EXCEL APPLICATION LEVERAGES XML TO CONFIGURE BOTH AIRBORNE DATA ACQUISITION SYSTEM AND GROUND BASED DATA PROCESSING SYSTEM

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ABSTRACT

Flight test instrumentation/data processing environments consist of three components:

- Airborne Data Acquisition System
- Telemetry Control Room
- Post Test Data Processing System

While these three components require the same setup information, most often they are configured separately using a different tool for each system. Vendor supplied tools generally do not interact very well with hardware other than their own. This results in the multiple entry of the configuration information. Multiple entries of data for large complex systems are susceptible to data entry errors as well as version synchronization issues.

This paper describes the successful implementation of a single Microsoft Excel based tool being used to program the instrumentation data acquisition hardware, the real-time telemetry system, and the post test data processing system on an active test program. This tool leverages the XML interfaces provided by vendors of telemetry equipment.

KEYWORDS

Instrumentation, Data Acquisition Systems, Telemetry, Configuration Management, XML

INTRODUCTION

The Instrumentation Configuration List (ICL) is an EXCEL hosted VBA application that exports XML files that are compatible with a vendor supplied setup tool for loading airborne data acquisition system hardware. This application is a second generation tool that has evolved over approximately 12 years and four flight test programs.

After initial familiarization with the vendor provided hardware configuration tools, it became apparent that configuring a system with one thousand plus parameters would be extremely labor intensive. The vendor provided GUI interface required too many mouse clicks and did not have provisions for bulk entry of data. Another limitation of the vendor tool was the absence of transducer calibration information required for engineering unit conversion calculations.

The first generation tool was based on a database application with a grid like user interface that looked like a spreadsheet but did not have spreadsheet functionality. The first generation tool was capable of creating hex files required to program a specific vendor's hardware and the database file itself was provided to the data center to support engineering unit conversion and post processing of data. This implementation was tightly coupled to a specific vendor's hardware. And the lack of true spreadsheet functionality was a productivity limitation of the first generation tool.

This paper will discuss the features and operation of the second generation ICL. The paper will also discuss the productivity enhancements inherent in using EXCEL to capture the complete set of information required to configure the data acquisition hardware system, the telemetry and real-time display system, and the post processing system. Additionally the paper will show how the use of a robust XML interface simplifies the integration of products from different vendors to implement complex data acquisition and processing systems.

DESCRIPTION OF APPLICATION

The Instrumentation Configuration List application consists of an Excel spreadsheet with color coded columns defining four basic groups of information. The four basic groups of information are:

- Documentary Information (Green)
- Transducer Information (Blue)
- Data Acquisition System (DAS) Hardware Information (Yellow)
- Data Processing Information (Red)

In addition to these four basic groups, there is a column dedicated to the status of each measurement. The status column information and the column headings for each major group are shown below in Table 1.

DOCUMENTARY INFORMATION
MEASUREMENT ID
SUFFIX
MEASUREMENT NAME
RANGE LO
RANGE HI
ENGINEERING UNITS
FREQUENCY RESPONSE
MININIMUM SAMPLE RATE
GROUP

TRANSDUCER INFORMATION
TRANSDUCER DESCRIPTION
MANUFACTURER
PART NUMBER
TRANSDUCER S/N
TRANSDUCER EXCITATION
TRANSDUCER OFFSET(A0)
TRANSDUCER SENSITIVITY(A1)
TRANSDUCER ENGR UNITS
CALIBRATION DATE
CAL EXPIRATION DATE
TRANSDUCER RANGE LO
TRANSDUCER RANGE HI
TRANSDUCER FS RANGE
REQUESTED GAIN

MEASUREMENT STATUS
ON
OFF
FOR REFERENCE ONLY
HARDWARE ONLY

DAS HARDWARE SPECIFIC INFO
REMOTE NAME
REMOTE TYPE
REMOTE PORT
REMOTE ID
MODULE TYPE
MODULE ID
MS1
MS2
MS3
MS4
MSxxx

DATA PROCESSING INFO
FORMAT
WORD
WORD INTERVAL
FRAME
FRAME INTERVAL
WORD LENGTH
INPUT DATA TYPE
MOST SIGNIFICANT BIT
LEAST SIGNIFICANT BIT
PROCESS
A0 (OFFSET)
A1 (EU/COUNT)
A2
A3
A4
A5
OUTPUT DATA TYPE
STATES

Table 1 – Column Definitions

There is also a context sensitive form that displays the information as well. Using this form, the user can view all the required test information for a single measurement on one screen. The application also has support utilities for exporting XML files, performing data validity checks, and generating reports.

