

# On the Right Track with APRS

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Canards West  
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# On the Right Track with APRS

- Tracking Systems for Aircraft
- APRS and How it Works
- Get your Amateur Radio License
- Equipment Overview
- Example Tracks
- Questions

# Tracking Systems for Aircraft

- Why would you want to track your plane?
  - Family & Friends want to know:
    - Where are you?
    - How long until you get there?
    - Are you safe at the hangar?
    - Are you stuck somewhere and need help?
  - Historical tracks of where you have been
  - Geo-tag pictures you've taken
  - Racing data or flight-test telemetry

# Tracking Systems for Aircraft

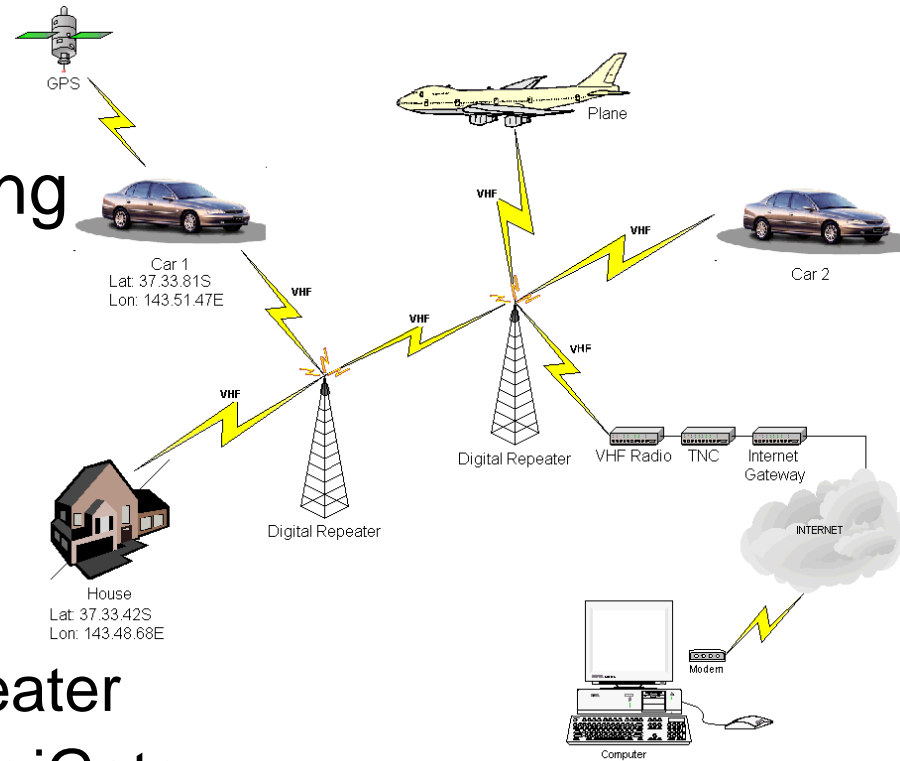
- SPOT Satellite Messenger
  - Uses the Globalstar Satellite Network
- SpiderTracks
  - Uses the Iridium Satellite Network
- Smartphone
  - iPhone, Android using GSM & other networks
- GPS Tracks
  - Not capable of live tracking
- APRS
  - Amateur Radio Based network

# Tracking Comparison

	SPOT	SpiderTracks	Smartphone	GPS Track	APRS
Initial Cost	\$100	\$1000	\$0 - \$500	\$50 - \$\$\$	\$100 - \$200
Subscription Cost	\$100 / yr	\$15 - \$85 / month	~\$50 - \$150 / month	N/A	N/A
Live Tracking	YES	YES	NO	NO	YES
Update Rate	10 min	2 min	~ continuous	N/A	1-2 min
Emergency Notification	YES	YES	NO	NO	MAYBE

# APRS and How it Works

- Automatic Packet Reporting System
  - Need “Automatic Position Reporting System”
- Network Topology
  - Transmitter
  - Packet Repeater or Digipeater
  - APRS Internet Gateway or iGate
- Data
  - Position/Object, Status, Message



# Get your Amateur Radio License

- Technician Class License
  - Entry-level amateur (ham) radio license
  - Required to operate a transmitter for APRS
- Step 1: Get an FCC Registration Number
  - <http://wireless.fcc.gov/uls>
- Step 2: Study
  - 35 Question Exam, 392 Question pool
    - <http://www.ncvec.org/downloads/Revised%20Element%202.Pdf>
  - Available Study Guides
    - Gordon West, “Technician Class 2010-2014”
  - Online Practice Exams
    - <http://www.qrz.com/exams>
- Step 3: Take the Exam
  - Find an exam location & time near you
    - <http://www.arrl.org/getting-your-technician-license>
  - Score a 75 or higher

# Can I Operate Without a License?

47 CFR 97.221 - Automatically controlled digital station.

(a) This rule section does not apply to an auxiliary station, a beacon station, a repeater station, an earth station, a space station, or a space telecommand station.

