of the personnel and assets were equipped with any of these devices it would be possible to construct a real-time map of the affected area. This real-time map would be available not only to the UCC; it could also be made available to key personnel on-the-ground at the incident via their GPRS handset. If very high precision positioning were needed it would also be possible to broadcast differential GPS data over the GSM signaling channel.

3.5 Coverage and Extended Range

Standard GSM operates in the 900, 1800 and 1900 MHz band. Coverage within these bands is normally classed as line-of-sight. The 900 MHz version of the ERIC system has been successfully used over 18 miles; however, range is adversely affected by local conditions. The height of the antenna is the single most important factor as well as the number and density of local buildings.

The ERIC system can be equipped with telescopic masts which can be carried and used from the back of a standard pick-up truck. When unused it is two feet high; when power is applied (from the pick-up truck), a rigid mast is automatically constructed which extends to a height of twenty feet in less than three minutes.

Figure 5- Indoor Unit

Figure 6- Small STE and Booster

For absolutely maximum coverage (50miles +) it is possible to install the ERIC system onto an airborne platform such a helicopter, airplane or Unmanned Aerial Vehicle (UAV). A purpose-built UAV is currently under development which can remain airborne within a given area for up to 30 hours. This would not only maximize the range of the cell it can also broadcast live images of the affected area directly to users handsets by using the onboard the ERIC system with video.

3.6 Cost and Operability

Unlike other specialist emergency handsets (P25), the ERIC system uses standard GSM phones which can currently be purchased from almost any retail store or outlet for as little as $15. The ERIC system is a tailorable, cost effective solution with flexible pricing options.

Users also have the option to use their own GSM handsets in conjunction with a purchased the ERIC system base station. To integrate the personal GSM handset with

the base station requires only a one time registration of their SIM card with their Team Based Number. Once this is done the phone will continue to operate as normal on the public network but then also has the option to switch over into the ERIC system network. That is, the ERIC system can restore operability of legacy communications by supplanting them or acting as an interface to the broader communications world via any of the following technologies: POTS, PSTN, PBX, VOIP (H323, Sip, ASTERISK compliant switch, Skype) and/or ISDN interface to other analogue switch systems.

3.7 Communicating With Victims

In a post disaster situation such as Katrina and Haiti many victims were left trapped in homes and offices. Although many had mobile phones most of the public networks were out of action. Although in normal operation only authorized users would be able to use the system, it is possible to switch the ERIC system into a mode that would enable any mobile phone to be logged in. It would then be possible to send a “General Broadcast Alert” to all handsets to reassure victims that help is on its way. The ERIC system would then have a list of handsets which received the message; from that information it would be possible for the emergency team to call the victim to coordinate a rescue if necessary.

3.8 Summary

Flexibility and interoperability is at the core of the ERIC system system. Handsets can be programmed and networks reconfigured to suit user needs. ERIC is not only a way to communicate, is a tool to help restore order, structure and organization into the affected area. Communication is a powerful tool, a key enabler to achieving a desired end state. The ERIC system will help to monitor, evaluate, map and execute a successful campaign to save and protect lives.

Enhancement Devices

900 MHZ GSM BOOSTER

LRB 900

900 Mhz Long Range Booster			
PRODUCT	Gain	Frequency	Power
LRB 900 Uplink	+25dB	890-915 Mhz	
LRB 900 Downlink	+25dB	935 - 960 Mhz	3 Watts
Standby			0.2 A @ 12VDC
Transmit			1.6 A @ 12VDC

900 MHZ ANTENNAS

LRY 14

900Mhz Fixed Location Yagi		
	LRY 8	LRY 14
Isotropic Gain	8 dBi	16 dBi
VSWR	1.5:1	1.5:1
Polarization	Vertical/Horizontal	Vertical/Horizontal
Number of Elements	8	14
Impedance	50 Ohms	50 Ohms
Frequency Range	824 - 960 Mhz	870 - 960

LRO 500

900Mhz Mobile Omni		
	LRO 300	LRO 500
Isotropic Gain	5 dBi	7 dBi
Compared with 1/4 wave	3 dBi	5 dBi
Height of Whip	300 mm	500 mm
Height of Base	36 mm	36 mm
Diameter	72 mm	72 mm
Frequency Range	812 - 960 Mhz	870 - 960

Figure 7