Users are provided with two options for data entry. All relevant information for a single measurement may be entered on a single row in the spreadsheet or entered on the context

sensitive form. While the user has to scroll left and right to access all of the columns, the form presents all information for a single measurement at once on a single screen. Fields on the form populate corresponding cells on the row for a given measurement. A sample of the context sensitive form is shown below in Figure 1.

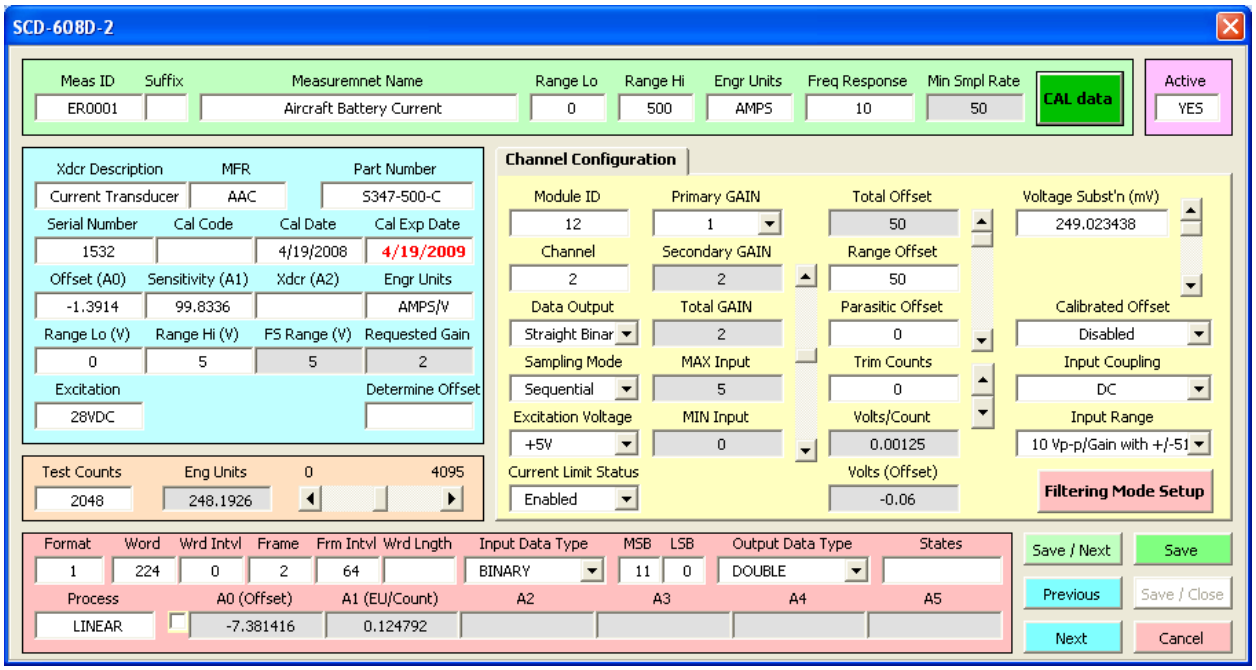

Figure 1 – Example context sensitive form

The fields in the hardware section (yellow) of the form vary depending on the type of signal conditioning card. Once a type of measurement is setup using the form, similar measurements can be quickly created by replicating rows in the ICL. Using standard Excel copy and paste functions, the user can quickly enter the common setup information for the similar measurement types. Basically the user has access to all the Excel functionality while also having the ability to manipulate the measurement setup information.

Pseudo measurement identifiers are also used to represent hardware specific setup information that can not be directly linked to a measurement. Examples of hardware setup information are bit rates, PCM frame sizes, as well as global card settings.

OPERATION OF APPLICATION

Once the ICL is populated, a vendor compatible XML file may be created. Data validity checks are performed while the XML is being generated. The XML file may then be imported into the vendor application. The vendor application compiles the XML project file and then loads the hardware.

The ICL spreadsheet is imported directly into the data processing system database. This database contains all information for the test environment including instrumentation hardware configurations, test mission configurations, and test data. Database tools are used to extract information required to setup the real-time display system and the post test data processing system. The extracted setup information is both XML and vendor proprietary. When XML coding is utilized, the integration of vendor tools is greatly simplified.

The required information for setting up the instrumentation hardware and the data processing system is entered one time only when utilizing the ICL application. The configuration information is then electronically propagated to the downstream applications using XML when available. This ensures that all components of the instrumentation / data processing environment are configured with the same set of information. An illustration of the data flow process from the ICL application is shown below in Figure 2.

