

#### WELCOME TO THE

#### **MicroHAMS Digital Conference**

which this year includes the

NW APRS Group's 2007 Winter Gathering Microsoft Campus February 24, 2007











#### Your Master of Ceremonies: Herb Gerhardt KB7UVC

Email: hgerhardt@wavecable.com

APRS)

unwind with a little German.

# Schedule of Presentations

(Times will be adjusted as needed after each presentation)

0900 - 0910 0910 - 1000 

- 1000 1100
- 1100 -
  - 1200
- 1200 1300
- 1300 1400
- 1400 1500

1500 -1600

1600 - 1700



APRS Presentation -- Herb KB7UVC
W WA 9.6k UHF APRS -- Kim AC7YY
Developing information services for APRS with

Welcome and House Rules -- Herb KB7UVC

- Developing information services for APRS with digi\_ned and Microsoft Visual studio -- Larry N7BCP
- Lunch (Provided on-site with Registration)
- Software Defined Radio and Amateur Radio -- Lyle KK7P
- WinLink on Mercer Island -- Dave WA0TTN
- WJST/Meteor Scatter Doing fun stuff with ARGO and SPECTRAN -- Bob N7OFT
- Introduction to DSTAR -- Scott N7SS
- Wrap-up of this years event & Socializing!
  - Join us for Pizza & Beer at Roundtable Pizza at 1830

# Welcome and House Rules

- We are guests in Microsoft's house.
  - Please don't drink the soda, juice or anything
    else from the taped-off area of the kitchen.
    The organizers of the conference will provide refreshments purchased for this event.
- Please do not prop doors open.
- Please don't leave a mess.

0900

to

0910

- Please don't steal anything!
- Please don't damage anything.
- Please enjoy yourself at this conference!



#### Automatic Position Reporting System (APRS)

Presentation for the 2007 MicroHams Digital Conference/ Winter Gathering

#### Your Host:







of Bob Bruninga WB4APR



# APRS Presentation by Herb Gerhardt/KB7UVC





#### A ham since 1993

NW APRS Group West Sound Coordinator

Mason County ARES/RACES SAR Com's

Goal is to get APRS integrated into SAR Missions.



In my previous life, I was a Nuclear & Utilities Engr. In my other life, I spend my time in the mountains! What are the most important things about APRS?

- You must use APRS for SAR!
- You must have FUN!
- You must own at least one Garmin Mapping GPS
- You must own a Kenwood TH-D7A HT radio
- You must have FUN!
- You must use APRS for SAR!
- You should own a Kenwood TM-D700 mobile radio
- You must have FUN!
- You should own a good laptop
- You must have FUN!



YES, YOU MUST HAVE FUN and use APRS for SAR!

### What is APRS?



#### Automatic Position Reporting System

- A method of transmitting information by converting it to digital "packets" for transmission by radio of:
  - Location of fixed resources and objects
  - Location, course and speed of mobile resources and objects
  - Weather data: wind speed, direction, temp, rainfall
- Information is displayed on a computer
- Information is sent to the Internet to FindU.com
- Information can be logged and played back
- Great tool for fun, SAR, public service, and, disaster communications support

Great way to keep tract of SAR teams during a search



# "Father of APRS"

#### Author of APRSdos



Bob Bruninga WB4APR

His first APRS-like protocol was run on a Commodore VIC-20 in 1984 to report the position and status of horses in a cross-country endurance run.



## **APRS** Platforms

- 1992: First DOS version
- 1994: First MacIntosh version
- 1995: First Microsoft Windows version
- 1998: First PalmOS version
- 1999: First Linux/Unix version
- 2000: First WinCE version
- Today: We have many applications to choose from, including some which run on multiple operating systems.



#### WinAPRS & UI-View with Precision Maps – Great Detail







Lat 47 31' 34"N Lon 122 20' 11"W New sta



## WinAPRS Tiger Map Screen





## APRSPoint uses Microsoft MapPoint Maps



#### This is a regional UI-View/Precision Map snapshot



#### National APRS Snapshot, UI-View





### Xastir Satellite View









## Xastir Satellite View





### About APRS

**APRS** sends and receives UI frames (unconnected packets) Packets contain position and other info that is decoded at the received station and plotted. Mobile operators update positions with GPS. Weather Data & telemetry can also be sent. The individual operator determines how far, or how many "hops", his/her station makes, using a "flooding" protocol. (WIDE2-2)



#### About APRS (cont.)

Remote or mountaintop wide-area digipeaters hear signals and repeat them.

