Executive Summary

Many state agencies and local governments across the State of Iowa own and operate disparate radio systems that are aging rapidly and in need of modernization. The lack of ability to intercommunicate with other agencies (multi-jurisdictional or cross-discipline), especially in emergency situations, is a matter of great concern to public safety officials. In order to address the issue of interoperability, Governor Chet Culver signed legislation in April 2007 establishing the Iowa Statewide Interoperable Communications System Board (ISICSB). The ISICSB was given the responsibility to develop, implement and oversee the policy, operations, and fiscal components of communications interoperability efforts at the state and local level and is ultimately responsible for developing and overseeing the operation of a statewide integrated public safety communications system.

Through a highly competitive selection process, the ISICSB selected Federal Engineering, Inc. (*FE*) to further analyze the communication needs across the State, and develop an overall strategy to address an interoperable communications system design and implementation plan for public safety agencies in Iowa. The system, referred to as the Iowa Statewide Interoperable Communications System (ISICS), will provide voice, data, video, and enhanced 911 communications capability for local public safety entities across the State, as well as state agencies such as the Department of Public Safety, Department of Transportation, and Department of Public Defense - Homeland Security and Emergency Management Division. Pivotal to this system offering is the underlying capability to provide ease of interoperation between and among the various state and local agencies in Iowa.

This ISICS Master Plan was developed through a collaborative process involving stakeholders form both state and local agencies, and includes the following:

- Analysis and results of user surveys
- Results of coverage modeling
- Radio and transport conceptual designs
- Plans for state and local agency migration to the statewide system including alternatives for joining the system or interfacing to it
- Proposed phased implementation approach
- System costing estimates and funding strategy options

There are a number of key phases in the development of the overall statewide system design that are captured in the ISICS Master Plan. These are:

1. Identification of the current Iowa public safety communication environment

2. Evaluation of Iowa public safety communication needs and issues to be addressed in the ISICS offering

3. Creation of a conceptual design for the ISICS offering

4. Definition of interoperability processes for working with the ISICS network

5. Estimation of system cost and identification of funding strategy options for a phased system implementation

At the monthly ISICSB meetings, *FE* provided technical presentations and briefed the Board members on project progress. During these briefings, the Board affirmed *FE's* general findings with regards to user need analysis, and overall conceptual system design.

The current communications environment throughout the State of Iowa is described in this document and partitioned into segments that each focus on the state and local levels. As a starting point to understanding the Iowa communication environment, *FE* used the previous *Iowa Statewide Interoperable Radio System Feasibility Study* conducted by CTA Communications in 2007. Additionally, baseline system assumptions from the ISICSB including such as the use of 700 MHz narrowband spectrum, APCO P25 trunked system, dedicated microwave backbone, reuse of existing tower sites, and shared system approach were used to guide the ISICS conceptual system design. Essential to the overall design process was a concerted effort to accomplish widespread stakeholder participation of Iowa's public safety agencies at all levels – state and local, rural, and urban alike. *FE* conducted an extensive survey process to identify the user's needs as well as document the various current systems and their characteristics. These efforts included:

- Addressing the broadest user audience possible across the public safety agencies of Iowa (local and state agencies, small and large, urban and rural) through electronic survey questionnaires. Approximately 300 agencies responded from multiple disciplines (e.g., fire, law enforcement, emergency management, medical services, and communications).

- Conducting in-person meetings, discussions, and telephone interviews, with individuals and groups to augment the questionnaire responses. Issues needing further clarification were handled via the personal interview process.

The *FE* team drew upon its depth of experience with advanced communication system design to analyze the information gathered through the survey process, to identify issues for the current communication offerings and discern elements of common needs across the stakeholders.

Factored into development of the system conceptual design were trends in technology (e.g., Internet Protocol (IP) based technologies, peer to peer architecture approach, "end of production" types of equipment) and the FCC mandate that all communications systems operating in the VHF and UHF frequency bands migrate to narrowband emissions prior to January 1, 2013. These considerations will greatly extend the life of the ISICS solution and allow for upgrades to future technologies currently being proposed. The outcome of this extensive analysis defined the common needs and points of focus for the communication system design. These were categorized into the following main categories:

- Shared state and local agency need (e.g., improved county level coverage, seamless roaming)
- State agency need (e.g., seamless roaming throughout the State of Iowa)
- Local agency need (e.g., portable radio coverage)

The shared state and local agency needs and the state agency needs are primary drivers for the conceptual communication system design. The local agency needs are addressed as considerations in the system design, such that flexibility of the design supports inclusion of these elements, but they are not considered mandatory at this time. Some primary drivers from this analysis for the ISICS system design are:

- Standards-based solutions
- Common frequency band
- Mobile coverage across the State
- Seamless roaming support
- Flexible architecture
- Wireless video service support
- Advanced data service support

The ISICS is a network-of-networks designed to provide unified voice and data services for local and state agency users on a statewide basis. The ISICS consists of the ISICS

radio network, the ISICS wireless data network, and the ISICS dispatch network; all interconnected via an IP-based ISICS transport network. The ISICS conceptual design incorporates the following key system tenets:

