

# RVSM Height Keeping Performance (Monitoring Methods) (WEBINAR)

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# RVSM Height Keeping Performance



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# Introduction & Monitoring Objectives



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Monitoring aircraft height-keeping performance consists of collection of necessary data using specialized systems. The Altimetry System Error (ASE) process, is determined by comparing the identified true height of the aircraft and the true height of the barometric pressure surface associated with the altimetry measurement.

## The objectives of monitoring are two;

- To ensure the continued safe use of the RVSM.
- To ensure that individual operators and aircraft comply with applicable RVSM requirements, as per ICAO Annex 6 Part 1.

# Monitoring Methods GMUs

## 1. GPS-based Monitoring Units (GMUs),

- The GMU is a **special-purpose data collection system** carried aboard an aircraft for one flight, during which the unit collects Global Positioning System pseudo-ranges. Post-flight processing of these data ensures estimates of aircraft geometric height which are of sufficient accuracy to permit estimation of relevant height-keeping performance parameters. In parallel, the current-generation GMU also collects secondary surveillance radar Mode C data, which also contributes to parameter estimation.

# Monitoring Methods

## Generations of GMUs

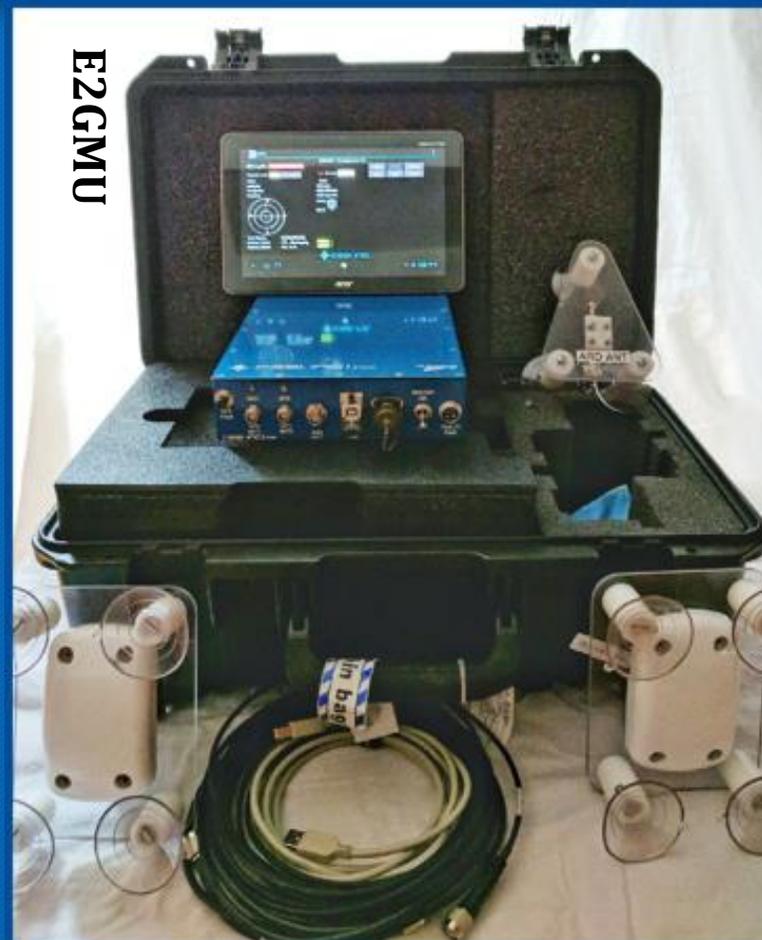


GMU 1995/1996

GMU has been  
in  
use since 1996



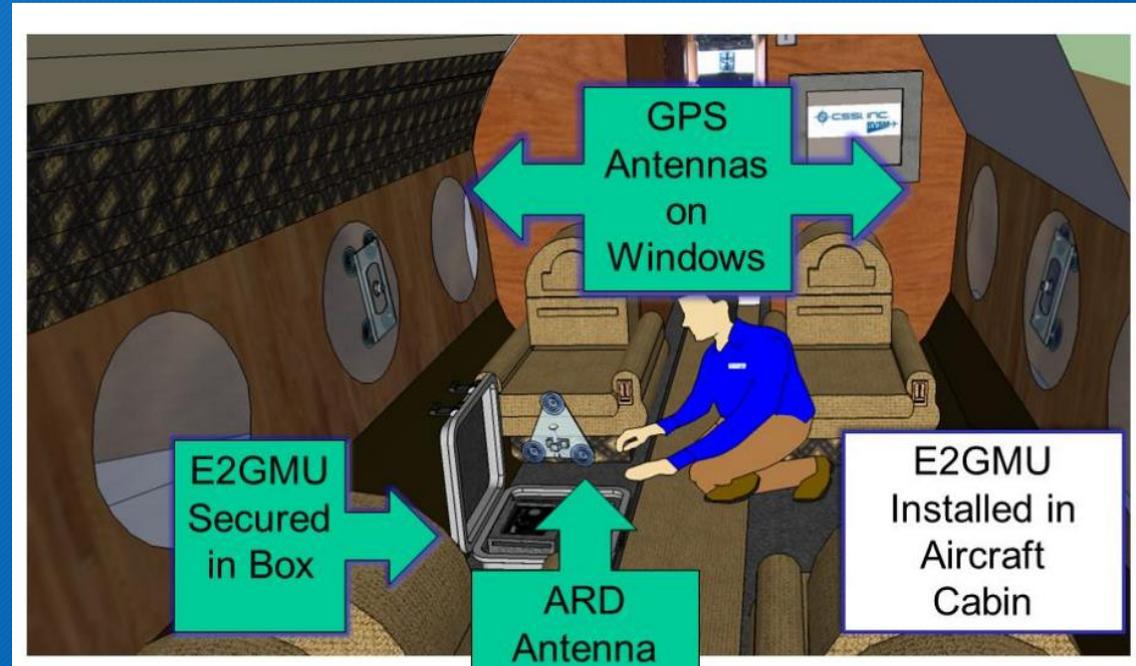
EGMU 2003



E2GMU

E2GMU 2013

