



# IVHM-ARRIVE<sup>™</sup>

ARRIVE<sup>™</sup> is a cost-effective online solution that simplifies IVHM data management and decision making. Integrated Vehicle Health Management (IVHM) is proven to reduce the cost of ownership and enhance the availability of larger helicopter fleets but, until now, this has been out of the reach of the mass helicopter market.

ARRIVE addresses this opportunity through a cloud-based computing solution that provides access to the benefits of IVHM technologies and world-leading expertise including virtual fleet comparison.

#### **IVHM Capabilities**

- Alerts for immediate post-flight fault diagnosis
- Helicopter Health Status
- Rotor Track and Balance
- Engine Exceedance Monitoring
- Transmission Vibration Monitoring
- Transmission Usage Monitoring
- Advanced Oil Debris Monitoring
- Secure storage of historical data

Combined with Helitune's HT-VHM on-board system, ARRIVE provides a complete IVHM solution. Key innovations include:

**Assimilate** - Pulling together all of the data from sources as diverse as helicopter sensors, mission information, business records, environmental conditions and other open data sources.

- **Refine & Relate** Aligning the data and making it relevant, usable and useful to you in a variety of physical and environmental contexts.
- **Interrogate** Providing you with actionable information for key decision makers using cutting-edge data analytic techniques.

**Visualise** - Taking patterns of information and transforming them into an easy-to-understand and visually-meaningful display.

**Exploit** - Increasing your aircraft availability and reducing costs by extracting maximum value from the data.

#### **IVHM-ARRIVE – The Complete Vehicle Health Management Solution**

ARRIVE has been designed to be intuitive and easy-to-use. When used with the Helitune on-board HT-VHM system, data is automatically transferred via a Smart Data Link to the secure ARRIVE data server. As new data is received, ARRIVE automatically performs data integrity and exceedance checks, and will raise an alert if an anomaly is detected. Users access the fleet overview page via a standard web browser. Detailed data analysis pages are also available to assist with fault diagnosis and long-term trending. All data visualisation pages have been developed to display critical information at a glance.

Options exist for customers to either host their own instance of the ARRIVE data server or to subscribe to the ARRIVE cloud-based service.

#### **Key Features**

- Automatic Download from on-board data collectors e.g. HT-VHM
- Data Preprocessor (data quality checking)
- Limit Checking and Event Logging
- Condition Indicator Trending
- Display of Individual Helicopter and Fleet Data
- Rotor Adjustment Calculation

- Component Usage Calculation
- Data Analytics and Statistics
- Secure Data Archive
- Virtual Fleet Performance Comparisons
- Automated Report Generation
- Interface to third party HUMS systems



Through application of IVHM-ARRIVE web technologies as a service, IVHM running costs, including infrastructure and personnel, are considerably reduced, removing barriers to entry and providing a means to substantiate a business case for health monitoring in any fleet size.

Users interact with IVHM-ARRIVE via a secure web portal. Data analysis is automated and exceptions validated by HUMS specialists, removing the need for operators to employ their own experts. Data may be anonymised and shared so that smaller operators may gain the knowledge benefits currently enjoyed by larger operators. At a glance, the fleet health status page shown above displays an overview of the health of each of the aircraft within the operator's fleet. Each icon represents one aircraft and highlights areas of exceedance. This allows the operator to quickly identify aircraft that require attention. The activity feed, on the right of the screen, displays the most recent events relating to the operator's fleet, e.g. data uploads and alerts.

#### ARRIVE can be used to

- · Efficiently detect and isolate faults
- Enhance safety
- Increase asset availability and readiness
- Reduce maintenance burden
- Reduce operational and support costs
- Effectively plan maintenance long-term actions
- Monitor health of an entire fleet regardless of physical location
- Efficiently and securely exchange data between operators, maintainers and OEMs

When used by technicians, operators and engineers, IVHM-ARRIVE enables them to identify problems rapidly, evaluate the situation and determine the appropriate remedial action.

#### **Transmission Vibration Monitoring**

- Compliant with CAP-753
- Report by Exception
- Quick Glance Health View
- Gearbox Shafts and Gears Analysis
- Gearbox Bearing Analysis
- Advanced Anomaly Detection
- Condition Indicator Algorithm Toolbox



Condition Indicator (CI) visualisation screens provide intuitive representations of the CI status for the operator's fleet or an individual aircraft. This example display shows a large quantity of data on one page, allowing the operator to quickly assess the situation and identify potential issues. Additional pages are accessible from this screen if a more in-depth analysis is required.