- *Encourages use of current and proposed standards-based solutions* – a narrowband voice and data system based on APCO Project 25 (P25) trunked standards (current and proposed)

- *Defines a common communication platform* – employs flexible system topology and configurations to meet the demands of geographic constraints, and operational needs

- *Incorporate peer-to-peer architecture* – distributed call control for wireless communications spanning multiple communication areas

- *Employ IP networking technologies* – a common IP-based transport backbone network interconnecting the network elements of the ISICS offering

The ISICS radio network forms a wireless communication framework to support the voice communication needs for local and state agency users throughout the state, employing APCO P25 trunked system technology in the 700 MHz public safety spectrum. The radio network is segmented into three regions across the State of Iowa. Each region has a regional controller that manages communication needs within that region. Each regional controller interacts with the other regional controllers on a peer-to-peer level to provide support for communications that span regions. The radio network is designed to be fault tolerant and avoids any single point of failure that could totally disrupt communications.

The coverage goal for ISICS is to support a minimum of mobile-based coverage across 95% of each county in Iowa, providing a DAQ of 3.4 (public safety grade performance). As a point of comparison, the current VHF statewide LEA communication achieves the mobile-based 95% coverage goal in only 19 of the 99 Iowa counties. The *FE* coverage analysis indicates a network of 265 700 MHz sites can meet this coverage performance goal. The conceptual design allows flexibility to address future coverage need enhancement.

The ISICS wireless data network supports the wireless data communication needs for state and local agency users across the State. This is provided as a tiered approach sharing the 700 MHz public safety spectrum with a ubiquitous low bandwidth

narrowband data solution, and a high bandwidth broadband overlay data solution. This combines the TIA standards-based P25 narrowband integrated voice and data solution with the 3GPP standards-based Long Term Evolution (LTE) broadband data offerings in the 700 MHz public safety spectrum. The P25 narrowband integrated voice and data solution is available throughout the ISICS coverage area. The LTE solution is to be implemented initially in select areas that have an immediate need for high speed data functionality, such as high density population centers, or public safety control centers, and later expanded to other areas of the ISICS network coverage. ISICS users may also utilize other available high-speed data services (e.g., cellular, WiFi) in the area to address data service throughput needs in excess of the P25 narrowband data solution.

The ISICS dispatch network supports the interface between the E911 centers and the ISICS network to facilitate dispatch operations for state and local public safety agencies. Information captured from the E911 caller provided through the E911 PSTN-based network, and the Next Generation 911 (NG911) IP-based networks may be shared with the dispatch positions that support direct IP-based interfaces to the ISICS, or with radio control centers that interface via the ISICS radio network. The dispatch positions utilize the ISICS radio network and ISICS wireless data network to perform the necessary dispatch communications between the field responder units.

The ISICS transport network provides the cohesive interconnect between each of these networks (radio, wireless data, and dispatch) as well as the intra-network connectivity for all the elements of each of those networks. The ISICS transport network is a fault-tolerant, self-healing IP-based architecture composed of dedicated microwave network that is supplemented by wireline segments to interconnect each of the elements of the ISICS network. In this fashion, information and control can span the entire statewide network. This allows the potential for physical separation of controlling and controlled elements to afford better system resiliency.

The overarching driver for the ISICS development goes beyond simply supporting operable communications, addressing the need for effective interoperability among the multitude of first responders in the State of Iowa. Traditionally, jurisdictions and agencies have built stand-alone systems that meet their individual agency needs. However, these independent non-integrated systems throughout the State hamper inter-jurisdictional, and interdisciplinary (police, fire, EMS, transportation, etc.) communications. The ISICS design fosters ease of interoperability between state and local agencies through the statewide coverage network employing a unified radio system architecture. Implementing ISICS will allow state and local entities to

communicate and share information in real time, provide for the consolidation of resources, and maintain a level of independence and autonomy during day-to-day operations.

While directly integrating with the ISICS common platform represents the highest level of interoperability as defined on the SAFECOM Interoperability Continuum (shown in Figure 1 – SAFECOM interoperability continuum), local entities will have the ability to join the ISICS network on a voluntary basis. Each entity will have the flexibility to consider their current infrastructure investment and make one of the following choices:

- Adopt the ISICS common platform (representing a Level 5 on the SAFECOM Interoperability Continuum)

- Directly interface their current P25-compatible system assets into ISICS (approaching a statewide Level 5 on the SAFECOM Interoperability Continuum)

- Keep non-compatible infrastructure equipment and use available technologies to access ISICS with a lower level of interoperability possible and associated limitations with the given approach (Level 2 on the SAFECOM Interoperability Continuum)

