Nationwide Resilient Communications System (NRCS)

Kickoff Meeting

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Wednesday, January 22, 2025

Click on three dots "…"
- Select "**Slido**" to take the poll
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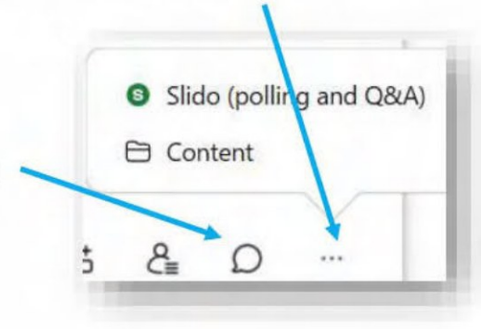
Use the Chat throughout the presentation



Agenda

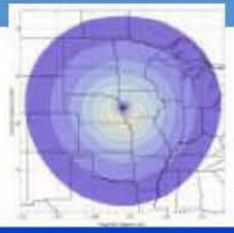
- Background
  - Why a Nationwide Resilient Communications System is Needed
- Project overview
- Review findings of prior work
- Fundamental requirements
- Discussion & Call to Action

Background

Black Sky Events & Hazards (Man Made and Natural)

A Black Sky event: An extraordinary, hazardous event producing large, regional infrastructure disruptions that last significantly longer than typical weather or operational outages.

It impacts electricity, natural gas, water, wastewater treatment, telecommunications and transportation services



EMP – High Altitude Electromagnetic Pulse

IEMI – Intentional Electromagnetic Interference

Cyber Terrorism – *Recently, Salt Typhoon*

Coordinated Physical Assault

Wildfires

Seismic Event – High Magnitude Earthquake

GMD – Geomagnetic Disturbance (Severe Space Weather)

Hurricanes and Other Severe Weather Events
Hurricane Maria – Puerto Rico

What Critical Capabilities do We Need to Recover the Grid?

NATF Spare Tire Project – Voice & Data Communication Needs

1. **External voice communications**
2. **Internal voice communications**
3. Area Control Error (ACE) calculation
4. Frequency telemetry
5. Transmission system monitoring and control
6. Generation dispatch and Automatic Generation Control (AGC)
7. Personnel deployment ("human Remote Terminal Unit (RTU")))
8. State estimation/real-time contingency analysis
9. Interchange scheduling
10. Off-line power flow analysis
11. Load and wind forecasting

Communications are Critical to Recover from a Black Sky Event

Black Sky Communications – Why Important

- No nationwide, coordinated technical communication solution exists today
- Increasing natural and man-made threats
- Existing Emergency Communication Solutions Challenges:
  - Many individual satellite phones are dependent on ground stations & commercial carriers – which are assumed to be down in a black sky event
  - Don't natively provide multi-party conference calls
  - Are not interoperable with primary and backup communications

There is a growing need to establish a nationwide solution

EPRI Approach – Industry Collaboration:

Formalize Engineering & Design Spec to Meet Nationwide Requirements
Inform a Phase 2 Buildout and Operational Sustainment Plan

E-ISAC
ELECTRICITY INFORMATION SHARING AND ANALYSIS CENTER
A DIVISION OF NERC

Resilient Communications Project Update

Jesse Sythe

E-ISAC GridEx Program Manager

TLP:CLEAR

RELIABILITY | RESILIENCE | SECURITY




Project Background

GridEx V, VI, and VII identified gaps in communication:

1. Expanding the type of information communicated.
2. Need for increased resilience of existing communications channels.
3. Importance of clear roles in crisis communications plans.
4. Large-scale events strain grid monitoring and control capabilities.

For the past three GridEx iterations, over 60% of the recommendations have been related to communication.

