



Communication Technologies for Alert and Notification Applications

Evaluation Criteria for Architectures and Systems

**ITIC TRAINING PROGRAMME HAWAII (ITP-HAWAII)
TSUNAMI EARLY WARNING AND MITIGATION SYSTEMS**

**August 2012
Honolulu, Hawaii USA**

**Ed Young
Kelly Sponberg**

Architecture Concepts of Redundancy: Eliminating Single Points of Failure

- Circuit Type
 - E.g.- Cellular | FM Broadcast
- Carrier
 - E.g.- Mobile Provider / Carrier | Station
- Channel
 - E.g.- SMS | Frequency / Channel
- Device
 - E.g.- Mobile Handset, GPRS Modem, etc. | Radio Receiver
- Redundancy leads to complexity. Take on only that which can be managed.

Promoting Diversity in the Architecture to Address

- Transition Threats
- Time of Day Limitations
- Geographic Coverage
- Reach of Device(s)
- Authentication (Cross Reference)
- Active and Passive Alert Purposes
- Opt In or All Within Coverage
- Device Multipurpose or Single Use

System Specific Considerations

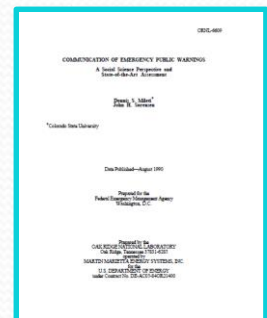
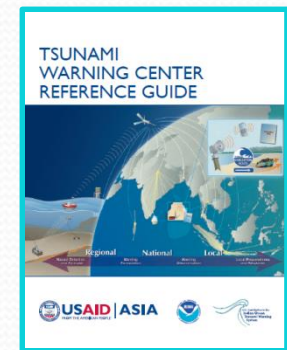
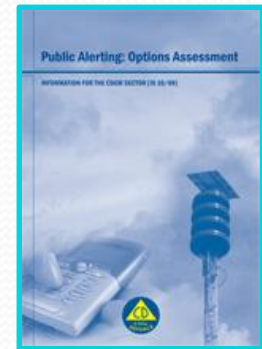
- Costs
 - Differentiate Between Emergency Response and Alert / Notification Systems.
 - Deployment
 - Equipment
 - Setup
 - License
 - Training
 - Operation and Maintenance
 - Recurring Service Fees
 - Per Message / Use Costs
 - Replacement / Maintenance Costs, E.g.- Replace Batteries

System Specific Considerations

- Inherent Authentication
- Security and Control
- Message Preservation
- Support of Acknowledgement
 - Source Send
 - Network / Carrier Send
 - Device Receive
 - Human Receive
- Time Performance
- Repeat Frequency / Ability

Useful References

- NZ Public Alerting: Options Assessment
<http://bit.ly/c819K8>
- Tsunami Warning Center Reference Guide
<http://bit.ly/dzsdG9>
- Communication of Emergency Public Warnings
<http://bit.ly/dw9jfg>





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Int'l to National: WMO WIS / GTS

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Communication Technologies for Alert and Notification Applications

Int'l to National: EMWIN

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EMWIN: What is it?

- Emergency **M**anagers **W**eather **I**nformation **N**etwork
- EMWIN provides the emergency management community with access to a set of NWS warnings, watches, forecasts, and other products at no recurring cost.



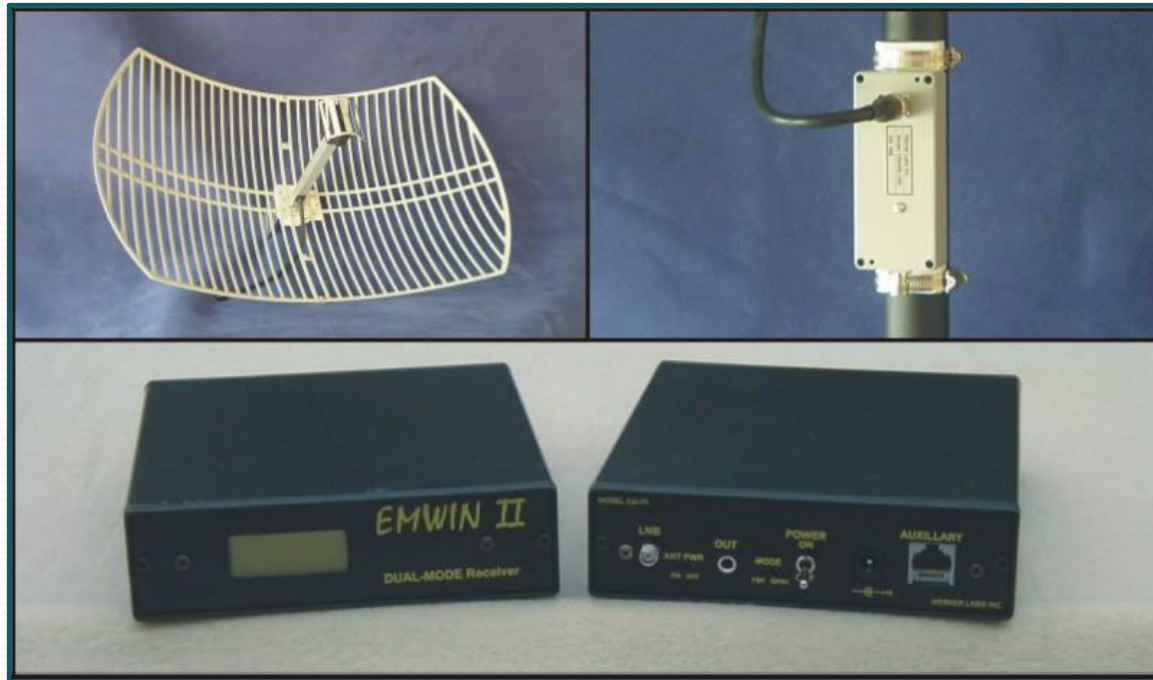
EMWIN: What is it?

- EMWIN utilizes the US NOAA GOES satellite constellation as its main dissemination mechanism, although with some EMWIN clients, it is possible to receive the EMWIN stream via the internet.
- The broadcast is also mirrored on some private satellites (Ku-band over the US), as well as on other civil / government dissemination platforms, such as LRIT over GOES, PEACESAT, Weather Wire, etc.

EMWIN: Generalized Benefits

- Beyond equipment, no recurring fee or subscription cost.
- Very robust system, allowing for information to be received via satellite, thereby avoiding many terrestrial hazards.
- Relatively easy to operate and deploy.
- Depending upon software, capabilities to re-transmit, trigger alarms, send e-mails, archive warnings, etc.

