



Technical presentation of VDL Mode 4 for General Aviation



EGOA – Enhanced General Aviation Operation by ADS-B



Disposition

- Applications

- *ADS-B*
- *FIS-B*

- Data link

- *VDL Mode 4*

- Equipment

- *VDL Mode 4 Transceiver/Com radio*
- *Cockpit display*
- *Ground station*
- *Ground network*
- *Ground presentation equipment for flight clubs, flight schools etc*
- *ATC TWR presentation equipment*



Applications

- ***ADS-B***

Automatic Dependent Surveillance - Broadcast

- ***FIS-B***

Flight Information Service - Broadcast



ADS-B

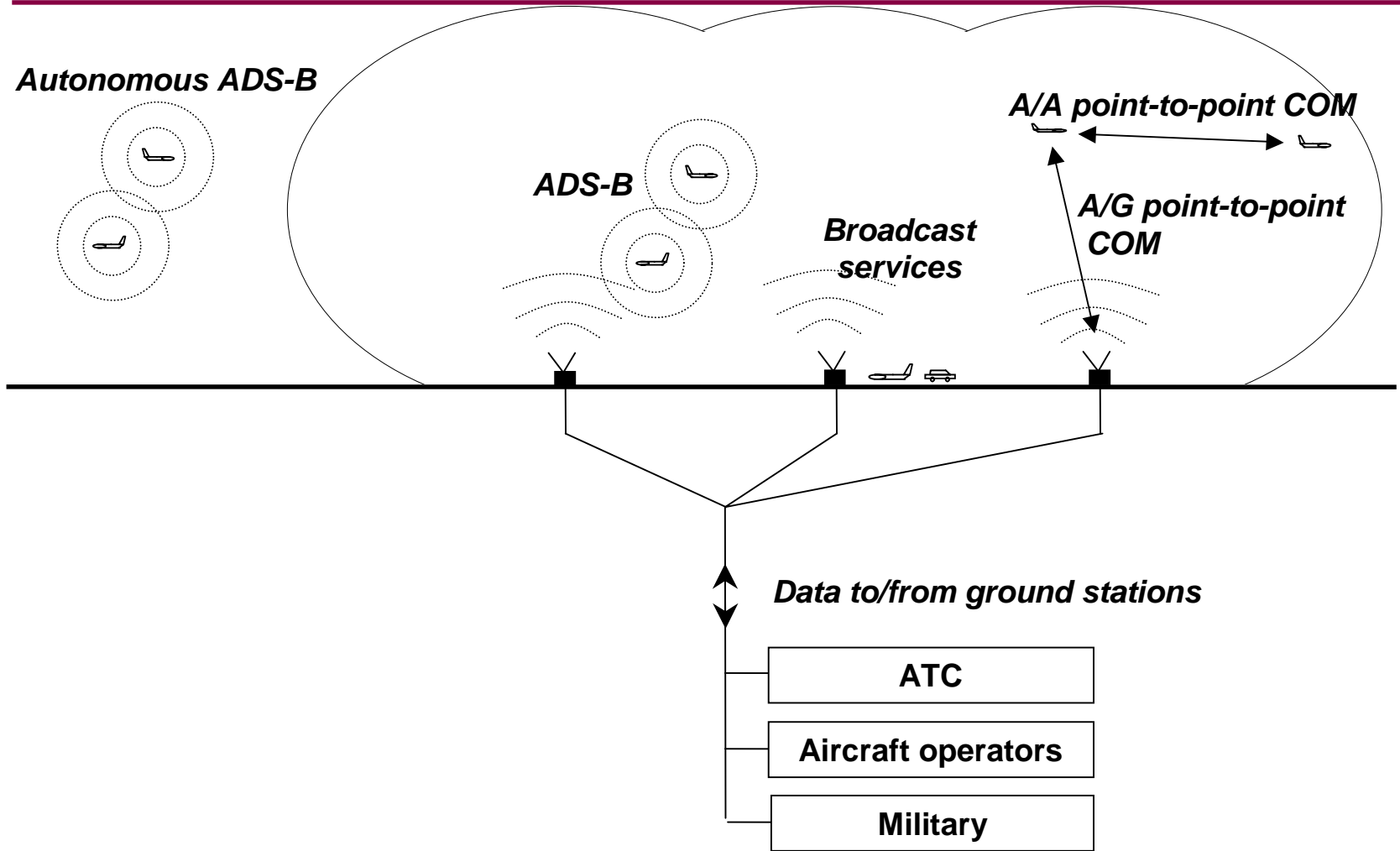
Automatic Dependent Surveillance – Broadcast

Fundamental idea: "To see and be seen"

- Automatic, i.e. the system requires no external stimulus to elicit a position transmission.
- Dependent, i.e. the system is dependent on on-board equipment to find own position and to transmit it.
- Broadcast, i.e. all equipped surrounding users are able to receive the information.