- Internet Gateways (iGate's) are used to pass data between radio and the internet.
- Each operator determines how far his/her signal will travel.
- Both software programs & Trackers can transmit location data



## Getting Started With APRS

#### Home Station setup

- Computer, APRS Software
- Terminal Node Controller (TNC) aka radio modem
- Amateur radio set to APRS freq of 144.39 MHz simplex
- Suitable antenna

#### Mobile Tracker setup

 Radio, antenna, TNC, and GPS. If desired, add laptop or PDA for a full APRS mobile station.

Track yourself/spouse/teenager driving your car.

My wife (KC7CYQ) has dinner on the table when I drive into the driveway! She keeps track of me while in the mountains and on my hunting trips.



### Fixed Station Location

- Upon starting APRS software for the first time, the user manually supplies his/her location on the map.
  - This location is transmitted to other stations on network following a user defined path. (WIDE2-2 is recommended here in W WA)
  - No acknowledgment is required.
    - Uses a decaying transmission rate.
    - All stations on local network eventually hear a packet from each station if a path exists.
  - User can define how their station is displayed on everyone's map
    - Antenna, Tower, QTH, Car, Jeep, Bus, Plane, dozens more
- With just a PC or Macintosh computer, TNC and radio, you can become active on APRS and show the local APRS users where you are, plus see where they are.

With an internet feed, you only need a computer to have a fully-functioning APRS station (May not get transmitted locally).



### Radios That Work With APRS

Radio Shack Icom Kenwood Alinco Yaesu MFJ Maxon etc, etc











#### GPS Receivers & TNC's for APRS

GPS is set to output NMEA data strings





# **Best Mobile APRS Solution**

- Kenwood TM-D700 & Garmin Street Pilot III color GPS or the AvMap G4T (GeoSat4).
- APRS activity appears on radio display
- APRS icons appear on certain GPS displays
- Radio still used for voice communications at same time as APRS

Kenwood radios can send/ receive messages & email









# Curt's Mobile APRS Solution

- Kenwood 2-meter FM mobile radio (\$140), Radio Shack DigiTraveler GPS (\$30), Opentracker-1 TNC (\$29).
- Transmits position with SmartBeaconing(tm). Better precision than Herb's setup.
- Firmware can be updated by user for free.
- No receive or messaging capability.
- Requires 2<sup>nd</sup> radio/antenna to do voice comms.
- Requires laptop plus different TNC in order to receive packets, perform map plotting or do messaging.



Note: Opentracker-2 is a better solution here.

# APRS using PDA's

PocketAPRS developed by Mike Musick N0QBF. Uses Palm OS but is no longer supported

- Truly portable station when combined with TH-D7A and a GPS
- APRSce is available for WinCE PDA's







# Miniaturizing Components

Desirable to reduce size and weight of tracker Great for Amateur Rocketry, Ballooning, Personal and SAR Dog tracking **Transmit-only TNC** MIM, Pic-E, TinyTrak, Tigertrak, PocketTracker OpenTracker, Tracker2, uTNC, etc (Tracker2 is transmit/receive/digi).







## APRS "WIDEn-N" Digipeaters

Integral part of an effective regional coverage system
Generally installed on remote mountaintops
Digis "relay" signals heard via UI packets
Use remote function for easy remote programming
Equipment: Radio, TNC, Antenna, Filtering solution
Currently about 75 WIDE's in NWAPRS Network





### Portable Trackers

- Self-contained with Radio, TNC, GPS, power
- Useful during SAR and public service events where asset tracking is important
- Build trackers applying KISS principle
  - One switch for ON / OFF
- Label the Tracker properly, to avoid confusion



#### Portable Trackers

GPS

**TinyTrak** 

Kenw ood

THD-7A

Standard H T

#### Herb's Ultimate Tracker: Kenwood TH-D7A HT with Garmin V GPS







## Portable Trackers

<u>Curt's Ultimate Tracker</u>: 5-watt handheld radio, OpenTracker2, Garmin mapping GPS.

This works as a tracker, an anti-tracker (plots other stations as waypoints on the GPS screen), and as a WIDEn-N digipeater.

With the addition of a PDA or laptop, this setup can do full 2-way mapping / messaging as well.



#### How an APRS Tracker Works

- GPS constellation of 24 satellites are continuously sending a time-synchronized signal toward earth.
- APRS Tracker is equipped with GPS receiver. Position is determined by comparing time it takes to receive the GPS signal from 3-12 satellites. The more the better for accuracy.
- Position sent to the tracker TNC and output as audio on APRS frequency.
- Nearby wide-area digi repeats signal across larger area/region.
- Receiving station running APRS plots and updates the object on map screen or GPS screen.