EMWIN: System Components



Components of Werner Labs EMWIN-N Receive Station – Antenna, LNA, Receiver / LNB

EMWIN: System Components

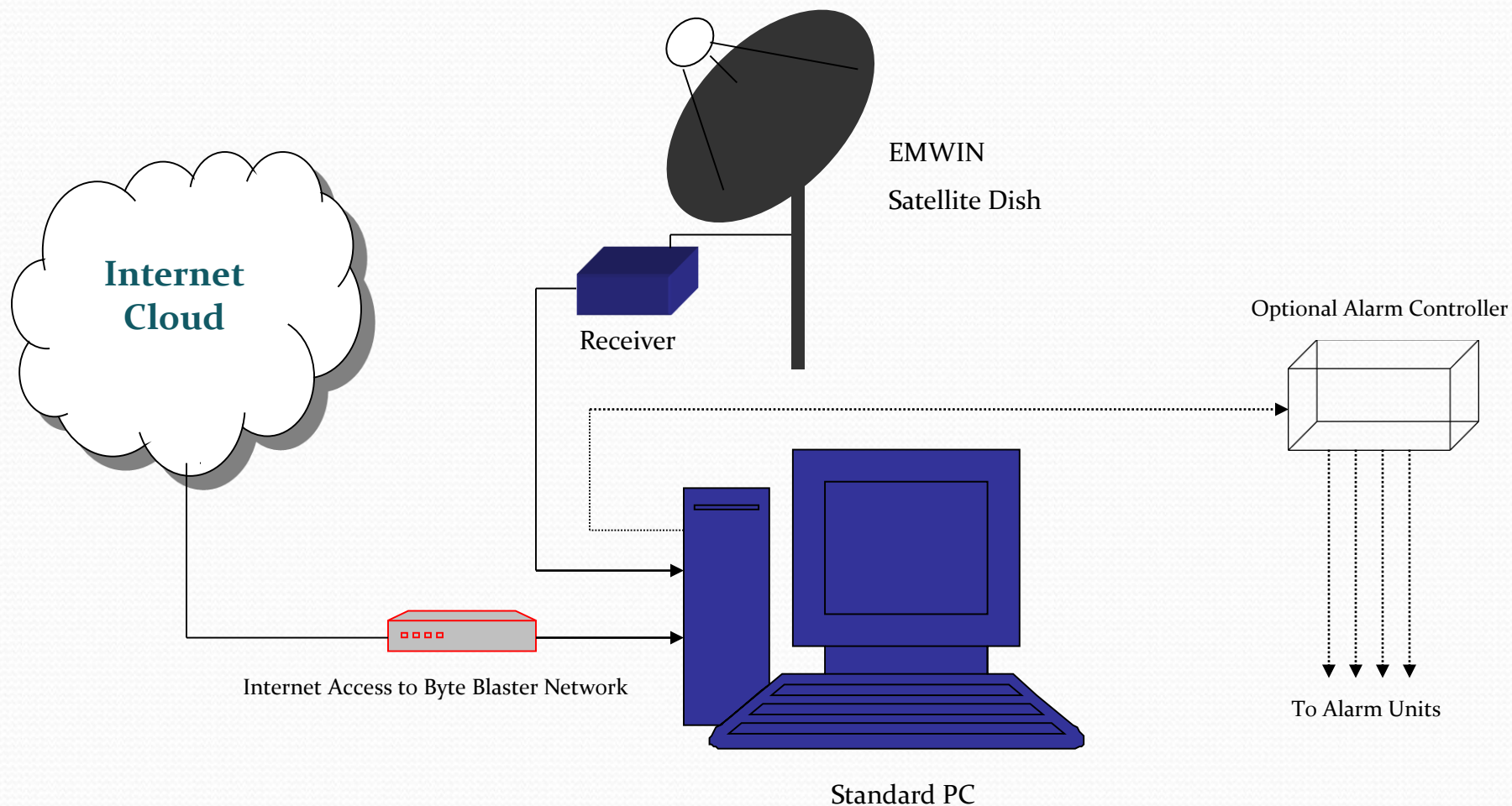


*Typical EMWIN setup - Bonriki
Airport Met Office Tarawa*

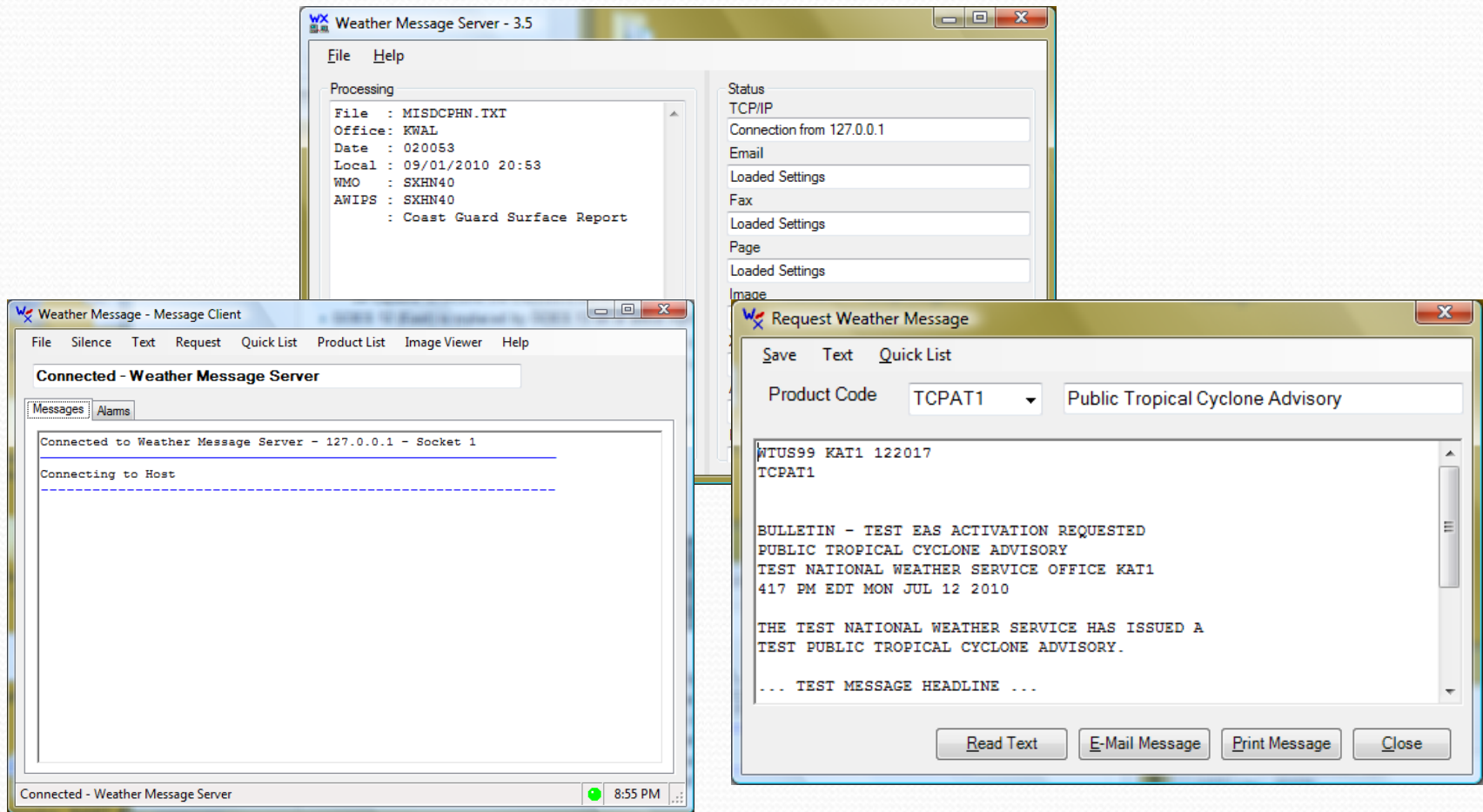


*EMWIN C-Band Dish Antenna at Met
Office, Port Vila, Vanuatu*

EMWIN: System Components



EMWIN: System Components



EMWIN: System Components

The image displays two overlapping windows from the EMWIN software. The background window is the 'Configuration' dialog, and the foreground window is the main 'RealEMWIN v1.5 - Professional Version' application.

Configuration Window:

- Operational Mode: Standard, Network, Weathermode(TMI)
- Region: US, N. America, Pacific
- Comm Port: 1, Baud: 9600
- Text: e:\Weather\EMWIN\Data\
- Images: e:\Weather\EMWIN\Images\
- AFOS: e:\Weather\EMWIN\AFOSgp\
- Hourly: e:\Weather\EMWIN\Hourly\WM
- Data-In: e:\REALEM\track\trander\
- Custom: e:\Weather\EMWIN\Archiv\
- Buttons: GPHPLOT, WXPLOT, Log WFO's, Purge Time: 12

RealEMWIN v1.5 - Professional Version:

