Heavy Mobile Equipment for the Future: Intelligent, Connected, Autonomous
Powerful onboard computers are helping meet the needs of next generation connected and autonomous heavy vehicles. With the secure and innovative platform from Kontron and Intel®, customers benefit from accelerated time-to-market, reduced total cost of ownership, as well as vehicle safety and performance.

Valentin Scinteie
DIRECTOR, BUSINESS DEVELOPMENT — TRANSPORTATION
KONTRON

Intel® has partnered with Kontron to create platform architecture designed for maximum flexibility to meet today’s demands and future needs for in-vehicle AI, deep learning, and High Performance Edge Computing for heavy-duty industries such as mining, agriculture, construction, and trucking.

Sameer Sharma
GLOBAL GENERAL MANAGER IOT
INTEL CORPORATION
Team

Authors

RAVI SINGH
Ecosystem Development Manager, Smart Cities & Transportation, Intel Corporation
Ravi leads IOT ecosystem development, sales acceleration, and new business incubation initiatives for Smart Cities and Transportation at Intel. He is passionate about converting business strategy to technology implementations that benefit cities, businesses, and citizens. Ravi has a B.S. in Mechanical Engineering and an MBA from the University of Maryland.

VALENTIN SCINTEIE
Director, Business Development, Transportation, Kontron
Valentin is responsible for product market alignment and business development of Kontron’s next-generation transportation “Autonomous Anywhere” rugged Intelligent Vehicle Computers (IVCs) and IoT (Internet of Things) ready gateways for onboard and smart city applications. Valentin also chairs the TVAC (Technologies for Vehicle Automation and Connectivity) APTA (American Public Transit Association) Subcommittee and the TRB AVS (Automated Vehicle Symposium) Enabling Technologies Breakout Sessions.

Executive Sponsor

SAMEER SHARMA
Global General Manager, IoT, Intel Corporation

Executive Contributors

SAJID KHAN
Global Director, Smart Cities & Transportation Strategy & Marketing, Intel Corporation

MAHADEV EAKAMBARAM
Senior Director, Cities & Transportation, Intel Corporation

Contributors

SOLEDAD ALBORNO
Global Director, Solutions for Fleets, Intel Corporation

GREG ARMAND
Account Executive, Intel Corporation

JEAN–FRANCOIS CLEROUX
Product Manager, Transportation, Kontron

YVES GAGNON
System Integration Designer, Solutions Integration, Kontron

RYAN MATSUMURA
Platform Architect, Intel Corporation

TANIA PIUNNO
Marketing Manager, Kontron

ANDREA THOMAS
Senior Product Marketing Engineer, Solutions for Fleets, Intel Corporation

RESEARCH CONSULTANT

Bridge Partners

For follow-up and questions, please contact:
Valentin Scinteie
valentin.scinteie@kontron.com
Ryan Matsumura
ryan.matsumura@intel.com
Overview

For heavy mobile equipment industries, ongoing digital transformation holds the promise of improving productivity and performance by enabling innovation and reducing the costs of a range of business processes. Heavy mobile equipment has become increasingly connected and automated. Smarter, connected vehicles are enabling enhanced productivity and safety, generating insights that reduce total cost of ownership, and more.

Mining, agriculture, and construction are at the leading edge of these changes as evidenced by forecast growth. For example, the Automated Mining Equipment Market is expected to grow at a compound annual growth rate (CAGR) of 7.21% through 2025.1

The overall Artificial Intelligence in the Agriculture Market is projected to grow from an estimated USD 1.0 billion in 2020 to USD 4.0 billion by 2026, representing a CAGR of 25.5%. This market growth is propelled by three things: the increasing implementation of data generated through sensors and aerial images for crops; increasing crop productivity due to deep-learning technology; and government support for the adoption of modern agricultural techniques. In the Americas, large scale agriculture players are already using AI technology to significantly improve the speed and accuracy of their planting and crop management techniques.2

Similar trends are forecast in the global Automated Construction Market, which is expected to reach a value of USD 186.6 billion by 2024, registering a CAGR of 15.5% from 2019-2024.3

Connected and Intelligent Solutions for Heavy-Duty Industry

Advances in smart heavy equipment vehicles are revolutionizing the mining, agriculture, and construction industries. For industries that require heavy-duty equipment, intelligent and autonomous solutions are not luxuries: they are necessities that enable operators to run machinery safely, increase production, reduce waste, and systemize their work. Mines, for example, are in remote and challenging locations where operations run all day, every day, to meet demand. Vehicles that can operate with minimal human direction (semi-autonomous) or independently (autonomous) can work 24/7, thereby allowing operators to perform valuable tasks from their cabs, choose the most efficient routes, and automate critical processes.

