Small form factors – well suited solutions for MIL-STD-1553

By George Los, DDC

Small form factors are becoming more popular in embedded military applications, allowing reduction in size and weight for rugged embedded systems. There are many different standards for small form factor cards and Data Device Corporation offers a variety of different solutions for MIL-STD-1553 and ARINC-429 applications.
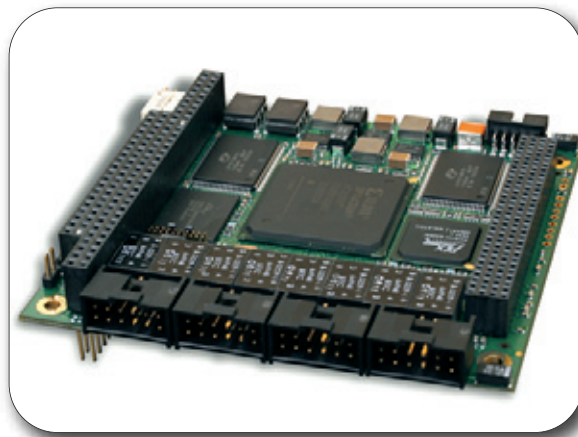

Figure 1. DDC MIL-STD-1553 PC/104 Plus Card

■ The PC/104 Plus and PCI-104 form factor is still a very popular small form factor that has allowed embedded and laboratory system designers to keep development costs low through the use of commercial off-the-shelf (COTS) products. The form factor is a small and compact design that is well suited for small embedded applications and rapid prototyping in the lab. The card is only 3.575 inches x 3.775 inches (90mmx96mm) and uses a stacking concept where one card sits on top of the other and allows you to build a tower of cards. The pins from one card insert into the card below it to provide the bus interface. The stacking concept allows system designers to eliminate backplanes that consist of large metal card cages making the overall format smaller in size and lower in cost. This proved to be an ideal format for military platforms such as tanks, fighter-jets, cargo aircraft and other platforms that require a small form factor. Applications such as displays, data recorders, data loader / verifiers, small situational awareness systems, or mission computers are an ideal fit for the PC/104 format.

Data Device Corporation provides cards for MIL-STD-1553/1760, Enhanced Bit Rate 1553, ARINC-429, and Synchro/Resolver with many cards combining many different types of I/O on one board to save even more power, space, weight, and cost. Providing Multi-RT support

with concurrent bus monitor or bus controller with concurrent bus monitor per 1553 channel allows legacy LRUs and systems that responded to only one RT address to be consolidated into one small form factor with an AceXtreme 1553 PC/104 Plus or PCI-104 card. DDC newest PC/104-Plus and PCI-104 cards that contain ARINC-429, MIL-STD-1553 and Multi-IO 1553/429 on one board can be powered off only +5V.

The Small Form Factor Special Interest Group (SFF-SIG) is an independent group that develops, promotes, and supports small form factor circuit board, I/O, and storage specifications. The group embraces the latest technologies, but also has a philosophy of maintaining legacy compatibility and enabling smooth transitions to next-generation interfaces. The SFF-SIG is focused on trying a variety of different approaches to suit the miniaturization of board-level electronics. The Stackable USB camp for its part is focused on using USB to replace ISA, PCI, or PCIe as the board-to-board interconnects in rugged stacked systems. A new group has formed around a new specification called Feature-Pak, to address small modules.

DDC has a USB board solution that contains up to 2 dual-redundant MIL-STD-1553 channels, 4 ARINC-429 receivers, 2 ARINC-429 transmitters, 8 user-programmable digital

