Ready for Take-Off
Reliable Solutions for Mission-Critical Aerospace Applications

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MCN
Always reliable. Always ahead.
The Right Partner for Aerospace Electronics

- ARINC 653
- ARINC 717
- ARINC 600
- ARINC 664
- DO-254
- EN/AS 9100 certified
- Modular concepts
- Deep FPGA knowledge
- In-Flight experience up to DAL-B
- Certifiable products up to DAL-A
- Collaborations for EASA part 21 and 145

Requirements and Standards in Avionics

- ARINC 429
- Design Assurance Levels / DAL
- DO-160
- EN/AS 9100
- GRESS / ABD
- DO-178C / EUROCAE ED-12B
Quality from the Beginning

MEN develops according to the V-Model including RAMS methods (Reliability, Availability, Maintainability, Safety)

- System definition
- Hazard and safety analyses
- Safety verifications

Integrated management system

- ISO 9001 since 1997
- ISO 14001 since 2003
- EN/AS 9100 since 2008
- EFQM – heading towards a total quality management system
Long-Term Availability

- In-house production
- Obsolescence management
- FFF successor boards

Open Standards → Platforms instead of proprietary solutions

Future-safe for up to 30 years
Flexibility in system design
Certification

- Support for certification process
- Certification packages up to DAL-A available for:
  - D602 - Triple-redundant CompactPCI SBC
  - A602 - Triple-redundant VMEbus SBC
  - CS1 - FPGA with Integrated AFDX/ARINC-664

Safes time and cost
Speeds up the certification process
Dramatic risk reduction for customer
Various architectures for functional safety

One key element is redundancy
- MEN is pioneer of on-board redundancy
- Less software effort, less cost
- Standard boards with certification package up to DAL-A

Additional methods like supervisors, determinism, diversity and event logging

SEU (Single Event Upsets) resistant through implementation in FPGA

Fail-safe, fail-silent, fail-operational solutions
Robustness

Rugged for harsh environments

- -40 °C to +85 °C operating temperature
- Shock, vibration, humidity, dust, chemical influence
- SEU resistant
- 7 days/24 hours operation, up to 30 years

Pre-qualification in our in-house laboratory

- EMC emission/immunity
- Electrical safety
- Environmental tests
Time-to-Market with Building Blocks

Modular building blocks

- Open standards for hardware and software
- Extensive use of FPGA designs
- Own IP core library
  - Safe, flight-proven at DAL-B
  - Non-safe, prepared for DAL-D

Flexibility on board level

- Scalable processor platforms
- Flexible I/O configurations
- Form-fit-function successor boards
Software Support

The right platform for different purposes

- Non-safe systems
  - Focus on Linux
  - Windows

- Safe systems
  - Usage of PikeOS, VxWorks, Integrity

Safe RTOS to achieve ARINC 653 or DO-178C

Long relationship with Sysgo, WindRiver, Green Hills
AFDX-based Ethernet Communication

Avionic
Full Duplex Switched

- Communication backbone of modern aircraft
- Based on IEEE 802.3 standards
- Standardized as ARINC 664, Part7
- Virtual link
- Deterministic timing
- Guaranteed bandwidth
- Physical redundancy
CS1 – AFDX Functions in FPGA

- AFDX functionality integrated in a Flash based FPGA
- SEU (Single Event Upset) resistant
- Onboard AFDX protocol stack implementation
- Certifiable up to DAL-A
- Host driver with ARINC-653 compliant port API
- Integrated SNMP/ICMP support

Flexible and open AFDX solution
Customizable AFDX independent of form factor
Reduction of risk, cost and time-to-market
Interoperable with Airbus and Boeing
With certification support packages

Reduction of risk, cost and time-to-market
MEN COTS Products for Aerospace
MP70S – ARINC 600 4 MCU Aircraft IFEC-Server

- ARINC 600, 4 MCU housing with status display
- Intel Core i7, quad-core processor
- 16-port managed Gigabit Ethernet Switch
- 2 hot-pluggable HDD/SSD shuttles
- WiFi and/or 3G/4G cellular interfaces
- Display port, USB 3.0, GB Ethernet and 2 SIM card slots on front
- Qualified according to DO-160G
Safe Computers

A602 / D602 – 6U Power PC Safe Computer
- VMEbus or CompactPCI
- Triple-redundant PowerPC 750 CPU
- Fail-safe, SEU-resistant, CCA frame possible
- Certifiable up to DAL-A

CS1 – AFDX / ARINC-664 Controller
- AFDX integrated in a Flash based FPGA
- SEU immune configuration
- Interoperable with Airbus and Boeing
- DAL-D certifiable/prepared for DAL-A

P522 – AFDX / ARINC-664 Interface PMC
- PMC module with onboard CS1
- Two full duplex AFDX networks
- Onboard CPU for SNMP and ICMP traffic
- -40° C to +85° C with qualified components
Computer-on-Modules

