Aviation Data Monitoring

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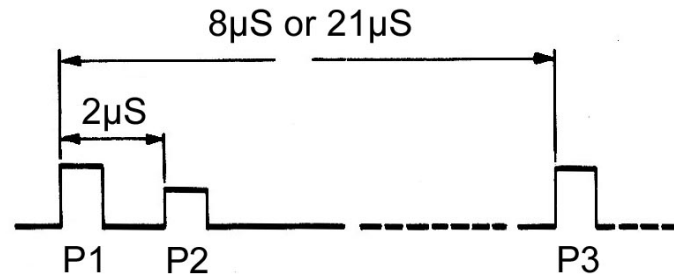
Secondary Surveillance Radar (SSR) modes

Military/Civilian Modes
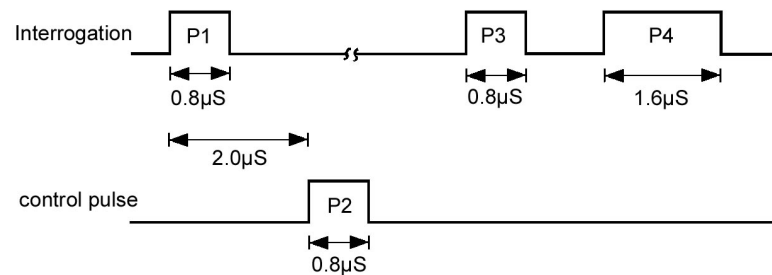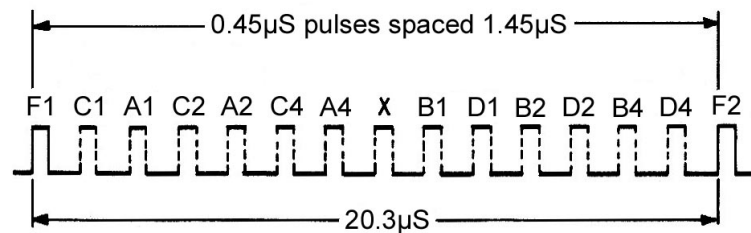
1   2-digit 5-bit mission code

2   4-digit octal unit code

3/A   4-digit octal ID (4,096 Squawk codes)

3/C   altitude in 100' increments

4   pulse coded challenge/reply (IFF subset)

5   cryptographically secured Mode-S

S   ADS-B data

SSR

Mode 3A/3C interrogation

Mode 3A/3C reply

Mode S all call

SSR

Mode 3A/3C control unit

ADS-B (Automatic Dependent Surveillance-Broadcast)

Part of Next Generation Air Transportation System (Must have by 2020 to fly in US)

Replaces radar for air surveillance

Ground unit pings commercial aircraft at 1030 MHz (L-band), general aviation @ 978 MHz

Aircraft responds at 1090 MHz with ID, GPS location, speed, altitude, …

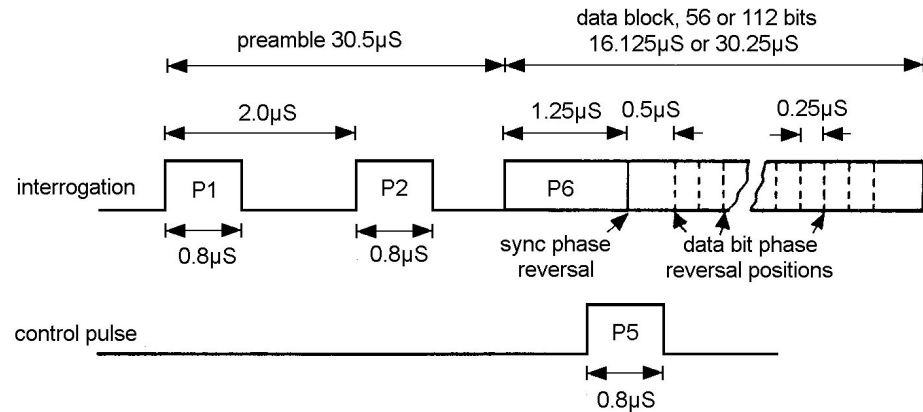# ADS-B (Automatic Dependent Surveillance-Broadcast)

Rotating directional ground antenna

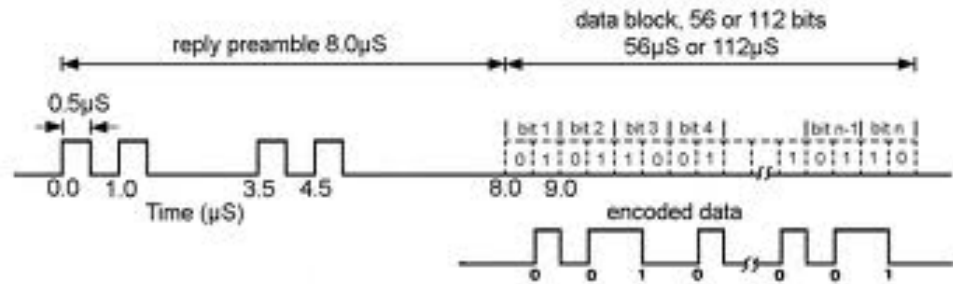Fixed omni-directional antenna also used

ADS-B (Automatic Dependent Surveillance-Broadcast)

Mode-S interrogation

Mode-S reply

ADS-B (Automatic Dependent Surveillance-Broadcast)

Response - Extended Squitter (ES):

  Pulse position modulation (PPM)

  Data Format - 5 bits

  Capability (message type) - 3 bits

  ICAO address - 24 bits

  ADS-B data - 56 bits

  Parity - 24 bits

  Re-sent at 1-Hz rate for a period

ADS-B (Automatic Dependent Surveillance-Broadcast)

How to monitor air traffic:

   Antenna - vertically oriented collinear array

   Receiver - RTL-SDR, scanner, HT, ...