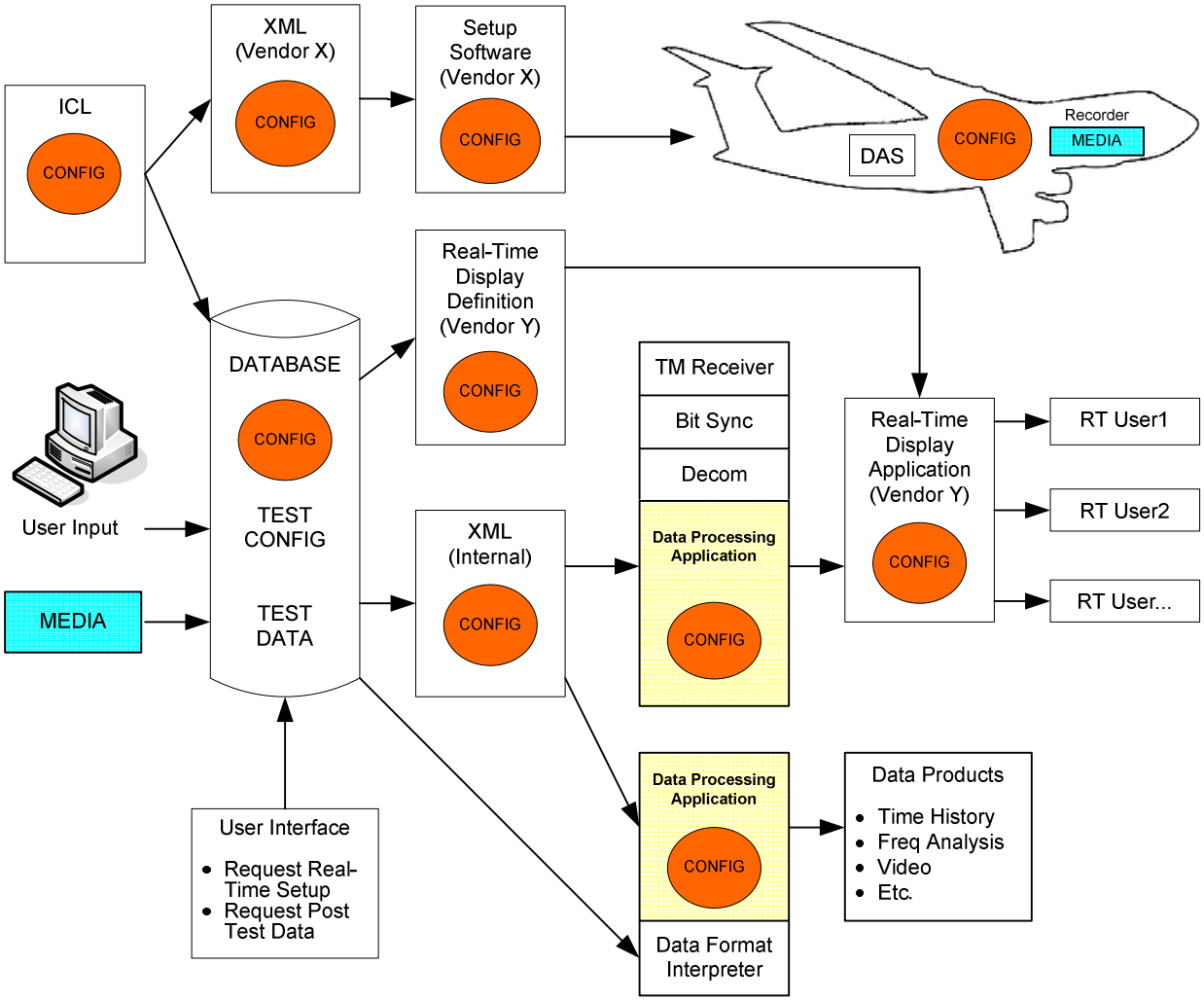

Figure 2 – Flow of setup information in an instrumentation / data processing environment

CONCLUSION

XML provides a convenient mechanism for communicating instrumentation setup information to different applications from a diverse group of vendors. While it is not necessary that all vendors use the same XML schema, the use of XML facilitates the interoperability of tools from a variety of vendors. The single entry of the configuration information significantly reduces errors and increases the data entry efficiency. The ICL application is easily adaptable to support any vendor's hardware and XML schema.