CB30C – Safe Rugged COM Express Module
- Freescale QorIQ P1022 CPU
- 2 GB ECC SDRAM, soldered
- Fail-safe, safe supervisor, event logging
- Conduction cooled

CB70C – Rugged COM Express with Intel Core i7
- Up to 16 GB ECC DRAM, soldered
- Open CL 1.1 support
- -40° C to +85° C Tcase screened
- Conduction cooling

XM51 – QorIQ Multi-Core COM Module
- Freescale QorIQ P4080, P4040 or P3041
- Up to 8 cores, up to 1.5 GHz
- Up to 16 GB ECC SDRAM, 1 or 2 controllers
- -50° C to +85° C Tcase, qualified components
Display Controllers

CC10S – Multi-Display Controller SBC
- Freescale ARM i.MX 6 Series
- Dual-channel LVDS or two single channels
- Multi-stream-capable HD video engine, OpenCL support
- For LCD TFT panels from 7” to 15”, full HD, 1920x1200

G214 – cPCI Serial Multi-Display Controller
- AMD Radeon E6760 GPU, 600 MHz
- 6 SIMD engines, 480 shaders
- 1 GB integrated graphics RAM
- For visualization or as a co-processor
CompactPCI Serial Single-Board Computers

G25A – cPCI Serial Intel XEON D SBC
- Multicore server grade virtualization platform
- Up to 16 cores, up to 32 GB ECC DDR4 DRAM, soldered
- 10 Gb Ethernet, PCIe 2.0/3.0 bandwidth
- Security with TPM (Trusted Platform Module)

G52A – cPCI Serial QorIQ Enhanced Network SBC
- Multicore server grade virtualization platform
- Up to 12 cores
- Up to 12 GB ECC DDR3 DRAM, soldered
- 10 Gb Ethernet, PCIe 2.0/3.0 bandwidth

G23 – cPCI Serial SBC with Intel Core i7
- Up to 32 GB ECC DRAM, soldered
- mSATA and microSD card slots
- Front I/O: 2 DisplayPorts, 2 Gb Eth., 2 USB 3.0
- Intel Turbo Boost, Hyper-Threading, AMT 9.0
CompactPCI Serial Ethernet Switches

G101 – Managed Industrial Ethernet Switch
- Up to 25 Gigabit Ethernet ports on rear I/O
- Or 3 ports on front and up to 22 ports on rear
- 29 Gbit/s carrier grade switch matrix
- -40°C to +85°C with qualified components

G302 – Managed 16-Port Industrial Ethernet Switch
- Up to 16 Gigabit Ethernet ports on rear I/O
- Or 3 ports on front and up to 13 ports on rear
- Configuration via Telnet CLI, SNMP or ext. dongle
- Service interface via M12
Proven In-Flight Experience
Cargo Load Control of A400M

Electronics for mission-critical control computer

- Safe, triple-redundant CPU cards
- SEU-resistant
- Conduction cooled
- DAL-B certified
- Extensive BITE features
- Critical I/O functions implemented in FPGA
Collision Avoidance System

- Sensor system for UAVs with four cameras
- CompactPCI Serial system based on COTS components
- 4 Intel-based CPU cards
  - 3x G20 (control/pre-processing of 3 cameras)
  - 1x G20 (interface maintenance unit)
- Communication via full Ethernet mesh on backplane
- G215 multi-function I/O card (FPGA-based)
- G501 with SSD
Passenger Dial Unit

- Multi-touch controller to adjust various multimedia settings in passenger seats
- FPGA chip installed in underlying system
- Close cooperation between customer (housing) and MEN (electronics)
- Combination of state-of-the-art technology and high-quality design
Flight Display Control

- Display control electronics for various types of displays
- For small and medium-sized commercial aircraft
- Custom-specific SBC with conduction cooling frame
- Based on PowerPC QorIQ processor
- Adjustable core frequency in range of 400 MHz to 1.5 GHz
- FPGA for customized safety functions
- Sophisticated power control and thermal management
Multiport Gigabit Switch for Entertainment Server

- Used in in-flight entertainment server
- Interoperability between cards of different suppliers was mandatory
- Based on standard protocols
- Connected in ring topology to increase reliability
- Powerful 29 Gbit/s switch matrix
- 25 Gigabit Ethernet ports on rear I/O
- -40°C to +85°C operating temperature
Our Know-How – Your Benefits

- Development according to market-relevant standards
- Extensive quality management
- Expert for rugged and reliable products
- High-quality in-house production
- Environmental testing in-house
- Long expertise in FPGA technology
- Why MEN?
- Custom design of boards and systems
- Customer assistance for mission-critical systems
- Complete system solutions developed in-house
Outlook – Space CompactPCI Serial

- New working group of PICMG
- MEN to advise and coordinate
- Extension of CompactPCI Serial standard in terms of suitability in space
  - Conduction cooling
  - SEU-resistance
  - New serial interconnections
  - High availability
  - Fault detection
  - Environmental requirements