# Monitoring Methods GMUs



# Monitoring Methods **HMUs & AGHME**



## **2.1 Height Measuring Units (HMUs)**

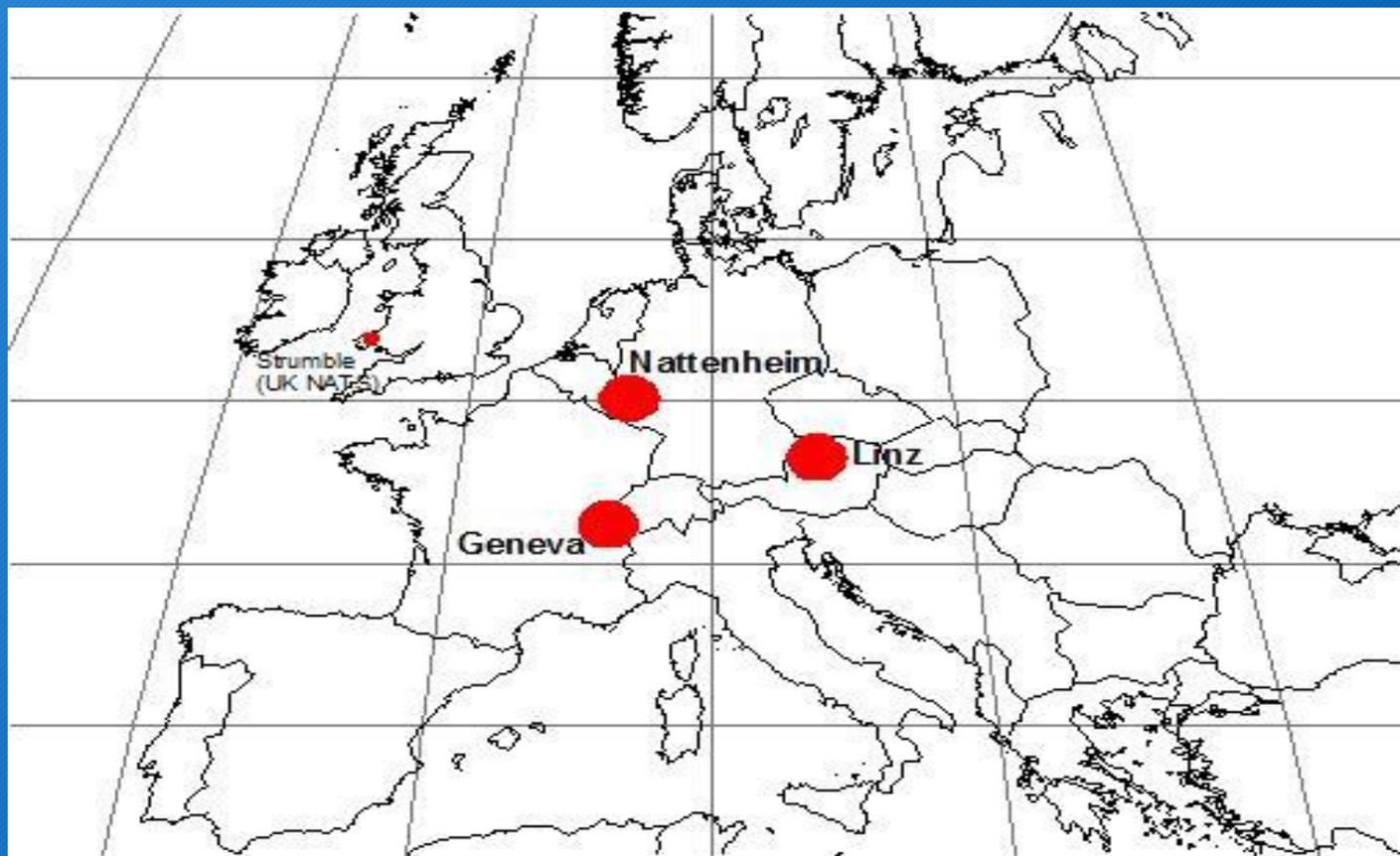
Ground-based monitoring units are stationary stations installed at fixed locations. These systems can compute Altimetry System Error (ASE) for all aircraft flying over their operational coverage's. Ground-based systems can give repetitive measurements over a period of time, which allow RMAs to discover undesirable patterns or trends.

## **2.2 Aircraft Geometric Height Measurement Element (AGHME)**

- The FAA has developed its own ground based monitoring system called (AGHME) that works on similar principles to the HMU but in different design. Data sharing between Euro-Control and FAA indicates that similar results are obtained for aircraft that have been monitored by both the HMU and AGHME systems.

