CAN Newsletter Online

MILITARY ELECTRONICS

CAN is increasingly used in army, navy, and air force

Already since many years, Cots (commercial off-the-shelf) technologies are used in military equipment. CAN is one of them.

Since the millennium, CAN is increasingly used in military vehicles, weapons, and other equipment for soldiers. Smart weapons such as drones are equipped with embedded CAN networks as well as tanks and other military special-purpose vehicles. There are developed two Milcan standards: Milcan A is based on J1939 and Milcan is similar to CANopen.

There is a continuing upward trend that began in the early 2000s. The volume of international transfers of major weapons in 2013â€'17 was 10 percent higher than in 2008â€'12, according to new data on arms transfers published by the Stockholm International Peace Research Institute (Sipri). The flow of arms increased to Asia and Oceania and the Middle East between 2008â€'12 and 2013â€'17, while there was a decrease in the flow to Africa, the Americas, and Europe. The five biggest exporters — the United States, Russia, France, Germany, and China — together accounted for 74 percent of all arms exports in 2013â€'17 (for details see the insert below).

Power conversion device with CAN interface (Photo: Brookx)

From dedicated chips to ruggedized computers

The supplier of military electronics use increasingly Cots technologies such as CAN. Some CAN suppliers do not support directly the military market. Bosch and Vector, for example, do not deliver products and services for military applications by the companies' statutes. Nevertheless, they supply soâ€'called dual-use projects. CAN products dedicated for military use are available from the chip level via the board level to the computer level.

Sital Technology (Israel) provides IP core for Classical CAN and CAN FD as well as cyber-security solutions for CAN. The company supplies in particular to avionics and aerospace industries, which includes military applications, of course. In recent years, the company has developed unique technologies and products for detecting serial-bus faults during operation. This patented technology is capable of pinpointing the location of a fault, even on intermittent faults of disconnections and short-circuits without interfering with the normal bus operation. Sital's customer list includes leading military organizations throughout the world: BAE Systems, Honeywell, Raytheon, Lockheed Martin, Thales, etc.

Nolam Embedded System, another CAN IP core provider, has teamed up with Reflex CES to supply FPGA boards for Cots applications. One of the first outcomes of this collaborative venture is the release of an SDK (software development kit), composed of the "Achilles" Arria 10 system-on-chip combined with the CAN IP core and the CAN FMC module.

Atmel, now Microchip, supplies micro-controllers for military and space applications (Photo: Microchip)

Microchip's recent acquisition Atmel is one of the Cots micro-controller suppliers supporting CAN connectivity in its MCUs. The AtmegaS64M1 has been designed to meet the needs of space and other critical aerospace applications. It comes in a 32-lead ceramic package (QFP32). The MCU is specified for a temperature range of -55 °C to +125 °C. It is the first Cots-to-radiation-tolerant MCU combining a CAN module, digital-to-analog converter, and motor-control capabilities. These features make it suitable for variety of subsystems such as remote terminal controllers and data handling functions for critical avionic applications. Microchip is also offering the STK 600 development board. The Atmel Studio IDE (integrated development environment) and software libraries for development and debugging support this board.

Cots board-level products are also used in military applications. For example, Kvaser's (Sweden) PC104+ boards with CAN connectivity sit inside the Multifunctional Display Unit (MFDU) by Nijkerk Computer Solutions (Netherlands), an rugged display unit that has been designed for observation and command and control systems. It can handle composite video and has a graphical processing unit within it that generates overlays with various effects like alpha-blending, rotation/translation, and scaling. Programming is done in Linux or Windows. As the Commander in a tank or armored vehicle, the ability to make quick, accurate decisions is vital, but to perform in such a way, an intimate knowledge of the surrounding environment is necessary. It is for this reason that armored vehicles used for reconnaissance or battle situations these days typically boast a variety of externally mounted cameras – near-infrared, night-vision, thermal-imaging among them – to relay as much outside information as possible to those inside the cabin. Mike Hantson from Nijkerk Computer Solutions stated: "The applications designed by our customers (mainly system integrators) exchange information with other external applications and systems within the vehicle, for which they use a communications bus such as CAN or Ethernet." These might be other vehicle-mounted sensor subsystems, such as ground surveillance radar, chemical or IED detection systems, or vehicle subsystems such as the engine, transmission, turret,

or stabilized gun systems.