Project Objectives

Define resilient communications challenges that ESCC leadership faces during large scale incidents

Assess the current state of communications platforms and processes by reviewing existing policies and interviewing industry leaders

Develop recommendations to close the gap between the current state of communications platforms and processes, with the communication capability desired by ESCC leadership

Initial Findings

- Existing NA-wide coordination processes do not adequately reflect communications needs during major events
- Familiarity with these coordination processes varies widely
- Communication tools currently in use vary widely
- There is no single "minimum viable product"
- PACE planning should be incorporated into these coordination processes, recognizing technological flexibility and optionality will be key to ensuring continuity of operations

Final report February 2025

Primary	• The best, and intended, methods of communications
Alternate	• Another common, but less optimal method
Contingency	• Method may not be as fast, convenient or reliable, but can accomplish the task
Emergency	• Communication method of last resort. Emergency methods may cause delays or otherwise affect operations

Project Overview

EPRI National Resilient Communications Project

The Challenge

Black Sky Event

An event producing large, regional infrastructure disruptions of long duration

Impacts electricity, natural gas, water, wastewater treatment, telecommunications and transportation services

Communications is essential to enable restoration and black start

Solution Concept

Independent of Commercial Communication Solutions

Capable of operating for weeks without an external power source

Hardened against Black Sky hazards

Inexpensive enough to be stationed &/or mobilized to critical nodes

Interoperable with other existing systems & Scalable – Regionally, Nationally

Proposed Solution

Permanent Fixed Stations (Intended for ECCs, EOCs, and other large critical facilities)

- Estimated station cost $400K
- Plus site improvements and installation

Equipment Bill of Materials (BOM)

- VSAT GEO terminal
- LEO terminals
- HF base station and antenna
- Interoperability bridge
- Leverage extended duration emergency power from host facility

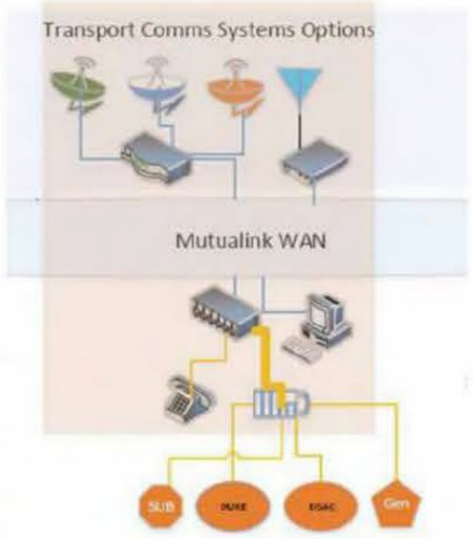
Funding Strategy

EPRI and group of utilities develop requirements as a supplemental project.

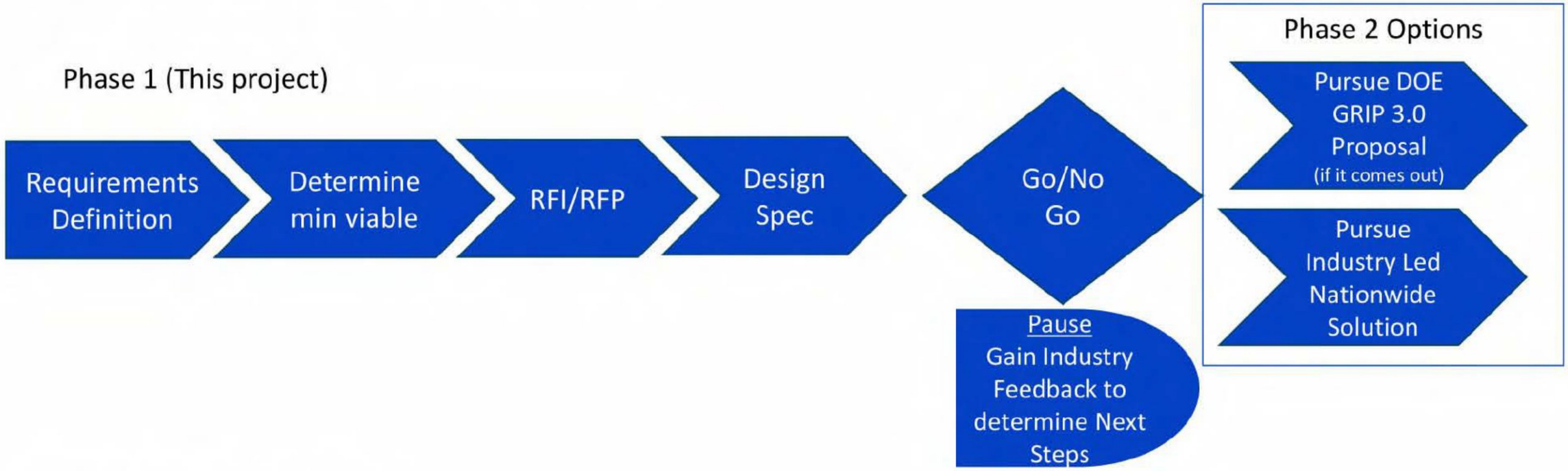
Establish core deployment sites ready to commit to cost share

