

# CARS

Common Altitude Reference

For whom, and when?

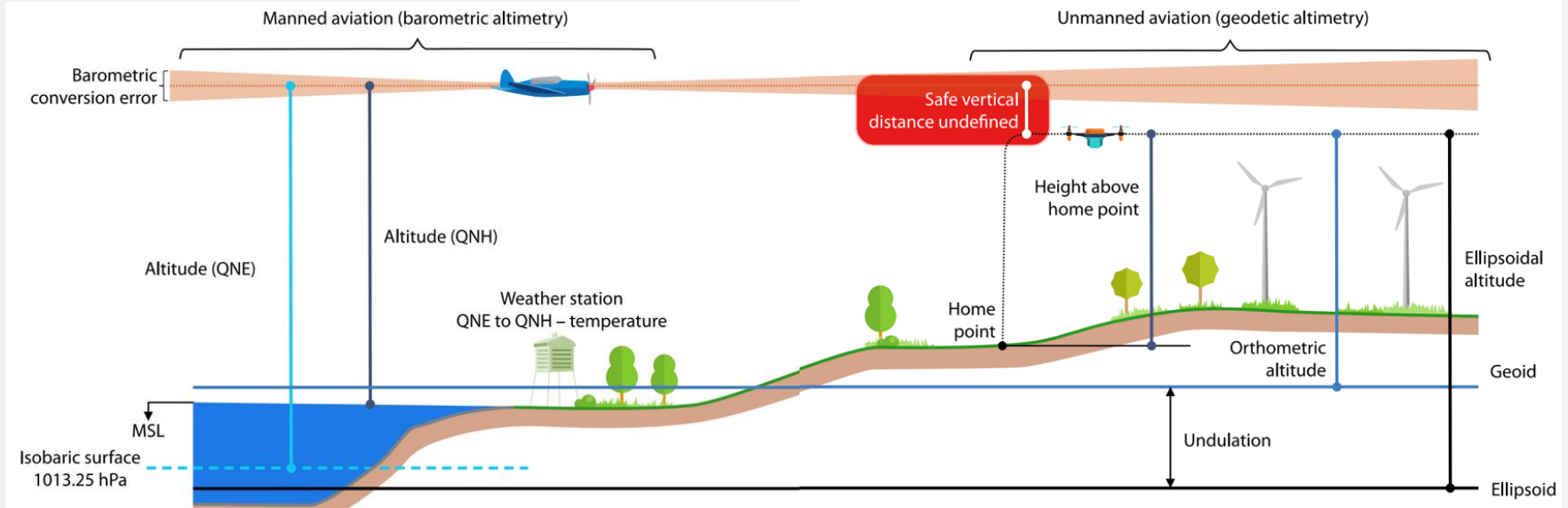
# Common Altitude Reference System



- For whom?
  - Ultimately, for everyone, without exception
- When?
  - When for the first time, for real, someone will allow to fly at least two aircraft from two different operators in the same volume of space and at the same time
  - When a major disaster occurs due to ambiguity in height/altitude assessment resulting from measurement errors, lack of standardization, misunderstanding and misinterpretation



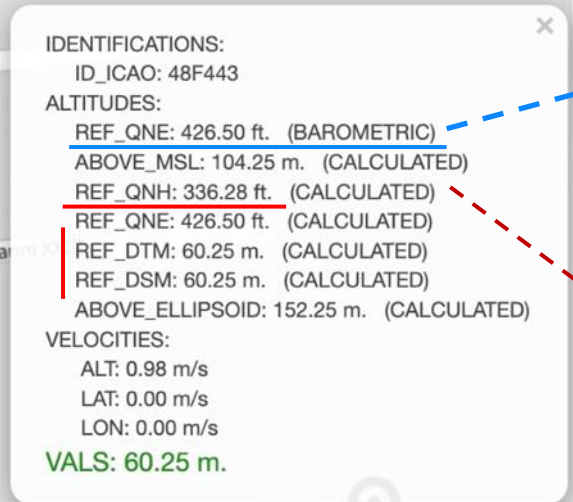
# Multi sensor Height/Altitude problem



# CARS conversion example

Barometric Altitude (ref. to 1013,25 hPa)

GNSS Altitude (ref. To Ellipsoid)

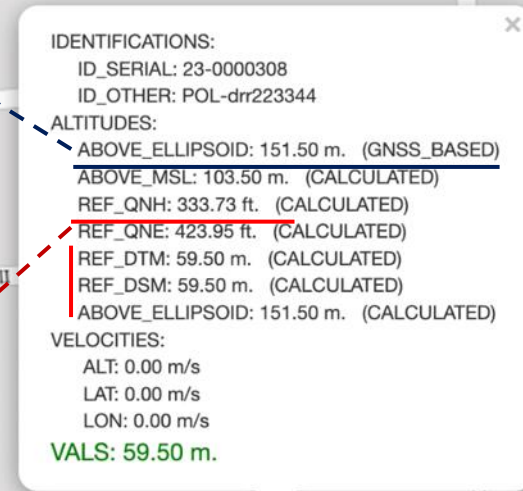
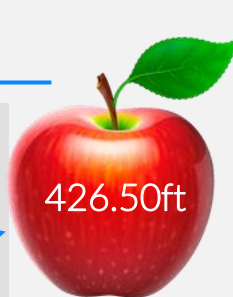