The boards by Kvaser are integrated in a closed system that needs to meet extremely constrained environmental conditions. Toughest amongst these are vibration and shock, which will be of no surprise for an all-terrain vehicle that may be fired upon. But equally hard are the temperature requirements. The system needs to be able to start-up and operate at temperatures down to -40 °C and up to +71 °C – this is the temperature outside the box, meaning that the temperature within the box may be closer to +90 °C. Among the key reasons for choosing Kvaser products, said Hantson, was the performance of the boards, the number of available channels and total bandwidth, as well as the support for Linux. He noted: “Kvaser’s Linux libraries were good and very easy to use, and since we recommend that developers use Linux, Kvaser’s approach fits well with our thinking.”

Evercom (Belgium) uses the USB/CAN interface modules by ESD Electronics (Germany) in its ruggedized dongles. They support on the CAN side transmission rates up to 1 Mbit/s. The bit-rate as well as several other functions can be set up via software. The CAN Interface itself is galvanic isolated from power supply and the USB interface using a DC/DC converter.

USB dongle with embedded CAN interface module by ESD (Photo: Evercom)

Besides board-level products, there are also dedicated military devices on the market featuring CAN connectivity. An example is the 2â€‘kVA DC/AC inverter and the 3â€‘kW AC/DC converter by Brookx (Netherlands). The IP67-rated power conversion devices come with CAN interfaces. They are designed for military vehicles.

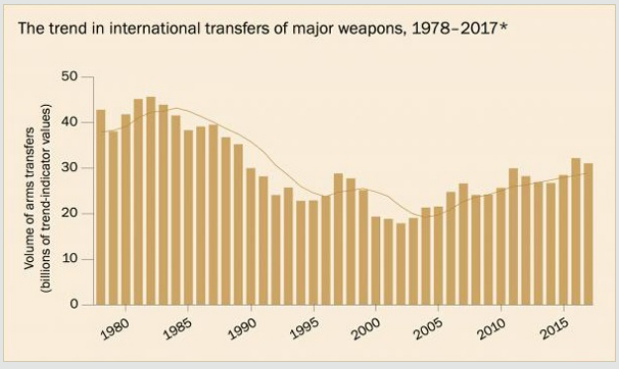
Last year, General Micro Systems (USA) has introduced a multi-domain server, which can be expanded by eight expansion cards providing CAN or MILâ€‘STDâ€‘1553B interfaces. The S1U401â€‘MD “Cyclone” multi-port Ethernet switch/router is based on the Intel’s Xeon E5 processor. The ruggedized product is designed for low price, space efficiency (1U rack-mountable), and battlefield network security. Its six functions per domain are suitable for the army’s multi-domain battlefield and command networks; for the Navy’s and Marines’ shipboard operation centers and command/control; and for the Air Force’s airborne C4ISR platforms.

The VBOX-3611 computer made in Taiwan is intended for military applications (Photo: Sintrones)

Military computer systems are also equipped increasingly with CAN interfaces instead of other special communication technologies such as MIL-STD-1553 originally introduced in 1973 and updated in 1978 (MILâ€‘STDâ€‘1553B). The manufacturers of such computers are located not just in the countries, which are the biggest exporters of arms. Amdtec (Turkey), for example, has introduced the ATRâ€‘600M military computer based on Intel’s Core i7 processor. It features two MIL-STD-1553B and one CAN channels as well as Ethernet and serial ports. Another example is the VBOXâ€‘3611 military computer by Sintrones (Taiwan). It is also based on the Core i7 processor and comes optionally with one CAN port.

Arms exporters: The USA extends its lead

Besides the liberal gun laws in USA, the country is also the market-leading exporter of arms. In 2013â€‘17 the USA accounted for 34 percent of total arms exports. They increased by 25 percent between 2008â€‘12 and 2013â€‘17. US arms exports in 2013â€‘17 were 58 percent higher than those of Russia — the second largest arms exporter in that period. The USA supplied major arms to 98 states in 2013â€‘17. Exports to states in the Middle East accounted for 49 percent of total US arms exports in that period.



The bar graph shows annual totals and line graph shows the 5-year moving average (Photo: Sipri)

“Based on deals signed during the Obama administration, US arms deliveries in 2013â€‘17 reached their highest level since the late 1990s,” said Dr. Aude Fleurant, Director of the Sipri Arms and Military Expenditure Program. “These deals and further major contracts signed in 2017 will ensure that the USA remains the largest arms exporter in the coming years.”