ADS-B





ADS-B

How is the information used?



In ATC/TWR



In aircraft
cockpit



ADS-B and Radar

What information is included in a radar report?

- Position
(Bearing and distance)
- Identity
(non-unique four digit code)
- Altitude
(barometric altitude, from pressure altimeter)



ADS-B and Radar

What information is included in an ADS-B report?

- Position
(latitude and longitude, accuracy better than 100 m)
- Identity
(unique ICAO code)
- Altitude
(barometric or geometric altitude)

→→→ to be continued →→→



ADS-B and Radar

What information is included in an ADS-B report?

- Ground speed
- Ground track
- Climbing/descending
- "Accuracy category" for positionen (nucp)

...and more...



FIS-B

Flight Information Service – Broadcast

Purpose:

To provide cockpit with airport specific information, such as current weather conditions, runways in use etc (ATIS, NOTAM)



FIS-B

Flight Information Service – Broadcast



In cockpit →



Data link

What is VDL Mode 4?

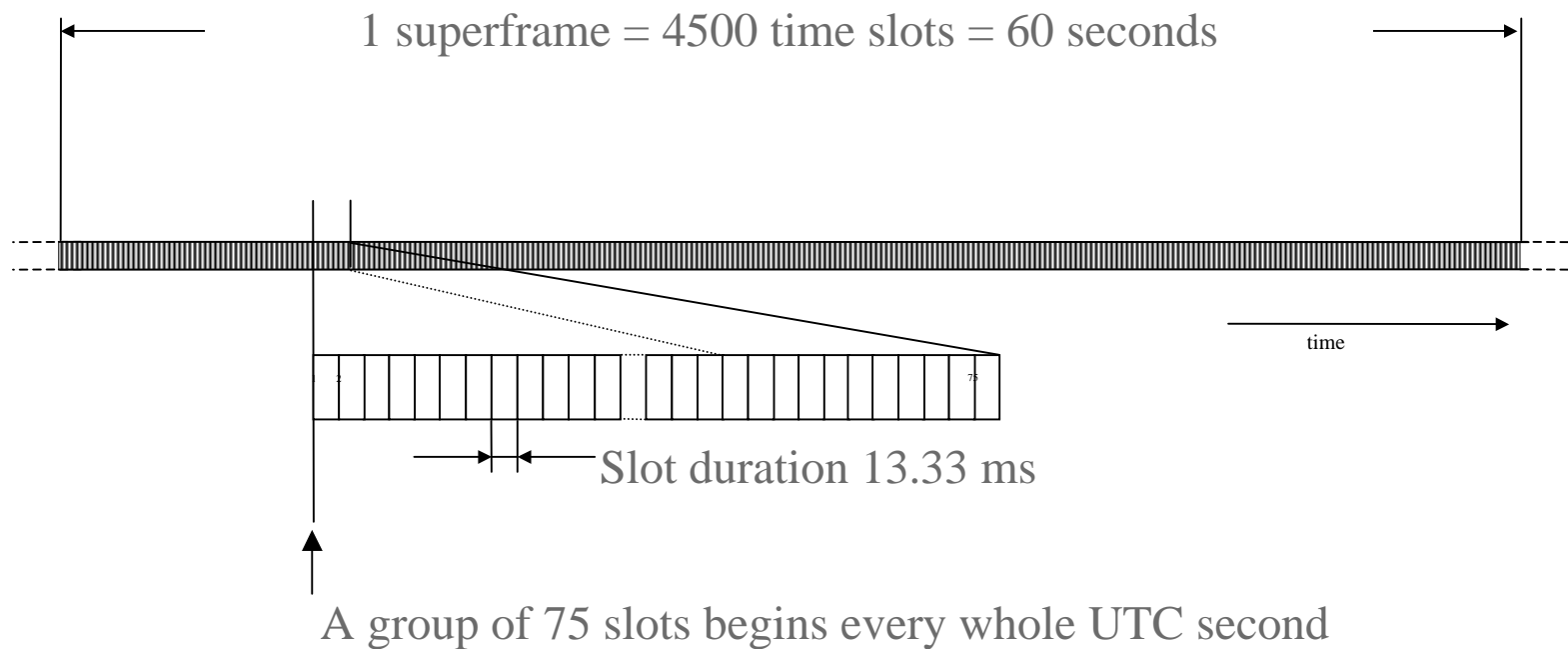
- Wireless data link
- Based on STDMA, invented by Håkan Lans



