

# DESCRIPTION OF THE AB139 HUMS



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An **AGUSTAWESTLAND** Company



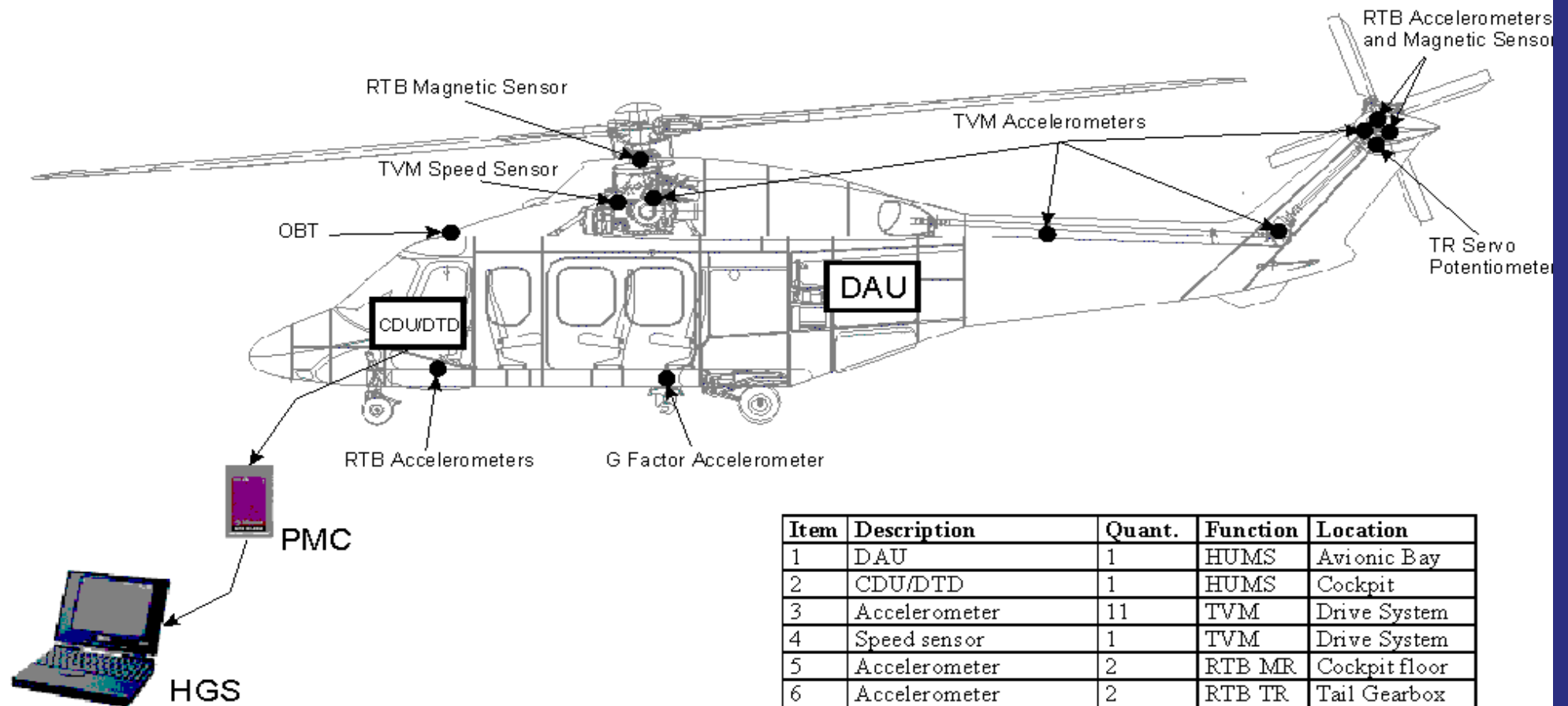
# AB139 HUMS Kit

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## HUMS Kit main functions:

- **Transmission Vibration Monitoring (TVM);**
- **Usage Monitoring (UM) encompassing:**
  - **Logbook data**
  - **Transmission Usage Monitoring (TUM);**
  - **Structural Usage Monitoring (SUM);**
- **Rotor Track and Balance (RTB).**

# AB139 HUMS Layout



Item	Description	Quant.	Function	Location
1	DAU	1	HUMS	Avionic Bay
2	CDU/DTD	1	HUMS	Cockpit
3	Accelerometer	11	TVM	Drive System
4	Speed sensor	1	TVM	Drive System
5	Accelerometer	2	RTB MR	Cockpit floor
6	Accelerometer	2	RTB TR	Tail Gearbox
7	OBT	1	RTB MR	Cabin roof
8	Magnetic sensor	1	RTB MR	Swashplate
9	Magnetic sensor	1	RTB TR	Tail Gearbox
10	G factor Accelerometer	1	Usage	Cabin floor

