



Fatigue No MATCH for Swift Data Loggers and Analyzers

Parameters such as strain, torque, temperature, rotational speed, load, displacement and voltage can all shorten the fatigue life of any mechanical system. While fatigue can negatively impact almost any mechanical system, its effects often manifest themselves most tragically in aircraft disasters. Once such disaster was the tragic crash of a German military Westland LYNX Mk88 helicopter in the late 1990s. Caused by a broken tie-bar, the crash prompted the Dutch Navy, which operates 22 helicopters of the same kind, to implement a Smart Maintenance Policy that proactively monitors the effect of fatigue in its own helicopter fleet.

Like many other operators of mission-critical equipment, the Dutch chose AIDA, an Automatic In-Flight Data Acquisition System developed by Germany's Swift GmbH for this important task. Built around the Swift's MICRO II, a flexible 20-channel data recorder, AIDA is able to monitor and record a variety of parameters that influence fatigue life. These parameters include main rotor speed,

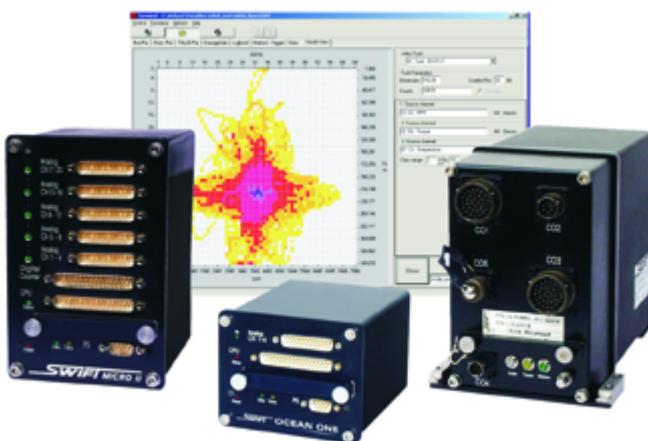
compressor and turbine speeds, engine torque, bank angle, indicated air speed, and sponson strain. Data are read from the recorder using a laptop/PC card interface and then evaluated using Swift's proprietary algorithm SQTMS (Sequential Peaks and Troughs with Time and Master/Slave) as well as such standard routines as RF (Rainflow), TAL (Time at Level), and TM (Transient Mode).

According to Swift's CEO Renate Dickler-Schütz, the Dutch Navy reported no less than spectacular results for this AIDA-based Smart Maintenance Policy. Since its implementation, the policy has slashed overall maintenance costs for Holland's Lynx fleet by roughly \$2.5 million per year and extended replacement intervals for engine components by 25%. It has also significantly extended fatigue life by using measure-

ments of actual flight loads to determine and limit a helicopter's flight hours.

The company behind this innovative measurement solution, Germany's Swift GmbH, will be no stranger to readers who regularly attend Mess-Comp, the Wiesbaden-based trade show devoted specifically to PC-supported measurement technologies. Visitors to last year's venue (October 28 to 30) got a hands-on look at MAS MATCH II, a pocket-sized, two-channel standalone data acquisition unit that is now replacing Swift's original MATCH I system.

As part of Swift's MAS family of independent data loggers, the MATCH II system is designed for automotive, marine and related applications. With built-in signal conditioning and filtering, all MAS data loggers are capable of providing long term statistical evaluation of parameters such as strain,



From left to right: Swift's Micro II data recorder, the new OCEAN system and an AIDA recorder. In the background is RAINFLOW, a software package used to recognize peak values of closed hysteresis loops and store the results of this process in an easily viewed matrix.

torque, temperature, rotational speed, load, displacement and voltage.

The MAS MATCH II Recorder accepts 2 analog and 2 digital input signals. It features a built-in shunt resistor, a 4-pole anti-aliasing filter, and software-controlled gain and offset functions. Data is processed at up to 2000 samples per second / channel using a high-performance 16-bit micro-controller running Swift's RF, TAL, TM and SQTMS algorithms. Users looking for even more power should consider MICRO II, a data recorder that accepts 20 analog and 8 digital input signals.

Swift has several new products that weren't quite ready for the runway at MessComp 2004, but which are expected to hit the streets by early spring 2005. First up is MATCH II-ADV, a ramped up version of the MATCH II recorder that features a faster, more powerful micro-processor while remaining connection-compatible with its MATCH II and MATCH II-4 siblings. Although it continues to use the same compact case as the MATCH II base system (80 x 50 x 25 mm), MATCH II-ADV doubles the previously available number of virtual channels (from 2 to 4) and RAM memory (from 864 Kbytes to 1.888 Mbytes). Available options include a CAN-Bus interface, an RS232 fast-transfer interface (57600 baud) and sampling rates of up to 10 kHz / channel.

Also new from Swift is OCEAN, an acronym for Online Counting Evaluation and Analysis. OCEAN addresses a data analysis and logging challenge felt perhaps most acutely in the automotive industry. Here, vehicle makers must conduct extensive on-road testing to

The MAS MATCH II, MAS MATCH II-4 and MICRO II data recorders. As part of Swift's MAS family of independent data loggers, the Match II system is designed for automotive, marine and related applications.

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confirm the course of damage and deterioration to vehicles resulting from stress, loads and other forces tested or modeled under laboratory conditions. Because of the global character of the industry, vehicles must often be tested in regions and countries across all five continents to reflect usage profiles, temperatures and other conditions.

Testing of this kind is extraordinarily time-consuming and costly, a fact that is especially true when measuring wheel forces. These are normally measured using expensive measuring wheels; the data is then characterized as a time series. However, this is difficult using conventional testing methods, not only because of the need to conduct the testing at a variety of global locations, but also because of the extremely high volume of data generated by this process.

OCEAN solves this conundrum by pairing Swift's advanced MAS Micro-II data recorder with a new Durability Transfer Concept developed by a leading German

university, FH Kempten. The combination of the two technologies makes it possible to correlate a one-time reference measurement performed during a vehicle test drive with data gathered by just three accelerometers. The accelerometer data is analyzed using RainFlow algorithms, which permits the virtually unlimited recording of data.

FH Kempten's Durability Transfer Concept then applies band-pass filtering to the 3D acceleration forces to create virtual channels and correlate the accelerometer data with the previous reference measurement. It is then possible to reconstruct the course of damage and deterioration resulting from stress, loads and especially wheel forces. The OCEAN process

significantly simplifies the measurement process and slashes dramatically the memory requirements of the virtual channels to only a few kilobytes. The overall effect is a dramatic saving in money and time.

Readers interested in a more detailed look at the entire range of Swift measurement and data acquisition systems are encouraged to visit the company's well designed website at www.swift-online.de. Highly recommended are the company's downloadable PDF data sheets and product profiles.

More info is also available on request by contacting the company directly. Swift welcomes inquiries and is pleased to provide further details upon request.

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