Arms exports by Russia decreased by 7,1 percent between 2008â€‘12 and 2013â€‘17. France increased its arms exports by 27 percent between the two periods and was the third largest arms exporter in 2013â€‘17. Arms exports by Germany — the fourth largest exporter in 2013â€‘17 — fell by 14 percent between 2008â€‘12 and 2013â€‘17. However, German arms exports to the Middle East increased by 109 percent.

Few countries outside North America and Europe are large exporters of arms. China was the fifth largest arms exporter in 2013â€‘17. Its arms exports rose by 38 percent between 2008â€‘12 and 2013â€‘17. While Pakistan was the main recipient of China’s arms exports in 2013â€‘17, there were large increases in Chinese arms exports to Algeria and Bangladesh in that period.

Israel (55 percent), South Korea (65 percent) and Turkey (145 percent) substantially increased their respective arms exports between 2008â€‘12 and 2013â€‘17.

Most states in the Middle East were directly involved in violent conflicts in 2013â€‘17. Arms imports by states in the region increased by 103 percent between 2008â€‘12 and 2013â€‘17, and accounted for 32 percent of global arms imports in 2013â€‘17.

“Widespread violent conflict in the Middle East and concerns about human rights have led to political debate in Western Europe and North America about restricting arms sales,” said Pieter Wezeman, Senior Researcher with the Sipri Arms and Military Expenditure Program. “Yet the USA and European states remain the main arms exporters to the region and supplied over 98 percent of weapons imported by Saudi Arabia.”

In 2013â€‘17 Saudi Arabia was the world’s second largest arms importer, with arms imports increasing by 225 percent compared to 2008â€‘12. Arms imports by Egypt — the third largest importer in 2013â€‘17 — grew by 215 percent between 2008â€‘12 and 2013â€‘17. The United Arab Emirates was the fourth largest importer in 2013â€‘17, while Qatar (the 20th largest arms importer) increased its arms imports and signed several major deals in that period.

India was the world’s largest importer of major arms in 2013â€‘17 and accounted for 12 percent of the global total. Its imports increased by 24 percent between 2008â€‘12 and 2013â€‘17. Russia accounted for 62 percent of India’s arms imports in 2013â€‘17. However, arms imports from the USA rose by 557 percent between 2008â€‘12 and 2013â€‘17, making it India’s second largest arms supplier. Despite its continuing tensions with India and ongoing internal conflicts, Pakistan’s arms imports decreased by 36 percent between 2008â€‘12 and 2013â€‘17. Pakistan accounted for 2,8 percent of global arms imports in 2013â€‘17. Its arms imports from the USA dropped by 76 percent in 2013â€‘17 compared with 2008â€‘12.

“The tensions between India, on the one side, and Pakistan and China, on the other, are fuelling India’s growing demand for major weapons, which it remains unable to produce itself,” said Siemon Wezeman, Senior Researcher with the Sipri Arms and Military Expenditure Program. “China, by contrast, is becoming increasingly capable of producing its own weapons and continues to strengthen its relations with Pakistan, Bangladesh and Myanmar through arms supplies.” China’s arms imports fell by 19 percent between 2008â€‘12 and 2013â€‘17. Despite this decrease, it was the world’s fifth largest arms importer in 2013â€‘17. Not to forget that China has increased efforts to develop its on weapon and military equipment. The military budget is 8,1 percent higher than last year, and sums to US-$ 175 billion. The U.S. budget 2018 is USâ€‘$ 700 billion. This is four times higher than the Chinese one.

CAN in tanks

CAN is not the dominating network technology in military equipment, but it is an option for some military applications. For example, it is used in German, Polish, as well as Swedish tanks for several purposes. The Leopard 2PL tank uses a CAN backbone network. Also the Exact tank fire-protecting system by Mikro-Pulssi (Finland) uses embedded CAN networks. Several tanks (e.g. Patria XA and Leopard 2) as well as in the Asrad-R missile platform by Rheinmetall implement it. HDVS (Greece) provides a CANâ€‘based cooling system for Leopard 2 tanks. You also find some research-oriented articles about CAN networks in tanks by Chinese authors. More detailed information on the use of CAN in military applications is normally not available publically. We just see the tip of the iceberg.

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