

APPLICATION WHITE PAPER

# DIGITAL HF - FOR EARLY WARNING AND DISASTER COMMUNICATIONS SYSTEMS



**CODAN**  
COMMUNICATIONS

[CODANCOMMS.COM](http://CODANCOMMS.COM)

## SUMMARY

The Early Warning Disaster Communication Solution (EWDCS) is a solution with the premise of “resilience and simplicity”. The EWDCS provides communications in times of emergency pre, during and post disasters. It has the ability to trigger warning sirens remotely and disseminate information across a large geographic area via voice, text, phone and / or email.

It is a communication solution that is simple to use, independent of existing traditional infrastructure, based on proven technology, and scalable with the ability to add more complex or latest capability.

## INTRODUCTION

The Early Warning and Disaster Communications System (EWDCS) is a multipurpose communications capability designed to provide a backup to conventional emergency communications systems. It has the ability to provide High Frequency (HF) email between remote sites and, more importantly to broadcast voice communications covering wide areas before the full impact of any national disaster.

EWDCS stations have the capacity to act as gateways for radio, telephone and email traffic, as well as disseminating emergency warnings. They can support both analogue and digital voice communications using an advanced multi-level addressing (alert) system. The Codan Automatic Link Establishment (ALE) voting capability also drastically optimizes signal quality.

HF Radio is recommended as the back-up transmission medium because of its non-reliance infrastructure, compared with 3G / 4G and satellite systems which are prone to failure in times of disaster. Additional benefits include broadcast capability, simple training & operation, and very low operating costs.

The hierarchical structure of the EWDCS enables scaling of the system to support networks of varying complexity without the requirement for total reconfiguration when the systems is expanded.

## OPERATIONAL DESCRIPTION: SYSTEM HIERARCHY

The network control of the EWDCS would be located at the National Disaster Authorities (NDA) main headquarters (typically situated in a country’s capital or at a site of strategic importance) and act as a HF radio telephone and / or email access point for any remote regional or provincial emergency operation centres, including their associated “out-stations” and emergency rapid response teams.

This would be a central point for the dissemination of warnings by HF radio, email, GSM and Public Switched Telephone Network (PSTN), as well as the control station for the networks voice communication capability.

The remote regional or provincial emergency operations centres act as localised control stations for its nominated control area. Each of these can have a similar capability and can also be configured as required, to act as a replacement for the NDA HQ in the event of a catastrophic failure. A remote regional emergency operations centre can provide an alternate HF radio telephone route for stations in the network, and by so doing provide support for a unique signal routing (or voting) capability which automates selection of the most suitable phone access when an ALE call is initiated, thereby dynamically optimising signal quality.

Emergency warnings from a remote regional emergency operations centre are disseminated on a national or a regional basis using advanced multi-level addressing in the same way as a message sent from the NDA HQ.

An “out-station” might be a smaller town or village with less complex capabilities but still able to either receive or generate emergency notifications. This EWDCS has great flexibility in such that the emergency response systems can be scaled to suit the size of the network and the requisite functionality of each unit within the network for a national disaster authority.



# EWDCS FUNCTIONALITY

## Voice Communications

The EWDCS supports either analogue or digital voice transmission or a mixture of both. The use of multi-level addressing enables operators to call (or alert) an individual station, that is a NDA HQ, regional operation centre, out-station or even a deployed emergency rapid response team directly or alternatively, either on the fly or by predetermined groups of stations, when establishing communications. Network wide station addresses and call parameters are stored in the HF radio's address book to simplify operation, however, the EWDCS software interface also holds the HF addresses and the NDA personnel phone numbers for SMS or calling purposes.

## Email Access

HF Email access at the NDA HQ and all regional operation centres provides capability for these stations to send and receive emails via HF independent of the internet infrastructure. This enables the sending and sharing of critical situation reports and assessment reports either between the affect event epicentre and the nation coordinating HQ or between each of the regional operation centres. The linking protocol is based on HF, ALE and the latest technological Waveforms are used achieving rates of up to 19.2Kbps providing efficient data transfer.

## HF Radio telephone

The HF radio telephone paths can be established at the national and region level. These access points enable use of the PSTN by all HF stations in the network, from the out-stations and rapid response teams to the established offices (subject to operational requirements). Redundant paths to the PSTN exist by nature of the number of radio telephone capable sites in the network (ie. national office and the number of regional centres with this capability). Multiple PSTN access points can provide support for signal routing (or voting), thereby automatically establishing the best path for PSTN connectivity at the point of call, irrespective of location.

