

Fatigue, Durability and Lifing Solutions for Aerospace Applications

- Design
- Analysis
- OLM and HUMS
- Data Warehouse



Aerospace





Measure, Predict and Design with Confidence

For many years, aerospace companies have maintained the reliability, safety and robust operation of aircraft and equipment by trusting in nCode's powerful and highly versatile software solutions. Our latest generation of graphical, process-centric software provides a well-trying and tested basis for a "Physics of Failure" approach to determining fatigue and durability throughout the product lifecycle. However, we fully understand that aerospace companies have individual, often unique requirements and with this in mind we have designed our solutions to enable you to easily facilitate the interaction of your own proprietary programs with our software modules.

All nCode analysis solutions share the same user interface, architecture and algorithms. As an example, this holistic approach allows direct correlation between operational flight loads and the original design and validation tests. This leads to increased confidence in safety and performance, and an ability to implement CBM initiatives.

Product Lifecycle Performance

Modular software products for monitoring, analyzing and predicting performance.

● Save money, resources and time

- ___ Accelerate design evaluations and design changes
- ___ Extend the life of existing systems and improve maintenance scheduling

● Reduce operational failures

- ___ Increased reliability
- ___ Rapidly understand the impact of system modifications
- ___ Understand impact of mission changes
- ___ Improve deployment scheduling based on structural integrity—mission readiness



Operation

OLM – Operational Loads Monitoring

- ___ Understand usage severity by automatically validating and characterizing measured data

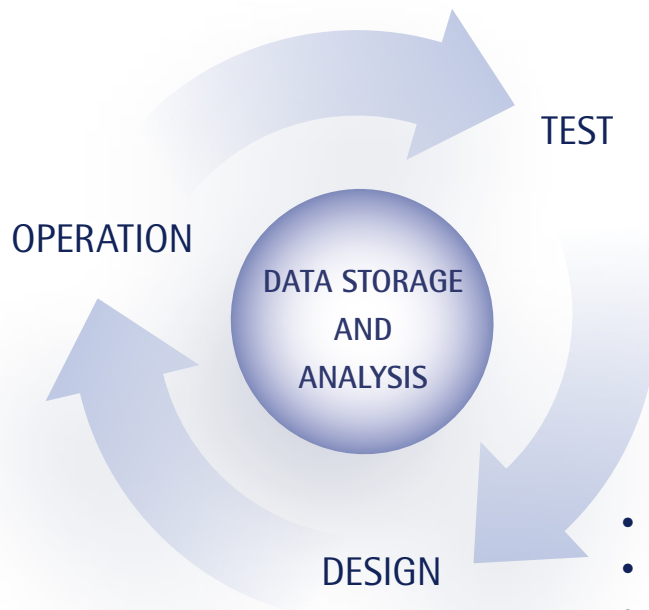
HUMS Ground Station

- ___ Automatically assess damage and trends to warn of durability issues using "Physics of Failure"; plus, identify CBM and RCM requirements

Aging Aircraft Support Systems

- ___ Assess life extension or operational restrictions by integrating HUMS information with design models and test results

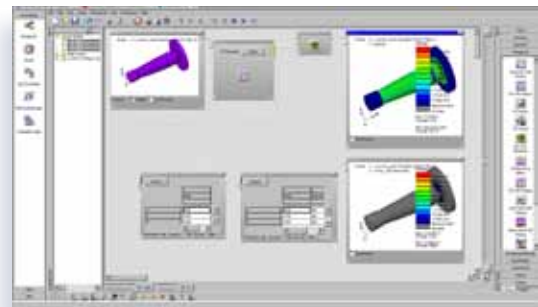
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- OLM: Operational Loads Monitoring
- HUMS: Health and Usage Monitoring Systems
- Aging Aircraft Support Systems

- Structural Test
- Engine Test
- Environmental Test
- Flight Test
- Accelerated Flight Approval
- Human Factors Assessment

- CAE-based Fatigue Analysis
- Virtual Test Rig Simulator
- Damage Tolerance Analysis
- Materials Characterization



Test

Structural, Environmental and Engine Test Analysis

- ___ Increase value of tests by rapidly analyzing test results and trends over thousands of channels
- ___ Accelerate flight approval by simplifying and accelerating tests
- ___ Qualify components for service on different aircraft platforms by using existing evidence

Flight Test

- ___ Automatically validate and convert data into information for design and certification teams and qualification
- ___ Increase value by providing consistency between design, structural and flight test information