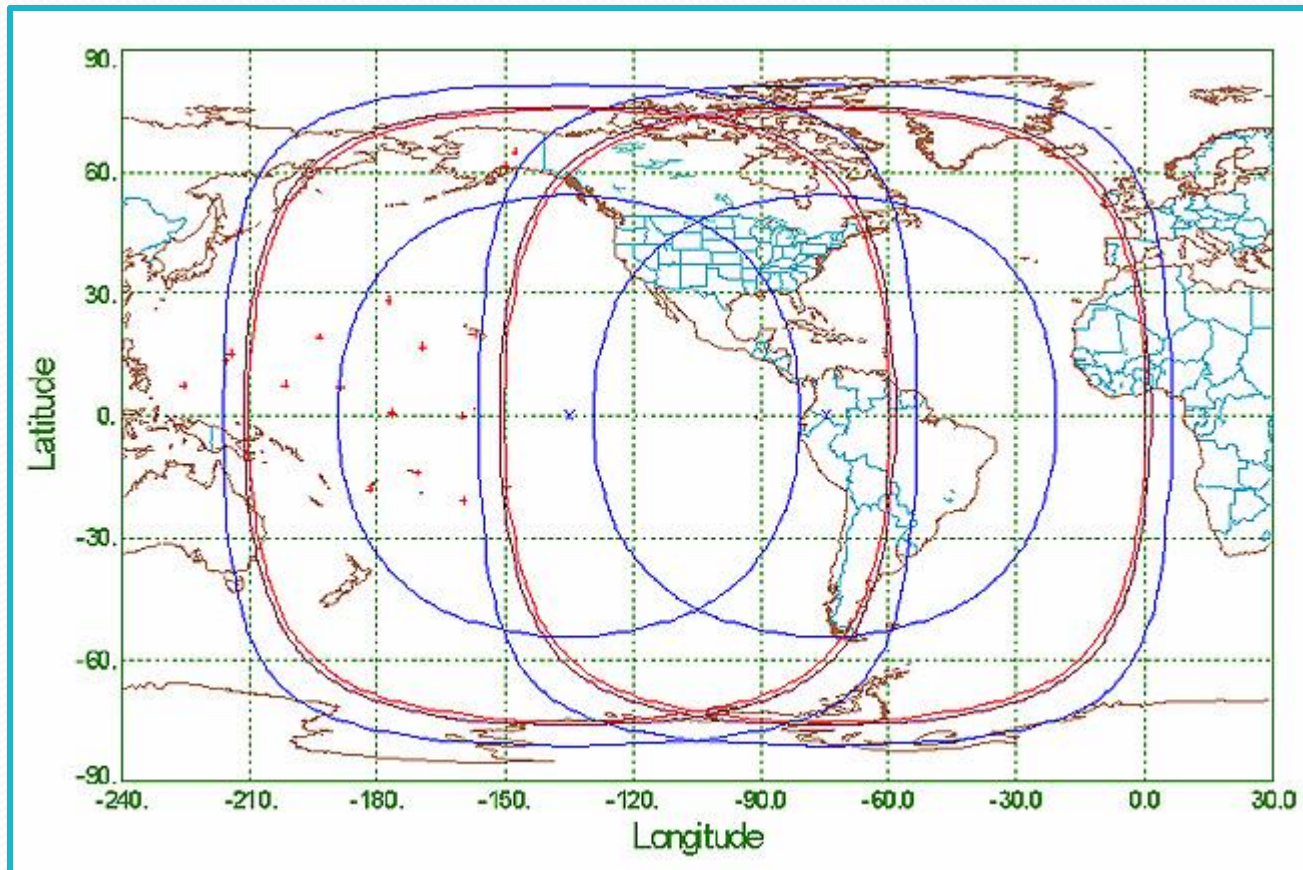
- Menu: File, Quick, Bulletins, Add-ins, Edit, Help
- Buttons: TORNADO, SEVERE, WATCH, FORECAST, HOWELL, PETOSKEY, HOURLY, TOR-NAT, SVR-NAT
- Log/METAR: Log, METAR, <, >
- Message Box: Received CURIND from KBOU
- Terminal Output:

```
FXUS64 KMAF 201417 AAB
AFDMAF
AREA FORECAST DISCUSSION...UPDATED
NATIONAL WEATHER SERVICE MIDLAND/ODESSA TX
816 AM CST SUN JAN 20 2002

SKIES HAVE CLEARED OUT EARLIER THAN EXPECTED OVER THE PERMIAN BASIN
AND WESTERN LOW ROLLING PLAINS. WILL FIRE OFF AN UPDATE TO CHANGE
SKY WORKING SOMEWHAT. THE REMAINDER OF THE FORECAST LOOKS ON TRACK
AND WE PLAN NO OTHER CHANGES AT THIS TIME.

.MAF...
TX...HIGH WIND WARNING UNTIL 20/2300 UTC FOR THE GUADALUPE MOUNTAINS
OF CULBERSON COUNTY...TXZ258.
...WIND ADVISORY UNTIL 20/2300 UTC FOR THE DAVIS AND APACHE
MOUNTAINS OF WEST TEXAS...NMZ074.
NM...HIGH WIND WARNING UNTIL 20/2300 UTC FOR THE GUADALUPE MOUNTAINS
OF EDDY COUNTY...NMZ027.
```
- Station List (WFO Request):
 - AFDMAF --KMAF-TX
 - OSOICRP --KCRP-TX
 - OSOICRP --KCRP-TX.1
 - OSOICRP --KCRP-TX.2
 - RTPMAF --KMAF-TX
 - RVABRO --KBRO-TX
 - RVACRP --KCRP-TX
 - RVASJT --KSJT-TX
 - RVDBRO --KBRO-TX
 - RVDSJT --KSJT-TX
 - SFPTX --KEWX-TX
 - SEPTV --KZEP-TX
 - SWRMT --KGTf-MT
 - CGRNMW --KMMW-OR
 - MTRSP8 --KWBC-US
 - MTRSP7 --KWBC-US
 - OMRAK --PAFC-AK
 - RVASJT --KSJT-TX
 - G08HURUS-01200829.JP
 - STOOR --KPQR-OR
 - CGRNMW --KMMW-OR
 - ZFPRAH --KRAH-NC
 - SNPS40 --AMMC-AU
 - MTRSP7 --KWBC-US
 - STOOR --KPQR-OR

EMWIN: General GOES Coverage



Transition Issues

- With the new GOES 'N' generation, EMWIN will and has already begun to transition its broadcast.
- This transition requires an eventual replacement or upgrade of equipment.
- GOES East (covering Americas) began transition on April 26, 2010.
- GOES West (overlapping with Americas and covering parts of Pacific) will transition in December 2011 or earlier if it fails.
- Official Transition Plan: <http://bit.ly/cAitPp>

Transition Issues

GOES Scenario 1 - The GOES East and West satellites provide service until the scheduled removal dates.

- GOES 12 (East) is replaced by GOES 13 (N) on or about April 26, 2010.
 - **Option 1** Users of GOES East migrate using a transition ready system
 - **Option 2** If they are under the footprint of GOES 11 (West) they re-point their satellite dish and keep receiving the EMWIN-I broadcast. This will be possible for almost all the CONUS users. However **this is only a temporary solution**. Users that are unable to receive the transmission from GOES 11 (West) should make preparations in advance to be capable to receive the EMWIN-N transmission.
- GOES 11 (West) is replaced by GOES 14 (O) in December 2011.
 - Users of GOES West migrate using a transition ready system
 - At this point both GOES East and West are GOES-N series satellites

Transition Issues

GOES Scenario 2 – GOES 11 (West) prematurely fails and is removed from service.

- GOES 11 (West) is replaced by GOES 14
 - **Option 1** Users of GOES West migrate using a transition ready system
 - **Option 2** If they are under the footprint of GOES 12 (East) they re-point their satellite dish and keep receiving the EMWIN-I broadcast. This will be possible for most CONUS users. This will not be possible for most of the EMWIN Pacific users and is only a temporary solution. Users that are unable to receive the transmission from GOES 12 (East) should make preparations in advance to be capable to receive the EMWIN-N transmission.
- GOES 12 (East) is replaced by GOES 13 on or about April 26, 2010
 - Users of GOES East migrate using a transition ready system
 - At this point both GOES East and West are GOES-N series satellites

Benefits of Transition

Transition Improvements


- Increased data rates from 9.6kbps to 19.2kbps.
- Better data compression.
- New data and products, such as regional radar images.

Cost Implications for GOES Transition

- A new EMWIN-N station (not including a computer) will cost around \$2,000 USD.
- Existing stations can be upgraded. Estimated costs are as follows:
 - For users with frequency stable legacy LNB's, the system requires only an I/F adapter and receiver costing approximately \$800 USD.
 - For users with frequency stable legacy LNA's, the system requires only an I/F adapter and receiver costing approximately \$1000 USD.

Current EMWIN Activities

- Pacific upgrade and deployment beginning.
- Small form factor equipment used.
- Some software customization for the Pacific implemented.



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Int'l to National: LRIT

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LRIT: What is it?

- Low-Rate Information Transmission (LRIT) is a standard broadcast method to disseminate satellite imagery and other products via meteorological / environmental satellites.
- LRIT was established by the Coordination Group for Meteorological Satellites (CGMS).
- On NOAA GOES, LRIT carries, in addition to GOES imagery products, EMWIN, tropical cyclone information, DCS, graphics of MeteoSat and MTSAT, and other charts and non-imagery products.
- The broadcast stream is currently 128 kbps. With GOES R it will be expanded to 400kbps and EMWIN and LRIT will merge.

LRIT: What is it?

- The cost of LRIT stations varies depending upon supplier(s) of hardware and software. Typically, the range is \$8,000 - \$15,000 USD.



LRIT: Future Transition GOES

- Currently there is a separate EMWIN broadcast, as well as a combined EMWIN and LRIT transmission on GOES satellites.
- Starting with the GOES-R series and generation of satellites, the LRIT and EMWIN services will likely be formally merged into a single channel at 400kbps.
- This provides a potential opportunity for EMWIN users to receive additional information, but a ground station change for both LRIT and EMWIN will likely be needed.
- It is important for potential users of the system to understand that the merge of EMWIN and LRIT on NOAA GOES (effectively removing a separate EMWIN broadcast) is likely ~5-10 years away; although possibly sooner if there are unforeseen satellite failures or similar issues. Possibly later.