(b) A station may be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the 28.12028.189 MHz, 24.92524.930 MHz, 21.09021.100 MHz, 18.10518.110 MHz, 14.095014.0995 MHz, 14.100514.112 MHz, 10.14010.150 MHz, 7.1007.105 MHz, or 3.6203.635 MHz segments.

(c) A station may be automatically controlled while transmitting a RTTY or data emission on any other frequency authorized for such emission types provided that: (1) The station is responding to interrogation by a station under local or remote control; and (2) No transmission from the automatically controlled station occupies a bandwidth of more than 500 Hz.



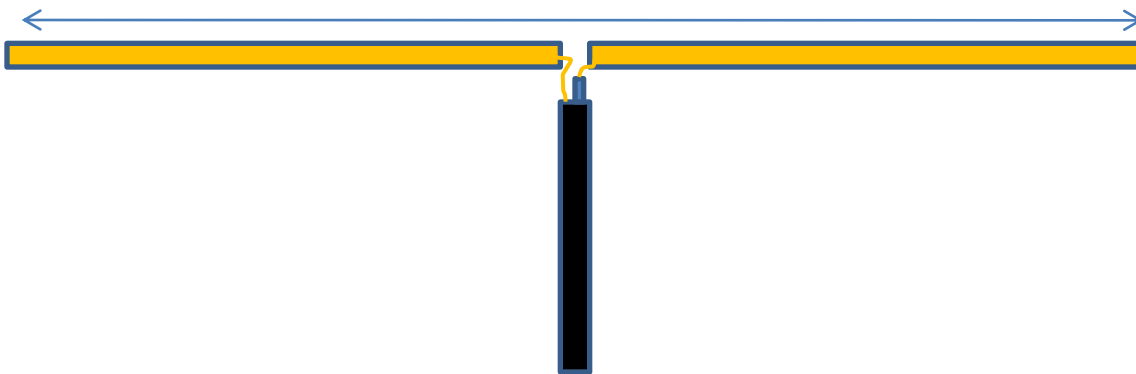
# Equipment Overview

- GPS
  - Use one already in your plane
  - Install a separate GPS for APRS
- TNC – Terminal Node Controller
  - The “modem”
- Transmitter
  - ~1-10W transmitter
  - Operating on 144.390 MhZ (US)
- Antenna
  - Dipole or whip antenna
- Suppliers
  - [www.byonics.com](http://www.byonics.com)



# Dipole Antenna

- Similar to Nav & Comm
- Foil tape & Co-axial cable
- $l = 143 / f$
- $f_{\text{APRS-US}} = 144.390 \text{ MHz}$
- $l = 0.988 \text{ m} = 3' 2 \frac{29}{32}''$



# Example Tracks

- Example Tracks
  - <http://aprs.fi>
  - <http://www.mail2600.com/cgi-bin/everyone.cgi>
  - <http://www.findu.com/>
- Providing Links
  - Replace “NOCALL” with your callsign
    - <http://aprs.fi/NOCALL>
    - <http://www.mail2600.com/cgi-bin/position.cgi?call=NOCALL>

# http://aprs.fi

The screenshot shows a web browser window displaying the Google Maps APRS interface. The address bar shows the URL: `aprs.fi/?addr=Columbia%2C%20CA&mt=roadmap&z=11&timerange=3600`. The browser's address bar also shows several open tabs, including Gmail, San Francisco Bay Area, West Valley Flying Club, CNN, craigslist, Sundial Moto Sports, and VAF Forums.