Human Factors Assessment

- ___ Whole body shock and vibration assessments

Design

CAE-based Fatigue Analysis

- ___ Identify where and when fatigue failures will occur

Virtual Tests

- ___ Accelerate development by modeling structural performance to predict test results

Durability and Damage Tolerance Analysis

- ___ Optimize inspection periods by understanding critical crack sizes and growth rates

Material Characterization

- ___ Deliver the right material properties for modeling and evaluation

Solutions

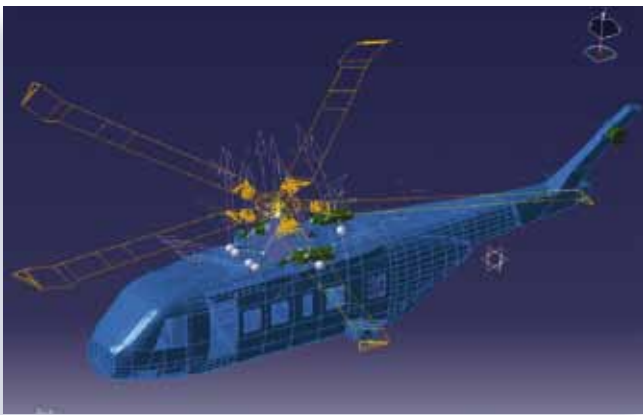




Aerospace Design Applications

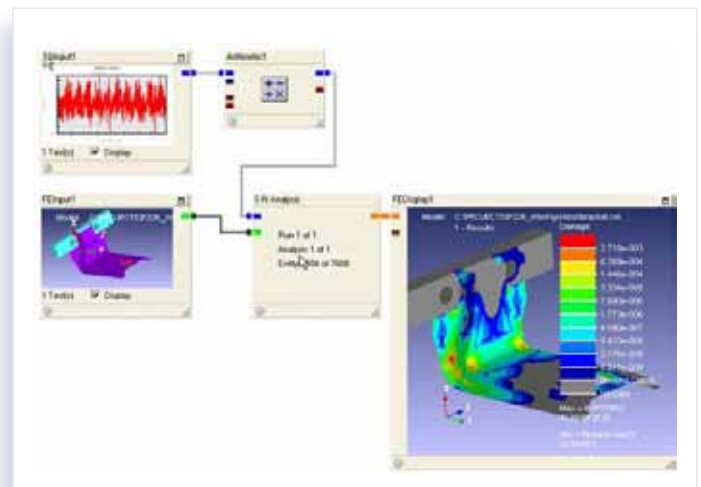
Aerospace design and engineering can be extremely demanding on software applications. Processes have to be rigorously applied and controlled, so software solutions must be well designed, easy to understand, consistently repeatable, and straightforward to execute.

With nCode DesignLife software, you can build an entire analysis and reporting process by simply dragging analysis components (called 'glyphs') and connecting them to form processes, which can be 'locked down' to enforce QA procedures and protect your IP if required. There are extensive glyph libraries available to analyze everything from multi-gigabyte files of measured flight and test data, to large FE stress models, all within the same user environment. You can also extend this functionality by embedding your own algorithm glyphs or interacting with your existing code.



CAE-based Fatigue Analysis

- Identify when and where failure could occur
- Multi-axial SN and EN fatigue analysis (including elevated temperatures)
- Non-linear and linear FE analysis of transient or quasi-static loading
- Simple to complex multi-axial loading spectra

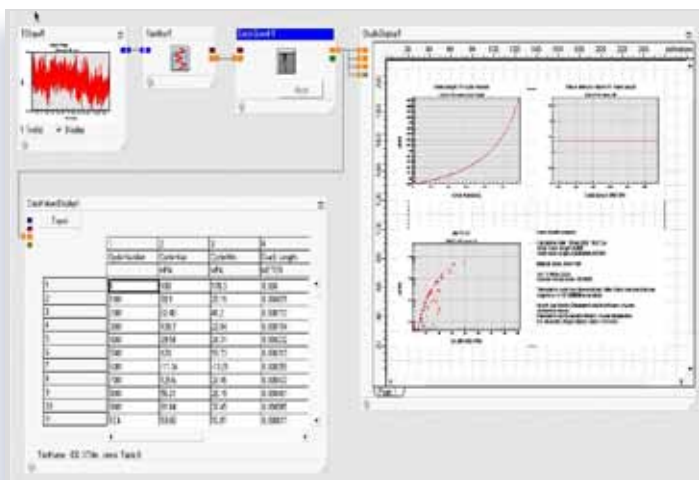


Virtual Test

- Accelerate evaluation and minimize prototype tests and costs (e.g. MIL-STD-810F) by predicting the structural performance directly from FE models

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- This consistent use of algorithms and user interface allows OLM, test and CAE design data to be combined to facilitate correlation studies and operational HUMS.
- The prediction of durability performance avoids expensive design changes and unexpected failures.