Technology advancements, including the greater bandwidth coming with 5G connectivity, will enable near-instant communications between operators and machines. Data from connected machinery will fuel more advanced analytics tools and allow for adjustments in real time.

Automated vehicles are becoming more common for rugged operations such as excavators, graders, diggers, combine harvesters, backhoe loaders, and more—all enabled by the latest communications and computing technologies. These applications increasingly connect and automate heavy vehicles on busy worksites, helping companies realize enhanced safety, productivity, and efficiencies while also reducing infrastructure needs. By utilizing intelligent vehicle capabilities, companies can access the information they need for better decision-making, delivering longer vehicle lifespans and reducing operational costs.

This eBook provides an overview that manufacturing and fleet management leaders can use to develop strategies for smarter heavy mobile equipment. These strategies bring together solutions that help organizations improve safety, lower total cost of ownership, sustain new performance efficiencies, and realize new insights. With these advances, mining, agriculture, and construction companies can achieve the ultimate goal of becoming safer and more productive.

### Mining

To improve safety, mining companies, worldwide, are swiftly leveraging investments in human resources, equipment, and technology. Automation is providing significant benefits to this sector, such as lowering costs, driving productivity, and increasing safety.4

<table>
<thead>
<tr>
<th>Expected benefits of automated mining trucks:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>90%</strong></td>
</tr>
<tr>
<td>expected availability</td>
</tr>
<tr>
<td><strong>15-20%</strong></td>
</tr>
<tr>
<td>productivity increase</td>
</tr>
<tr>
<td><strong>7%</strong></td>
</tr>
<tr>
<td>tire wear reduction</td>
</tr>
</tbody>
</table>
Did You Know? Intelligent Transport Is Similar to Intelligent Heavy Mobile Equipment

Kontron and Intel are enabling digital transformation in transportation, providing the required foundation to connect disparate systems and make them more intelligent. Parallels can be drawn between the benefits of intelligent transportation systems and potential use cases in heavy mobile equipment.

Smart shuttles can improve traveler experience while maintaining a high level of safety as they deliver passengers to locations in limited access areas such as campuses or remote work zones. Autonomous shuttles can navigate without direct human intervention by using radar, ultrasound, lidar, GPS, odometry, and cameras. Computer systems enhance transportation efficiency and safety by enabling vehicles to recognize, analyze, and operate automatically. Shuttles can avoid obstacles, as well as pass or overtake other vehicles. A fleet management system like this provides a convenient, more sustainable, low-cost, and flexible traffic network.
Benefits of Connected and Intelligent Heavy Machinery

Companies from around the world are upgrading their operations to incorporate connected and intelligent heavy mobile equipment. Regardless of industry, companies can realize several benefits to operations and worker safety by adopting smart features and connectivity.

**Safety**

**Monitoring:** Operators can increase safety by using enhanced monitoring capabilities to reduce hazards and prevent accidents and injuries. Verifying conditions can increase awareness and visibility, plus help identify operator fatigue and distraction. Active monitoring can also alert operators to potential collisions.

**Data and analytics:** Accidents can be prevented, or at a minimum, have reduced impact, through better use of data and analytics. By applying Artificial intelligence (AI) to data at the edge, operators can gain real-time insights through predictive analysis. These insights can alert operators to dangerous situations and equipment failures before they occur.

**Automation:** Automation helps reduce costs, improve the operation of engines and machines, and reduce the likelihood of human errors. Integrated control and monitoring systems for automation include connected alarms, auxiliary controls, power management, and engine controls. Automation also enables operators to manage their vehicles in ways that are more economical and ecologically beneficial, while helping to ensure compliance with safety regulations.

**Return on Investment**

**24/7 operations:** Continuous operation can lead to lower production costs and higher output. Uninterrupted flow can enable organizations to save time, process more material, and expend less energy.