Socialize concept with DOE, NATF, NERC, and other organizations and stakeholders

Prepare proposal for GRIP 3.0 FOA



Proposed Project Tasks



Reasons to Participate

- Increased resiliency of the bulk electric system due to reduced likelihood of major communications outages
- Define requirements and a technical specification to provide an NRCS capability.
- Demonstrate NERC/CIP compliance with regulations and standards around emergency and alternative communications.
  - COM-001-3 Alternative Interpersonal Communication capability

Image by AI

Common methods of compliance may not be enough

EPRI Nationwide Resilient Communications Solution (NRCS) project

Objectives and Scope

- Define requirements for a minimum viable system.
- Completely independent of commercial service providers but can interoperate with terrestrial service providers and internet when and if available.
- Issue vendor RFI/RFP's and produce a design specification.

Value

- Increased resiliency of the bulk electric system
- Improve understanding of requirements and the technology necessary to provide an NRCS capability.
- Contribute to an ability to demonstrate NERC/CIP compliance with regulations and standards around emergency and alternative communications.

Deliverables

- Documented Requirements for a NRCS
- Inform Phase 2 – Buildout and Sustainable Operational Plan

https://www.epri.com/research/products/000000003002031079

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Interdependency and the black sky hazard has been recognized as a key vulnerability by the DOE

Review Findings of Prior Work

ESCC Resilient Communications Working Group (RCWG) Demo

- Problem Statement
  - Resilient communication systems that BES operators presently have, in addition to their primary and backup systems, are mostly individual satellite phones which allow point to point communications to either other satellite phones or operating commercial phone systems.
  - These satellite phones do not natively support multi-party conference call and are not interoperable with the primary and backup communications.
- Approach
  - Identification of the essential electric grid functions and emergency communication requirements
  - A short-term demonstration of COTS technologies that have the potential to satisfy the requirements for a resilient emergency communications capability.

EPRI Report:
Resilient Communication Demonstration Project: Demonstration Evaluation Report

ESCC RCWG Demo Project Needs Assessment

- Support four stages of restoration:
  - **Stage 1 - Initial "all-call"**
    - ..of Transmission Owner/Operator (TO/TOP) control centers with Regional Balancing Authorities (BAs) or Reliability Coordinators (RCs)
  - **Stage 2 - Visibility into the substations**
    - ..that are essential to establishing an initial picture of grid status and behavior. These substations reside at the intersection of primary transmission corridors or load pockets
  - **Stage 3 - Execution of Black Start Plans for grid restoration.**
    - This is the first tier where persistent connectivity to individual generation sites for dispatch is required, given the level of system visibility (albeit limited) into the current state of the system.
  - **Stage 4 - At this critical stage of restoration**
    - ..when voltage flows and balancing are still volatile, tie-line and substations monitoring is essential for the restoration to the next tier of priority loads following black start critical loads. This category can include life support infrastructure systems such as water/wastewater, natural gas bulk delivery systems, and the commercial communications backbone.