# HUMS Kit Main LRUs

**Cockpit Display Unit/  
Data Transfer Unit**



**Data Acquisition Unit**



# HUMS Kit Sensors

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- 11 TVM Accelerometers
- 4 RTB Accelerometers
- 1 Tail Rotor Magnetic sensor
- 1 Load Factor Accelerometer
- 2 DTD (PCMCIA card)

# Main Rotor Tracker

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# HGS overview

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- **HGS provides functions to:**
  - **Initialise usage values for the OBS via the DTD**
  - **Download measurement data from the DTD**
  - **Store results into database**
  - **Display of individual aircraft and fleet data**
  - **Calculate effective usage of components**
  - **Calculate rotor adjustments**
  - **Maintain aircraft build information**
  - **Manage the database**

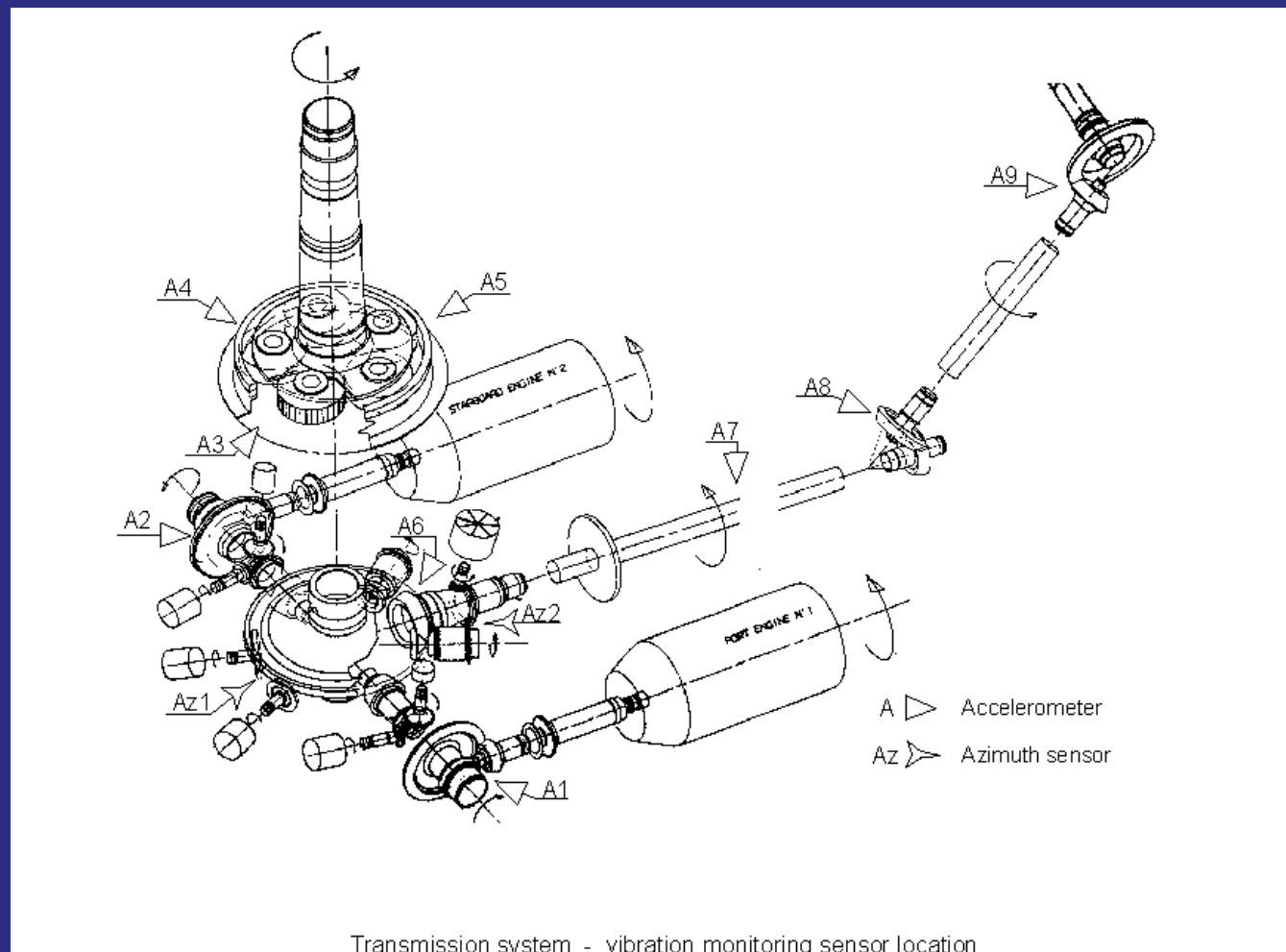
# Transmission Vibration Monitoring

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- Engine to main gearbox input drive shafts
- Main gearbox shafts and gears
- Main gearbox bearings
- Accessory gears shafts and bearings
- Tail rotor drive shaft and hangar bearings
- Intermediate and tail gearbox
- Oil fan monitoring



# TVM Sensors Layout



Transmission system - vibration monitoring sensor location

A10 and A11 are on 2nd stage of Engine Inputs (not in scheme)

# TVM Processing on HGS

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- **Download TVM Exceedances from the DTD**
- **Download TVM Component results from the DTD**
- **Download raw vibration data**
- **Individual Aircraft Summary**
- **TVM Trend at Component level**
- **Spectral Vibration Display**
- **Harmonic Vibration Display**

# Usage Monitoring – Logbook Data

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- Engines
  - Engine starts
  - One engine ground idle
  - Both engines stopped
  - Engine running time
- Rotors
  - Rotor turning time
  - Operation Time
  - Rotor start/stop
- Ground/Air transition
  - Flight Time
  - Landing count
  - GAG cycle

# Transmission Usage Monitoring

- **Monitoring occurs from Operation Start to Operation End**
- **Two type of data collected and recorded are:**
  - **TUM histogram record which is updated throughout the operation and recorded at the end of the operation**
  - **TUM event records which are recorded out to the DTD each time a TUM event has been detected**
- **Data recorded in TUM histogram record consists of:**
  - **Time (over the entire operation) spent in each defined band for the following histograms:**
    - ◆ Rotor Speed (9 bands)
