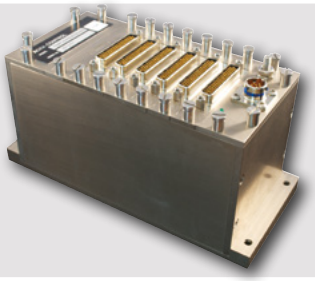
SPACE SYSTEMS

CURTISS-WRIGHT

CURTISSWRIGHTDS.COM

LAUNCHERS RE-ENTRY SATELLITES



DATA ACQUISITION

NETWORKING

RECORDING

ABOUT CURTISS-WRIGHT

Curtiss-Wright Corporation (NYSE:CW) is a global integrated business that provides highly engineered products, solutions and services mainly to Aerospace & Defense markets, as well as critical technologies in demanding Commercial Power, Process and Industrial markets. We leverage a workforce of 7,800 highly skilled employees who develop, design and build what we believe are the best engineered solutions to the markets we serve.

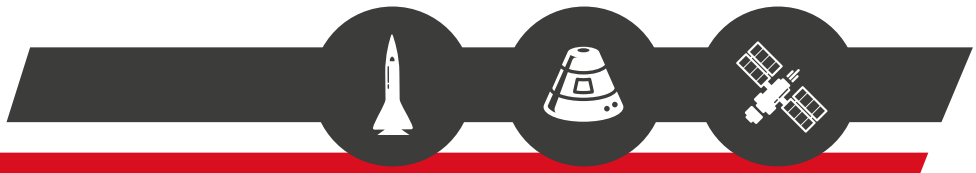
Building on the heritage of Glenn Curtiss and the Wright brothers, Curtiss-Wright has a long tradition of providing innovative solutions through trusted customer relationships. For more information, visit www.curtisswright.com.

The Curtiss-Wright Space COTS Advantage

Curtiss-Wright helps reduce costs, development time and risk by using a commercial off-the-shelf (COTS) approach that utilizes an extensive library of proven IP and decades of rugged system design experience. Our designers optimize systems for low cost of ownership based on a customer's application and the procurement life of the platform. The Curtiss-Wright space COTS versatility has been fully proven – no other COTS system has been qualified and used successfully in such a wide variety of space missions for both development flight instrumentation (DFI) and operational flight instrumentation (OFI) requirements.

The industry leading design balances small size, low mass and power with high performance and channel density. The modular and scalable systems utilize plug-in modules to access a wide range of digital and analog sensors, video, actuator interfaces and data buses. Curtiss-Wright's space COTS products have reliability and efficient thermal performance in a space environment. The unique Smart Backplane provides a low cost radiation-tolerant solution for protecting our space COTS data acquisition systems from damaging radiation induced latch-up events.

Curtiss-Wright has been the trusted supplier on a wide range of missions and with leading space organizations around the world. Our heritage includes proven success on a variety of launcher, sub-orbital, re-entry and International Space Station (ISS) applications. Dedicated in-house space engineering and product assurance teams ensure the delivered hardware and documentation meet the space-customer requirements.



Lower cost

- Removes 'one-off' design costs by using modular COTS design
- Optimized for low cost of ownership based on customer application and procurement life of platform
- Reduced program cost and schedule risk through standard COTS test and integration tools

21st century design

- Compact size, low mass and power with rugged high performance and channel density
- Designed for efficient thermal management in a space environment
- Modular, scalable system with proven radiation tolerant and reliable design

Experienced

- Proven on a wide range of space applications with leading space companies and organizations
- COTS approach leverages decades of research, development experience and an extensive proven IP library
- Only supplier of Space Development and Operational Flight Instrumentation with same product line

Heritage

Curtiss-Wright has experience on a wide variety of platforms and missions using the same COTS equipment in both development and operational applications.