ESCC RCWG Demo Project Stakeholder Identification

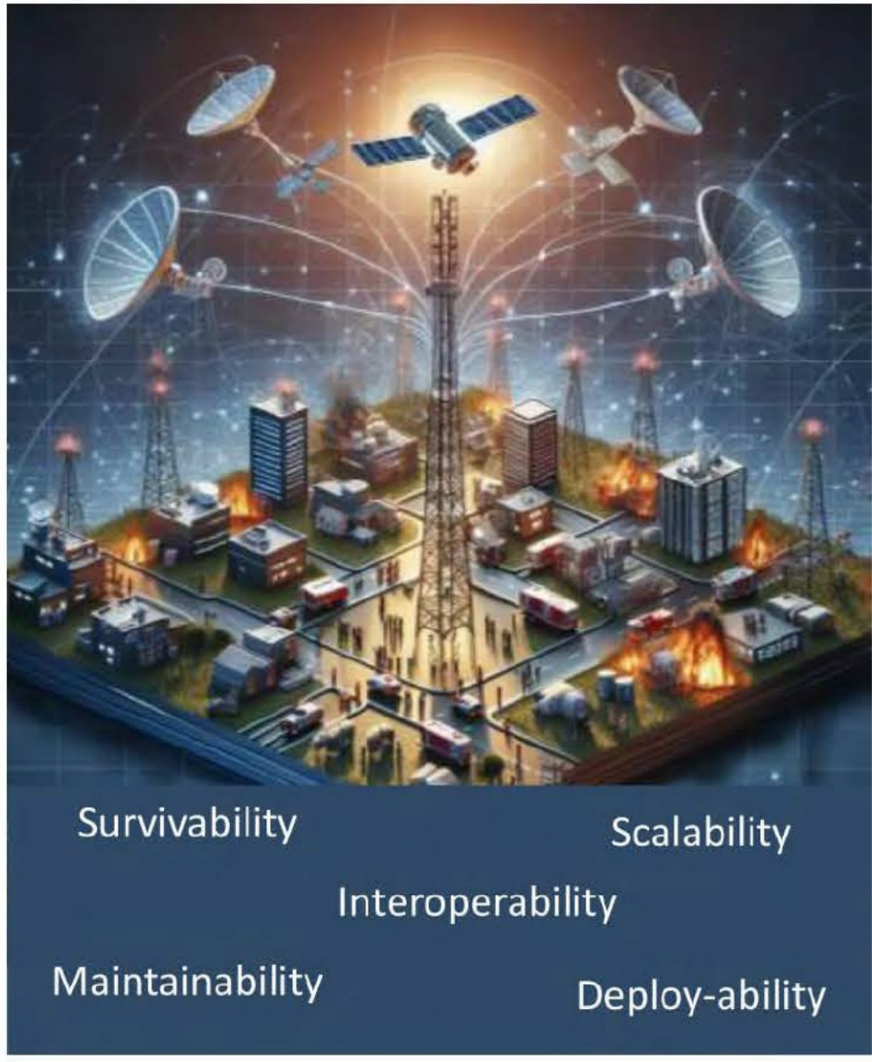
- Stage 1 through 4 requires resilient communications between the following stakeholders:
  a) Transmission Owner/Operator (TO/TOP) control centers
  b) Regional Balancing Authorities (BA) or Reliability Coordinators (RC)
  c) A subset of generators
  d) A subset of substations
  e) Critical loads