    - ◆ Engine 1 Torque (50 bands)
    - ◆ Engine 2 Torque (50 bands)
    - ◆ Main Rotor Torque (50 bands)
    - ◆ Tail Rotor Torque (50 bands)

# Structural Usage Monitoring

- SUM is based on Flight Condition Recognition (FCR) algorithm.
- Monitoring occurs from Operation Start to Operation End
- Data collected and recorded are:
  - Time History of 12 flight parameters at 8 Hz
  - SUM histogram based on 46 Flight Condition Types
  - Flight Condition History where each Flight Condition record consists of:
    - ◆ Time of day and Date the condition started
    - ◆ Flight Condition duration
    - ◆ Average value over the regime for the following parameters:

Roll Attitude	Pitch Attitude	True Airspeed
Longitudinal Acceleration	Normal Acceleration	Normal Jerk
Engine 1 Torque	Engine 2 Torque	Density Altitude
Radar Altitude	Vertical Speed	Roll Rate
Pitch Rate		

# TUM & SUM HGS Processing

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- Data download from the DTD
- TUM Events and SUM Parameters Time History Display
- Calculation of Usage Rate & estimated Available Life for each monitored component
- Display of Flight Spectrum and Torque Spectrum
- SUM Regime Summary
- Component Usage Display
- Component Usage Trend
- Usage Threshold Alert

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# Rotor Track & Balance

## ● Manual Data Acquisition

- Initiated by crew via the CDU/DTU
- Tracker Fitted
- Rotor Track and Balance
- 5 Demands (Idle, FPOG, Hover, Cruise & VNE)
- 1R & 1T Target Measurements
- Plus 2 Event Logs

## ● Automatic Data Acquisition

- Initiated Flight Regime Detection via the EDPU
- No Tracker
- Rotor Tuning Only
- 5 Regimes (FPOG, Hover, Cruise, VNE & Unrecognised)
- 1R & 1T Target Measurements

# RTB – HGS Processing

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- Individual Aircraft Summary
- RTB Display
- Spectral Vibration Display
- Harmonic Vibration Display
- Track & Lag Display
- Vibration Trend
- Track & Lag Trend



# DTD Storage Approach

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- DTD consists of a 384 Mbyte flash card
- Basic format is DOS
  - DTD can be formatted with a standard PC running Windows
  - Files can be viewed, deleted, moved. etc. with a standard PC running Windows
- HGS normally used to initialize the card for HUMS use
- Initialization consists of writing a number of standard files to the DTD.
- User files can be managed individually as to the whether or not they wrap when full of data
- Files will be oversized to handle more than 25 hours of data