

DESCRIPTION OF THE AB139 HUMS



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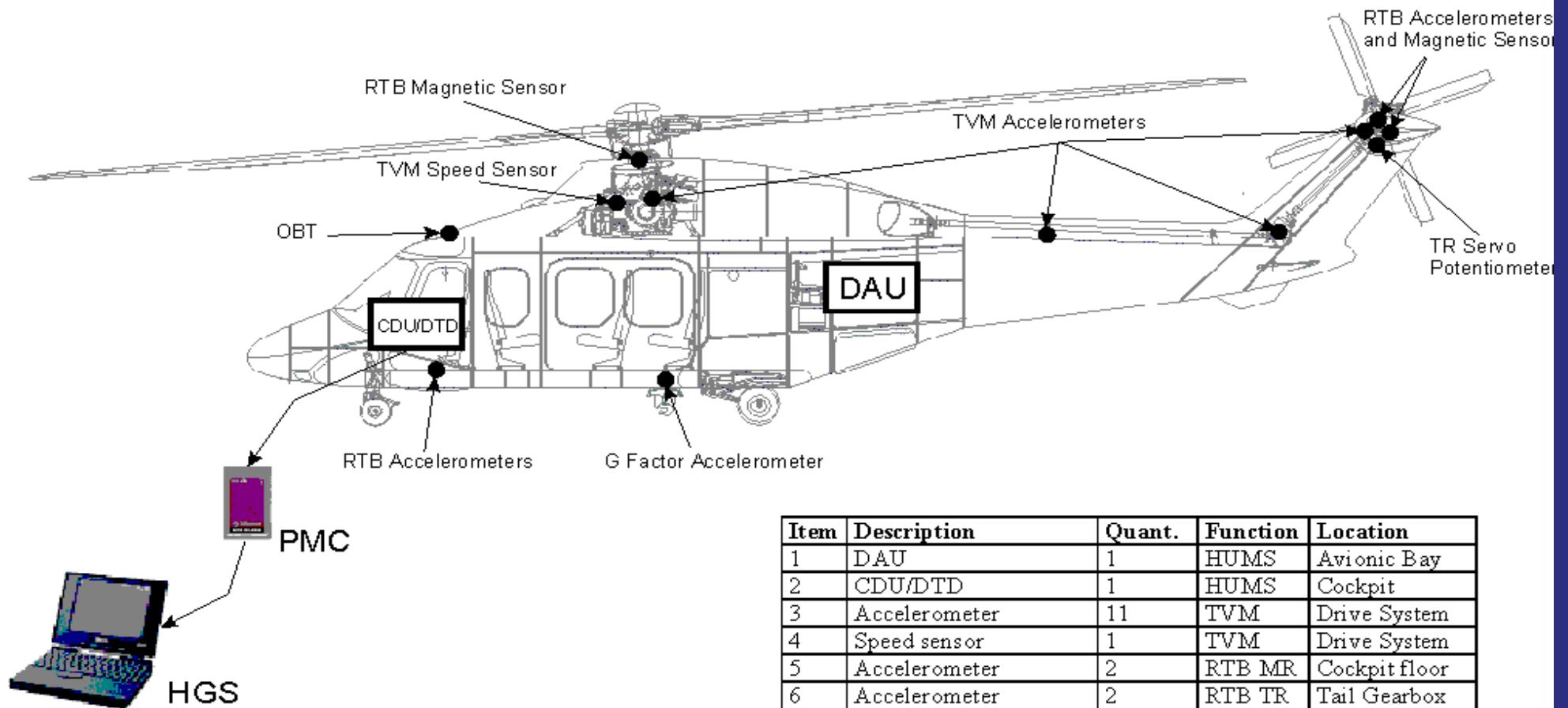

AB139 HUMS Kit

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).**

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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