**Inventory and service efficiencies:** Standardizing common parts for equipment enables successful inventory management with much less variety. With a single unique platform in use across a customer fleet, the team will not need specialized knowledge about multiple solutions. Service and repairs will be more consistent from vehicle to vehicle.

**Added value from operators:** With operators freed from routine driving tasks, they are available to undertake data analysis, monitoring, and other strategic initiatives.

**Performance/Efficiency**

**Predictive maintenance:** As the complexity and interconnectivity of heavy machinery increases, predictive (or ‘just-in-time’) maintenance grows in value. With innovative maintenance technologies, it is possible to integrate diverse sets of equipment, systems, and platforms. Behavioral indicators can be sent from each vehicle or asset to be analyzed at the edge. Precise actions and responses, including predictive maintenance, are recommended as needed. This improves operational efficiency and increases productivity by providing just-in-time analysis of engine parts, low-voltage motors, and other mechanical devices. It reduces the cost of sending maintenance crews on expensive rounds, decreases the frequency of accidental breakdowns, and eliminates unplanned downtime.

**Waste reduction:** Operators can reduce waste by helping to maximize payload and identify bottlenecks, measure the volume of material cut and filled, and ensure machines move the right amount of material with every load.

**Fuel efficiency:** Organizations can increase fuel efficiency by enabling automated and optimized routing, braking, acceleration, and on/off, instead of idling.

**Uptime:** With real-time performance data and contextual analytics, organizations can anticipate potential outages or equipment failures and avoid downtime. Predictive maintenance enables customers to prevent interruptions from breakdowns, and keep equipment running reliably.
Industry Roundup

Mining

Technologies that optimize mining equipment fleets by monitoring productivity and gathering machine information are helping to improve mine yields. They also contribute substantially to building highly efficient mining operations. In an autonomous mining operation, high-performance computing (HPC) platforms provide the processing power to capture, monitor, and use data from technology-equipped machines for greater insight into equipment operations. They also allow operations to be managed from a single, remote location which can translate into large gains in productivity. Operators can use sophisticated on-board intelligence to find optimum drilling locations.

Agriculture

In agriculture, smarter techniques that automate processes have started to have a far-reaching impact on reducing waste, improving yields, and subsequently, our quality of life. Allowing farmers to automate existing equipment helps maximize their capacity and efficiency. Using wireless connectivity technologies to connect agricultural machinery, farmers can synchronize workflows via cloud services. Computing platforms are also being used in mapping applications that help farms carry out field-specific fertilization and apply it reliably using GPS positioning. This also helps during harvest when autonomous tractors can be deployed to specific field locations, adjusted for speed or direction, and even synchronized for crop loading.

Construction

Construction machines can benefit greatly from autonomous and intelligent solutions. Predictive data can enable proactive maintenance that allows components to be replaced before they malfunction or fail. These solutions can also track information such as idle time and fuel consumption, enabling managers of building sites and public-works projects to make better decisions about the use of their fleets. These machines can carry out much of their work automatically, while an operator can be dedicated to higher value, decision-making tasks. Operators will also be able to better coordinate groups of machines and facilitate scheduling and fueling, potentially speeding up each project phase.
Heavy Mobile Equipment for the Future: Intelligent, Connected, Autonomous

Kontron and Intel Solutions

Together, Intel and Kontron offer increased safety and value through state-of-the-art automation technologies for heavy mobile equipment. Customers can take advantage of high-performance computing platforms for the processing power to capture, monitor, and use data from technology-equipped machines for greater insight into equipment operations. Customers can manage their operations from a single, remote location, translating into even larger productivity gains and return on investment (ROI). Autonomous equipment provides a safer environment to conduct remote operations, leading to improved equipment availability, operational consistency, and lower overall costs. Operators can also use sophisticated on-board intelligence to achieve continuous improvement and innovation.

Organizations can count on sturdy, dependable heavy mobile equipment solutions that are designed for flexibility and durability. The powerful COM Express and COM-HPC modules offer different sizes to provide flexibility for any embedded device. The EvoTRAC-S1901 System Platform architecture is designed for maximum flexibility to meet today’s demands and future needs for in-vehicle AI, deep learning, and High Performance Edge Computing.