   Decoder/display - PC soundcard

   Web - Flightradar24.com, radarbox24.com
             crowd-sourced ADS-B data

ADS-B (Automatic Dependent Surveillance-Broadcast)

Software:

   PC:

      RTL-1090, ADSB#

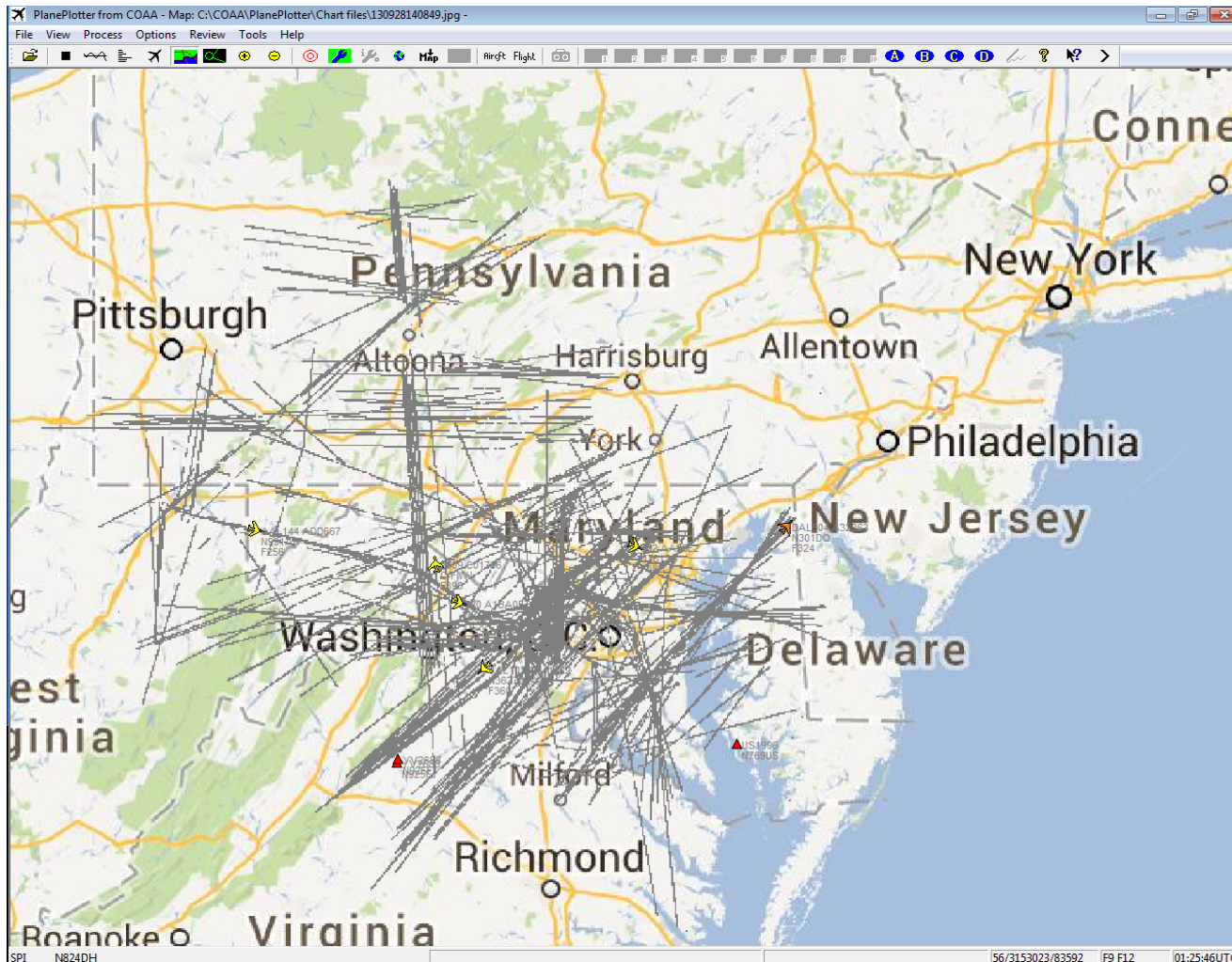   Planeplotter, Virtual Radar, ADSB Scope

   Linux:

      Dump1090

      GNU Radio

   Mac:

      Cocoa1090

ADS-B (Automatic Dependent Surveillance-Broadcast)

ADS-B (Automatic Dependent Surveillance-Broadcast)

In the news:

Defcon 20 RenderMan presentation

9/11 hijackers turned off transponders

ACARS

Aircraft Communications and Reporting System

Formatted and free text air/ground link

US VHF Frequencies:

131.550	Primary Channel worldwide
130.025	Secondary channel for USA and Canada
129.125	Additional channel for USA & Canada
130.450	Additional channel for USA & Canada
131.125	Additional channel for USA
136.700	Additional channel for USA
136.800	Additional channel for USA

ACARS

Receiver array

ACARS

AM modulated MSK @2400 bps 1,200Hz & 2,400Hz tones

Messages < 220 characters, tail number first

~ 100 message types

Messages may contain free text or formatted data

ACARS

Software:

PC:

acarsd (combines up to 8 radios)

PlanePlotter

Mac:

MultiMode

Linux:

acarsd