- Operate at the lowest level of interoperability using a radio cache when needed (Level 1 on the SAFECOM Interoperability Continuum)
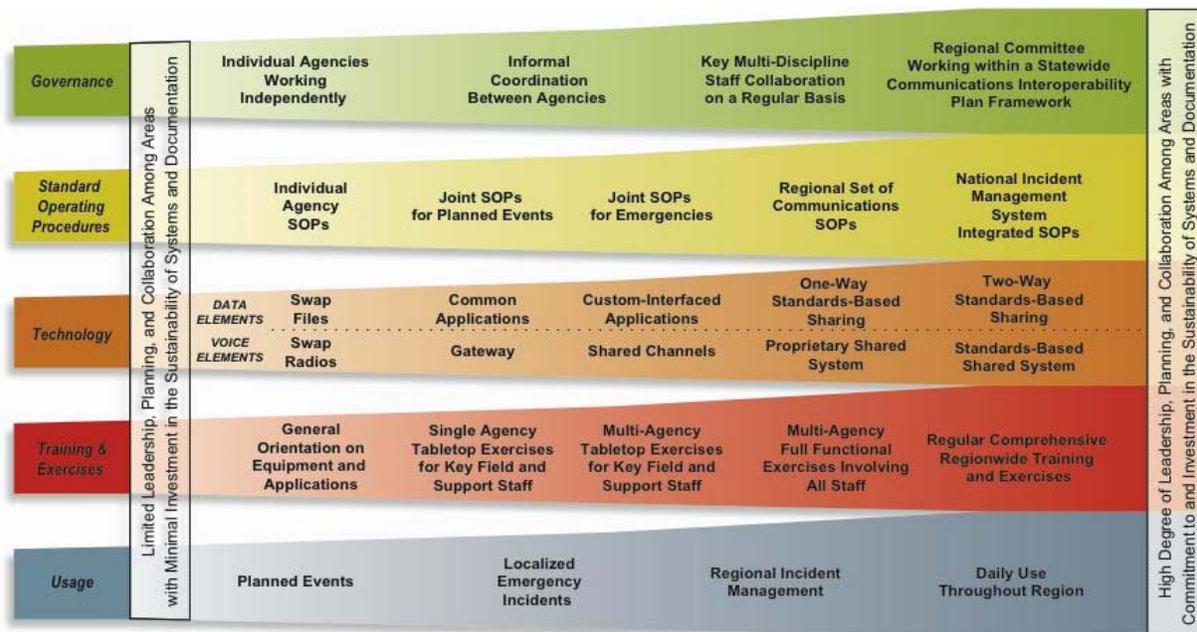
Figure 1 – SAFECOM interoperability continuum

Strategies have been developed to help establish what level of interoperability can be achieved within a given approach.

Although the migration to ISICS encompasses many complex tasks, it can be achieved through an orderly process and partnership of the ISICSB, state and local agencies, project consultants, and the system contractor selected via competitive procurement. This Master Plan recommends that the 265-site ISICS be deployed in six phases that take into account limited financial resources, functional building blocks, the initial proof of concept, and logical expansion of the system. In addition, costs estimates associated with each phase have been included to aide for planning and budgetary purposes. The estimates provided are based on current and historical data derived from similar procurements in comparable jurisdictions The following elements are included in the total cost estimate of ($336M):

- Site equipment
- Digital microwave network
- Physical infrastructure
- Project management, engineering, and implementation
- Contingency and spares

Since the subscriber costs will be driven by individual jurisdictions' implementation plans, the ISICSB chose to focus this analysis on the infrastructure cost elements. Subscriber costs are not included in the estimates, but need to be accounted for in each jurisdiction's ISICS budget.

The ability to obtain necessary funding or financing represents one of the greatest challenges and risks to a statewide project of this scope. The procurement and implementation of ISICS can be funded through several approaches such as capital appropriations, bond issues and vendor lease-purchase agreements and may be supplemented with federal grants or the redirection of existing state revenue resources. Often, combinations of these sources are used over several budgetary cycles. While the approach that Iowa employs to fund the ISICS will be unique to its deployment, *FE* has provided examples of how similar procurement and implementation strategies addressed funding for significant statewide technology programs around the country.

In order for ISICS to succeed, more than technology needs to be addressed. As outlined in the SAFECOM Interoperability Continuum, interoperability must be addressed at the statewide level with regards to technology, governance, standard operating procedures (SOP), training, and system usage. As the creation of ISICS moves forward, emphasis on the establishment of regional committees representing stakeholder interests statewide should be prioritized.

Implementing ISICS will provide benefits far beyond its main purpose of achieving statewide interoperability. The ISICS architecture provides a statewide framework to address future communication system directions and enhancements, such as future movement to more stringent narrowband requirements (6.25 kHz equivalency). With the unified communication architecture ISICS will provide for the consolidation of resources while maintaining independence and autonomy during day-to-day operations. This cooperative use of assets will provide interoperability among agencies as well as potential future cost saving opportunities. The ISICS common standards-based platforms can leverage equipment costs across a multitude of state and local agencies in Iowa, and can benefit from utilizing nationwide standard equipment. The unification of the statewide communication offering through ISICS during a time of fragmented and limited funding, can minimize the need for the construction and maintenance of multiple disparate communications networks. In addition, ISICS interconnectivity can be available to non-public safety entities such as schools, hospitals, and other private enterprises fostering an environment of collaboration and unity around the common goal of interoperability.