- ESA IXV
- ULA Delta II & IV
- ULA Atlas V
- Boeing CST-100 Starliner
- SpaceX Falcon 9 & Dragon
- James Webb Telescope
- Boeing X-37 ALTV
- Virgin Galactic SpaceShip Two
- Space Shuttle STS 127 / 133
- NASA Orion EFT1
- NGIS Antares

Selected for

- Airbus DS ISS ACLS
- ESA ISS PLDR
- ASL Ariane 6
- TASI Space Rider DAS
- Orion EM1 & AA2
- SLS EM1 & EM2
- Firefly
- ULA Vulcan

CAPABILITIES

Curtiss-Wright designs and manufactures rugged digital and analog leading data acquisition, data handling, video, recording, actuator control, Ethernet switch and mission data processing systems. Standard products have been developed over decades and have been proven in a wide variety of space missions including launchers, sub orbital, re-entry and ISS. This unique heritage using the same core product was made possible due to our extensive IP library implemented in a range of COTS equipment purpose built for harsh conditions and with an inherent tolerance for radiation. Optional redundancy and radiation latch up protection Smart Backplane to further increase reliability when required by the mission.

Applications

Launchers

- Networking for multi-stage launchers
- Data acquisition in extreme vibration environments
- Video capture, telemetry and mission processing
- Integrated ruggedized recording available for reusable booster monitoring

ISS Data Acquisition / Low Earth Orbit Platforms

- Microgravity acceleration measurement
- Onboard health monitoring
- Experiment / payload supervision
- Data recording and networking solutions

Spaceplanes and Re-entry Vehicles

- Mission critical re-entry data handling and recording
- Video capture and telemetry
- Black out data buffering
- Latch–up tolerance

RAD Tolerant Remote Terminal Units

- Modular satellite Remote Terminal Units (RTU)
- Actuator control interface units
- Sensor and bus data concentration
- Hosted payload interface units

Features

- Optimized development time and risk with reduced recurring cost
- Proven, reliable off-the-shelf products
- Optional enhancements for demanding and lengthy missions
- COTS approach leveraging an extensive library of IP
- Modular, scalable system
- Wide range of sensor and actuator interfaces and data buses
- Highly scalable Ethernet native single to multi-chassis systems
- Balances small size, low mass & power with high performance & channel density
- Designed for efficient thermal management in a space environment
- Proven radiation tolerant design
- Dedicated space engineering, manufacturing and product assurance team


ATLAS
NASA
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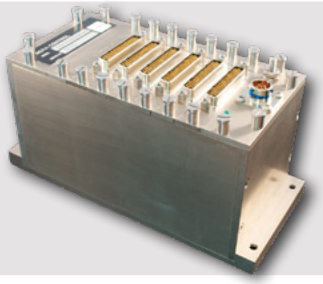
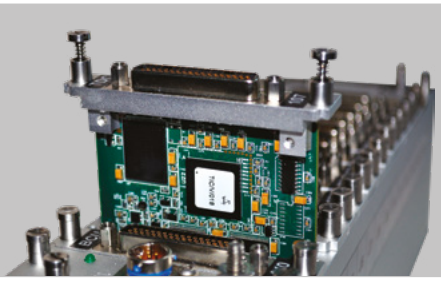


DATA ACQUISITION UNIT



MODULE

Data Acquisition

Curtiss-Wright provides data leading acquisition products with different levels of radiation tolerance to best balance the mission requirements against cost.

Space Qualified COTS Solution

The data acquisition and transmission systems consist of a chassis, a backplane controller and user selected modules. They are driven with a 'works once, works always' philosophy to make them extremely reliable. This low power design results in less heat and, coupled with its compact size and MIL-SPEC ruggedness, makes it ideal for installing in locations that have limited space are subject to harsh environments. This mature architecture has remained stable for over a decade thanks to the future proof design philosophy.

- Highly rugged, compact and low power design
- Robust finite state machine architecture
- Synchronous sampling of all sensors across the network

Smart Backplane: Latch-up Protected COTS Solution

The Smart Backplane chassis have been designed specifically with space-related data acquisition, data processing and recording in mind. Its smart radiation-hardened backplane design allows the use of 100+ plug-in COTS modules in a radiation-intensive environment without the need for those modules to have any in-built radiation protection. In the event of a Single Event Latch-ups (SEL) on a module, the backplane detects this phenomenon and resets the operation of the module. This operation ensures that the potential harmful effects of ionizing radiation (module electronic circuit malfunction) are eliminated. The backplane provides continuous health status information to the on-board mission computer as well as a watchdog capability.