IDENTIFICATIONS:  
ID\_ICAO: 48F443

ALTITUDES:  
REF\_QNE: 426.50 ft. (BAROMETRIC)  
ABOVE\_MSL: 104.25 m. (CALCULATED)  
REF\_QNH: 336.28 ft. (CALCULATED)  
REF\_QNE: 426.50 ft. (CALCULATED)  
REF\_DTM: 60.25 m. (CALCULATED)  
REF\_DSM: 60.25 m. (CALCULATED)  
ABOVE\_ELLIPSOID: 152.25 m. (CALCULATED)

VELOCITIES:  
ALT: 0.98 m/s  
LAT: 0.00 m/s  
LON: 0.00 m/s

VALS: 60.25 m.



IDENTIFICATIONS:  
ID\_SERIAL: 23-0000308  
ID\_OTHER: POL-drr223344

ALTITUDES:  
ABOVE\_ELLIPSOID: 151.50 m. (GNSS\_BASED)  
ABOVE\_MSL: 103.50 m. (CALCULATED)  
REF\_QNH: 333.73 ft. (CALCULATED)  
REF\_QNE: 423.95 ft. (CALCULATED)  
REF\_DTM: 59.50 m. (CALCULATED)  
REF\_DSM: 59.50 m. (CALCULATED)  
ABOVE\_ELLIPSOID: 151.50 m. (CALCULATED)

VELOCITIES:  
ALT: 0.00 m/s  
LAT: 0.00 m/s  
LON: 0.00 m/s

VALS: 59.50 m.

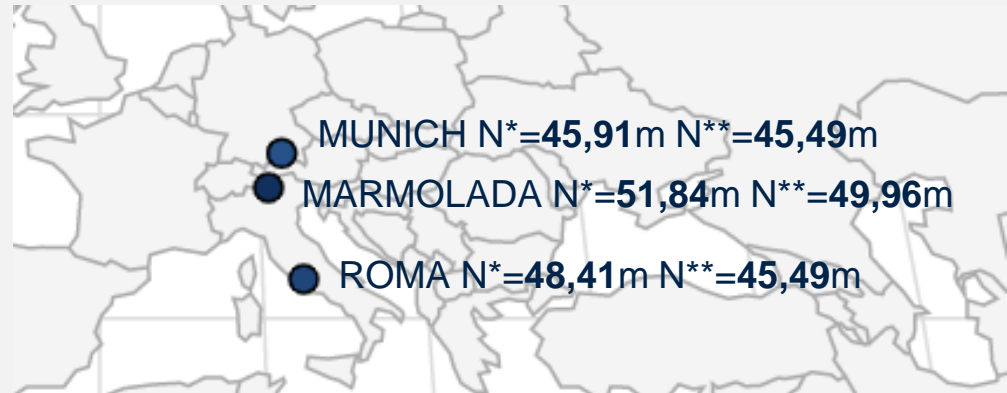
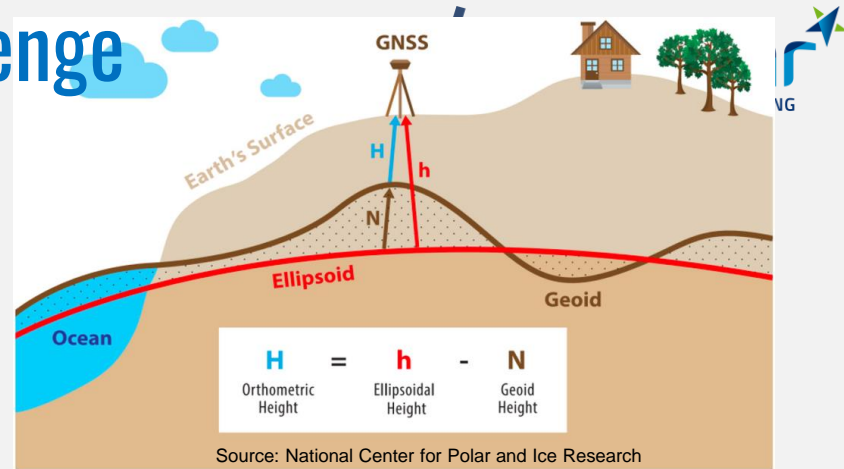
Blue drone use **BARO** alt sensor

Black drone use **GNSS** alt sensor

BOTH drones are 60m above Take Off point (RTK referenced)

# Example of “not obvious” challenge

In many cases unknown **UNDULATION** transformation tables in GPS chipset



$N^*$  EGM2008

$N^{**}$  EGM96



# CARS challenges

- Service specification for CISP/USSP/GSC... lack of common CARS data exchange requirements (reference, TSE, Undulation, units, etc...)
- In many cases unknown undulation transformation tables in GNSS chipset
- Lack of DTM/DSM standardisation and publication requirements
- Understanding the difference between MEASURED and CALCULATED altitude/height values
- A multitude of Electronic Conspicuity devices available and their lack of certification
- Need for modification of operational procedures for ATC (block altitude when GNSS conversion is used)
- Unified and accredited algorithms for TSE (Total System Error) calculation
- Building the awareness
- Certification



# Feel free to contact

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