Ruggedized, industrial grade devices perform well under challenging conditions, including shock, vibration, and thermal extremes. Intel and Kontron embedded devices are built to last, with Kontron offering an extended product lifecycle. For optimal performance in extreme circumstances, an ideal choice is Kontron’s hardened Type 7 COM Express module with a powerful 8 core Intel® Xeon™ processor, including a ruggedized configurable Carrier Board, myriads of customizable options all packaged in a natural convection, fan or liquid assisted cooling, sealed IP67 enclosure.

When customers choose Kontron and Intel, they can trust their reliable, hardworking solution will run 24 x 7 x 365. Built-in Artificial Intelligence (AI) and Machine Learning (ML) help them capture and analyze relevant data and develop new processes. Predictive maintenance can increase uptime and diminish potential outages. Using COM Express, a modular approach, Kontron and Intel solutions are compatible with a manufacturer’s existing systems. Organizations will be able to retrofit connected machinery. Customers can take advantage of cloud services to enable machine-to-cloud and machine-to-machine communications. They can synchronize workflow among machinery using the cloud.

Kontron’s embedded solutions empower customers’ teams and equipment to get more done, safely and efficiently. Predictable costs, such as fuel and insurance, give greater control over expenses and can improve total cost of ownership (TCO). With greater efficiency in place, organizations can free operators to focus on higher-value tasks and put their insights and judgment to uses beyond basic equipment operations. Mechanical data analysis enables customers to reduce fuel consumption.

Built-in, high-level driver assistance brings improved operator safety. For safer operation, our solution delivers increased automation in compliance with safety regulations. Kontron and Intel offer a safety mezzanine option, collaborating with manufacturers to implement functional safety to ISO specifications.

Reduce Total Cost of Ownership

<table>
<thead>
<tr>
<th>TYPICAL INDUSTRY PROPRIETARY DESIGN PLATFORM</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HW development, system integration</td>
<td>Application development</td>
<td>Validation testing &amp; GA</td>
</tr>
<tr>
<td>12-15 months</td>
<td>9-12 months</td>
<td>3-6 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KONTRON COM EXPRESS® STANDARDS-BASED PLATFORM</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HW development, system integration</td>
<td>Application development</td>
<td>Validation testing &amp; GA</td>
</tr>
<tr>
<td>6-9 months</td>
<td>9-12 months</td>
<td>3-6 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KONTRON EVOTRAC APPLICATION-READY PLATFORM</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Config</td>
<td>Application development</td>
<td>Validation testing &amp; GA</td>
</tr>
<tr>
<td>2-3 months</td>
<td>9-12 months</td>
<td>3-6 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KONTRON EVOTRAC APPLICATION-READY PLATFORM + CERTIFIED SOLUTIONS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Config</td>
<td>Application development</td>
<td>Validation testing &amp; GA</td>
</tr>
<tr>
<td>1-2 months</td>
<td>2-4 months</td>
<td>2-4 months</td>
</tr>
</tbody>
</table>

Total cost of ownership and lifecycle management

Infographic source: Kontron
Heavy Mobile Equipment for the Future: Intelligent, Connected, Autonomous

Our smart, flexible systems provide operational insights for current and future operations. Using the data from technology-equipped machines provides more information and insight into equipment operations and yields using AI and ML. Customers can measure and drive consistency in remote operations to improve efficiency. They can make faster decisions and complete speedier analysis through improved access to critical information.

Organizations can tailor the embedded solution to fit specific needs of different machines across the same fleet. The Kontron and Intel highly adaptable solution is flexible and can be deployed based on a particular customer’s needs. It is possible to upgrade processing and accelerators and configure storage capacity using expansion slots (mPCIe or M.2 B key slots). It can scale as a single system to manage a heterogeneous fleet.

Kontron and Intel intelligent heavy mobile equipment solutions can improve customers’ return on investment (ROI). Using a single unique platform across a fleet allows for efficient servicing. Harnesses are standardized, and the same harnesses are used across different equipment. Organizations need only a limited variety and amount of spare parts, reducing inventory management and inventory costs. As technology evolves, the unit can be upgraded to adapt to newer, more advanced technology.

**Kontron and Intel® Technology**

**Kontron**

Kontron solutions and open architecture platforms are helping to make heavy mobile equipment smarter, safer, and more efficient in the mining, agriculture, construction, and trucking industries. Kontron’s broad line of ruggedized, high-performance, standards-based, in-vehicle, embedded systems are designed for a wide range of applications.

