RAMROD

Ride Around Mt Rainier a in One Day
RAMROD
Redmond Cycling Club
July 25, 2019
800 riders / 210 volunteers / 60 hams
150+ miles / 10,000’ elevation gain
1. What is RAMROD?
2. Amateur Radio’s Role at RAMROD
3. Voice Systems
4. Tracking Systems (RFID / APRS)
5. Data Processing & Command Center
6. Event Preparation
7. Data Network & RF Engineering
What is RAMROD?

A cycling ride, not a race
Well organized, highly technical event
A communications challenge
A unique way to enjoy a beautiful place
WHY IS RAMROD OF INTEREST TO EMCOMM RESPONDERS?

RAMROD presents conditions that closely mimic what we would encounter in a major disaster

- Difficult terrain that makes radio reception unreliable
- Poor or absent internet access
- Nonexistent cell phone service
- Spotty and unreliable amateur repeater facilities
- Active areas with many participants and high demand for our support
RAMROD Course

No Cell Or Internet
Amateur Radio’s Role at RAMROD

Situational Awareness
Cyclist Tracking
Resource Tracking
Incident Response
Communications for Logistics
Voice Systems
Voice Systems

Command Network

Five FM repeaters, linked with AllStar VoIP provide contiguous mobile coverage around course.

- 3 Sisters, Eatonville, Paradise, Ohanapecosh, Crystal

Monitored continuously by:

- RAMROD command center
- Event Director
- Operations Chief
- Division Net Controls
Voice Systems - Command Net
Division Simplex Nets

The course has six divisions [A-F], each with their own simplex frequency.

Each Division Lead runs a Division Net Control.

Checkpoints, SAG vehicles, mechanics and other event vehicles in the section are under the control of the Division Lead and operate on the Division Simplex.
Voice Systems - Division Simplex Net
Tracking Systems
RFID Tracking System:
Tracks 800 cyclists as they pass through 8 checkpoints.

APRS Tracking System:
Tracks 15+ key vehicles around the course: Operations Chief, SAGs, Mechanics, Ambulances.
APRS plays a crucial role

Tracked Objects:

- Ambulances
- Repair Vehicles
- SAG Vehicles
- Operations Lead & some Ham assets

Monitored at command and field stations

RFID Field stations and Start/Finish provide digipeating and beacon rider counts
APRS Client Software

- APRSIS32 - Free (but not open source)
- Plots APRS positions on the map display
- Courses and positions can be customized with tactical names and locations
- Maps are automatically downloaded from the internet, no need to manually identify, find and download maps
- Will accept positions either over the internet or via RF
- Capable of being used effectively in the field without internet access (cached maps)
- Easy to understand and operate
RAMROD S762 E672 N762 B761 C749 D688 G395 F288
RAMROD Start/Finish WR5J
power 25W, antenna HAAT 20 ft, gain 7 dBi omni, range 10.0 miles
[APWW10 via TCPIP*,qAC,T2STRAS]
being tracked · stop tracking · track in Street View
RAMROD S762 E672 N762 B761 C749 D688 G395 F288
RAMROD Start/Finish WR5J
power 25W, antenna HAAT 20 ft, gain 7 dBi omni, range 10.0 miles
[APWW10 via TCPIP*,qAC,T2STRAS]
being tracked · stop tracking · track in Street View
RFID Tracking of Cyclists

- **Awareness** - Rider count is crucial for positioning resources near bulk of riders on course
- **Rider safety** - tracking of riders overdue at successive check points
- **Provides progress information to participants and their friends/family**
Why the need for a custom software application

- Reliable data gathering
  - Filter out non-RAMROD RFID tags
  - Automate sequentially numbered filing
  - Control of the RFID reader connection
- Operator access to rider info & checkpoint crossings
- Automation to reduce operator fatigue
- Ability to add capability in the future
RFID Software

- Custom Java Applications
  - Data collection client at checkpoints
  - Data aggregation server
  - SQL for data management
  - Reporting
- Winlink for file transport
- Custom Web App for public access
10:22:20 --- 2 manually entered riders at 705 Alexander Wilson
706 Muse Vianney

Check point totals for APRS transmission:
S007 N000 B000 C000 F000
Typical RFID Station Hardware Configuration

915 MHz Nominal

RFID Tag

Interrogate Backscatter

Impinj RFID Reader

ASCII Tag Data

Acquisition Computer
SQLite Database

Manual Bib # Entry

Ethernet Router

DATA_RAMROD_2018-NIS-165339-0034-006.csv
0026, 453, RFD, 165135
0027, 042, MAN, 165202

Winlink Computer

Rider Group Data
Return Data Package

Pactor Modem

Transceiver
Data Processing and Command Center
### RAMROD Rider Search App 2018

**Enter Bib# or Last Name:** Smith

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<th>Eatonville</th>
<th>Deli Stop</th>
<th>Greenw...</th>
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</table>

### RAMROD RFID Checkpoint Totals

**Check Point:** startx eatony nisquily backbn cayuse delixx greenw finish

**Rider Count:** 726 672 745 761 766 721 641 758

**Update Time:** 19:37 09:57 16:53 17:03 17:28 18:12 19:12 20:26

**APRS Format:** S726 E672 N745 B761 C766 D721 G641 F758
Rider Status

Friends and families of riders can see the last check point recorded for their cyclist during the event.