Damage Tolerance Analysis

- Optimize inspection intervals by predicting critical crack lengths, growth rates and estimating maximum permissible flaw size
- Perform forensic failure studies (including estimation of initial flaw size - EIFS)



Material Characterization

- Provide accurate and comprehensive material properties for:
 - Fatigue life prediction and analysis
 - Comparison of material supply sources for consistency of quality

Solutions





Aerospace Test Analysis Applications

Aircraft development, testing, and monitoring programs can, and frequently do, generate vast amounts of data. nCode GlyphWorks software is a comprehensive solution for de-noising and analyzing measured test data gathered from multiple sources. A complexity of measured data can be quickly transformed into easy to understand information and reports from which informed engineering and management judgments can be made.

Analysis is performed using our graphical process environment. Within this environment, you can quickly build complex analysis processes which are capable of handling thousands of channels of measured data. Open file formats and common data models permit you to share data between other software packages and enables tests to be correlated closely with design so designs can iterate swiftly to completion.



Structural Test

- ___ Automatic data validation, processing, trending and fatigue analysis
- ___ Automatic alerts for trends defining onset of failure and excessive fatigue accumulation rates
- ___ Analyze and understand all types of data

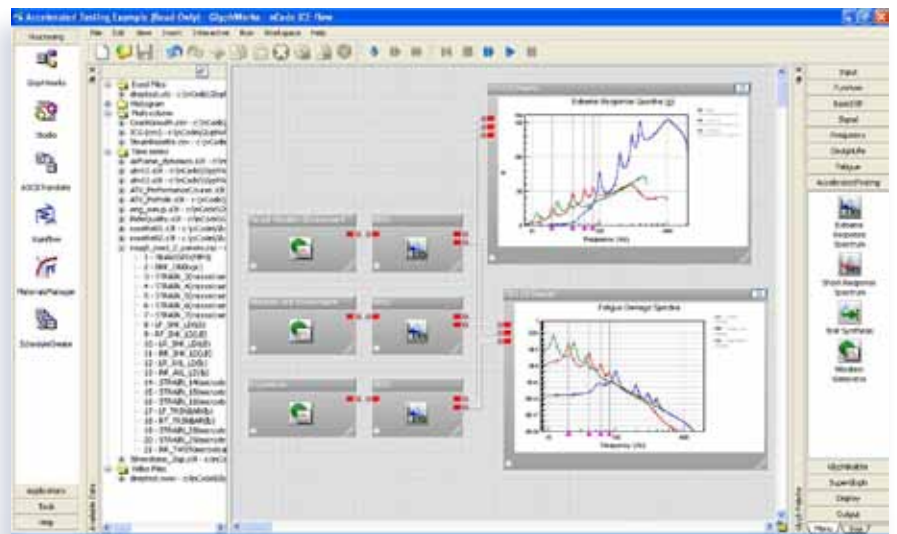


Engine Test

- ___ Vibration analysis with order extraction
- ___ Octave analysis
- ___ Noise weighting functions
- ___ Joint Time Frequency Analysis (JTFA)
- ___ Frequency Response Function Analysis (FRF)

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- Validate vast amounts of data and gain insight from huge amounts of measured data
- Reduce unnecessary testing and more quickly approve aircraft components



Flight Test

- ___ Improved quality and availability of information for design and certification teams through automatic data validation and upload
- ___ Understand mission readiness and usage severity
- ___ Advanced data analysis, trending and reporting

Environmental Test

- ___ Simplify, tailor and accelerate realistic shock and vibration tests
- ___ Qualify components and systems for service on different aircraft platforms using existing evidence
- ___ Equipment re-living and de-living assessments