These solutions deliver the reliability, availability, security, and flexibility that today’s heavy mobile equipment requires. Organizations can accelerate deployment of next generation connected vehicles with Kontron’s portfolio of in-vehicle solutions powered by Intel® technologies. As a result, customers benefit from accelerated time-to-market, reduced total cost of ownership, product longevity, and the best fully integrated applications overall.

**Kontron EvoTRAC-S1901**

The EvoTRAC-S1901 System Platform features the latest in Intel® high-performance processing power and is designed to meet the future needs of in-vehicle for AI, deep learning, and High Performance Edge Computing by providing multiple GPU or accelerator card options. Built to accelerate the deployment of demanding applications for heavy-duty mobile machinery in the construction, agriculture, trucking, and mining industries, the compact platform’s flexibility is unmatched. In a single IP67 enclosure, it includes high-speed I/O options such as 10GbE (cooper or fiber), USB 3.0, FAKRA connectors for RF, and rich camera interfaces. Storage capacities are met using M.2 NVME slots or high capacity 2.5” SSD slots (fixed or removable). Stay connected with the platform’s optional dual Wi-Fi or quad cellular modem features.
Heavy Mobile Equipment for the Future: Intelligent, Connected, Autonomous

Kontron COMe CPU module

Powerful COM Express modules offer different sizes to provide flexibility for any embedded device. COM Express defines standardized form factors and pin-outs for Computer-on-Modules. The standard includes the mini form factor (84 x 55mm), the compact form factor (95 x 95mm), and the basic form factor (125 x 95mm). Through the use of consistent COM Express connectors and feature implementation, Kontron’s modules are easily exchangeable and offer the most flexibility for customers designing them into different sizes of embedded devices. As a true partner, Kontron delivers all the needed support to help customers reduce time-to-market and gain a competitive advantage. Kontron has been a driving influencer of the COM Express standard and Kontron engineers continue to be deeply involved in new developments for the standard. Kontron is also a member of PICMG, the consortium governing the COM Express specification.

Kontron COM-HPC

Computer-On-Modules High Performance Computing, known as COM-HPC, is complementary to the existing COM Express standard, but is designed for applications that use artificial intelligence and the new 5G wireless standard. COM-HPC enables powerful embedded computing for lightning-fast, algorithm-based evaluation of huge amounts of data. As IoT devices, sensors, and actuators produce enormous amounts of data from autonomous vehicles, hundreds of signals have to be processed in fractions of a second. Many of these scenarios no longer take place in a protected high-performance computing center, or in the cloud, but close to where the data originates: autonomous vehicles and heavy mobile equipment in the field.

Kontron CMON

The CMON-Line Monitoring module offers a turnkey, extensible and data-centric solution for local or remote computer health monitoring. It complements Kontron’s Power-On Builtln Test (PBIT) which signals any modification made to the computer by comparing it against previous computer configuration recording. Both modules use ‘learn and compare’ techniques which require no programming.

Kontron Safety MCU

The functional safety module is a key feature of the S1901 for rolling machinery in industrial market applications where safety and reliability are critical design attributes. Equipped with the Infineon Aurix TC38x 4 cores series MCU and CAN bus buffers, the safety module enables the development of certifiable Safety Integrity Level (SIL) systems that comply with ISO standards covering earth-moving and agriculture machinery under the umbrella of IEC 61508 general functional safety standard.

Kontron EvoTRAC-G103

The EvoTRAC-G103 Gateway leverages the Intel® Atom™ processor on Kontron’s hardened Type 6 COM Express CPU module coupled with a ruggedized carrier board. It is all packaged in a natural convection, sealed IP67 enclosure to survive rigorous environmental conditions for on and off-road vehicle use. Featuring a compact COMe E3845 module, the EvoTRAC-G103 is designed to be a gateway platform for extreme rugged in-vehicle applications. This mechanically compact system integrates dual Gigabit Ethernet and dual CAN bus interface that supports 2.0 A and B, along with two USB 2.0 interface, and Wi-Fi, 4G Advanced Pro+ for wireless connectivity.
Intel provides scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics, helping companies achieve greater efficiency and transparency in their operations. Intel is helping IoT innovations get to market faster, reducing solution complexity, and defining how to derive actionable intelligence more quickly and securely.