I-Gates feed info into Internet for servers like FindU, etc.





### GPS Selective Availability

Think of SA as a big control knob that affects the accuracy of the GPS signal

- SA turned off May 2nd 2000. Was 100m accuracy, now better improve 3-6m accuracy
- Accuracy has improved greatly since SA was shut down, this is especially useful in SAR applications



# **APRS** Applications

Routine station location reporting (aka for FUN!) See where Grandpa is in his RV (more FUN) Automated weather reporting Direction Finding hidden / rogue transmitters Severe Weather spotting and locating Public Event support Disaster Communications Support High-Altitude Balloon Tracking Amateur Rocket tracking Grid Square determination Keeping track of **SAR teams!** 


# Weather Reporting



Using the Peet Brothers, Davis, Radio Shack, Oregon Scientific, LaCrosse or other weather station connected to APRS, data can be transmitted to the entire network.

 Temperature, Wind Speed, Wind direction, Rainfall, Humidity, Barometric Pressure

The user can also manually enter:

- Temperature, wind speed, direction, rainfall

National Hurricane Center uses APRS

Over 60 WX stations on NWAPRS

Seattle NWS monitors APRS weather data



NWS also sends Weather Alerts to APRS



#### Severe Weather Spotting

#### The APRS operator can place :

- Tsunamis
- Tornadoes
- Thunderstorms
- Eruptions
- Flooding
- Watches
- Warnings
- Fires



As the status of the object changes, any operator on the network can update the position or status and have the results shown to all operators on the network.





### Direction Finding

![](_page_39_Picture_1.jpeg)

- APRS stations can transmit DF information that includes direction of the object signal from that QTH.
   Add objects which correspond to non-APRS stations
  - participating in the hunt.

#### These non-APRS stations of known location become part of the MAP that the

- entire network sees.
- Triangulation becomes possible. Every APRS station sees the bearings at the same time on the maps.

![](_page_39_Figure_7.jpeg)

![](_page_39_Picture_8.jpeg)

### APRS and Ballooning

Trackers used by balloon and ground crews to track progress of High-Altitude and Hot Air balloon experiments

- Typical High-altitude experiment sends balloon to 100,000 feet AGL, balloon bursts, drops package back to Earth under parachute
- Hot air balloonists can enjoy the ride/view while ground crew does the tracking
- Ground crew tracks balloon on APRS

![](_page_40_Picture_5.jpeg)

![](_page_40_Picture_6.jpeg)

### APRS and Ballooning

![](_page_41_Figure_1.jpeg)

This was an actual balloon flight a couple of years ago plotted on a TOPO USA map using the DMapper patch program.

![](_page_42_Picture_0.jpeg)

## APRS in Search & Rescue

Man/Dog portable trackers
Guide search/recovery efforts
"Visualizes" search picture for IC

![](_page_42_Picture_3.jpeg)

![](_page_42_Picture_4.jpeg)

Photo used with permission of GPS World magazine

![](_page_43_Picture_0.jpeg)

# SAR Dog Tracker Defined

SAR Dog equipped with APRS tracker
Position reports received at SAR Base
Dog (re)-trained to seek and stay
IC sees tracker stationary and sends
SAR searchers to investigate
APRS tracker radio can be used to talk with the victim/subject of the search

![](_page_43_Picture_3.jpeg)

![](_page_44_Picture_0.jpeg)

# APRS + SAR Applications

DMapper application, captures APRS data and auto imports to topographic map product.

- DMapper & ViewPoint+ are stop-gap fixes for previous lack of full-blown APRS/topo app.
- Topo maps supported include MapTech (2D, 3D & Photo Maps), National Geographic TOPO! Maps, and, DeLorme Topo Maps 2.0.
- DMapper & ViewPoint+ can be set up to obtain its RF feed from WinAPRS, Ui-View, or Xastir, then plot trackers on real topo maps.

Xastir: An APRS app with built-in mapping & SAR features. Supports 125 map formats.

![](_page_44_Picture_7.jpeg)

n the Public Interest

Public Service and E

Mason County Mock Search May '98

Was first Demo using APRS in SAR Activity

Article from CQ VHF Oct '98

![](_page_45_Picture_5.jpeg)

#### APRS Supports Search-and-Rescue Operations

Hams in Washington State demonstrated the immense value of the Automatic Position Reporting System in search-and-rescue missions, first in a drill and then for "the real thing." But old habits die hard…

The value of APRS (Automatic Position Reporting System) in search-and-rescue (SAR) operations was demonstrated last spring during the annual Mock Search in Mason County, Washington. The demonstration—given to the county's Department of Emergency Services, its Search-and-Rescue Organization, Sheriff's Department, and the Civil Air Patrol—was very successful, it and showed what can be done with a little planning and some help. (If you're not familiar with APRS, see "APRS & GPS Basics" elsewhere in this column.—ed.)