## Emergency Alert Warnings

The emergency alert warnings are a component of the HF EWDCS and is designed to disseminate public warnings and emergency information over wide areas in countries where coverage by conventional public communications systems are unreliable, non-existent or vulnerable to damage by natural disasters.

It is equally suited to the notification of wide ranging

events such as bushfires (forest fires), earthquakes, volcanic eruptions, floods, cyclones / hurricanes, tornadoes, tsunamis, terrorist threats (or actions), or for localised events such as civil unrest, police emergencies, or missing persons.

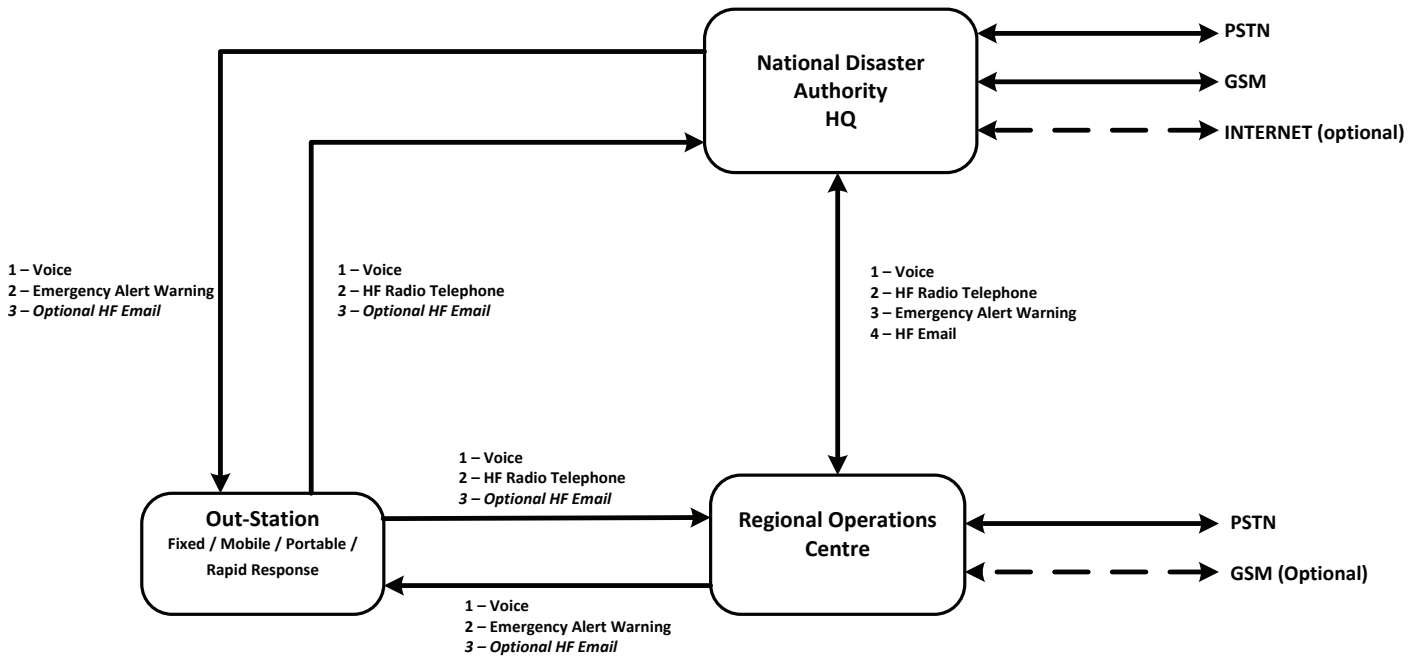
Alerting messages are disseminated by the EWDCS using one or more communications modes which can include SMS (GSM), recorded voice (GSM), email, and HF radio (recorded voice, text message and audible alert). The available modes may vary depending on the connectivity available at individual sites and the configuration selected.

The EWDCS software uses an address book and preformatted messages to simplify the alerting process. An allowance is made for "free form" messaging (either routine, urgent or emergency) with all access to the EWDCS messaging functionality being password controlled. Each EWDCS site uses an identical, remotely managed address book to ensure commonality across all sites.