# EUR Region HMUs Locations

## 1. EUR RMA HMUs; Three HMUs are stationed in the Euro RMA Region

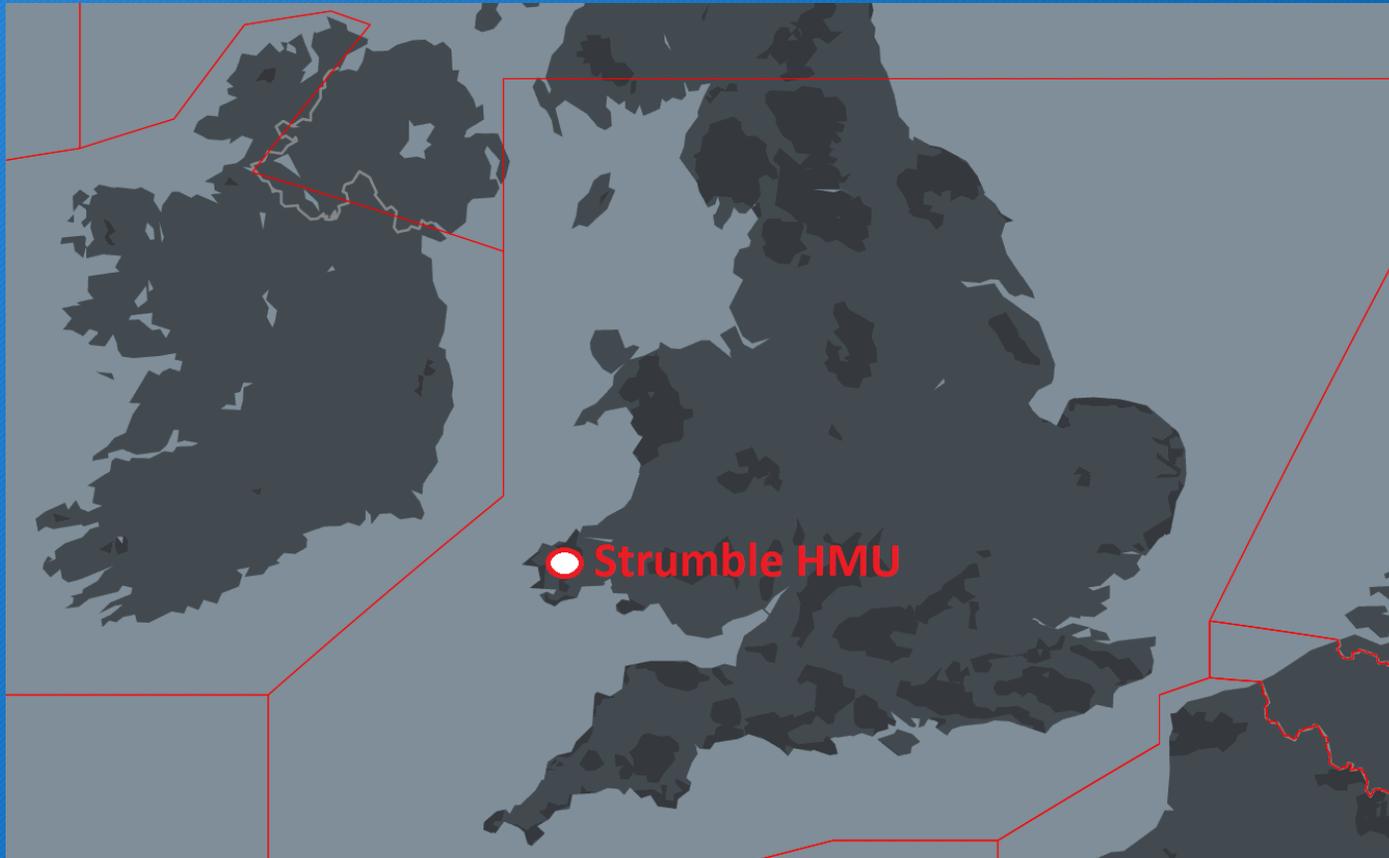


- **Linz in Austria** - 48°12'08"N, 014°17'35"E (near LNZ VOR)
- **Nattenheim in Germany** - 49°56'45"N, 006°33'25"E (near NTM VOR)
- **Geneva in Switzerland** - 46°21'49"N, 005°55'34"E (near GVA VOR)