#### Getting Started...

Herb Gerhardt, KB7UVC, first heard about APRS a little over a year ago when he saw a demonstration at a local hamfest. After asking a few questions, Gerhardt, who was already involved in SAR saw an immediate practical use dur-

![](_page_45_Picture_11.jpeg)

Hams in Washington State demonstrated the potential value of APRS (Automatic Position Reporting System) during a Mock Search last spring. Here, volunteers and rescue officials gather at the base camp. (Photo by Steve Hiltbrunn, KC7NUD)

### WinAPRS + MC SAR Applications

![](_page_46_Figure_1.jpeg)

# WinAPRS + MC SAR Applications

![](_page_47_Figure_1.jpeg)

![](_page_48_Figure_0.jpeg)

![](_page_49_Figure_0.jpeg)

# Computer Mapping

#### as we do it now & how it could be with APRS

![](_page_50_Picture_2.jpeg)

![](_page_50_Figure_3.jpeg)

![](_page_50_Picture_4.jpeg)

#### ViewPoint+SAR Example

![](_page_51_Figure_1.jpeg)

### APRS for SAR support

![](_page_52_Figure_1.jpeg)

#### APRS & Topo Map Support via DMapper

![](_page_53_Figure_1.jpeg)

![](_page_53_Picture_2.jpeg)

# Xastir SAR Applications

imes XASTIR – X Amateur Station Tracking and Information Reporting @ VAIO

File View Maps Stations Messages Interfaces Help 🛛 TrackMe 🖾 Measure 🖾 Move 🛋 🛦 🝸 🕨 Zoom In Zoom Out

![](_page_54_Picture_3.jpeg)

### APRS in the Emergency Center

- WA, OR State EOC's online 24/7
   WA & OR County EOC's on the air 24/7
   APRS used to pass critical messages during Summer 2000 fire season and the Y2K non-event
- One more means of amateur radio service to the community
- Mason County EOC
   was the first full-time
   EOC on the air

![](_page_55_Picture_4.jpeg)

![](_page_55_Picture_5.jpeg)

#### Mason County Public Works Division of Emergency Management ComVan (KB7UVC-1) & Relay Truck

![](_page_56_Picture_1.jpeg)

### Locating Non-APRS objects

#### Users can place objects on maps

- Clue locations, team locations, SAR Base location, location of found individual, etc.
- Every user on the network sees the location of these objects and can update the location or status of the object.
  - Flooding and road closures
  - Disasters, Fires, Chemical spills
- Objects can be configured for local computer display or to be seen by the entire network.

![](_page_57_Picture_7.jpeg)

### APRS & Special Events

#### Winter Olympics

- 2000 ALA Big Ride Across America
- March of Dimes Walk-a-thons
- Annual Army/Navy Football Run
- Marathons nationwide
- MS-150 Bike Rides nationwide
- Vancouver Island Challenge
  - Road Rallies, Parades, and more

**Monitor SAR Team Locations** 

![](_page_58_Picture_10.jpeg)

### APRS Messaging Features

APRS "one liners" for point-to-point or point-to-group bulletins/announcements NTS format supported w/some applications Not primary purpose of APRS but has become an important integration tool: – E. WA firefighter updates were sent to WA EOC via APRS when other means failed Users can SEND internet email one-way via APRS console, routed by radio through iGate Two-way Email now also integrated with

WinLink and get notified on TH-D7 & D700

![](_page_59_Picture_2.jpeg)

### **APRS** Frequencies

#### VHF/UHF

#### - 144.39 MHz - USA & Canada primary VHF frequency

 144.35 MHz - East Puget Sound Area via various alternate digi's in Puget Sound Area (alt BALDI, etc)

- 441.825 MHz - 9600 baud used in Western WA area

No official National UHF frequency has been established

#### HF

- 10.151 LSB Active (10.147.50 USB)
- 7.085 LSB Not very active
- 28.350 USB Not very active
- No 6 meter frequency (yet)

![](_page_60_Picture_11.jpeg)

### **APRS** Satellite - PCSat

#### Launched Sept 2001

- Works great, esp. getting signals in from remote areas w/o regional VHF infrastructure
- Had many daily tracks over the PNW.
- Dying but still works during mid-day sunny passes.
- PCSat2 presently attached to ISS Uplink is 145.825 Downlink is 435.275

![](_page_61_Picture_6.jpeg)

#### PCsat Afloat Operations Test

TH-D7 APRS HT PalmPilot Satellite Tracking

CDR Chas Richards W4HFZ (CO) LTjg Brian Young KC5KLE ETCS Curtis Mathews N1FDW ENS Brian Scrabek PCsat design team

SSN-683

USS Parche SSN-683

John Glenn me Space Day 200

#### APRS and the WWW

Many positions and data distributed over radio are fed to internet servers. Any station can be located and tracked via the internet and your web browser.