Intel® Artificial Intelligence (AI)
Intel has the industry’s most comprehensive suite of hardware and software technologies that deliver broad capabilities and support diverse approaches for AI. Intel’s AI portfolio helps customers enable AI model development and deployment at any scale from massive clouds to tiny Edge devices, and everything in between. Intel is leading the next wave of AI with new products designed to accelerate AI system development and deployment from cloud to Edge. The broadest in breadth and depth in the industry.

Technologies supporting AI include:

- **Intel® Xeon® Scalable processors**
  Powerfuly designed to handle the broadest range of AI workloads including deep learning

- **Intel® FPGA**
  Near real-time, programmable acceleration for deep learning inference workloads

- **Intel® Vision Accelerator Design products**
  Based on Intel® DL Boost running on the CPU vector neural network instructions (VNNI), or with 8-bit integer instructions on the GPU (Int8), Intel® Vision Accelerator Design products provide powerful, deep, neural network inference for fast, accurate video analytics to meet the demands of computer vision applications at the Edge

The Intel® Distribution of OpenVINO™ Toolkit

The Intel® Distribution of OpenVINO™ Toolkit is a comprehensive toolkit for quickly developing multiplatform applications and solutions that emulate human vision. Based on Convolutional Neural Networks (CNNs), the toolkit extends Computer Vision workloads across Intel® hardware, maximizing performance. Heavy mobile equipment industries can accelerate and deploy CNNs on Intel platforms with the Intel® Deep Learning Deployment Toolkit that is available in the OpenVINO™ toolkit and as a stand-alone download. Together with the new Intel® DevCloud for the Edge, OpenVINO addresses a key pain point for developers—allowing them to try, prototype, and test AI solutions on a broad range of Intel processors before they buy hardware.

The OpenVINO™ toolkit enables CNN-based deep learning inference on the Edge and supports heterogeneous execution across computer vision accelerators—CPU, GPU, Intel® Movidius™ VPU, and FPGA—using a common API. With the OpenVINO™ toolkit, developers can speed time to market via a library of functions and preoptimized kernels to easily enable optimization.

Intel® Technologies

As mining, agriculture, and construction industries connect more heavy mobile equipment and infrastructure to the cloud, they are seeing a greater need to place high-performance compute at (or near) the Edge to perform predictive analytics and AI using data from sensors, cameras, and other sources. This can reduce latency, improve near real-time responses, and relieve demand on network bandwidth for performance-hungry tasks like vision. Solutions based on Intel® platforms deliver high performance at the Edge.

Intel® Compute technologies are hardened to support today’s IoT scenarios for heavy-duty equipment. Intel® architecture helps enable smart heavy mobile equipment through a range of product offerings including Intel Atom®, Intel® Core™, and Intel® Xeon® processors. Each offering supports a wide range of performance points with a common set of code.
# Solutions Map

Kontron solutions are designed with Intel® technology to address key customer concerns.