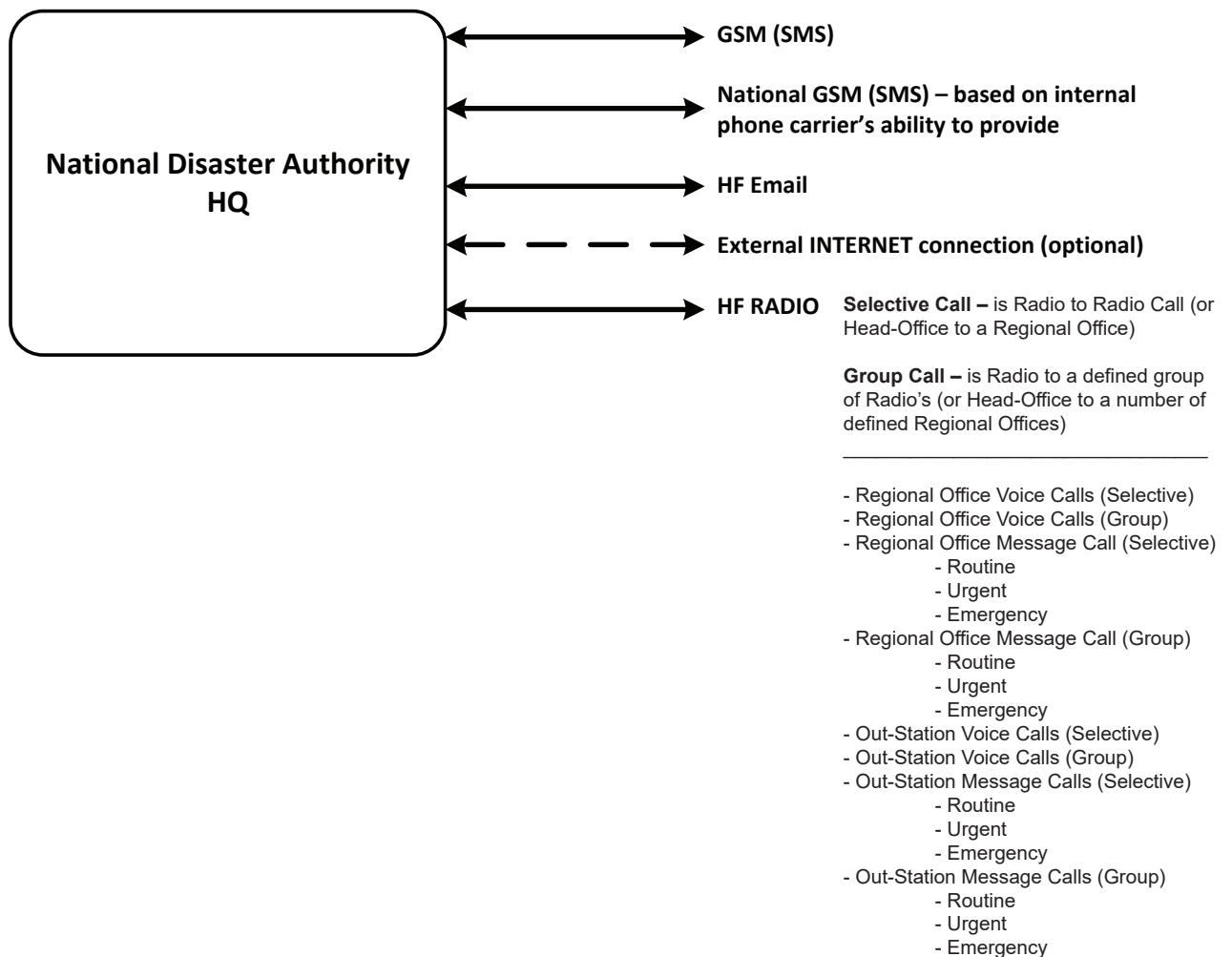
To guard against false and malicious alarms, all emergency messages are encrypted and will not trigger a response at the receiving station(s) unless a matching encryption key is set.

Message alerts are prioritised and raise different alarm states at remote stations depending on the received message status. The use of "priority messages" allows for specific triggering to occur depending on the message used. The highest priority message is an "emergency" which generates a continuous alert at the radio console and triggers the radio's remote alarm output. This output can be interfaced to a wide variety of external warning devices including waterproof sirens, bells, warning signs, strobe lights, etc. The next highest priority message is an "urgent" which will also trigger the remote alarm output but does it in a set cadence rather than continuous. The "routine" message is the lowest priority message and as such can be used for "day to day" messages between the national offices.