VDL Mode 4

STDMA

- Self-organising Time Division Multiple Access





VDL Mode 4

Self organizing

- Does not need a ground network to establish communication (i.e. can communicate aircraft to aircraft)...
- ...but a ground network can provide extra functionality



VDL Mode 4

Performance

- Bandwidth 25 kHz
- Baudrate 19 200 bits/s
- Frequency band 108.00 - 136.975 MHz
(Air VHF band)



VDL Mode 4

Summary

- VDL Mode 4 – Wireless data link
- Self organizing
- No risk for overload
- Can handle organized broadcast
- Can handle Point-to-Point communication
- No obligation to have a ground infrastructure



Equipment

Hardware

- VDL Mode 4 Transceiver/Com radio
- Cockpit display
- Ground station
- Ground network
- Ground presentation equipment for flight clubs, flight schools etc
- ATC TWR presentation equipment



Transceiver

Current transceiver





Transceiver

New GA transceiver: GP & C, EFR420



- Two-way voice and data communication (VDL Mode 4)
- Voice: 25/8,33 KHz bandwidth, 118,000-136,975 MHz
- Data: 25 KHz bandwidth, 112,000-136,975 MHz



Transceiver

Short facts: GP & C, EFR420

- Three receivers, one transmitter
- Possible to connect external display
- Current draw during transmit <6 A at 13,75 VDC
- Current draw during receive $<0,6$ A at 13,75 VDC
- Connections: BNC for VHF antenna, TNC for GPS antenna, 9 pin DSUB for power supply, 25 pin DSUB for other signal (such as altimeter, cockpit display)





Transceiver

Display (add-on, not default)

Display such as PalmOS5/PocketPC supporting ADS-B and FIS-B. Software to communicate with transceiver and zoomable maps with "moving map" function.

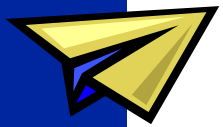




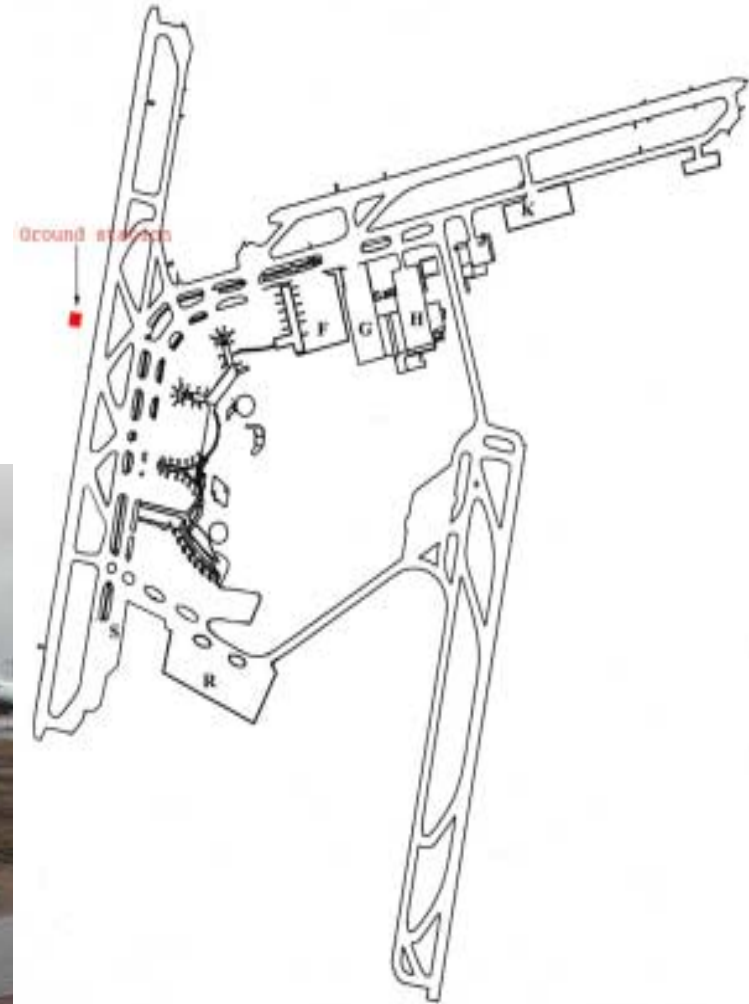
Ground station

4 ground stations placed at:

- Norrköping airport
- Skavsta airport (Nyköping)
- SAAB airport (Linköping)
- Malmen military airport (Linköping)



Ground station





Ground station

Inside ground station

- VHF transceiver
1 transmitter, 2 receivers
- GNSS unit (GPS)
- Time Reference System
- Data Management Subsystem (DMS)
Processes ADS-B-data and other services such as FIS-B
- Power supply and back-up

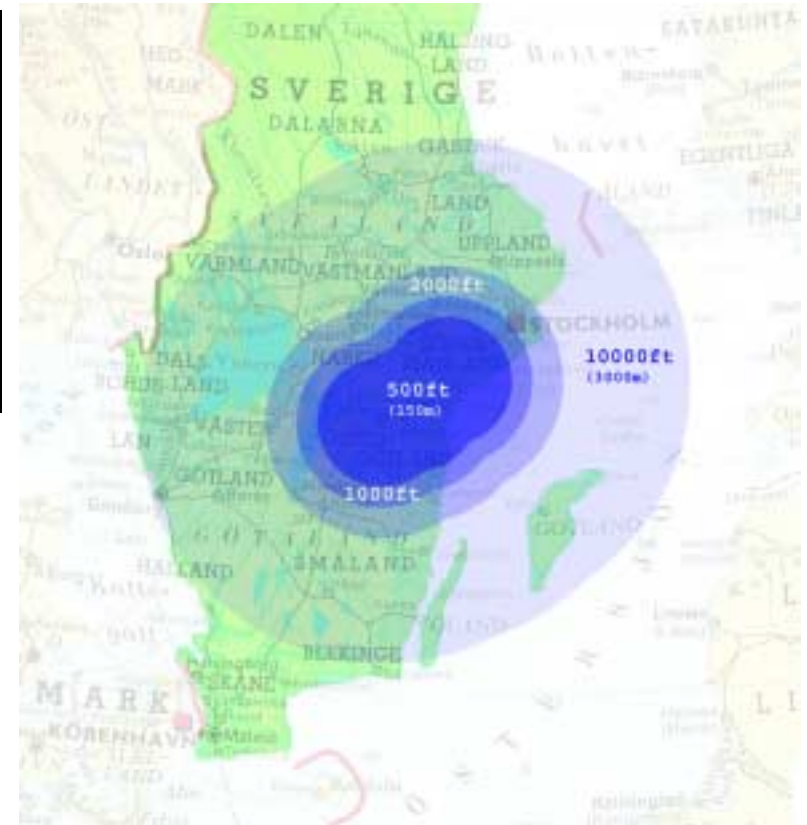




Ground station

Coverage

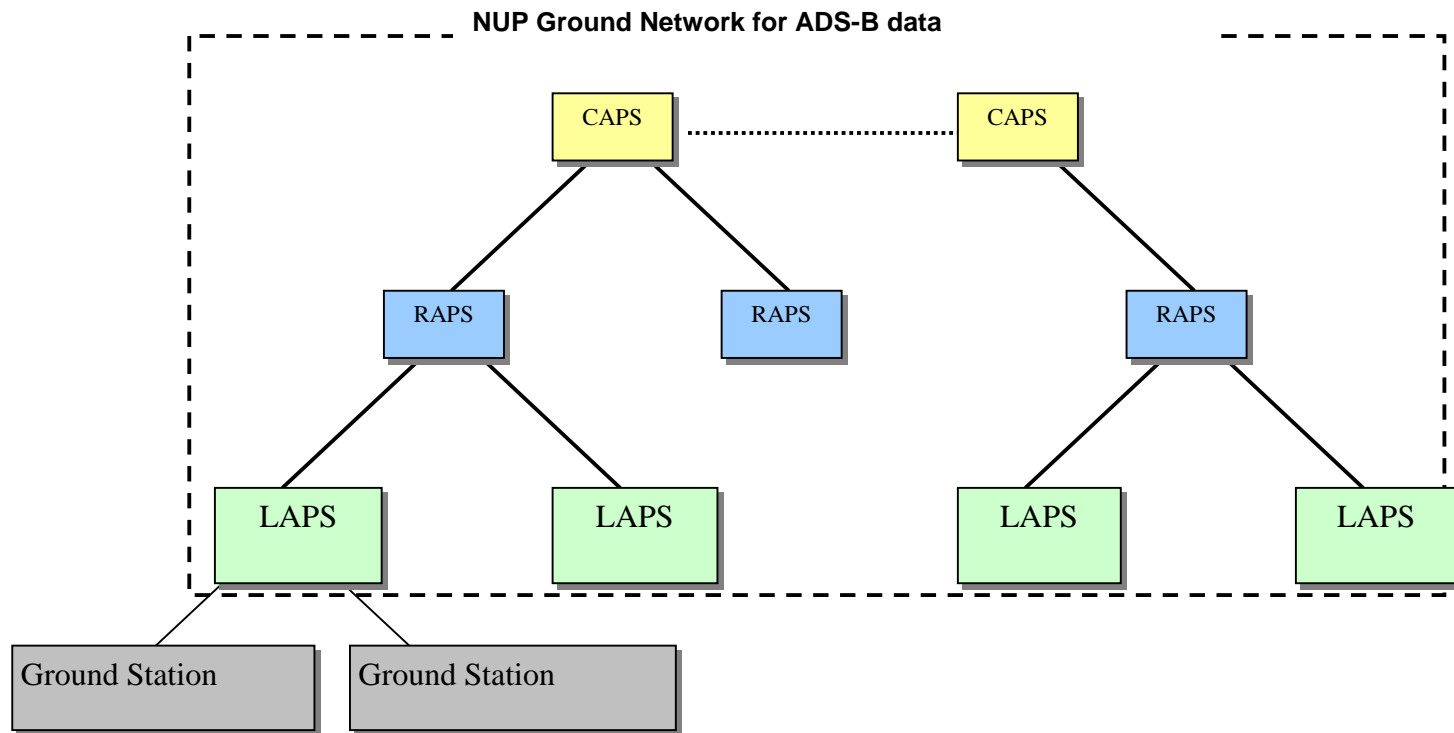
Alt (ft)	Coverage radius (km)
500	64
1000	85
2000	115
10000	241
20000	335