Human Factors Assessment

- ___ Whole body shock and vibration assessments

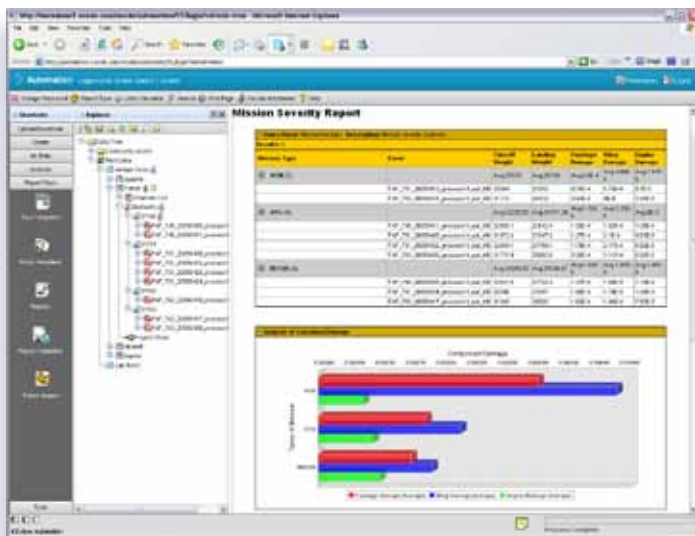
SOLUTIONS





Aerospace OLM and HUMS Applications

Many aircraft being built today will still be in service years from now and an increasing number of operational aircraft will be subject to re-lifing. nCode software has specific application to OLM (Operational Loads Monitoring) and HUMS (Health and Usage Monitoring) to provide engineers and operators with the tools they need to have confidence in the continuing airworthiness of aircraft throughout their lifecycle.



OLM – Greater understanding of loads

An OLM ground station uses measured flight load data to determine how aircraft are being used. nCode software can be used in this application to process thousands of channels of data and offers advanced analysis capabilities for signal de-noising, flight event characterization, prognostic and diagnostic damage modeling, vibration analysis and statistical trending by using nCode's intuitive visual processing environment.

Monitoring for improved life

A HUMS ground station predicts durability issues, assesses mission readiness and gives additional insight into usage trends. nCode software enables automatic data analysis

upon upload and issues alerts and usage reports to nominated stakeholders. nCode solutions are unique in offering an introspective analysis feature to 'mine' the stored data using advanced 'Physics of Fatigue' analysis techniques.

New detection processes can be added to a HUMS ground station at any time and the retrospective analysis features mean you can process all the archived data using the new processes; for example, to establish the health of any aging aircraft. This unrivalled functionality ensures a 'future-proof' system which can develop to capture service experience and obviate the risk of obsolescence.



- Learn from operational data and improve design processes
- Extend the life of aircraft in service by better understanding actual usage



OLM Ground Station

- ___ Understand usage severity by automatically validating and characterizing measured data
- ___ Categorize maneuvers and flight events to understand the loads generated
- ___ "Future-proof" long term usage by performing retrospective analysis on archived data at any time when new methods are implemented

HUMS Ground Station

- ___ Automatically assess damage and trends to warn of durability issues using "Physics of Failure"
- ___ Schedule maintenance based on CBM and RCM initiatives
- ___ Determine mission readiness by:
 - Comparing usage severity across the fleet
 - Diagnostic trending
 - Prognostic analysis
- ___ Re-lifing analysis

Solutions





Aerospace Data Warehouse Applications

With the huge amount of data generated from aircraft, cataloguing and management of data becomes an issue in itself. Often the information describing the data is not readily available; therefore finding and accessing the correct data is a time consuming process. Traditionally, test and development engineers have maintained their own 'data stores', usually on their own departmental networks. Add to this the fact that the data stores do not communicate with each other and it can be readily understood why such collaboration, at the data level, is seldom achieved.