LRIT: Pacific Transition

- JMA is expected to cease LRIT service via satellite broadcast in 2015; pending any changes.
- Users of the JMA LRIT service will need to make plans to receive the LRIT service via GOES (if in coverage), or via Internet from JMA.



Communication Technologies for Alert and Notification Applications

Int'l to National: GEONETCast & RAPIDCast

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GEONETCast: What is it?

- GEONETCast is a near real time, global network of satellite-based data dissemination systems designed to distribute space-based, air-borne and in situ data, metadata and products to diverse communities.
- GEONETCast was established as a Task in the GEO Work Plan and is led by EUMETSAT, the United States, China, and the World Meteorological Organization (WMO). Many GEO Members and Participating Organizations contribute to this Task.

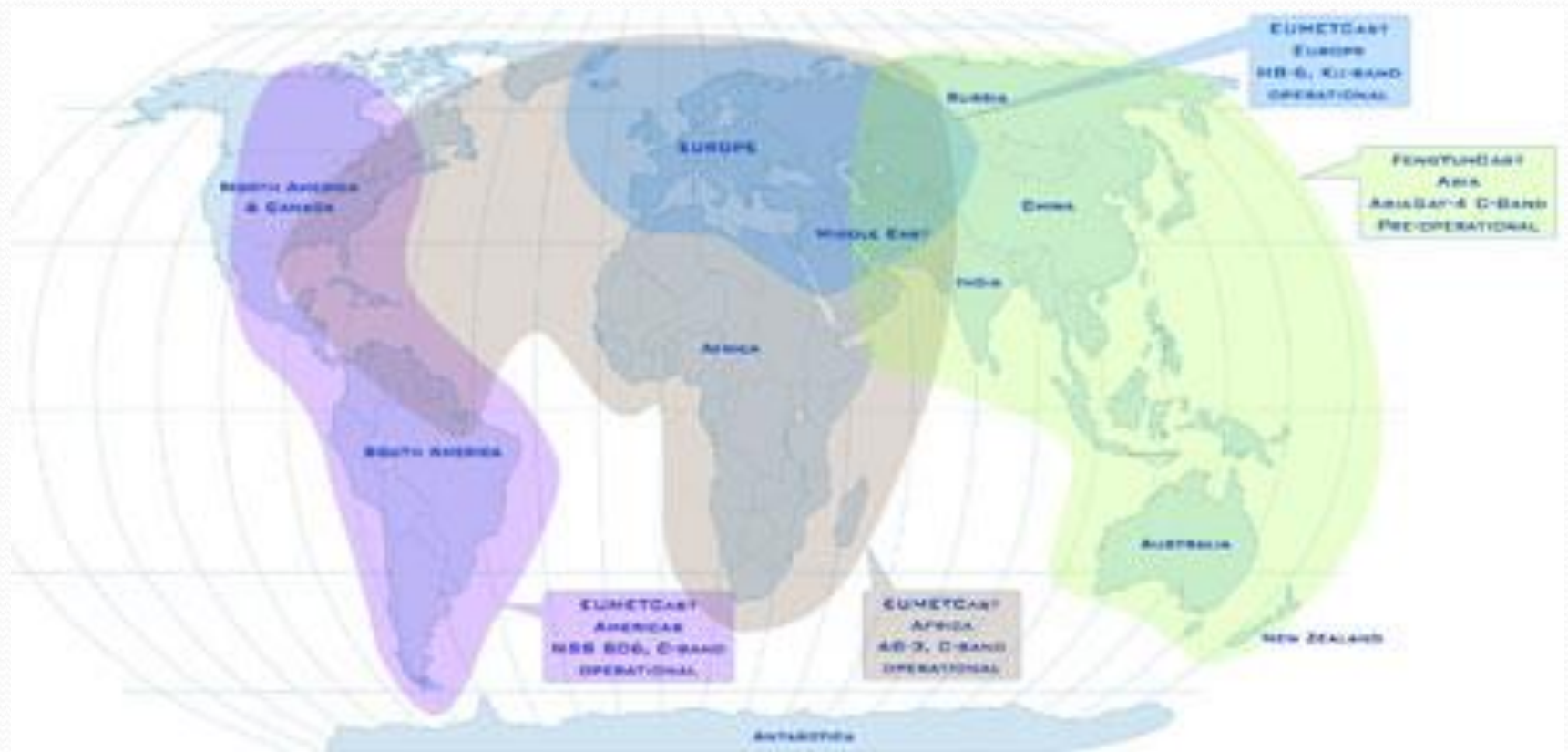
GEONETCast: What is it?

- System utilizes DVB-S/S2 broadcast capacity on mostly commercial satellites.
- GEONETCast Americas operates at 2mpbs, supporting a number of applications beyond the hydro-meteorological or geophysical community.

GEONETCast: Application Areas



GEONETCast Current Coverage



GEONETCast: Equipment



Users need only a satellite dish, receiver, and common computer to receive the broadcast -- no internet connection is required.



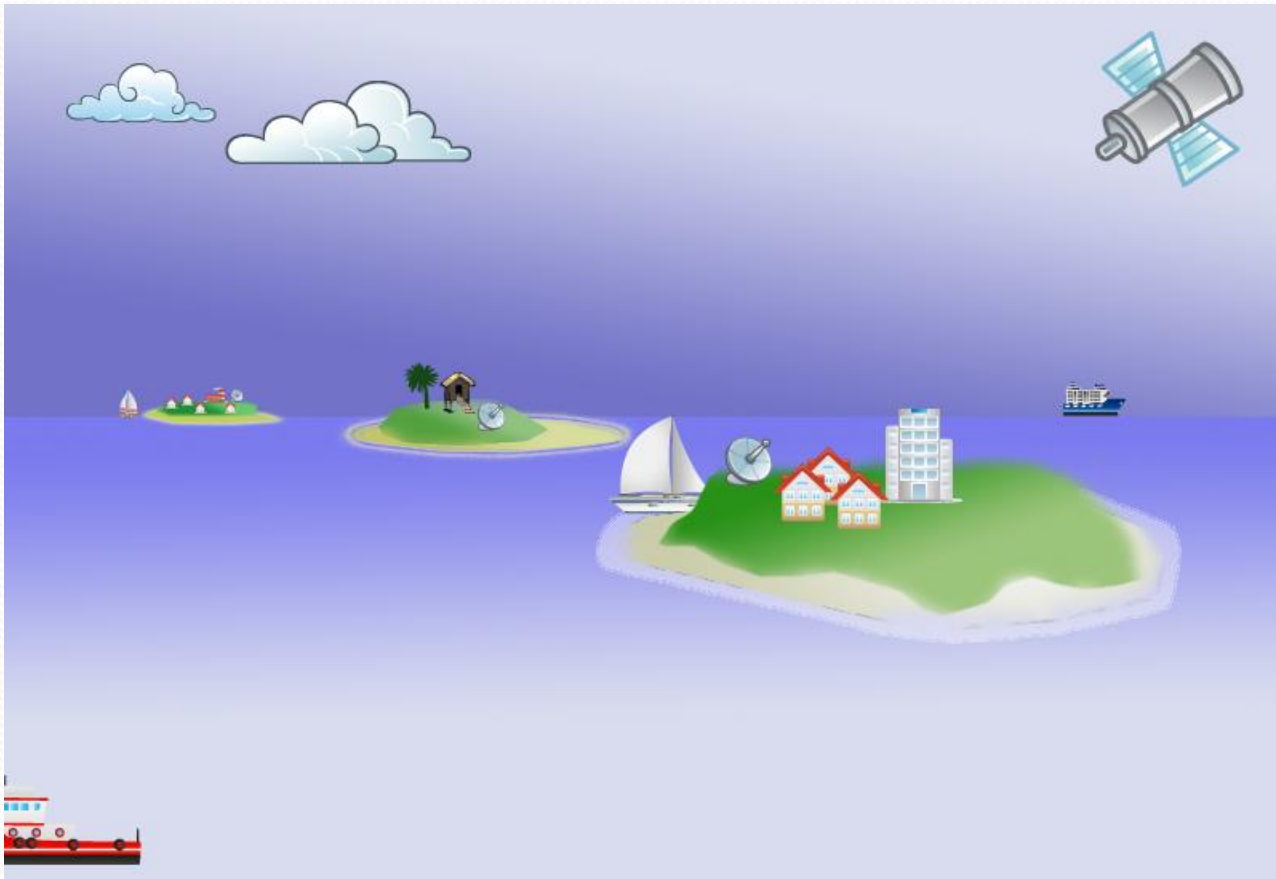
GEONETCast: Equipment

- GNC-Americas requires a 2.4 meter dish, a DVB-S/S₂ receiver, Kencast client software, and a standard computer.
- Actual station costs may vary depending upon the equipment manufacturer and features purchased. A basic station can be deployed for around \$4,000 USD.