discrete I/Os, IRIG-B time code input, and a 1 pulse-per-second (PPS) output. The USB board is approximately 3 inches x 2.6 inches (76.2mmx66mm) and can meet rugged levels of shock and vibration along with a temperature range of -40°C to +85°C. The rugged USB board solution is available as 1553 only, 429 only or fully populated with 1553/429 Multi-IO. The USB board can be powered directly from the USB interface eliminating the need for multiple power supplies to provide mixed voltages to the board. Its small size, light weight, and durable construction make the BU-67102U USB 1553/429 board a suited solution for use in flight instrumentation applications, small displays, situational awareness systems, portable rugged laptop type applications, or other small systems that do not have a standard form factor. The board is an ideal fit for applications that do not have a standard backplane but have a USB port in the system and require MIL-STD-1553 and/or ARINC-429 connectivity. The small board can be mounted inside a rugged enclosure and connected to a computer via a USB port. Each 1553 channel on the USB can operate in bus controller (BC) or Multi-RT (0 to 31) modes, and each mode has the ability to run a concurrent bus monitor (MT). The ARINC 429 channels can support full data line rate for low, high, and ARINC 575 speed communications with automatic slew rate adjustment while
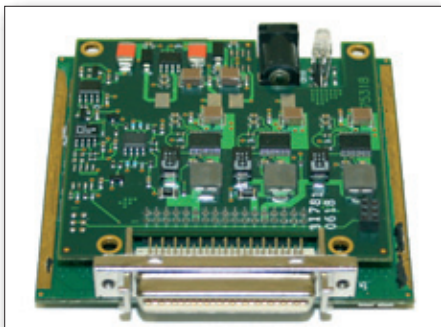
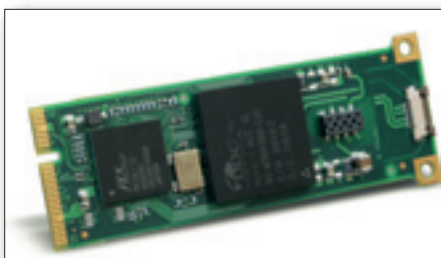Figure 2. DDC MIL-STD-1553/ARINC-429 Multi-IO USB Board

Figure 3. DDC MIL-STD-1553 Mini-PCI-e Board

Figure 4. Fully integrated 1553 terminal DDC Total-ACE

providing multiple reception and transmission methods for ARINC messages. A small Mini-PCI-e like form factor was also created that has one dual-redundant 1553 channel that is approximately 3 inches x 1 inch. It connects 1553 to a PCI-e x1 lane bus via an edge connector just like the standard mini-PCI-e small form factor and is ideal for laptop systems with mini-PCI-e that can fit this size 1553 solution. All the board solutions from DDC come complete with the MIL-STD-1553 AceXtreme software development kit (SDK) and the ARINC-429 Multi-IO C SDK with drivers for Windows 2000/XP/Vista/7, Linux and VxWorks. These SDKs allow to quickly integrate

DDC 1553 and ARINC 429 I/O into C source code applications. A common SDK exists across all operating systems allowing the programmer portability across different platforms. The easy-to-use high level functions abstract all low-level hardware accesses and memory allocations such that specific hardware knowledge is not required.

MIL-STD-1553 design includes protocol, memory management, transceivers, and transformers in addition to software drivers and software development kits. For designers looking to develop a small form factor 1553 card, DDC has created the Total-ACE to make development easy. The Total-ACE is the first fully integrated 1553 terminal consolidating all the necessary MIL-STD-1553 components within a single, small, cost-effective plastic BGA package. With one single plastic BGA package that is only 0.6" by 1.1" (15.24mmx27.94mm) you can now create a complete interface to a dual redundant MIL-STD-1553 bus. The small size saves valuable space on the small form factor board and the single package allows for an easier layout. The 1553 terminal is powered entirely by +3.3V to minimize board space even further by eliminating the need for having multiple voltage regulators.

Having just one part for a complete MIL-STD-1553 interface also increases overall reliability of the small form factor board. MIL-STD-1553 also has defined an RT validation test plan to ensure that the bus is electrically safe and reliable, and that all parameters are within specifications and no external noise exists or dynamic offset on the line. All MIL-STD-1553 products by DDC have successfully undergone full RT validation. In addition to this with the Total-ACE you can achieve DO-254 qualification on end systems if required. DO-254 is an FAA standard that provides guidelines for design assurance of complex airborne electronic hardware and calls out objectives that must be met by avionics equipment manufacturers to ensure continued airworthiness, safety, and reliability. DO-254 certification is required for all civil airborne electronic hardware and military contractors are finding DO-254 increasingly important for military aircraft that must fly through civil airspace. ■

Product News

■ **GE: rugged XMC module for video streaming in unmanned vehicles**
GE Intelligent Platforms announces the ICS-8580 Rugged Video Streaming XMC, a compact, flexible answer to the problem of capturing, compressing and delivering video. The ICS-8580's XMC form factor means that it is small, lightweight at 100 grams/3.5 ounces and consumes little power - typically, 10 15 watts.
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