Image by AI

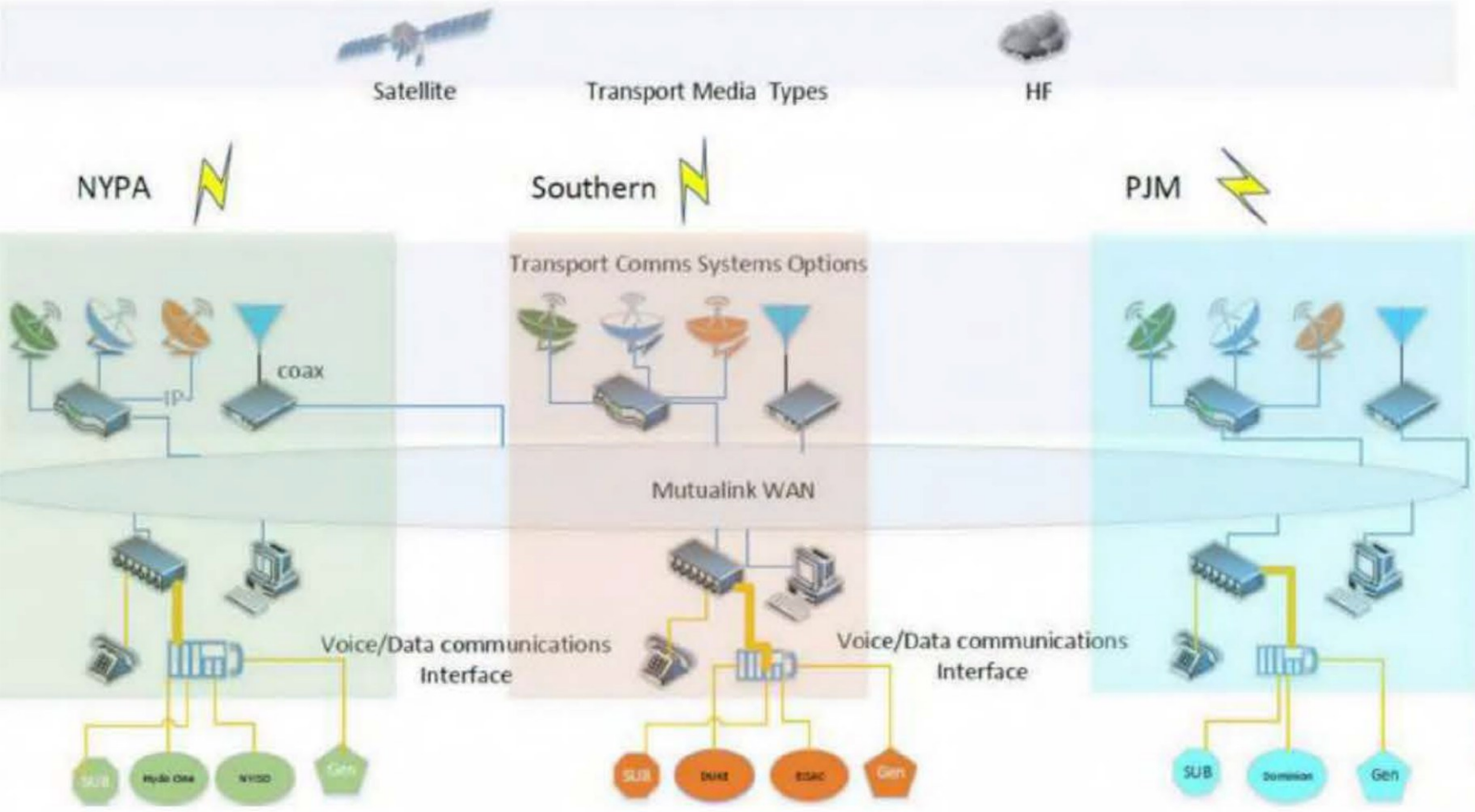
ESCC RCWG Demo Solution Design Considerations

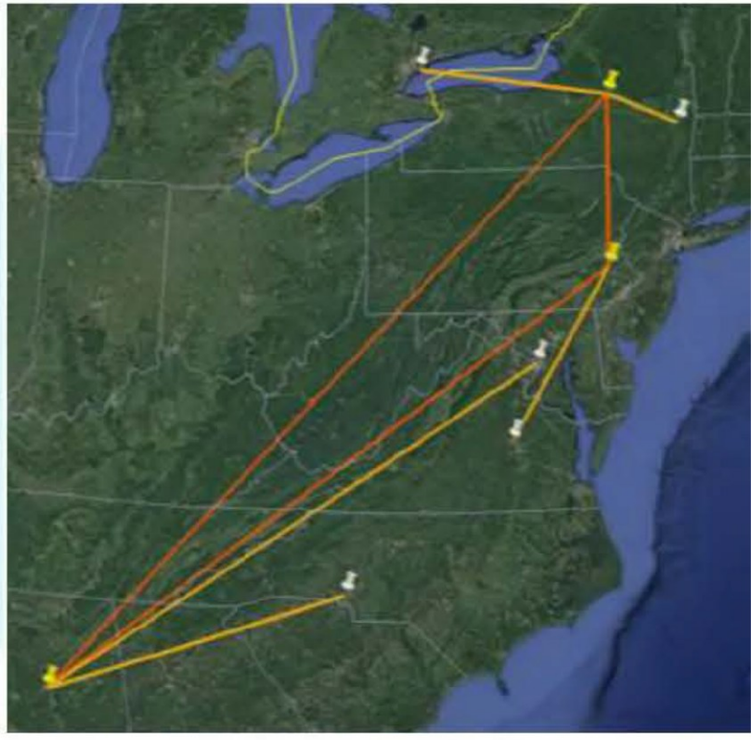
- Survivability, Interoperability, Scalability, Maintainability, Deploy-ability

- Investigated temporary deployment of two types of COTS solutions:
  - ***Emergency Communication Solution*** – a private network communications equipment, systems that provide full-duplex, real-time, point-to-point, voice channels at distances of up to 1,000 miles without requiring additional terrestrial infrastructure.
  - ***Interoperability Solution*** – consisting of distributed components that provide the functionality of bridging (conference call) and gateway (interconnection and/or extension of different communications paths).