### HMU radius of operation

- Linz - 30 nm
- Nattenheim - 45 nm
- Geneva - 45 nm

# NATCMA HMU Locations



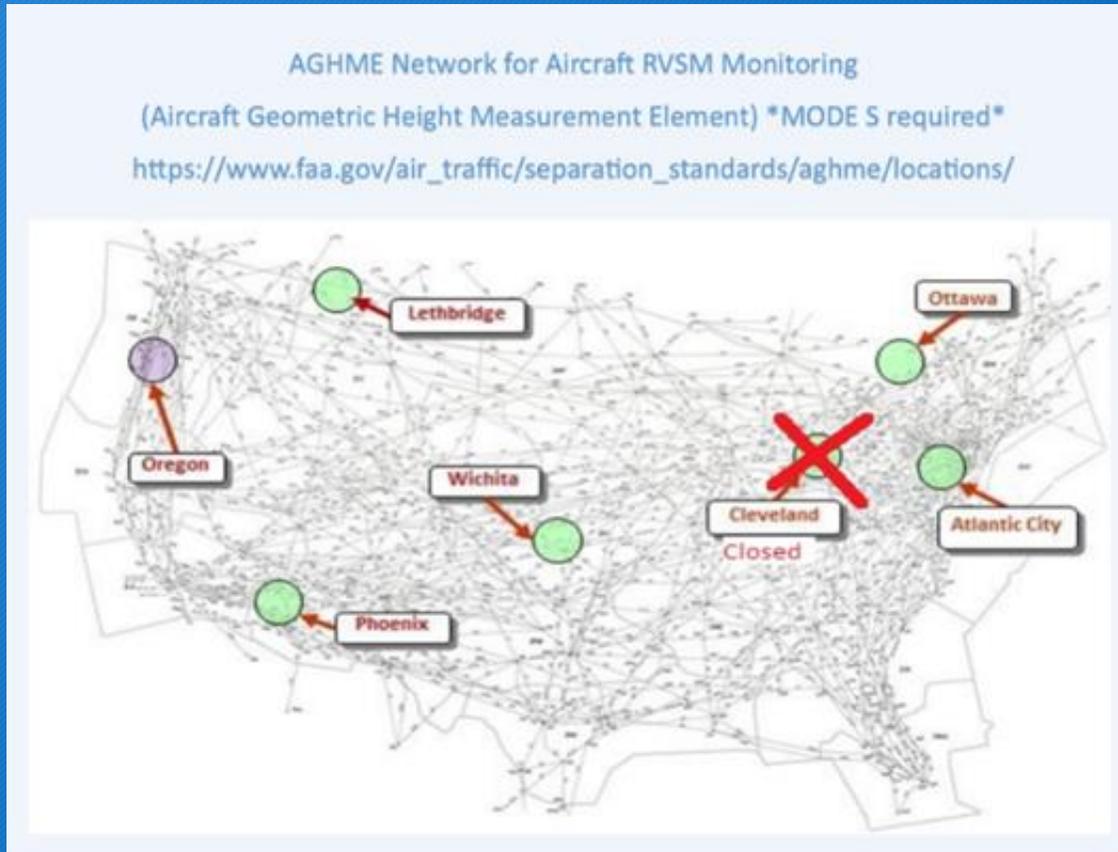
2. The North Atlantic Central Monitoring Agency (NATCMA) is responsible for 1 HMU which is located at Strumble (Wales) U.K.

# JASMA HMUs Locations

## 3. JASMA - Setouchi (343044N 1341627E), Niigata (375807N 1385205E), and Sendai (380903N 1403942E)

HMU	Setouchi	Niigata	Sendai
Coverage	 <p>Within a radius of 40 NM from 343044N 1341627E</p>	 <p>Within a radius of 30 NM from 375807N 1385205E</p>	 <p>Within a radius of 30 NM from 380903N 1403942E</p>

# NAARMO AGHME Location



- Aircraft Geometric Height Measurement Element (AGHME) - NAARMO - Atlantic City, Wichita, Cleveland, and Phoenix (United States); Ottawa and Lethbridge (Canada)