Visual Structural Usage Displays

#### **Rotor Track and Balance (RTB)**

- Rotor Track and Balance Display Summaries
- Minimum Flight Routine (MFR<sup>™</sup>) Adjustment Solution
- Vibration Trending
- Fleet Analysis / Comparison
- Harmonic FFT Display / Exceedance Monitoring



The RTB adjustment screen displays the balance plots and track data from RTB maintenance flights. Adjustment solutions are calculated automatically using Helitune's Minimum Flight Routine (MFR) algorithm. The MFR algorithm has been proven to reduce the average number of flights required for RTB exercises by more than a third.

#### **Usage Monitoring**

- Cumulative Flight Time and Landing Count
- Structural Usage Monitoring
- Transmission Usage Monitoring
- Rotor Turning Time
- Engine Starts Count and Running Time



With a greater understanding of the usage of individual helicopters and the fleet, benefits come from the identification of abnormal behaviour and out-of-limit events. In addition, capturing usage at a higher resolution improves the understanding of the fleet utilisation, and provides evidence for component life extensions plus maintenance schedule optimisation.

#### Highly Visual & User Centric Design

ARRIVE is designed with the operator at the foremost of the process.

#### Advanced Analytics & Big Data

ARRIVE takes advantage of developments in distributed computing, enabling advanced data analysis not available to local IVHM platforms.

#### Modern Architecture

ARRIVE is designed to support the latest hardware and operating environments, including mobile devices, and is served from scalable cloud architecture.

#### Secure & Robust

Security and access to your data is a key requirement of the ARRIVE team and has been designed in from the start.

#### Compatibility

Platforms	Windows®, Mac OS®, Linux®, iOS™, Android™
Browsers	Internet Explorer®, Google Chrome™, Firefox®, Safari®

#### **Product Development Team**

IVHM-ARRIVE is developed collaboratively in the United Kingdom under Helitune's lead, together with Critical Software Technologies and the University of Bristol:

### Helitune

Helitune develops and manufactures IVHM solutions for the helicopter industry. Its systems are fitted to helicopters worldwide, operating on major Original Equipment Manufacturer platforms, including AgustaWestland, Boeing, Bell, Sikorsky and Eurocopter, with enhanced marketing and technical support also provided through its three overseas subsidiaries in Germany, Italy and the US. The company is part of Condition Monitoring Group, whose aims are to make machinery safer while reducing the cost of ownership, through the intelligent application of technology, failure prediction and better business processes.

### Critical

Critical Software Technologies provides systems and software engineering services for mission and business-critical applications in the avionics, space, energy and defence industries. Familiarity with complex, software intensive, safety-critical requirements also allows the company to readily implement data-centric solutions that provide customers with the information needed to manage complex and costly assets.

## Minimiter of BRISTOL

University of Bristol's Department of Aerospace Engineering. The university brings expertise in physically-based vibration modelling for rotating systems, new approaches for structural prognostics, and algorithms for pattern recognition and fault analysis. ARRIVE builds on the university's broad experience collaborating with the aerospace and power sectors to demonstrate the effectiveness of embedded algorithms within structural health monitoring processes.

#### www.ivhm-arrive.com

ARRIVE, IVHM-ARRIVE and MFR and trademarks of Helitune Ltd in the United Kingdom and/or other countries. Windows® and Internet Explorer® are registered trademarks of Microsoft in the U.S. and other countries. Mac OS® and Safari® are registered trademarks of Apple Inc in the U.S. and other countries. Linux® is a registered trademark of Linus Torvalds in the U.S. and other countries. IS® in a registered trademark of Linus Torvalds in the U.S. and other countries. Windows® and Internet Explorer® are registered trademarks of Apple Inc in the U.S. and other countries. US™ is a trademark of Cisco in the U.S. and other countries. Andriod™ and Goolge Chrome™ are trademarks of Goolge Inc in the U.S. and other countries. Firefox® is a registered trademark of Mozilla in the U.S. and other countries.



Helitune's Quality Management System is certified to BS EN ISO9001:2008 and AS9100

PB-3566-01 - Issue 2 A4

This document is not contractual. Helitune maintain a policy of continuous product development and improvement. SCS This specification may change without notice.

Helitune UK Hatchmoor Industrial Estate, Torrington Devon EX38 7HP, UK

Phone +44(0)1805 624650, Fax +44(0)1805 624 689 Registered in England & Wales, No. 3979088 VAT Reg. No. 762 442 630 Helitune Germany Lilienthalstraße 2a 82205 Gilching, Germany

Helitune Italy Via Ferrarese, 3 40128 Bologna, Italy

Helitune USA 190 Gordon Street Elk Grove Village, IL 60007-1120, USA

www.helitune.com