## EWDCS HF Communication Modes



## EWDCS HF Communication Modes



# SYSTEM HARDWARE

## General

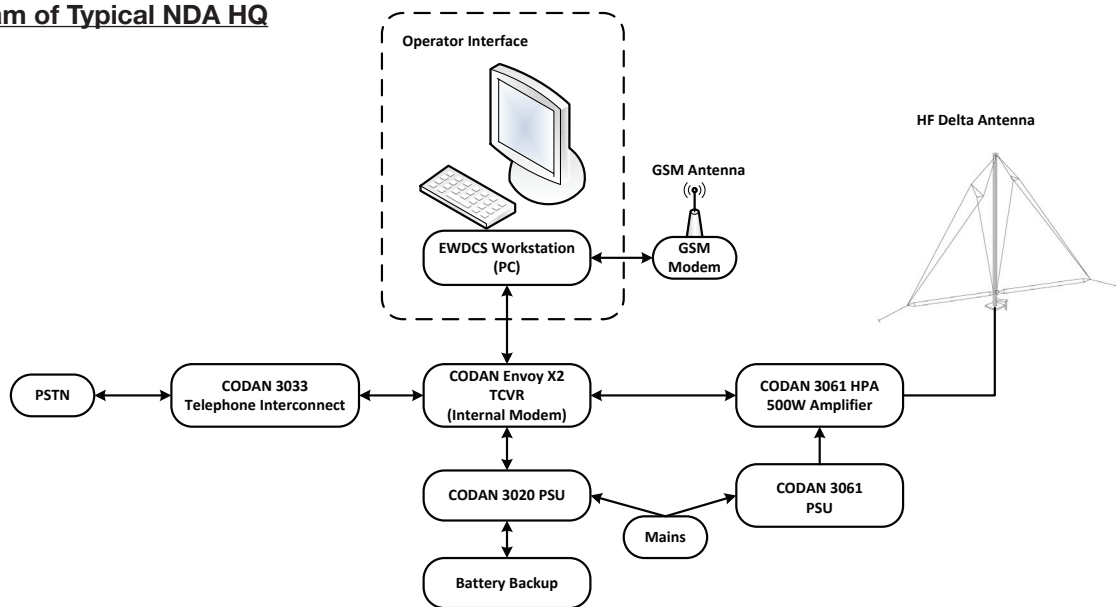
The platform suitable as the HF radio component of the EWDCS is Codan's software defined HF radio, the Envoy. In addition to its superior technical specifications and flexibility, the Envoy has a number of unique features that are critical to the initial implementation of any EWDCS, as well as to the long-term expansion and future supportability of the network. In terms of network expansion, we are not just referring to increasing the number of terminals or workstations on the network but the ongoing system development that may result in the addition of new features and expanded functionality. The flexibility of the new SDR platform enables the addition of complex features and radio configurations to be managed by way of simple user implemented firmware upgrades from a USB stick. The choice of this platform was essential to allow the option of a seamless migration path to emerging HF technologies in the future.

All EWDCS HF email would use the internal high-speed data modem fitted inside the Envoy with the option of a wired or wireless Internet Protocol (IP) connection to the device running the email application. This configuration supports rates of up to 19.2Kbps and provides a robust link optimised for the HF environment.