Ground network

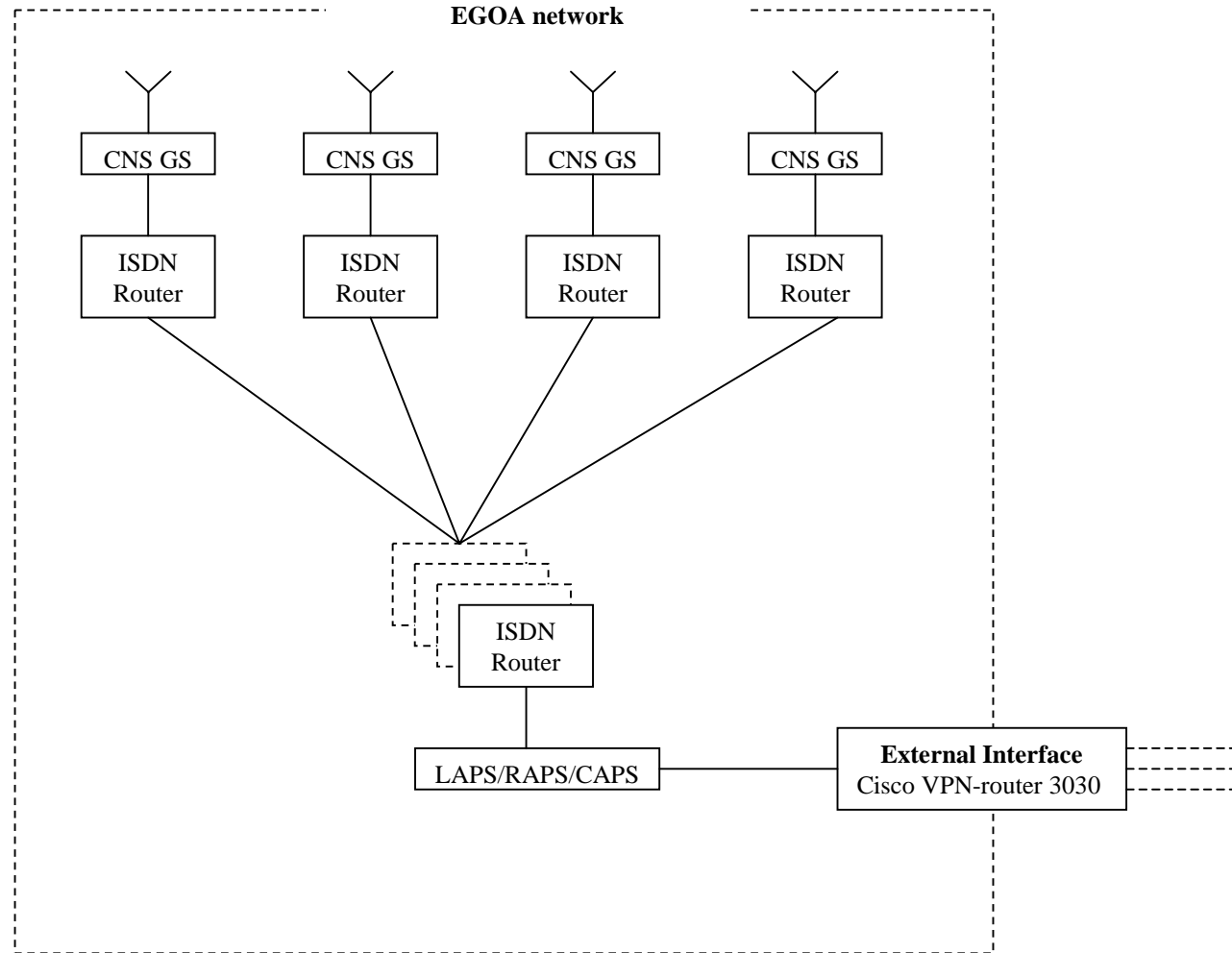
Logical structure





Ground network

Fysical
structure



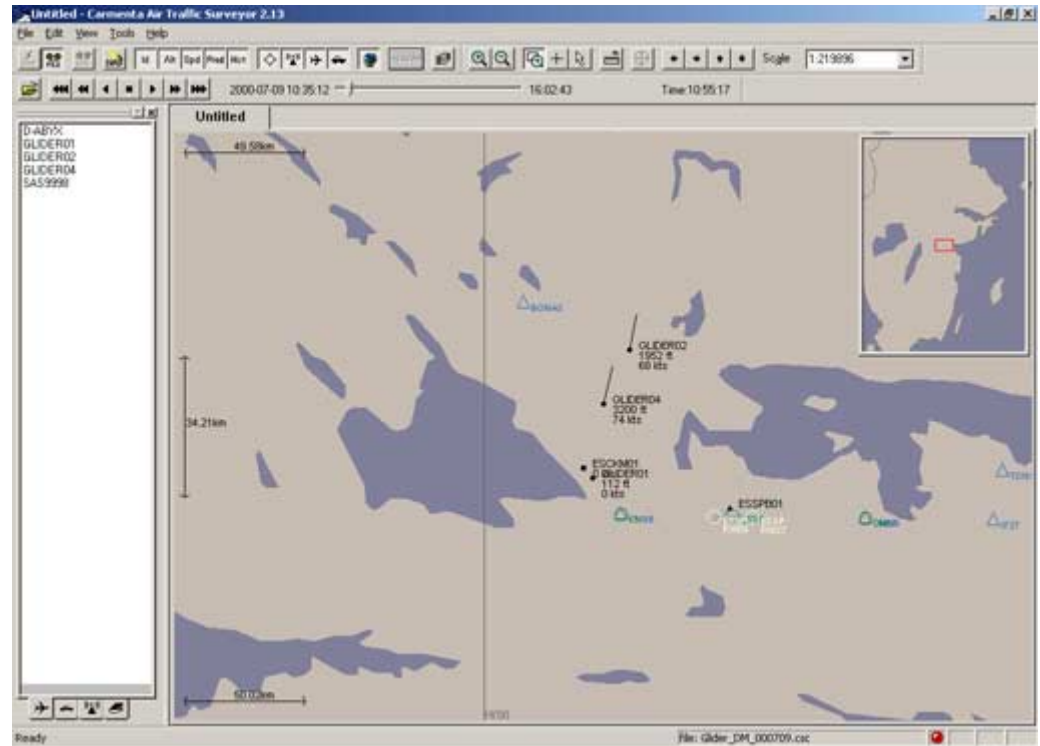


Presentation equipment

Ground presentation for GA flying clubs, schools etc.

Program for "fleet management", logging and follow-up.

- Runs on PC with Windows.
- Connection to CAPS via internet.





Presentation equipment

Presentation at TWR/ATC

Current equipment such as RDPs or RPU's will be used but with fused SSR data and ADS-B data. ADS-B data from CAPS via internet VPN (Virtual Private Network).





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