#### APRS mobiles can SEND email. You can now also send/receive short email

![](_page_62_Figure_3.jpeg)

messages via the Winlink system by using APRS! Even non-Hams can now send you a short email to your Kenwood TH-D7 & D700 radios!

![](_page_62_Picture_5.jpeg)

# Future Plans..... The sky is the limit!

- International Space Station (ISS)
  - Dedicated APRS Station 2004
- ISS OK for APRS digipeating via ARISS or RS0ISS-3

• For more info see:

http://www.ariss.net/ http://www.issfanclub.com/

![](_page_63_Picture_6.jpeg)

![](_page_63_Picture_7.jpeg)

![](_page_63_Picture_8.jpeg)

### NorthWest APRS System

#### • Area of coverage

- Washington, Oregon, Idaho, Montana, Alberta, British Columbia and the NorthWest Territories
- Over one million square miles of territory
- Est. 75 WIDE digipeaters, all are traceable WIDEn-N compatible, primarily located near metro areas and primary lines of communication
- Always looking for new WIDEn-N locations
- WIDEn-N digipeaters all follow NWAPRS guidelines
- Web page and mailing list (www.nwaprs.info)
- Elmers across the region
- We all have fun! That is the main reason we play APRS.

![](_page_64_Picture_10.jpeg)

# NorthWest APRS (NWAPRS) url: http://www.nwaprs.info

#### NorthWest Territories

![](_page_65_Figure_2.jpeg)

# The "new" WIDEn-N Paradigm adopted here during May 2005

APRS Generic Paths evolved over 13 years and the presence of many old legacy formats and procedures were really bogging down the network making it saturated and unreliable in busy metro areas.

In 2005 all old paths (RELAY, TRACE, TRACEn-N & WIDE) were declared obsolete. The entire APRS system in North America was then changed to use WIDEn-N generic paths with small values of N.

A WIDEn-N path goes N hops outward in all directions. The n values should be equal except for 2-1

■ NWAPRS recommends a path of WIDE2-2 for home Stations and WIDE1-1, WIDE2-1 for mobile trackers.

![](_page_66_Picture_5.jpeg)

### APRS WIDEn-N Paradigm (cont)

<u>USER RECOMMENDATIONs</u>: Use WIDEn-N for fixed stations (where N is appropriate for your area). WIDE3-3 only in extreme cases. **WIDE2-2** Most everywhere else. For Mobile Stations use **WIDE1-1,WIDE2-1** 

If you operate special state or section nets, use WAn-N or ORn-N for your state or other specific areas.

![](_page_67_Picture_3.jpeg)

### NWAPRS Annual Gatherings

WinterGathering: 1 day in Winter, Western WA & other areasSummerGathering: 3 days early September, North Bend, WA

![](_page_68_Picture_2.jpeg)

![](_page_69_Picture_0.jpeg)

# APRS SAR Presentation Wrap-up

# **Questions?**

![](_page_69_Picture_3.jpeg)

Feel free to call us or email us:

![](_page_69_Picture_5.jpeg)

![](_page_69_Picture_6.jpeg)

Herb: hgerhardt@wavecable.com Curt: archer@eskimo.com 1700 to 17?? 2007 MicroHams Digital Conference including NW APRS Winter Gathering Wrap-up

Hope to see you all at our NW APRS Group Annual SUMMER GATHERING in North Bend, WA on Friday, Sept 7 through 9, 2007
Are there any questions?
Are there any comments?
Should we continue with this type of Winter Gathering?
Email comments to: hgerhardt@wavecable.com and Kenny Richards: richark@gmail.com

#### **THANKS FOR COMING!**

![](_page_70_Picture_4.jpeg)

Now please join us at 1830 at Roundtable Pizza for pizza and beer!

### It's time to relax with a beer! Please join us at Roundtable Pizza.

![](_page_71_Picture_1.jpeg)

![](_page_71_Picture_2.jpeg)

![](_page_71_Picture_3.jpeg)
## It's time to relax with a beer! Please join us at Roundtable Pizza.



## APRS Demo

## Feel free to ask questions!



## DMAPPER APRS Demo

Feel free to ask questions!