ESCC RCWG Demonstration System Architecture





EPRI Report:
Resilient Communication Demonstration Project: Demonstration Evaluation Report

ESCC RCWG Demonstration Project Key Learnings

- **Two-hop broadband GEO satellite link NOT dependent on Ground stations were effective**
  - A network of point-to-point, two-hop*, broadband GEO satellite links created an effective backbone for reliable, low latency, voice communications between the three core sites across long distances.
- **An interoperability solution enabled connectivity to communication systems as they recover**
  - The common interoperability solution at the core sites was effective in connecting with and bridging a variety of edge site communications technologies (Inmarsat BGAN, Iridium, Globalstar, LMR, and POTS.
- **Use of COTS enabled using standard interfaces and protocols**
  - All technologies and vendors selected were COTS and integration used standard interfaces and protocols; however, a lab or factory integration test was not performed but likely would have improved results.
- **HF Radio Network was effective, but further investigation against requirements is needed**
  - HF radio network with remote base stations and NOC was effective in connecting to individual sites and between pairs of sites; however, the three-way connection between the core sites was not established using ALE and a contributing factor was inadequate operator training on the use of the radio consoles.
- **LEO terminals have physical unobstructed view requirements**
  - LEO terminals (both mobile handheld and fixed station) require an expansive, 360 degree unobstructed view towards the horizon for reliable communications.

* No reliance on satellite operators' ground stations, gateways, commercial carriers

Fundamental Requirements

Requirements Definition Approach

Start with findings from previous work

Refine and clarify, but avoid scope creep

Formal requirements definition likely not needed if continue restriction to COTS solutions

Natural language requirements statements will be developed

Baseline Fundamental functional requirements

Communications component

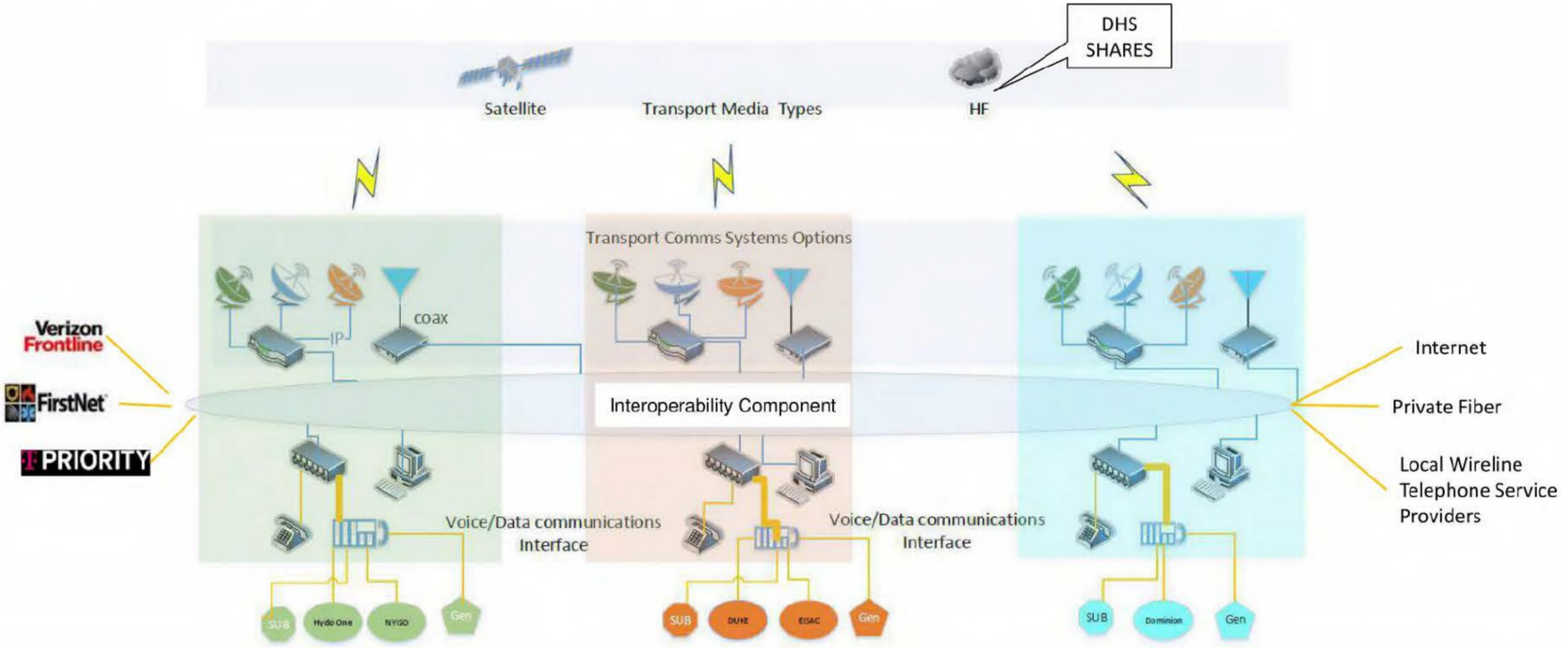
- Provides one or more voice channels (VoIP)
- Full-duplex capabilities (simultaneous talk/listen)
- Real-time experience (one-way latency less than 500 ms preferable)
- Simultaneous connection and operation between multiple* distant locations (scalable with tiered architecture to greater numbers for potential post-demo pilot project followed by wide-scale industry adoption)
- Continuous communications after initial setup and link establishment, i.e. channel remains open with no user actions (e.g. push to talk, dialing or other signaling) necessary to talk or listen