RAMROD provides active tracking of its participants for the safety and well-being of riders. This information is used by the safety team to know where riders are located out on the course, and to know when section of the course are clear of riders. Tracking stations are set up to monitor the Start Line, the Park Entrance, Backbone Ridge, Cause Pass, and the Finish Line.

Family and friends can check on the status of a rider during the event. Enter the Bib Number and the Last Name of the cyclist and you'll be shown what section of the course the rider is currently on as well as the time the rider went through the last tracking station.

Enter the bib number of your rider: 1

Enter the last name of your rider: PAVLIN

Check Rider Status
Rider Status
Friends and families of riders can see the last check point recorded for their cyclist during the event.

RAMROD provides the following information to friends and family looking to check on the progress of a given rider:

Rider Name: Ed Pavlin
Rider Bib Number: #1
Last Checkpoint: Finish Line - 154 Miles
Last Checkpoint Time: 7:32 p.m.
<table>
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<td>6:02 p.m.</td>
<td>Greenwater River Bridge</td>
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<td>4:30 p.m.</td>
<td>Deli Stop</td>
<td>116 Miles</td>
<td>Through Checkpoint</td>
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<td>4:13 p.m.</td>
<td>Cayuse Pass</td>
<td>108 Miles</td>
<td>Through Checkpoint</td>
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<tr>
<td>2:54 p.m.</td>
<td>Backbone Ridge</td>
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<td>Through Checkpoint</td>
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<td>10:01 a.m.</td>
<td>Nisqually Park Entrance</td>
<td>62 Miles</td>
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<td>7:01 a.m.</td>
<td>Eatonville Food Stop</td>
<td>36 Miles</td>
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<td>4:28 a.m.</td>
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<td>Through Checkpoint</td>
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<td><strong>Finish Line - 154 Miles</strong></td>
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<td>C</td>
<td>D</td>
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Post Analysis Results examined with SQL scripts and Open Office Calc

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### Checkpoint Counts by Status

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<td>147</td>
<td>126</td>
<td>98</td>
<td>48</td>
<td>35</td>
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</tbody>
</table>
Riders are tightly bunched near start (~3 hours spread)
Riders spread out later in the ride (~6 hours)
Automating RFID Stations

2 experiments run during 2018

- Yagi system
- Panel system (2)
Greenwater Automated Reader
Data Transport
Network and
RF Path Engineering
Data Transport Technologies

Narrow Band:
  Winlink over HF (Winmor/Pactor)
  FLDigi over VHF (For local relay)

Broadband:
  HamWAN
  4G/LTE
  Commercial Internet
Cayuse Pass
Example
RAMROD RFID “CAYUSE PASS”
2017 DATA FLOW AT CAYUSE PASS
2017 DATA FLOW AT CAYUSE PASS

RFID → Data Collection → FLDigi PC → VHF
2017 VHF TO HF RELAY SITE
RAMROD RFID “CAYUSE PASS”
4700’ ELEV. PASS BETWEEN MOUNTAINS

RFID checkpoint
HF relay site
RFID checkpoint
2017 RAMROD CONTROL

Data from Cayuse Pass → Winlink → HF Radio → Pactor → Winlink PC → RFID Data Aggregation PC → Cyclist Checkpoint Report
2017 ISSUES

- VEHICLE NOISE AT CAYUSE FORCED A REMOTE HF SITE.
- DATA TRANSFER FROM CAYUSE TO HF SITE WAS AN EXTRA STEP.
- LATENCY IN GETTING DATA FROM CAYUSE TO RAMROD HQ 30 TO 90 MINUTES.
- LACK OF VOICE COMMS BETWEEN CAYUSE RFID AND RAMROD HQ.
- NO SITUATIONAL AWARENESS AT CONTROL RE WHAT’S GOING ON OUT IN FIELD.
In 2017, a new VHF FM repeater was put on the air at Crystal Mountain to provide Voice Command Channel coverage for RAMROD at Cayuse Pass and area. It needed an IP connection to support AllStar VoIP linking to 4 other repeaters which are used to cover the entire RAMROD course. A HamWAN client radio was installed at Crystal and linked to Baldi.
Crystal Mountain

Crystal Mountain is home to a Ski Resort, with relatively easy access to the peak via tramway, or vehicles with prior approval.

Elevation is 6780’ and the site has a path to Baldy, enabling HamWAN IP Connectivity which is used for the Crystal repeater (Allstar).

However, the path from Cayuse to Crystal is 5 miles and not line of sight.
2. HamWAN All The Way

Somewhat ambitious, but it would enable several megabits of connectivity at Cayuse Pass.

This could enable other types of communications. Web Camera, VoIP Phone, APRS-IS gateway etc.

Use existing HamWAN link to Crystal, then bound through Sunrise to aim into the valley/pass at Cayuse.

