Prenscia HBM

Marshall

Marshall Aerospace and Defence Group uses nCode GlyphWorks to convert and validate large, complex flight test data

Modern aircraft must meet varied customer requirements based on intended usage and the environment they are to be operated in. Each aircraft configuration has to be individually designed, tested, and certified before the aircraft can enter into operation. Extensive ground and flight tests are conducted, resulting in massive amounts of technical data that must be processed and interpreted before being used as the basis for certification. Aircraft manufacturers sometimes contract this time-consuming and highly technical work to external engineering companies, such as Marshall Aerospace and Defence Group (Marshall ADG), to conduct tests and deliver validated test data. In order to obtain meaningful results as efficiently and quickly as possible, Marshall ADG uses nCode GlyphWorks to speed the calibration and conversion of the data recorded during ground and flight tests.

Featuring:

- Signal Processing
- Time Series Calculator
- PCAP File Format

Solution Requirements:

- Calibrate and validate thousands of measured channels
- Fast processing required to meet flight data delivery deadlines
- Data Review

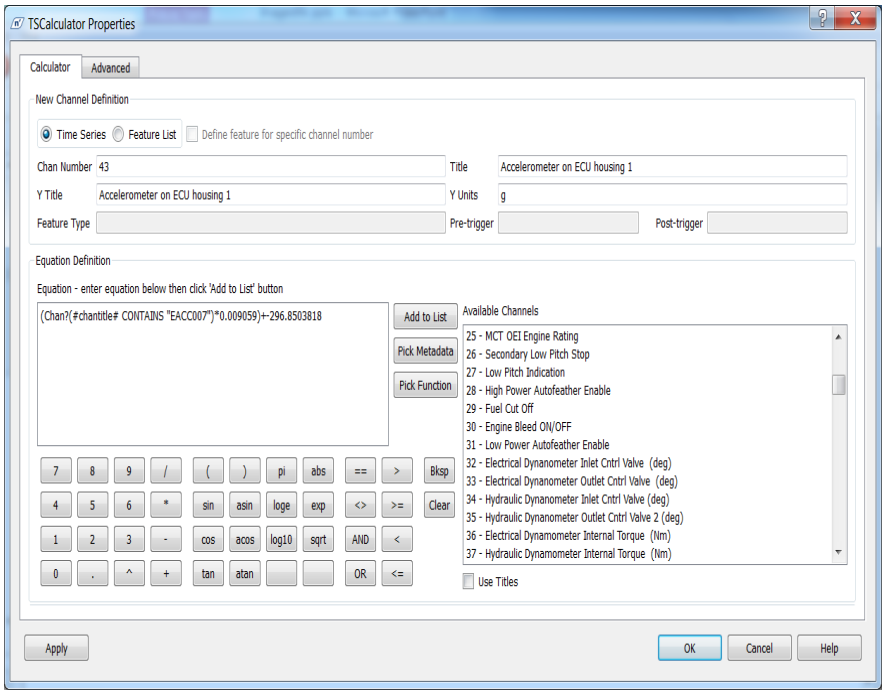
About Marshall ADG

With more than 40 years of testing experience, Marshall ADG is one of the largest independent aerospace and defense companies in Europe. The company, headquartered in Cambridge, UK, delivers innovation and excellence in air, land, and sea applications to customers around the world. Operating from Cambridge Airport, Marshall ADG is able to undertake both the ground and flight tests required to certify major aircraft modifications. Its test facility, measuring 21,500 square feet, is equipped with specialized rigs for full-scale component and equipment testing.

In addition, Marshall ADG has a long history of providing Operational Loads Measurement (OLM) systems on a variety of aircraft types, ranging from gliders to large transport aircraft, for the Royal Air Force and other customers. By installing instrumentation and calibrating the chosen platform, Marshall ADG helps their customers validate the fatigue monitoring process, understand the operational loading environment, identify causes of high fatigue damage, and determine load reduction strategies for the chosen platform.

Measurements include:

- Strain
- Acceleration
- Displacement
- Speed
- Temperature
- Pressure
- Force
- Torque
- Flow rate
- Mass flow rate
- Voltage
- Current
- State (on/off, open/closed)



All calibrations defined by the Time Series Calculator within nCode GlyphWorks. Calibrations include >1000 Y=mX + C, >300 bitwise, and non-linear calibrations with look-up tables.

The company's deep, broad expertise and extensive testing infrastructure are further enhanced by its judicious use of today's robust engineering software tools. One such tool, nCode GlyphWorks, played a significant role in one of Marshall ADG's most challenging projects.

Testing the most powerful turboprop engine in the Western world

Developed by Europrop International (EPI), a collaboration between Rolls Royce, MTU, Snecma and ITP, the TP400-D6 Turboprop engine/prop combination is the most powerful propeller engine ever to be designed and produced in the Western world. Marshall ADG was contracted by Airbus Military to conduct ground and flight tests of the new TP400-D6, which had been developed for use in their A400M Military Transporter. Marshall ADG developed and operated an engine Flying Test Bed (FTB) in order to reduce risk during the first flight of the prototype A400M aircraft.