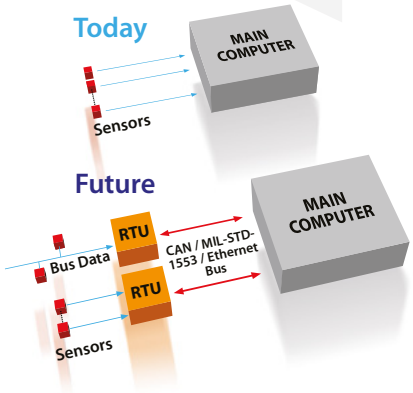
- Backplane designed using Rad Hard components allowing re-use of COTS plug-in modules, minimizing cost
- Detects SELs and corrects for normal operation, ensuring reliability
- Minimizes power consumption through different mission stages

	Data Acquisition Units, Recorders and Hardwired Ethernet Switches	Mission processors and Cisco® based Ethernet Switches
Thermo-mechanical environmental testing	MIL-STD-810 for shock, vibration, temperature etc.	MIL-STD-810 for shock, vibration, temperature etc.
EMC testing	MIL-STD-461 for RE, CE, CS & RS	MIL-STD-461 for RE, CE, CS & RS
Radiation testing	Total Ionizing Dose Single Event Upset testing	N/A
Thermal vacuum testing	TV Test from -40ºC to +85ºC	N/A

Radiation Tolerant Solution

The COTS performance of our products are being further developed to provide additional mission critical features, to expand the operating envelope. These include

- Purpose designed: Meets the requirements of high radiation space applications with built-in latch-up protection and Single Event Upset resistant
- Failure tolerance: Operate after failures of components
- High reliability: Meet specific time reliability requirements
- Safe design: Meets safety and mission assurance requirements



Networking Products

Curtiss-Wright's network switch products are specifically designed for the unique requirements of high reliability networks in harsh conditions. The range includes models with advanced Quality of Service filtering, intelligent IP network management capabilities, Cisco IOS-based data, video and voice services, and modules with hardwired switching for deterministically predicable data output.

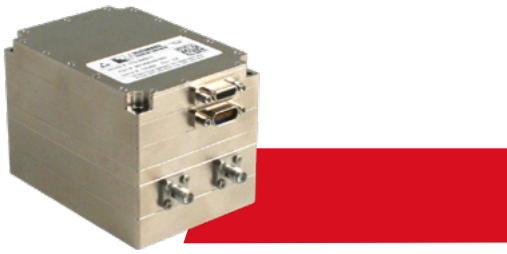
Features

- Rugged and compact with low mass and power
- Live at power-up/ fast boot options
- IEEE 1588 PTP Grandmaster and transparency, SNMP support
- Store and forward switching architecture

DuraNET ETHERNET SWITCH

Telemetry Products

Curtiss-Wright telemetry systems are high-performance, dependable, economical solutions for many flight and remote ground-based applications requiring accurate transmission of telemetry, digital, wideband, and video data. We provide flight termination receivers, airborne telemetry receivers, radar transponders and telemetry transmitters.



MULTI-BAND MULTIMODE TRANSMITTER

Camera Products

Curtiss-Wright provides rugged camera products and systems that can capture, convert, route, transmit, record, view, and test imagery. All cameras ruggedized for the harsh aerospace environments and come in high definition, IP and high speed varieties.

HD CAMERA

Recording Products

Curtiss-Wright's recorders are rugged, compact and utilize removable COTS solid state media. The range features data recorders, recorders with integrated data acquisition capabilities and miniature bus recorders.

Rugged Processor Products

Parvus DuraCOR small form factor processors are highly scalable, modular subsystems for applications such as pre-launch avionics and laboratory experiments.

- Size, Weight and Power (SWaP) optimized with transient protected power supply
- High-performance computing and graphics engines with open architecture I/O module expansion

DuraCOR PROCESSOR

CURTISS-WRIGHT

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