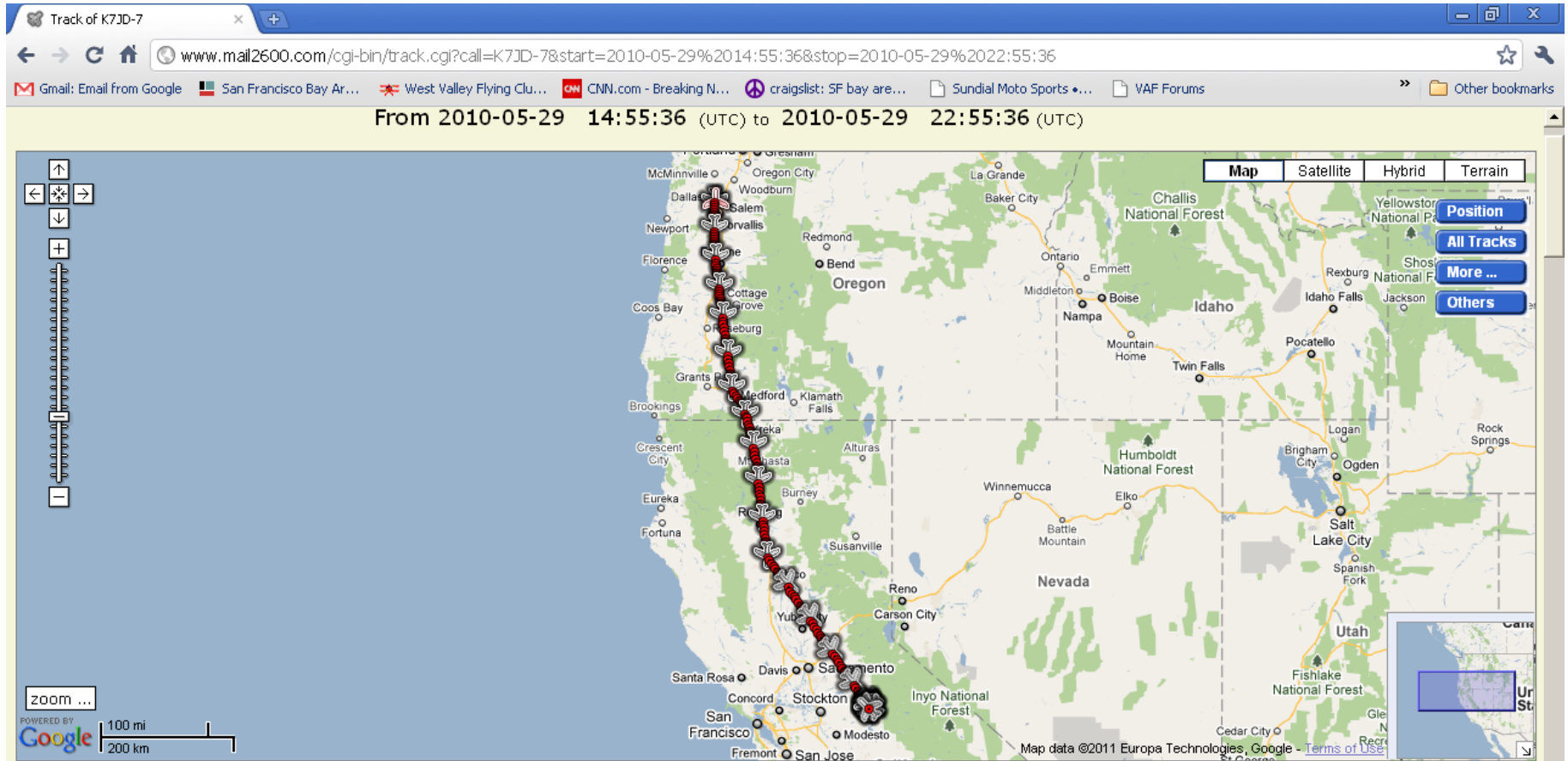
The main content area is a map of Columbia, CA, USA. A popup window is displayed over the map, showing the location details: **Columbia, CA, USA**, Latitude: 38°2.18' N, Longitude: 120°24.08' W, and a [Delete](#) button. The map shows various APRS stations marked with call signs such as **KF6NY**, **CW9085**, **CW0887**, **N6FRG-2.A**, **CW8746**, **K3UG**, **K6TU0-3**, **KD6EUG-3**, **CW3161**, and **DW2740**. The map also displays major roads like Highway 49, Highway 108, and Highway 120, as well as geographical features like Lake Mendocino and the Sonora Pass Hwy.

On the right side of the map, there is a sidebar with the following content:

- aprs.fi · Login**
- Found: **Columbia, CA, USA**
- Show last: 1 hour
- Track callsign: [Clear / Show all]  Search [?]
- Address, city or Locator: [Clear] Columbia, CA Search [?]
- Wx: 56.8°F 59% 1015 mbar 2.1 MPH SW
- Other views:**
  - Station info
  - Raw packets
  - Status packets - Beacon packets
  - APRS/CWOP weather - Telemetry
  - Messages - Bulletin board
  - Prefix browsing
  - Google Earth KML [?]
  - Data export tool
  - Preferences - My account
- Information:**
  - APRS stations currently moving · User guide (new!) · FAQ · Blog · Discussion group · Linking to aprs.fi · AIS sites · Service status · Database statistics · Advertising on aprs.fi · Technical details · API · Change log · Planned changes · Credits and thanks · Terms Of Service
- idle
- What's up on aprs.fi

The bottom of the browser window shows the Windows taskbar with the Start button, several application icons, and the system tray displaying the time as 11:15 AM.

# Joe Dubner's Trip to Columbia Last Year



Click on any of the markers (icons) or Date/Time links for a position report.

Date/Time (UTC)	Latitude	Longitude	Course (degrees)	Speed (MPH)	Altitude (feet)
<a href="#">2010-05-29 14:55:36</a>	44.8643° N	123.1923° W	64°	0	---
<a href="#">2010-05-29 15:01:20</a>	44.8670° N	123.1977° W	359°	12	173'
<a href="#">2010-05-29 15:06:10</a>	44.8710° N	123.1982° W	201°	13	177'
<a href="#">2010-05-29 15:07:11</a>	44.8522° N	123.1983° W	179°	107	692'

# Questions