Interoperability component

- Bridging of multiple (min. number TBD) selected voice communications channels to provide conference call functionality
- Interconnection of two selected voice communications channels to provide extension of one remote channel to a second remote channel
- Interface with minimum number (TBD) of voice communications channels

* Based on agreed-upon minimum viable deployment

Initial Requirements Based on Prior Project



Highly Resilient and Widely Scalable

Sierra Club v. Dept of Energy,
4:25-cv-5027

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Discussion

Considerations & Discussion Items

Discussion Items

- What other requirements should be considered for a minimum viable solution?
  - Technical Requirements
  - Industry Stakeholder Requirements
- What other Stakeholders should be engaged in this effort?
- Beyond NERC /CIP are you subject to any state/local/PUC requirements for communications resiliency?

Considerations for you

- Have you done a self-assessment on your emergency communications for a Black Sky Event?
- Have you analyzed external entities on different systems where public communications service provider networks are used?

Enter Comments in the Chat or Unmute yourself to Speak

Previous Vendors for the RFP and Demo

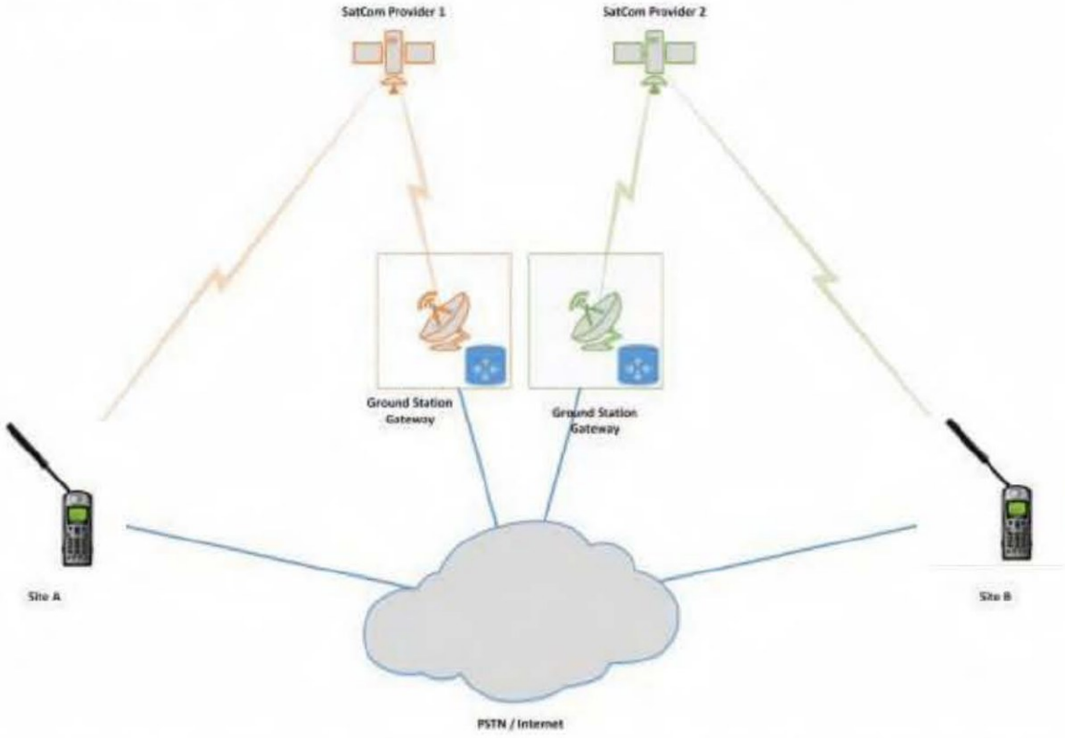
- Communications Component
  - Globalstar Inc
  - Intelsat
  - Stallion Oilfield Services (Intelsat VAR)
  - Collins Aerospace - Urgentlink
  - Blue Sky Networks LLC (Iridium)
  - Raphael Advanced Defense Systems Ltd
  - BAE Systems
  - Inmarsat
  - Cubic Mission Solutions
  - Raytheon Space and Airborne Systems
- Interoperability Component
  - Mutualink

Are there other Vendors to Consider for a COTS solution?
Enter Comments in the Chat or Unmute Yourself

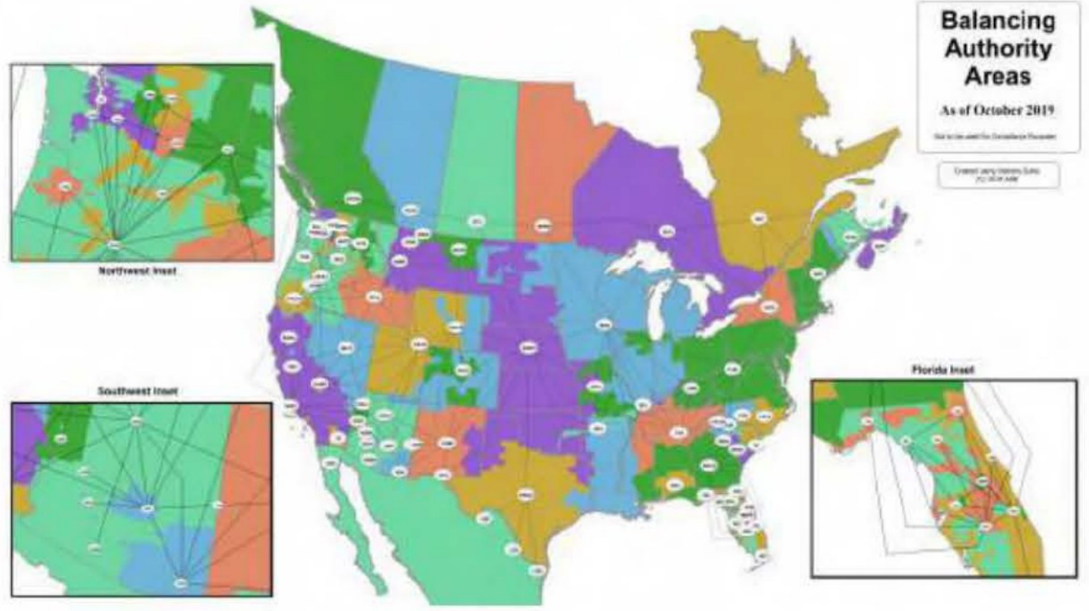
Image by AI

Final Discussion and Feedback

Communication Resiliency Self-Assessment Key Item



Determining Minimum Viable Implementation



Call for Action – We Need Critical Mass Participation for a True Nationwide Solution
Please respond to the Poll if interested

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