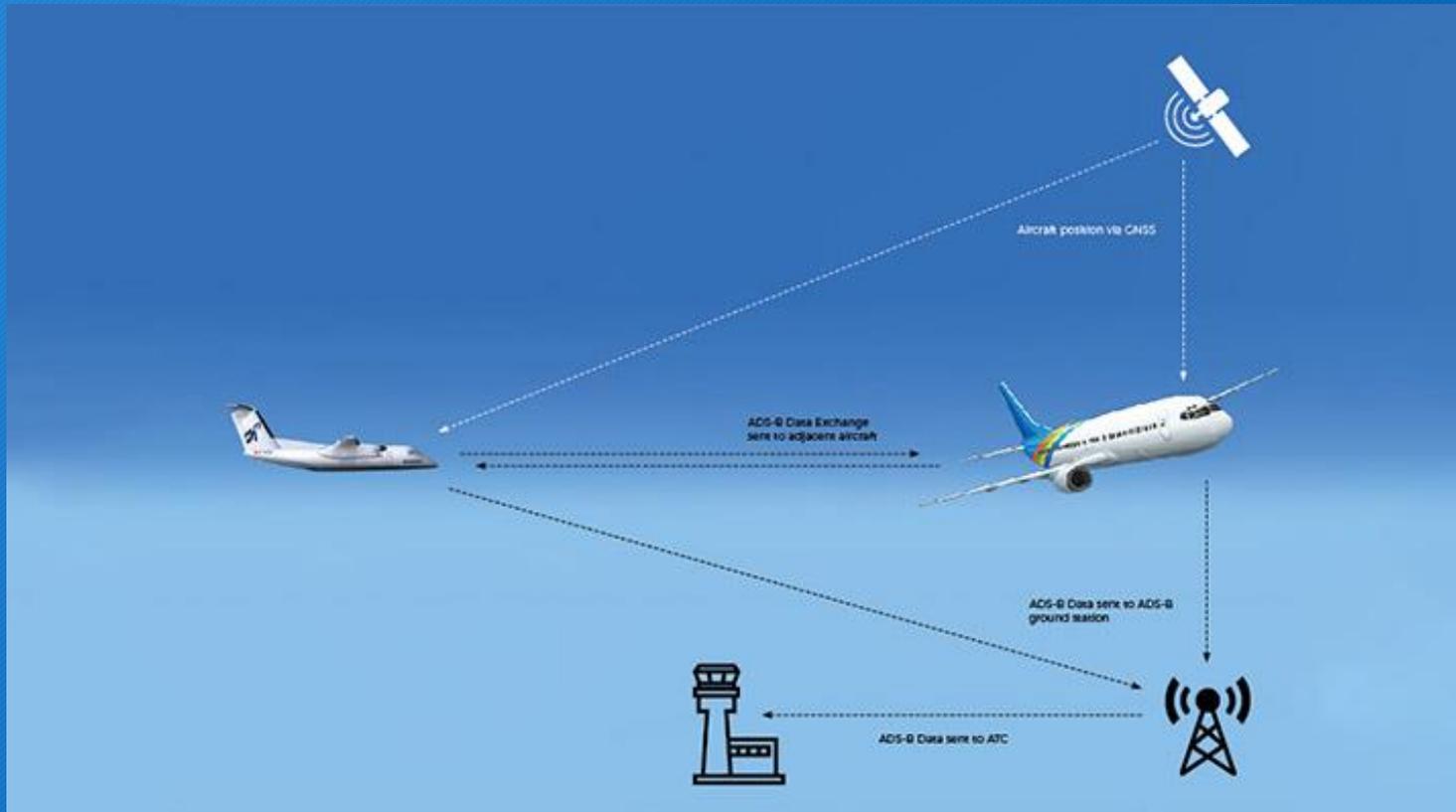
# Monitoring Methods **AHMS**



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Automatic Dependent Surveillance Broadcast (ADS-B) Height Monitoring Systems (**AHMS**) use ADS-B receivers to obtain **geometric height data from ADS-B** equipped aircraft. To use this method requires the aircraft to be ADS-B equipped and for the aircraft to fly in a region where ADS-B monitoring is performed.

# Monitoring Methods AHMS



AHMS - A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position, altitude and additional data, as appropriate, in a broadcast mode via a data link.

Thank You



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