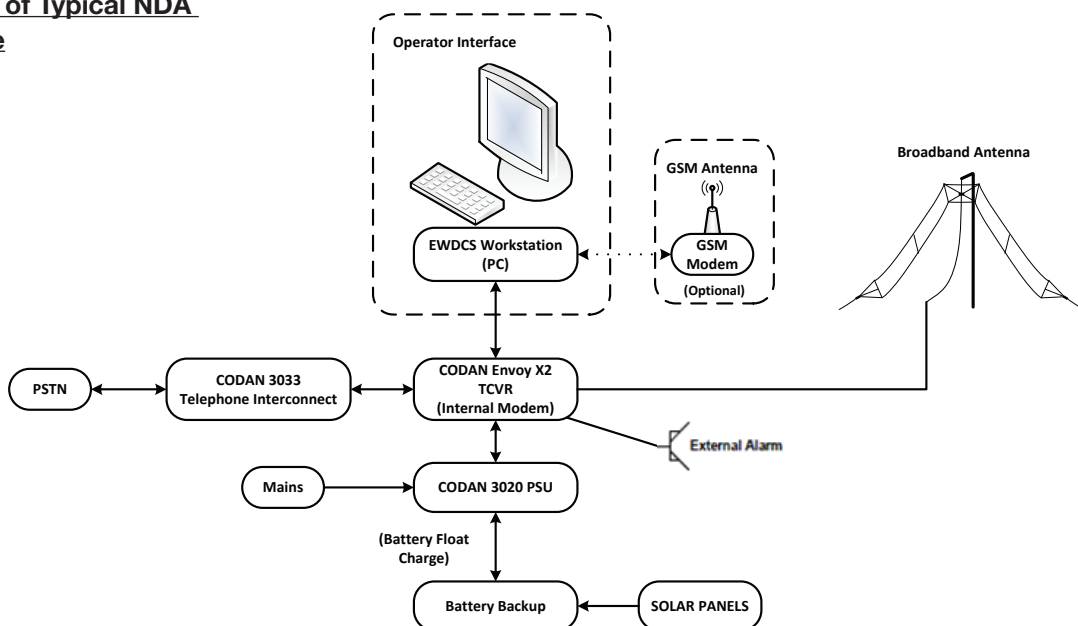
## PSTN Interface

The Codan 3033 telephone interconnect integrates seamlessly with the Envoy platform to provide connectivity to the PSTN. This level of integration enables users to take advantage of advanced signal routing (voting) features which automate and enhance HF radio telephone operation and signal quality. When calling activity is automatically logged, it can provide important information about the time of critical events.

### Block Diagram of Typical NDA HQ



### Block Diagram of Typical NDA Regional Office



## Emergency Warning Disaster Communication System

The EWDCS utilises simple bespoke software allowing the operator to manage the dissemination of emergency warning messages and associated communication across multiple mediums (ie. GSM, email, and HF radio). The EWDCS operator interface can be hosted on a typical Windows PC and the system architecture is designed to be easily software upgraded in the field. All EWDCS modules including the operator's terminal (PC) operate directly from a 12V power supply to ensure seamless operation in emergency situations.

## Emergency Response Teams

The EWDCS is designed to provide communications support for emergency response teams in a wide range of disaster scenarios. From the "first responder" who may require a simple self-contained Codan 2110 Manpack transceiver to provide them with "at location" voice communications with fitted GPS for tracking purposes, to the disaster management team requiring the flexibility of the Codan MRAY providing a link between the HF environment and a local VHF / UHF radio network.

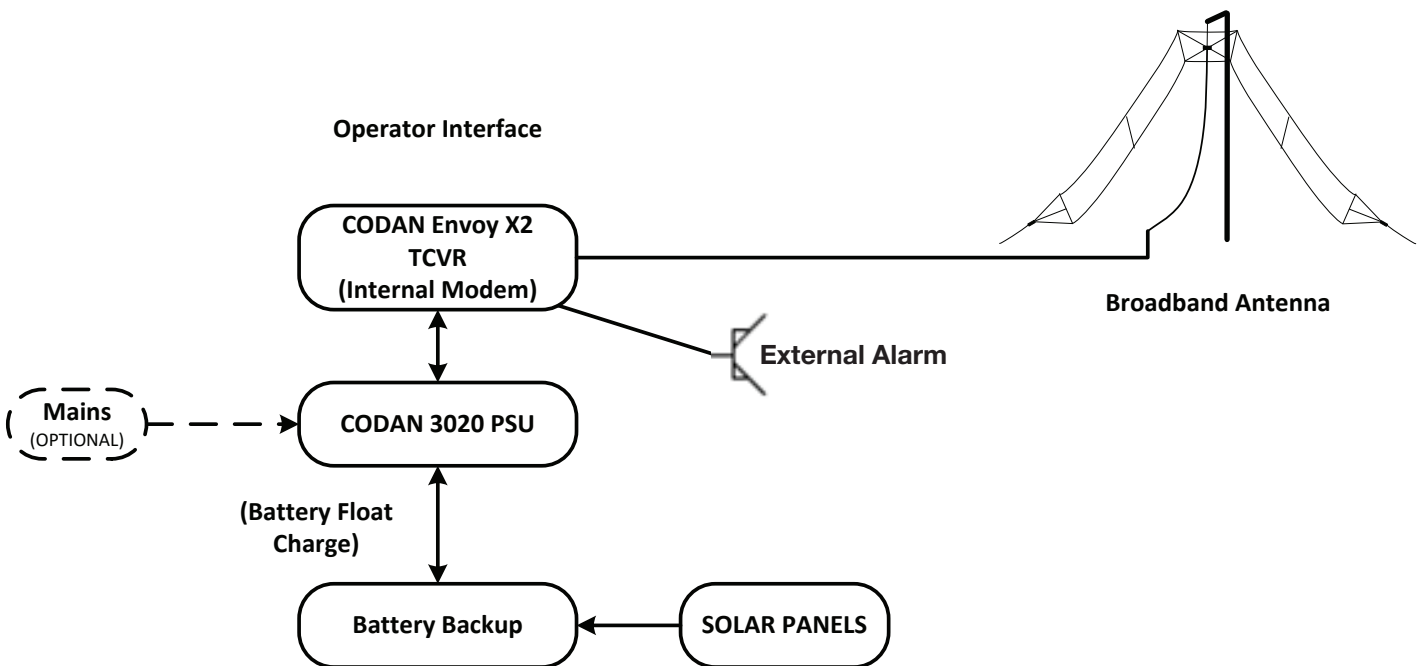
The premise of the EWDCS is to be scalable and support many different operational scenarios. Optional GPS integration in the 2110 Manpack and MRAY and a mapping application installed at the NDA HQ and / or the regional centres adds to fielded NDA personnel safety by providing precise locations of emergency rapid response teams during a disasters.