Potentially leaving the radio at Crystal year to year would simplify setup, and enable access at Sunrise for other events and purposes. (Contesting)
2. HamWAN All The Way

Baldy to Crystal

Crystal to Sunrise

Sunrise to Cayuse
Spring Road Opening
Sunrise Peak…
Any guesses where Crystal Mountain is?
Choosing a different location

Sunrise

X

Rock Crusher Corner

Crystal
Sunrise Repeater to Cayuse
HAMWAN REPEATER...
SOLAR RADIO TRAILER WITH 20’ MAST
THIS IS HAPPY RANDY WITH 5 BARS OF SIGNAL
CHECKPOINT DATA APPLICATIONS

- Data Collection PC
- HD IP Camera Streaming w/ sound
- WinLink PC
- HamWAN
- IP Phone
Event Preparation
RFID Operations Timeline for Cayuse - Not Start Finish - See Start Finish Tab

**Weeks in Advance**

Assemble Volunteer Team - Knowledge of Data Acquisition and DB Apps - Digital Radio and Antennas/Reliability and Flexibility - Use Main RAMROD Volunteer System

Test Software, Hardware, Update Firmware in Readers and Modems and Load Computers

Test Radio Links, Control Software, Connections to Computers, Networks - Coordinate Use. Possible coordinate with RMSGateway Operators

Assemble Equipment and Organize (Supports/Shelters/Food/Safety Equip/Comfort/Hydration 12v/Radios/Feedlines/Antennas/Antenna Supports/Mesh Networks

Provide Overview of Activities EMAIL to Team

**Days in Advance**

Team Trainings - Saturday June 10 (Before FD) and/or Saturday July 1 at South Seattle, WA 98106 - Open field at SE corner of campus near Olympic Hall

Ham Volunteer Meeting at Fran’s 4pm 7065 121st Place SE, Newcastle 98056 - Final IO

Team Leads pickup T-Shirts for Team members

Check Solar Flux and update WinlinkExpress RMSGateway station list - Same thing day

Begin Load Out Vehicles

Curt sends to teams updated Frequency Plan (ICS205) and Planning Spreadsheet (this is a possible Dropbox distribution)

**Mobe Day - Wednesday Before Ride**

Load Theft Prone/Valuable Items in Vehicles - Computers/Readers/Modems/Radios - C
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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</thead>
<tbody>
<tr>
<td>26-Jul</td>
<td><strong>Thursday - Day of Ride</strong></td>
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<td></td>
<td>All TEAMS - Work Safely, Drink Plenty of Fluids, TAKE LOTS OF PHOTOGRAPHs of YOUR TEAM. Access Your Inner Happy Ham</td>
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<td>Learn all you can from each other, Record all observations/suggestions/thoughts on the operation. Rotate Jobs to the extent possible. Please cross train - you may be on different teams next year</td>
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<tr>
<td>0300AM</td>
<td>Start/Finish Initial Team Members Up and Cleanup for a 0400 departure</td>
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<tr>
<td>0415AM</td>
<td>Have Start Line Readers and Tag Verification Test Station operational - begin Voice PA announcement test. Test Reads of tags to confirm software functionality - start line music and announcements begin</td>
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<tr>
<td>0800AM</td>
<td><strong>Cayuse Pass Teams</strong> <em>Mobe to Cayuse Pass - 1 hour drive from Enumclaw</em></td>
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<td>8:00am</td>
<td>Cayuse Pass Team leaves for Cayuse Pass RFID Station Setup from Enumclaw - Set Up 2 signs (of 6) at Pass</td>
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<tr>
<td>9:00am</td>
<td>Cayuse Pass Sub-Team moves down 123 for setup 2 signs (Bicycle Rally - Pass Safely on 123 just before Cayuse Pass - Caution at Stevens Canyon Entrance toward Paradise west bound) Start/Finish Truck or Cayuse Truck</td>
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<tr>
<td>9:30am</td>
<td>Cayuse Team Begins Setup - Start with Shelters - Refer to site diagram - Cayuse Team Lead is Overall Manager for all operations</td>
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|   | Meet 3 non-Ham Volunteers - have them deploy the Cayuse Pass Signs and setup Water Station XXXZ
ZZZZZZ |
|   | Setup Power Distribution for reliable power of Cayuse Station and Readers - 12 V Supply and Dist/Adapter Cable for Charging |
|   | Test Cayuse Data Reader and Laptop with test RFID Tags |
|   | Test Data Acquisition and Database App and confirm Tag Numbers Read and written to file in format - check that time is correct |
LESSONS WE HAVE LEARNED FROM EXPERIENCE

- Value of higher speed data networks
- Winlink systems using RF have volume limits and are at risk of human error
- Regional division of leadership is more effective in this environment
- Centralized Net Control is ineffective in this environment
- APRS is a highly useful tool for tracking mobile assets
- APRS assures more accurate position finding for incident response
- Video feeds are helpful to RAMROD management
- Video has potential for role publicity and community engagement (onsite displays, network streaming)
Questions?

To Volunteer Contact:
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