"Our primary role was to integrate the engine into the aircraft and provide data that enabled our customer to truly understand the characteristics of the engine. We also had to prove the airworthiness of the FTB aircraft," said Ben Jakubowski, senior flight test instrumentation engineer at Marshall ADG. "To handle these tasks, we carried out various testing scenarios to make sure that the aircraft was capable of flight. Whenever we collect data during a flight test, we use nCode GlyphWorks to convert the raw data into engineering units. This data is then used by our external and internal customers within the development process."

nCode GlyphWorks is a powerful data processing software for analyzing engineering test data, with specialized capabilities in durability and fatigue analysis. Intrinsically multi-file, multi-channel, and multi-format, it is optimized to handle massive amounts and complex data efficiently while providing an intuitive, graphical environment that enables users to go from raw data to results quickly and easily. Improvements in data correlation, consistency, and quality of results can be achieved with nCode GlyphWorks. From scaling specific channels to recalibrating raw data, setting high and low pass filters, position- and time-based resampling, and calculating derived channels, nCode GlyphWorks provides a complete range of tools for analysis in the time, frequency, and statistical domains that are needed for projects such as the A400M FTB project.

"Within the ground test group, Marshall ADG uses nCode GlyphWorks primarily to review data and convert it into meaningful engineering data that the next user can work with," said Ben Jakubowski. "Depending on the size of the project, this can be a very large undertaking. We can go from 20 parameters to more than 3,000. GlyphWorks enables us to validate the data produced for internal and external customers in a very short time."

Turning gigabytes of data into results – fast

Marshall ADG performed considerable structural work on a C-130K Hercules test aircraft in order to mount the TP400-D6 engine in the left inboard position for testing. Various tests were conducted including take-offs, in-flight engine restarts and vibration tests to understand its characteristics in detail.

In total, Marshall ADG carried out 17 ground tests and 18 flight tests. From all those tests, the engineers recorded 3,230 analog and digital channels of test data with sample rates from 1 Hz to 16 kHz.

Each hour of testing generated 20 gigabytes of data. This massive amount of recorded data was calibrated and converted into meaningful engineering data using nCode GlyphWorks, enabling Marshall ADG and EPI engineers to understand how the test engine was performing. HBM Prenscia engineers assisted Marshall ADG with this project by automating and optimizing their calibration process. Signal processing was handled with nCode GlyphWorks' Time Series Calculator using many different calibration equations to convert the data.

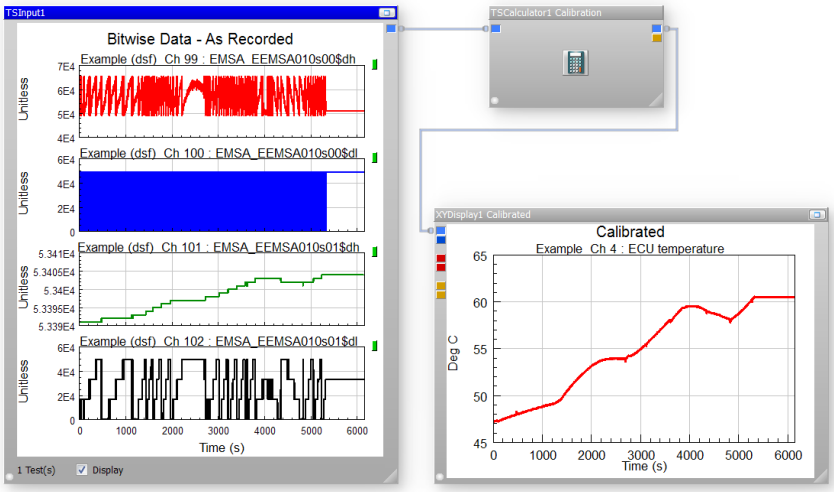
Meeting deadlines with understandable results

The project was a success for Marshall ADG, by using nCode GlyphWorks they were able calibrate and release the collected data to the other partners involved within 24 hours.

"Thanks to our team's hard work, expertise, and dedication, as well as the support of the HBM Prenscia engineering team, the FTB program achieved what it set out to do: improve the understanding of the TP400-D6 and greatly de-risk the A400M program," Ben Jakubowski said. "In this particular project, we were not responsible for the design and certification of the product. However, we do use nCode GlyphWorks to provide data for certification and, if needed, give engineering advice on possible design improvements. Without nCode GlyphWorks, I don't think we could provide such support." Ben Jakubowski further praised the software adding "I found GlyphWorks to be a very easy tool to look at data quickly, which is what we want to do. Other tools or manual methods don't offer this kind of data overview in such a short time."

Using nCode GlyphWorks enabled Marshall ADG's engineers to calibrate and convert large and complex data within a very short timeframe, keeping deadlines and delivering the data in a presentable, understandable format. Looking to the future, Ben Jakubowski anticipates continued reliance on nCode GlyphWorks for data calibration and conversion to help streamline the testing and certification process for Marshall's programs, as well customer programs.

During testing, thousands of data channels were constantly being monitored, using consoles designed and integrated by Marshall. The programe achieved what it set out to do; improve the understanding of the TP400-D6 and greatly de-risk the A400M program.



At the time of these flight tests some calibrations, for example ECU temperature, required bitwise calculations (bitmask, bitand, etc) to extract and calibrate the temperature from multiple measurement channels. For more recent flight tests this is now much simpler and faster using the GlyphWorks ability to import PCAP files to read these measurement parameters directly.

GlyphWorks enables Marshall ADG to rapidly calibrate and convert large and complex data recorded during ground and flight tests.

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- Ben Jakubowski,
Marshall Aerospace and Defence Group’s Senior Flight Test Instrumentation Engineer

About HBM Prenscia

HBM Prenscia leverages ReliaSoft and nCode software, training, and consulting to deliver solutions that empower the engineering community. We are committed to the development of innovative concepts for improving reliability, availability, maintainability, safety, and durability, while reducing risk across a broad range of applications.

For more information, visit our website at www.hbmprenscia.com

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