## Out-Stations

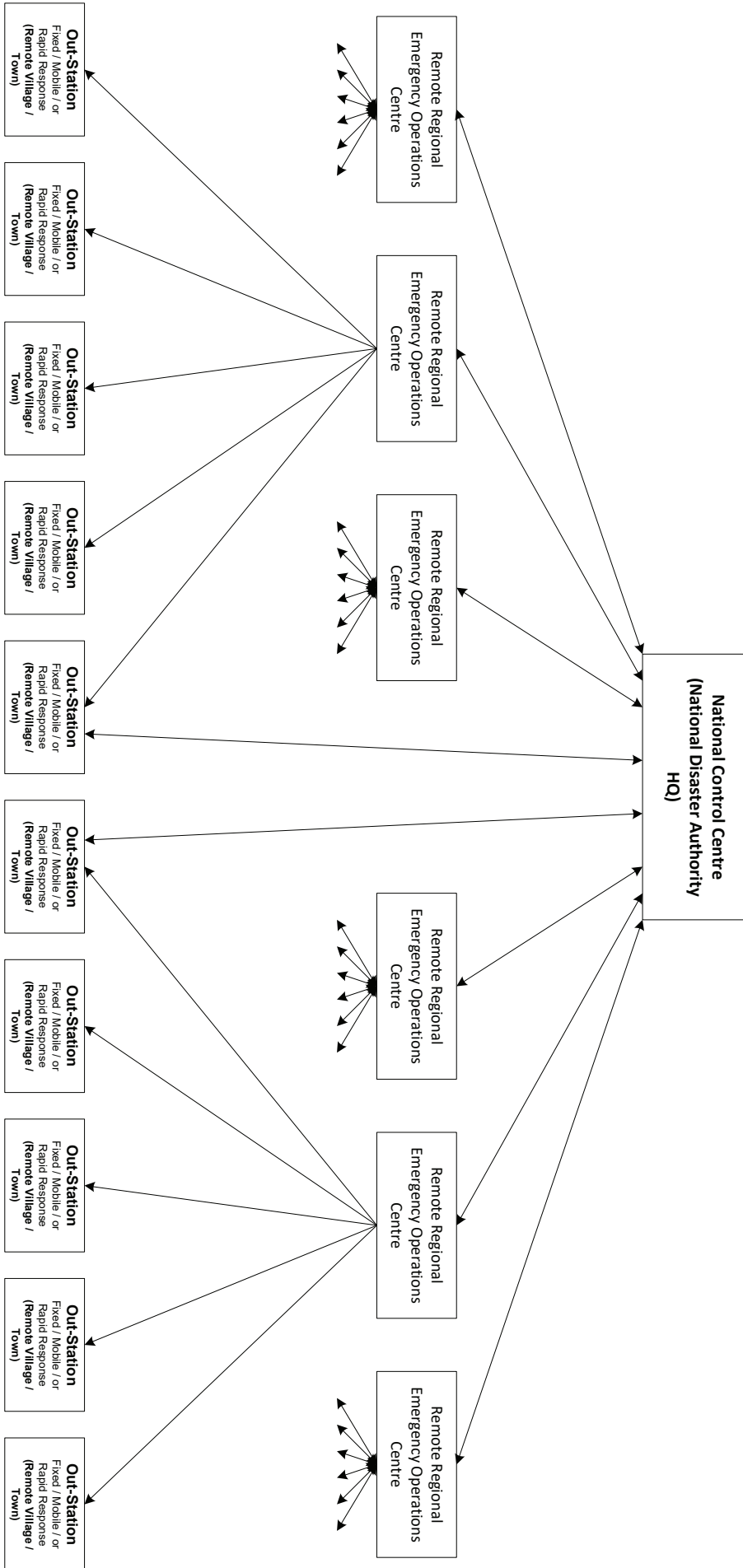
The purpose of the out-station is two-fold. It provides a vital communications link between isolated communities and the NDA in times of disaster and secondly, but by no means less important, it is the means by which authorities can provide timely warnings and critical emergency information to outlying communities in times of impending disaster or catastrophic event.