GEONETCast: Considerations

- The 2.4 meter dish utilized in the Americas is likely to limit GNC as a tool for national centers or key intermediaries, such as local government, extension workers, etc.
- The broadcast is still developing, so while many early warning products are available, users may need to develop visualization or file management software. Countries may need to request certain national level products be carried if using the system to relay internally.

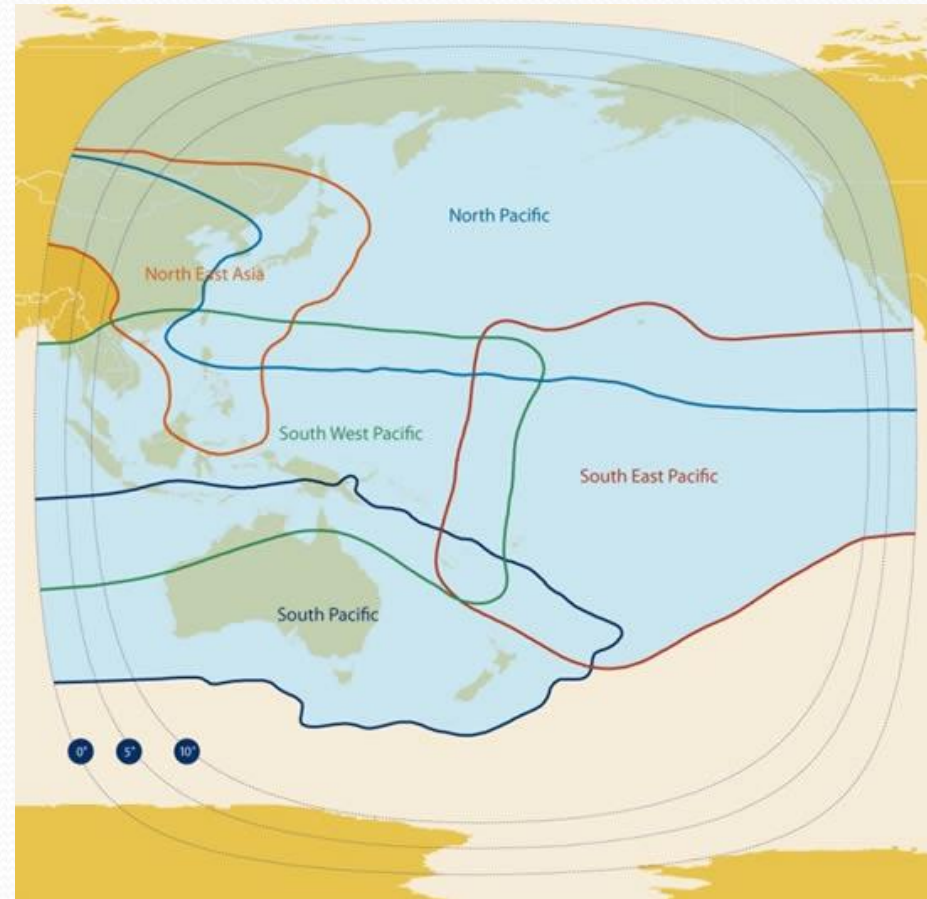
RAPIDCast



RAPIDCast

Remote **A**sia **P**acific
Information **D**issemination
Broadcast

RAPIDCast has the simple goal of providing access to warning, agricultural, and related information to remote areas of the Pacific.

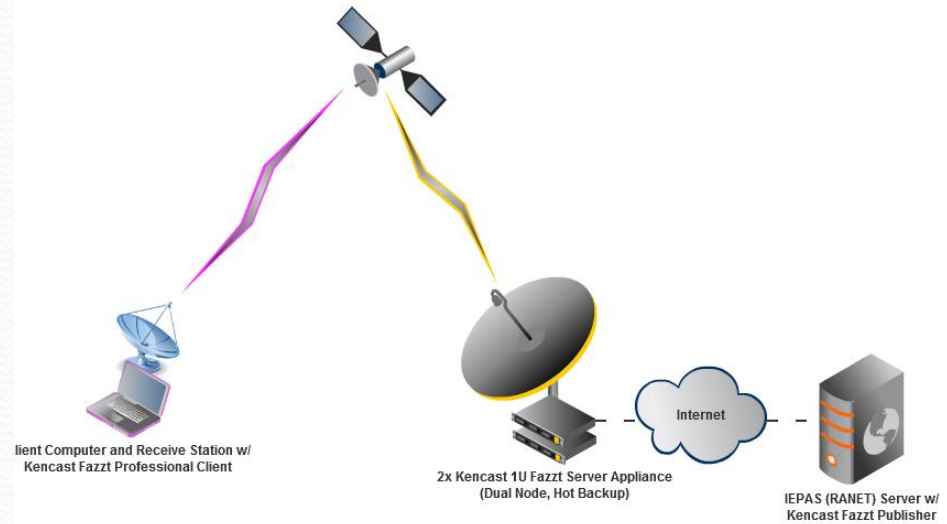


RAPIDCast

Using a similar dissemination model as experienced with WorldSpace, GEONETCast, and others, RAPIDCast will provide a 128kbps (burst to 512kbps) DVB-S broadcast service on GE-23.

Expect deployment in late 2011.

RAPIDCast: Basic Component Diagram





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Cellular SMS in Early Warning

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Issues to Address When Using SMS for Alert and Notification

- Weak Authentication
 - SMS sender identifications (numbers, short codes, etc) are easy to spoof. While spoofing in many countries is illegal, this does not make it impossible or terribly difficult.
 - Many users may simply not pay attention or memorize the sender address / ID, allowing spoofing of message formats.

Issues to Address When Using SMS for Alert and Notification

- Weak Authentication - Cont'd
 - Weak authentication can be addressed by cross posting, educating users on where to find additional information, and use of highly formatted content, user PINs, etc.
 - The more closed the group, the easier it is to address authentication vs. public messaging.

Issues to Address When Using SMS for Alert and Notification

- Timeliness
 - Cellular networks are vulnerable to congestion, although during congestion SMS is a better communication alternative to voice. E.g.- Australia wild fire SMS notifications took hours.
 - Timeliness is best addressed by limiting your messaging to a closed group (vs public), as well as entering into a dialog with mobile carriers.
 - Depending upon how messages are sent, you will need to set up your messaging system to scale effectively. This is particularly an issue if using GSM modems, or if you have weak internet connections to an SMSC.

Issues to Address When Using SMS for Alert and Notification

- Network Resilience
 - Cellular networks may be affected (reduced capacity or altogether outage) due to the event for which you are expecting to provide an alert or notification.
 - Cellular networks, however, are often the first communications to be rebuilt post-disaster.
 - There is no real way to deal with outages or congestion, except by ensuring your overall network architecture utilizes several other means of communication.

Issues to Address When Using SMS for Alert and Notification

- Carrier Peering
 - Carrier peering and agreements are what allow you to send an SMS from one carrier network to another. In some cases such peering and routing relationships do not exist.
 - This is mostly an issue if attempting to message internationally (one country to another) but in-country issues are not uncommon – one carrier not passing SMS from another.

Issues to Address When Using SMS for Alert and Notification

- Carrier Peering - Cont'd
 - Cross carrier messaging is best address in the long run through government dialog with the carriers.
 - In the short term it is addressed simply by establishing links (SMSC or modems) on multiple carriers.