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HUMS Kit Sensors

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

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Main Rotor Tracker



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HGS overview

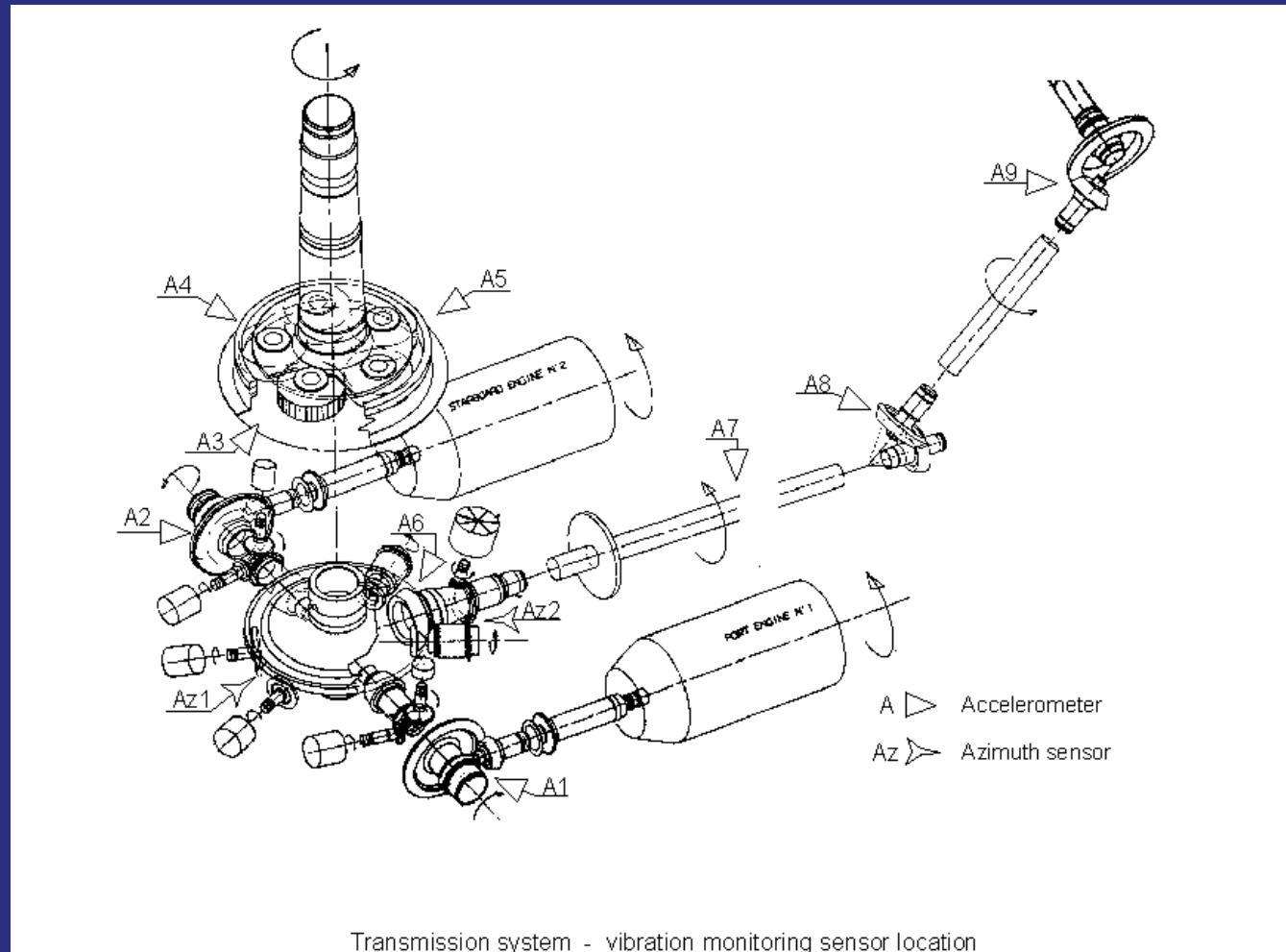
- HGS provides functions to:
 - Initialise usage values for the OBS via the DTD
 - Download measurement data from the DTD
 - Store results into database
 - Display of individual aircraft and fleet data
 - Calculate effective usage of components
 - Calculate rotor adjustments
 - Maintain aircraft build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

Transmission Vibration Monitoring

- 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

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TVM Sensors Layout



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

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TVM Processing on HGS

- 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

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Usage Monitoring – Logbook Data

- 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)

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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 | | |

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TUM & SUM HGS Processing

- 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 EDPUs
 - No Tracker
 - Rotor Tuning Only
 - 5 Regimes (FPOG, Hover, Cruise, VNE & Unrecognised)
 - 1R & 1T Target Measurements

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RTB – HGS Processing

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

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DTD Storage Approach

- 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

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