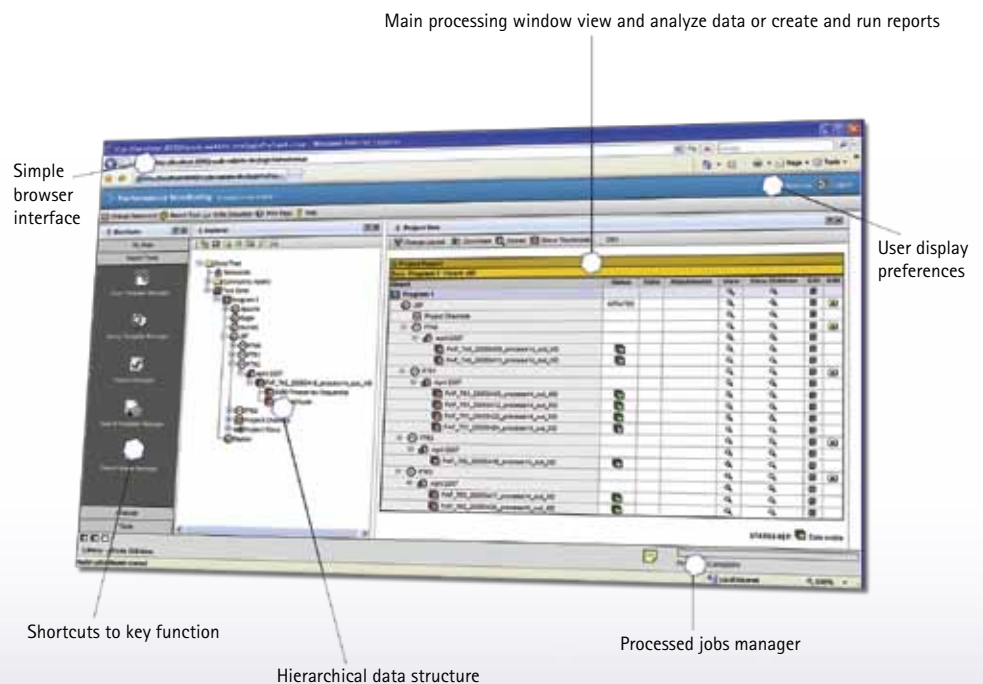
nCode Automation was designed with collaboration between design and test in mind. It provides a complete environment for automated data storage, analysis and reporting. Automation also provides a web-based collaborative interface for sharing test data and associated information throughout an organization.

- nCode Automation is much more than just a data management system.

It incorporates all the mathematical analysis features seen in our Design, Test and OLM applications to allow fully automatic batch processing of thousands of channels of measured flight and test data.

Powerful web-based architecture

- Provides consistent information and processes between design, test and flight operations
- Maximize availability of information throughout organizations while meeting import/export compliance requirements
- Server-side analysis avoids complex client desktop software proliferation and large file transfer



Learn from your data and keep learning

Data can be automatically processed on upload into nCode Automation. Automatic file format conversion, signal analysis and de-noising can be performed, followed by advanced fatigue and diagnostic analyses with alerts and reports automatically generated by the application.

New analysis routines, created visually in our design and test applications, can be uploaded to the system at any time to permit truly versatile data mining searches and retrospective analysis capabilities. You can even process archived data using new processes! All the analysis is performed locally on your servers, so there is no need to transmit huge data sets over the network. You can start your data warehouse on a single desktop machine and grow into a workgroup, or enterprise network.

- Searching, processing and downloading data can be done from anywhere in the world simply by using a web browser.

Share the knowledge

- Secure internet-based communications
- Automated data storage
- Automated data analysis
- Automated report generation

Secure and Scalable

- 'Future-proof' system that captures evolving experience and can rapidly re-process legacy data
- Maximum flexibility to instantly access information while recognizing required privileges and restrictions
- Scalable solutions from single server to multi-platform systems



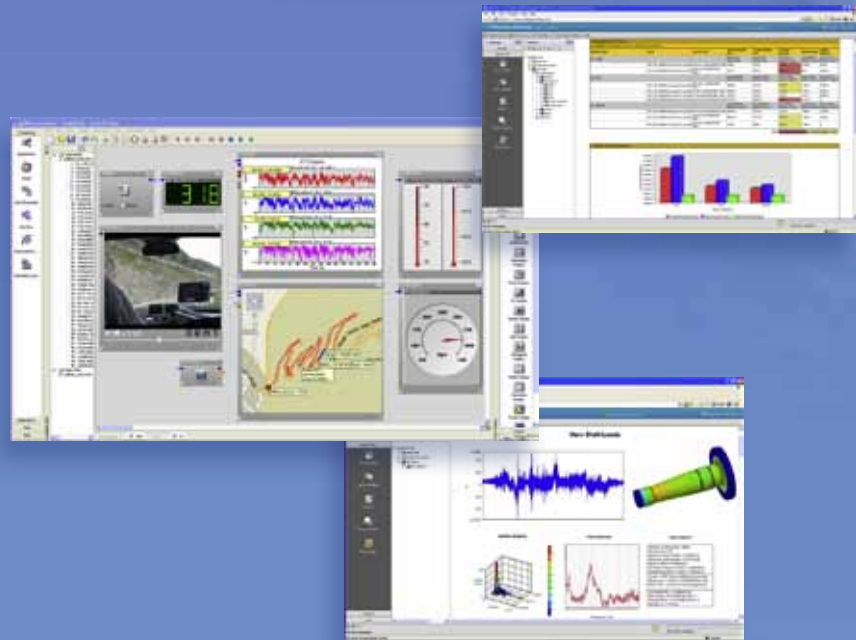
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Read more about HBM-nCode products at:

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