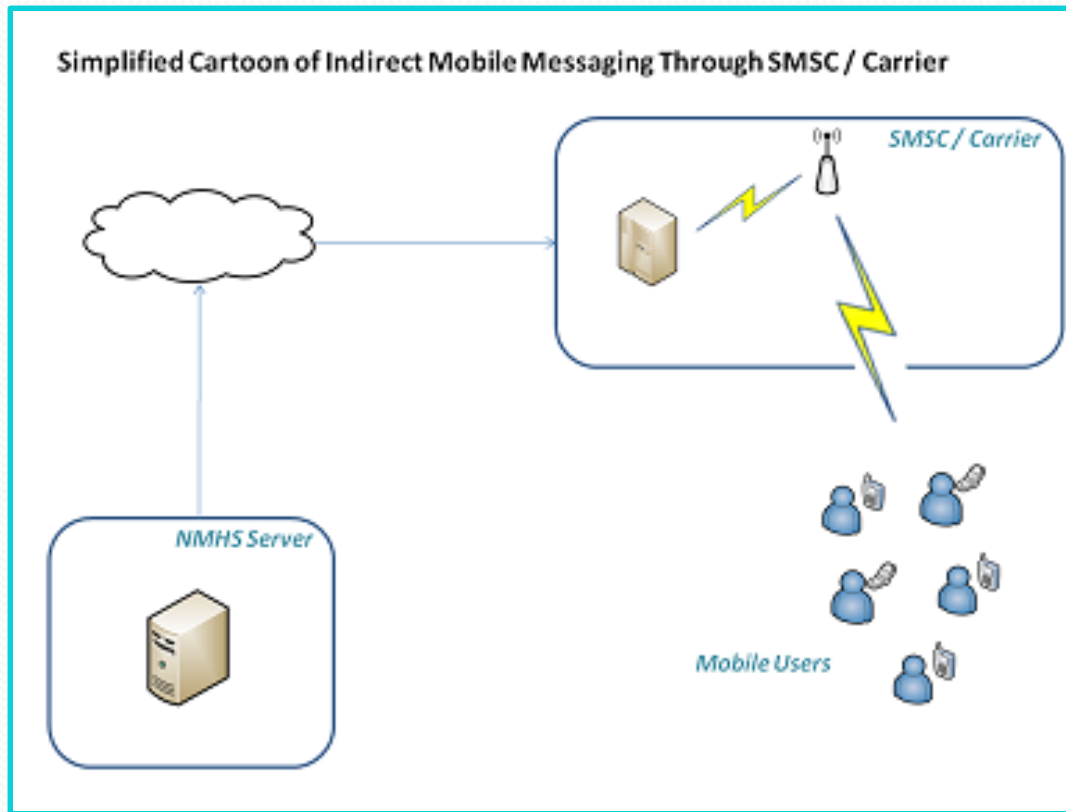
Issues to Address When Using SMS for Alert and Notification

- Given issues of timeliness and network resiliency, it is perhaps **best to consider cellular SMS as a quickly perishing capability.**
- Put another way, after sending first message, do not count on the network being available or timely. Use it as long as you can, but assume in your overall strategy that the system will be ineffective at sending repeated multiple updates.

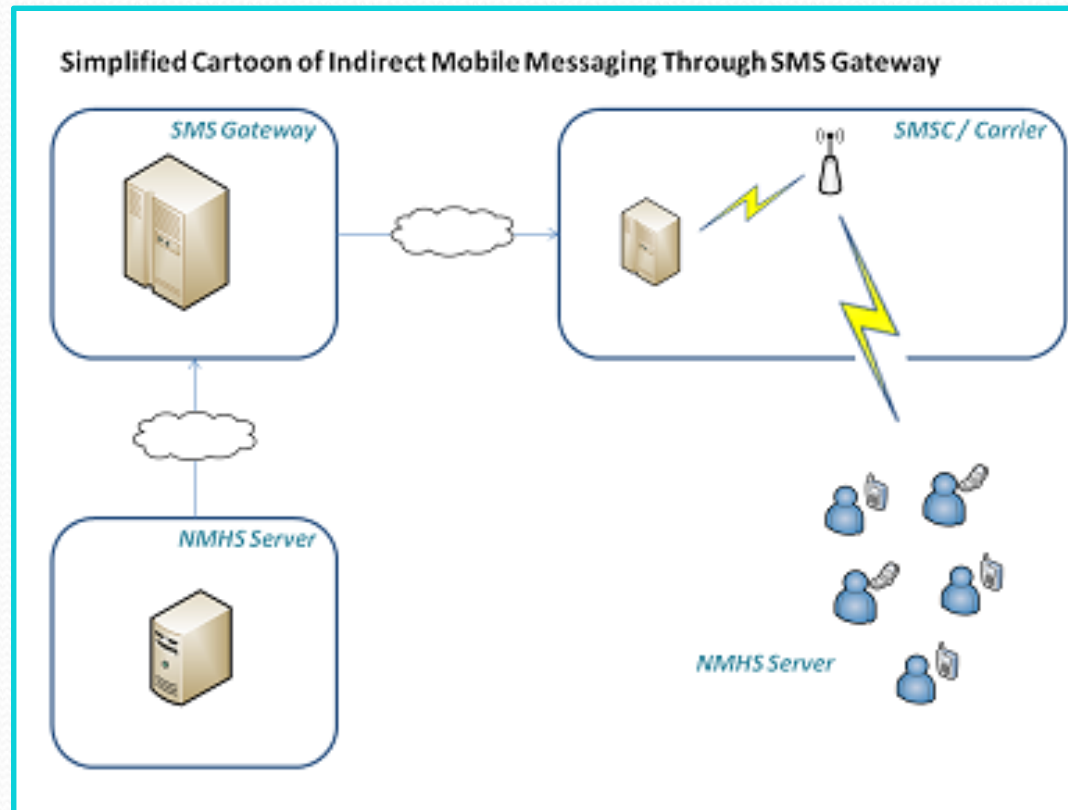
Issues to Address When Using SMS for Alert and Notification

- Cost
 - On a per message basis, SMS is pretty cheap, however, it is one of the most expensive means of sending information when viewed on a per byte basis.
 - Users in a few countries may be billed for receipt of message, as well as the sender.
 - Cost is easy to determine.
 - Some carriers may be willing to provide free messaging to government entities for alert and warning applications, but do not count on it.

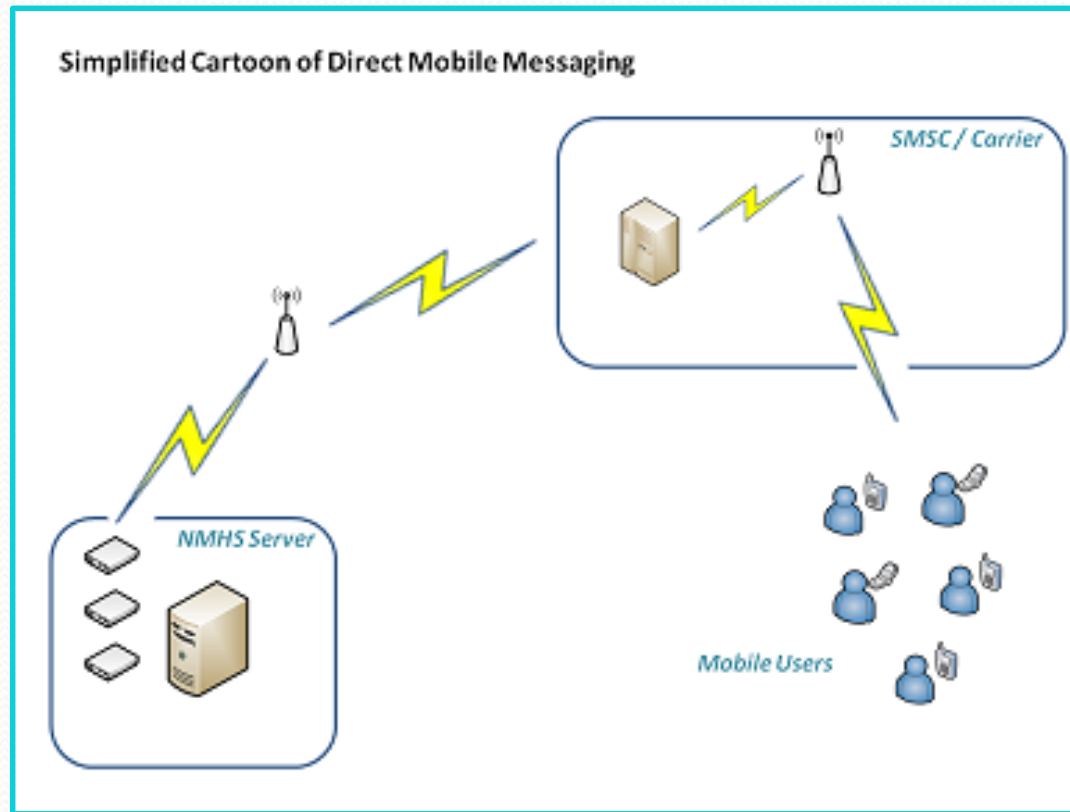
Methods of Message Sending



Methods of Message Sending



Methods of Message Sending



Summary Comparison of Integration Methods

	Indirect Network Integration	Direct Mobile Integration
Technical Difficulty	Easy - Medium	Medium - High
Outgoing Message	Yes	Yes
Incoming Message	No. (Yes, if paying for capability.)	Yes
Major Vulnerability	Network Connectivity	Maintenance of Onsite Infrastructure
Setup Costs	Low. For outgoing only, typically no cost, other than that required for messaging. Monthly or other service fee of \$60-200 may be required for receive services. Other services, such as priority messaging, may require additional fees.	Depends entirely upon intended application and volume of messages. A base system utilizing existing servers may only cost \$250. However, more likely to cost \$1,500 to \$5,000 for initial outlay of modems, software, and computer.
Message Costs	Typically \$.03-\$.15 greater than messaging from a mobile device in-country.	Set at rate of carrier(s) used. Usually less than INI.
Messaging Speed	Dependent upon gateway and current gateway and mobile network load. Typically very fast, particularly for high-volume messaging. Some gateway services may provide priority messaging, but at substantial monthly fees.	Dependent largely upon number of modems used in setup, and of course local mobile network congestion. Typically RANET estimates a message can be processed on a modem every 12 seconds or 5 every minute.