The out-station hardware consists of a HF transceiver, antenna, and power supply (battery / solar) and an external warning device. Provision can be made for integration of the emergency warning signal into any local warning system that may exist (fire station sirens, etc...).

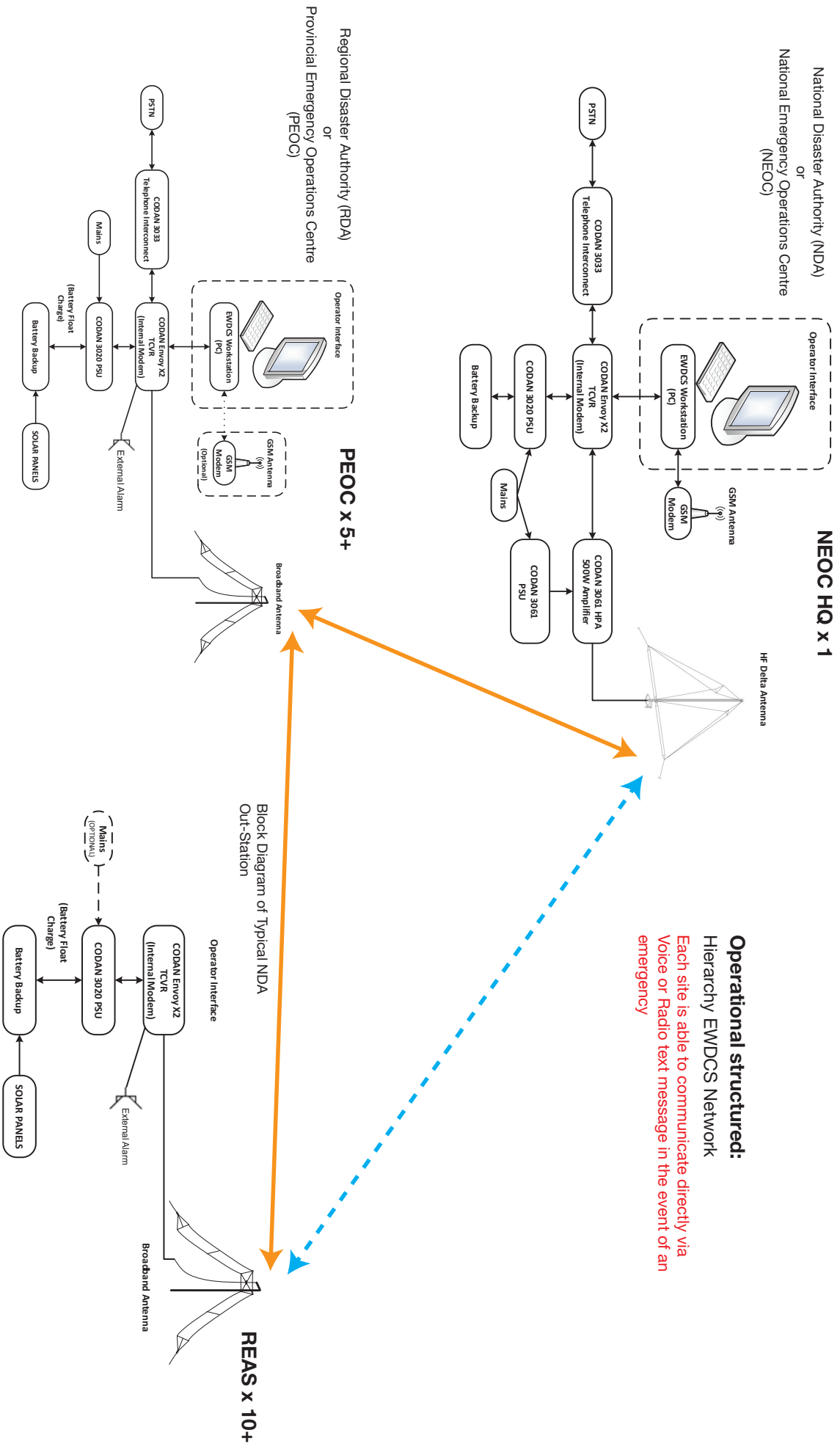
## Block Diagram of Typical NDA Out-Station



**EWCDs System Hierarchy**



# EWDCS overview as a Network



# CUSTOMERS

The clear challenge for Codan was coming up with a resilient, sustainable and robust way to provide communications in times of disaster and in addition have the ability to trigger sirens remotely from a centralised location – this is where the EWDCS grew from.