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Terrestrial Radio and RDS / Tone Alert

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Multiple Application Scenarios

- Relaying information on existing FM/AM stations (commercial or community / non-profit owned).
 - Primarily requires development of partnership, with some consideration of how to timely and reliably pass information. Time intensive, but least expense.
- Community Radio Station Setup
 - Time intensive and costly. Significant listener benefits and trust building.
- Dedicated Gov / Warning Authority Station
 - Less time intensive and some significant cost.
 - Very useful for establishing cross-reference authentication, providing detailed message information, and supports many passive roles.

Cost of Stations

- Varies widely depending upon broadcast power, sophistication and automation of equipment, etc.
- A minimal low-power / community FM radio station can be purchased for \$6-8K, however, deployment expenses, spare parts, etc., likely means a budget of \$25K a station.
- Licensing with national regulatory agency may require additional one time or recurring fees.
- Power, if using solar, wind, or generator, adds another significant upfront and recurring cost.

Indirect Cost Considerations

- Training, training, training, training.
 - Operators and listeners.
- Record keeping and regulatory compliance.
- Maintenance

RDS & Tone Alert: What is it?

- Radio Data System (RDS) is a digital carrier on an existing radio broadcast that can be used to send short (very short) text information or used as a trigger for receivers in stand-by.
- Tone Alert is an encoded signal in a radio broadcast that can be used to trigger radio receivers in stand-by.
- Such trigger systems are useful for remote alarm and receiver activation. E.g.- NOAA Weather Radio.

RDS & Tone Alert: What is it?

- Can be added to existing stations or deployed with new.
- Many, many manufacturers of broadcast systems as well as receivers.
- Generally considered an expensive system requiring users to acquire specialized receivers, and then installation of a broadcast system + command and control.
- Costs vary considerably depending upon command and control, but entry level is tens of thousands per station.

RDS & Tone Alert: What is it?

- Some security concerns depending upon setup of system. While it would take a technically sophisticated individual to do so, spoofing of signals is entirely possible.



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High Frequency (HF) Radio

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HF Radio: What is it?

- High Frequency (HF) radio is an 'old' technology often used in emergency situations for its robustness and ability to transmit over large distances.
- HF is typically used for two-way audio / voice services, but data applications are available and common.
- Bandwidth over HF is extremely limited, so if used for data services, the application should be limited to short text messages.

HF Radio: What is it?

- HF likely already exists in many government entities (police, military, etc), and weather services typically have been licensed some frequencies to use for data recording and exchange.
- Large amateur radio networks exist, which can make HF a valuable tool pre- and post-disaster for getting messages to and from communities.
- Note, however, that day-to-day operations cannot and should not run under 'HAM' / amateur licenses.

HF Radio: Limitations / Considerations

- Operation of HF 'rigs' often requires site and operator licensing, which depending upon local regulations can result in fees and/or limit use to a select few.
- Outside of regulation, HF tends to require technically trained personnel for operation.
- Equipment (for long distance communications) is relatively expensive. A digital / packet enabled station will cost \$12-20K.
- Point-to-point / minimal broadcast capability as defined by likely limited set of deployed station. Best as a government coordination tool.

HF Radio: Limitations / Considerations

- Atmospheric / solar conditions greatly affect HF signal quality, therefore either personnel must be trained to switch frequencies, or automated devices will need to be added to an HF unit to address such issues.
- Despite cost and limitations, a very, very useful tool to ensure basic communications pre- and post-disaster.



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Extensible Data Formats

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Extensible Formats: What is it?

- Extensible formats (XML) are generally associated with web applications, but need not be limited to the Internet.
- These structured data formats are widely used as a means of exchanging information in a reliable and predictable manner.

Extensible Formats: RSS / Atom

- RSS (Real Simple Syndication) was developed as a way to distribution (syndicate) updated information streams such as news reports, however it has been widely used by meteorological services.
- Atom is another syndication format designed to address some limitations and development issues of RSS.

RSS / Atom Example

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<rss version="2.0" xmlns:atom="http://www.w3.org/2005/Atom"
      xmlns:geo="http://www.w3.org/2003/01/geo/wgs84_pos#"
      xmlns:georss="http://www.georss.org/georss">

  <channel>
    <title>PTWC - Pacific Ocean Bulletins</title>
    <link>http://www.weather.gov/ptwc/?region=1</link>
    <atom:link href="http://www.weather.gov/ptwc/feeds/ptwc_rss_pacific.xml" rel="self" type="application/rss+xml" />
    <description>Tsunami warnings and information for Pacific Ocean countries</description>
    <language>en-us</language>
    <managingEditor>ptwc@ptwc.noaa.gov (PTWC)</managingEditor>
    <webMaster>ptwc@ptwc.noaa.gov (PTWC Webmaster)</webMaster>
    <image>
      <url>http://weather.gov/images/xml_logo.gif</url>
      <title>PTWC - Pacific Ocean Bulletins</title>
      <link>http://www.weather.gov/ptwc/?region=1</link>
    </image>
    <lastBuildDate>14 Aug 2010 23:11:26 GMT</lastBuildDate>
  <item>
    <title>Tsunami Information Bulletin</title>
    <pubDate>14 Aug 2010 23:11:26 GMT</pubDate>
    <link>http://www.weather.gov/ptwc/?region=1&id=pacific.2010.08.14.231126</link>
    <guid isPermaLink="false">pacific.2010.08.14.231126</guid>
    <author>ptwc@ptwc.noaa.gov (PTWC)</author>
    <category>information</category>
    <atom:category term="eid" label="us2010zyda"></atom:category>
    <geo:lat>12.2</geo:lat>
    <geo:long>141.6</geo:long>
    <geo:alt>-100000</geo:alt>
    <georss:point>12.2 141.6</georss:point>
    <georss:elev>-100000</georss:elev>
    <georss:radius>6.5</georss:radius>
    <georss:featurename>South of Mariana Islands</georss:featurename>
    <description><![CDATA[<pre>
000
WEPA42 PHEB 142311
-----
```

]]></description>
 </item>
</channel>
</rss>

Extensible Formats: CAP

- The Common Alerting Protocol (CAP) is another XML based data format concentrating on the exchange of warnings and emergency information.
- Intent is to ensure a warning / alert can be disseminated over multiple platforms while retaining message integrity.
- Created by the OASIS group and recognized by the ITU in recommendation X.1303.
- Promoted as part of WIS.

CAP Example

```
-<cap:alert>
  <cap:identifier>NOAA-NWS-ALERTS Iowa 2010-09-02T11:28:30-04:00</cap:identifier>
  <cap:sender>w-nws.webmaster@noaa.gov</cap:sender>
  <cap:sent>2010-09-02T11:28:30-04:00</cap:sent>
  <cap:status>Actual</cap:status>
  <cap:msgType>Alert</cap:msgType>
  <cap:scope>Public</cap:scope>
- <cap:note>
  Current Watches, Warnings and Advisories for Iowa Issued by the National Weather Service
</cap:note>
<cap:references> http://www.weather.gov/alerts/ia.html </cap:references>
- <cap:info>
  <cap:category>Met</cap:category>
  <cap:event>Flood Warning</cap:event>
  <cap:urgency>Unknown</cap:urgency>
  <cap:severity>Unknown</cap:severity>
  <cap:certainity>Unknown</cap:certainity>
  <cap:effective>2010-09-02T15:17:00</cap:effective>
  <cap:expires>2010-09-05T00:37:00</cap:expires>
  <cap:headline> FLOOD STATEMENT </cap:headline>
- <cap:description>
  FLOOD STATEMENT NATIONAL WEATHER SERVICE QUAD CITIES IA IL 1017 AM CDT THU SEP 2 2010 RIVER FORECASTS TAKE INTO ACCOUNT
  PAST PRECIPITATION...AS WELL AS PRECIPITATION AMOUNTS EXPECTED 24 HOURS INTO THE FUTURE FROM THE FORECAST ISSUANCE TIME.
  PRECAUTIONARY/PREPAREDNESS ACTIONS... IF YOU ENCOUNTER A FLOODED ROADWAY...TURN AROUND AND FIND AN ALTERNATE ROUTE.
  TURN AROUND...DON/T DROWN. ADDITIONAL RIVER AND WEATHER INFORMATION IS AVAILABLE AT WWW.WEATHER.GOV/QUADCITIES . &&
  IAC103-183-030317- /O.EXT.KDVN.FL.W.0231.000000T0000Z-100905T0037Z/ /KALI4.1.ER.100901T2215Z.100903T0000Z.100903T1237Z.NO/ 1017 AM CDT
  THU SEP 2 2010 ...FLOOD WARNING NOW IN EFFECT UNTIL FRIDAY MORNING... THE FLOOD WARNING CONTINUES FOR THE ENGLISH RIVER AT
  KALONA. * UNTIL FRIDAY MORNING. * AT 10:00 AM THURSDAY THE STAGE WAS 14.6 FEET...AND RISING. * FLOOD STAGE IS 14 FEET. * MINOR
  FLOODING IS OCCURRING AND IS FORECAST TO CONTINUE. * FORECAST...RISE TO 15.5 FEET THIS EVENING. FALL BELOW FLOOD STAGE FRIDAY
```

Considerations and Issues

- Extensible formats as CAP, RSS, Atom, etc. should not be served from critical infrastructure or where there is no QoS (quality of service) in place to manage bandwidth – protecting core operations. Many clients do not respect limitations on checking for updates and/or poorly implement cache checks. Publish - subscribe (push) methods are not as widely available or utilized.
- XML formats contain considerable overhead, which brings into question immediate utility for many existing platforms with bandwidth considerations / limitations. This also brings into question concept that these will support mass warning as a direct link to devices. For now it is more likely a back haul tool.

Considerations and Issues

- XML formats require a minimal ‘computer’ / text processor. Increases complexity at device level. Not useful to basic trigger systems, or those which are analog.
- Providing content in one or more XML formats will support transition to future communication systems and devices.
- Great tool for passive alerts – supporting regional and international users.



Communication Technologies for Alert and Notification Applications

RANET Chatty Beetle

**ITIC TRAINING PROGRAMME HAWAII (ITP-HAWAII)
TSUNAMI EARLY WARNING AND MITIGATION SYSTEMS**

**August 2012
Honolulu, Hawaii USA**

**Ed Young
Kelly Sponberg**

Chatty Beetle: What is it?

- The RANET Chatty Beetle is a text-based alert and messaging device designed by RANET for remote applications where other communications do not exist, are unreliable, or where a simple notification is needed. It is not designed to replace formal means of communicating alerts, but rather serves as a “heads up” notification.



Chatty Beetle: What is it?

- RANET developed the Chatty Beetle in response to needs articulated by the Pacific Communications Steering Committee.
- It is built upon and uses Iridium Short Burst Data.



Chatty Beetle: What is it?

- The system is currently in a 3 year pilot of 60 global deployments. This pilot will help to refine terminal design, improve system operations, as well as determine overall use and roll of the system.
- 22 additional units have been provided for US Pacific territories and flag countries as an expansion of the pilot.
- An additional 15 units as part of Phase II of the original pilot will soon be available to extend global experience.



Chatty Beetle: Basic Functionality

- Hardened terminal designed to operate in harsh environmental conditions.
- Can operate in both fixed and mobile applications.
- Two-way messaging.
- Audible and visual cues for alarms on terminal.

Chatty Beetle: Basic Functionality

- Can operate on battery for 36 hours+. (Tested performance at 72 hours+ depending upon use, but rated for 36 hours.)
- Capability of controlling external devices through relay and serial port functionality.
- Capable of sending messages from terminal or web interface to e-mail or as SMS.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



Network: Field Terminal



Definitions: A network in the RCB sense is often a national warning authority, emergency management organization, etc. Generally it can be thought of as the institutional affiliation. Networks are not allowed to generally interact. (Some exceptions.) The reason of networks is that multiple organizations relying on common infrastructure of RANET and Iridium.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



Network: Field Terminal



Definitions: A control node is able to trigger alarms on terminals within its network. It is given special permissions to manage messaging groups, and it is provided a web interface. Generally this is the headquarters of an organization and is responsible for managing terminals in its network. Aside from web interface, control nodes are given one or more specially designated terminals, which allows for administrative functionality.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



Network: Field Terminal



Definitions: A field terminal is just a RANET Chatty Beetle deployed in a remote office, community, or other operational setting. It is capable of receiving warnings, sending messages to the control node, triggering a distress / urgency code, as well as sending normal messages to any other terminal in or out of its network. It cannot trigger alarms.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



Network: Field Terminal



Definitions: The RANET Gateway is a series of servers that manage and route messages (normal or warning) among terminals and for networks. It interfaces to the Iridium gateway, and it provides a web interface to control nodes.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



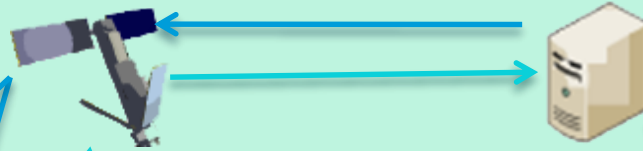
Network: Field Terminal



Definitions: The Iridium constellation is comprised of numerous Low Earth Orbiting communication satellites. It provides the Short Burst Data service utilized by the RANET Chatty Beetle system. The RANET gateway communicates with the Iridium gateway to receive and send (general routing) of SBD messages from and to terminals.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



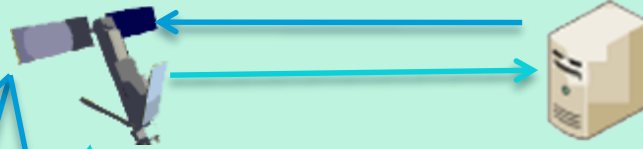
Network: Field Terminal



Sending an Un-Routed Message:
The field terminal simply types a message without routing to another terminal. This is routed to the Iridium gateway. RANET picks up the message, identifies the associated network, and sends to the control node.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



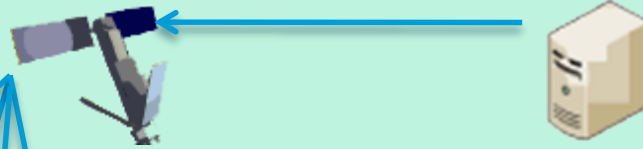
Network: Field Terminal



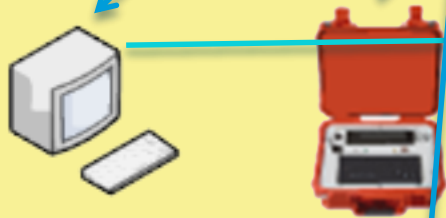
Sending a Routed Message: The field terminal simply types a message with routing number of another terminal. This is routed to the Iridium gateway. RANET picks up the message, identifies the associated network, and sends to target node AND copies to control node.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



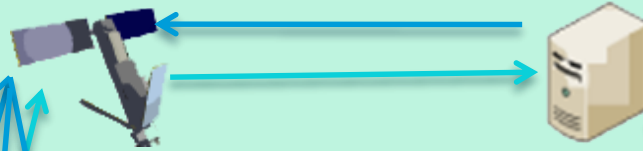
Network: Field Terminal



Sending a Alarm from Web GUI:
The controller uses the web interface to target a message to one or more terminals in its network. The RANET Gateway sends the alert message to target terminal(s) AND copies to control node.

Simplified Network and Messaging Diagram: RANET Chatty Beetle

Iridium Satellite Constellation and Gateway



Network: Control Node



RANET Gateway



Network: Field Terminal



Sending a Alarm from Control Terminal: The control terminal types a alert message with codes to target terminals and set alarm level. This is routed to the Iridium gateway. RANET picks up the message, identifies the associated network, and sends to target terminal(s) AND copies to control node

Chatty Beetle: Future Directions

- Streamlining into Operations
 - Format / Protocol (E-mail, SMS, etc.)
 - Input / Interface
- Message Fund
- Anonymous Push Network
- More Devices / Form Factors
- Writing Up the Experience