In 2016, the Solomon Islands National Disaster Management Office (NDMO) having secured funding from the World Bank via an initiative called the “Community Resilience to Climate Change and Disaster Risk in the Solomon Islands Project” or CRISP, purchased the first phase of their Digital HF Early Warning Disaster Communication System. The goal was to provide 4 out of the 10 provinces with the EWDCS solution into the selected Provincial Emergency Pperation Centres (PEOC), and being coordinated through the National Emergency Operations Centre (NEOC).

*[No “out-stations” have been selected or deployed though careful consideration will have been made for these.]*

## The 4 PEOC sites selected were:

- Lata, Auki, Gizo and Kirakira

## The 1 NEOC site selected:

- Vavaya Ridge, Honiara

## Part of the “Solution Offered” also included:

- 4 x Codan 2110 Manpacks
- 1 x Codan MRAY (One box solution containing a long Distance HF & local VHF repeater)

The United Nations Development Programme (UNDP) provided further assistance to the NDMO by donating an additional 6 x Codan 2110 Manpacks these are to be used by the NDMO rapid response teams.

There were many challenges to overcome in the Solomon Islands with the roll out of the EWDCS network with the last site being finally commissioned on December 7, 2016. A few days later the complete system was put to the test on December 9, 2016 when an earthquake was registered off the southern coast of Kirakira (province of Mikra) recorded at 7.8 on the richter scale. The system was in use immediately to make local contact with the personnel at Kirakira with the officer at the NEOC setting off the sirens at the Kirakira PEOC (northern side of Kirakira Island) in the very early hours of the morning. From that point on a blend of using the EWDCS and traditional communication were utilised.

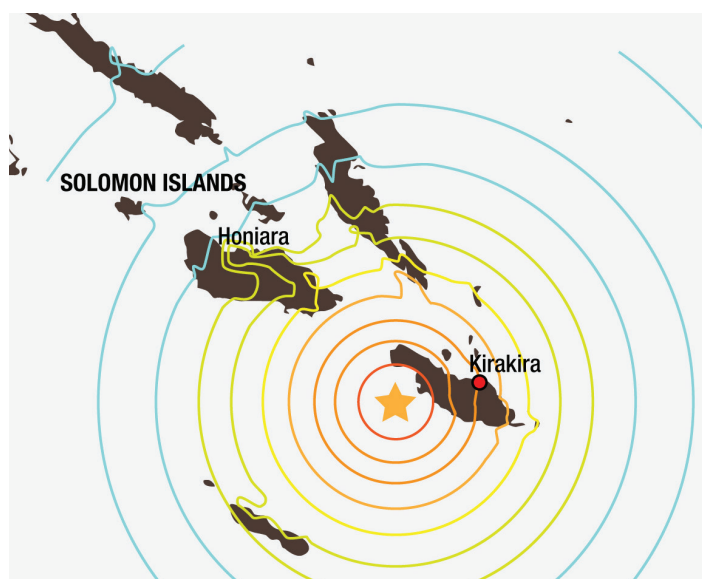
The director of the NDMO made a direct comment that it was fortunate that there was an actual active PEOC at Kirakira with the newly installed EWDCS in operation on the island. An outcome from this event is the need to install the proposed “out-stations” on the southern side of the island of Kirakira so that the NDMO team can have direct communication with the affected area within minutes of an earthquake.

The EWDCS was successful and the requirement to cover the remaining provinces is more important than ever, however, the best outcome from this particular event was that no one was seriously injured and that no “tsunamis” were generated from the earthquake to cause further damage to the region.

## Geographical Location of Solomon Islands



## Local Area, Epicure



## ABOUT CODAN COMMUNICATIONS

Codan Communications is a leading international designer and manufacturer of premium communications solutions. We deliver our capability worldwide for the military, defence, humanitarian, peacekeeping, commercial, security and public safety markets.

Our mission is to provide communications solutions that enable our customers to **be heard** – to ultimately save lives, create security and support peacekeeping worldwide. With over 60 years in the business, Codan Communications has garnered a reputation for quality, reliability and customer satisfaction, producing innovative and industry-leading technology solutions.

We know that every deployment of a communications solution is different, having deployed our solutions in more than 150 countries. And when lives are on the line, it's critical that each deployment is right and that every stakeholder is heard. That's why it's important to truly understand your situation, your infrastructure, your environment and your stakeholders.

At Codan Communications, that's what we're best at. Not fitting your situation into our products, but really understanding what's at stake. So whenever you work with Codan, you know that right from the start you'll **be heard**.

## CONTACT US

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