<table>
<thead>
<tr>
<th>Customer Concern</th>
<th>Kontron Solution</th>
<th>Benefits</th>
<th>Key Capabilities</th>
<th>Intel® Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>EvoTRAC-S1901</td>
<td>Enable in-vehicle driver assistance and reliable driving, while helping to reduce accidents and repetitive strain injuries (RSI)</td>
<td>Camera and sensor capture, ML/AI, sensor fusion to provide equipment with autonomous or assistance features, safety and reliability</td>
<td>Intel optimized multicore Xeon-D CPU, Intel Dual 10GbE (COMe module), GPU, VPU for ML/AI workloads, AI toolkits in OpenVINO and oneAPI (Intel Movidius)</td>
</tr>
<tr>
<td>Efficiency</td>
<td>EvoTRAC-S1901 or EvoTRAC-G103</td>
<td>Help increase operational efficiency and reduce material waste</td>
<td>Leverage Edge compute to aggregate sensor data to perform local analytics.</td>
<td>Intel optimized CPU, GPU, VPU for ML/AI workloads, AI toolkits in OpenVINO and oneAPI, libraries in oneAPI that help protect data, secure boot, HW based security</td>
</tr>
<tr>
<td>Fuel Costs</td>
<td>EvoTRAC-S1901 with CMON or EvoTRAC-G103</td>
<td>Enhance fuel efficiency, optimize routes, and automate operations</td>
<td>Fuel, weight, and other sensor capture combined with ML/AI and data analytics to increase fuel efficiency</td>
<td>Intel optimized CPU, GPU, VPU for ML/AI workloads, AI toolkits in OpenVINO and oneAPI</td>
</tr>
<tr>
<td>Predictive Maintenance</td>
<td>EvoTRAC S1901 and CMON or EvoTRAC-G103</td>
<td>Reduce downtime and increase operational uptime with predictive maintenance</td>
<td>Power-up build in and continuous built in test. Equipment sensor data capture utilizing ML/AI and/or data analytics detects unique equipment malfunction patterns ahead of failure</td>
<td>Intel optimized CPU, GPU, VPU for ML/AI workloads, AI toolkits in OpenVINO and oneAPI</td>
</tr>
<tr>
<td>Availability</td>
<td>EvoTRAC-S1901 or EvoTRAC-G103</td>
<td>Ensure 24/7 availability using rugged and hardened designs</td>
<td>Mechanically compact hardened design capable of handling harsh conditions, extreme temperature, and vibration. Ground isolated enclosure with elevated dust and water ingress protection. MTBF rating</td>
<td>Extended product lifecycle</td>
</tr>
<tr>
<td>Reliability</td>
<td>EvoTRAC-S1901 or EvoTRAC-G103</td>
<td>Enhance reliability, availability, and serviceability to reduce downtime</td>
<td>Reliability, availability, serviceability (RAS) features and redundant storage provide enhanced reliability</td>
<td>ECC, RAID capabilities, SoC Integrity features</td>
</tr>
<tr>
<td>Security</td>
<td>EvoTRAC-S1901 with CMON + safety processor MCU</td>
<td>Maintain integrity with security-enhanced technologies</td>
<td>Secure solutions that operate with authorized software, services, and devices</td>
<td>Secure boot, HW based security, device manageability w/vPRO</td>
</tr>
<tr>
<td>Flexibility</td>
<td>EvoTRAC-S1901</td>
<td>Increase flexibility through automation, repeatable work, optimized labor, 24/7 operations, increased productivity, and enhanced quality</td>
<td>Flexible design allows for reusability across segments with standards-based approach to both hardware and software. Reduce TTM and improve ROI</td>
<td>Frameworks that support all Intel silicon like OpenVINO and oneAPI to truly embrace a model of “write once, deploy many” allows for reusability across all solutions</td>
</tr>
</tbody>
</table>
Getting Started

This is only a starting point for a transformative journey towards automation in mining, agriculture, and construction.

Intelligent heavy machinery is critical to the future of workplace safety, performance, and return on investment. With experience working with heavy mobile equipment manufacturers and fleets worldwide, Kontron and Intel bring together the right solutions that organizational leaders can use to realize the future of heavy mobile equipment.

Kontron and Intel believe industry leaders can successfully transform their operations by establishing clear priorities, encouraging active stakeholder participation, and ensuring methodical technology infrastructure planning. Effective methods for implementing smart programs, assessing performance, and ensuring continuous improvement can also contribute to success.

With Kontron solutions powered by Intel® technology, organizations can reinvent their heavy mobile equipment business. Through edge-to-core-to-cloud solutions and a strong partner ecosystem, Kontron and Intel are dedicated to helping customers achieve their heavy mobile equipment goals.

Explore more about Kontron solutions powered by Intel® technology by contacting us today:

Kontron Sales  •  Intel® Sales

Think big
Steer your future with intelligent, automated heavy mobile equipment

Start small
Get going with projects and opportunities

Move fast
Learn, adjust, iterate
Heavy Mobile Equipment for the Future: Intelligent, Connected, Autonomous

Endnotes
1 Research and Markets: Automated Mining Equipment Market - Growth, Trends, and Forecast (2020 - 2025)
2 Markets and Markets: Artificial Intelligence in Agriculture Market by Technology (Machine Learning, Computer Vision, and Predictive Analytics), Offering (Software, Hardware, AI-as-a-Service, and Services), Application, and Geography - Global Forecast to 2026
4 Research and Markets: Automated Mining Equipment Market - Growth, Trends, and Forecast (2020 - 2025)
5 Markets and Markets: Artificial Intelligence in Agriculture Market by Technology (Machine Learning, Computer Vision, and Predictive Analytics), Offering (Software, Hardware, AI-as-a-Service, and Services), Application, and Geography - Global Forecast to 2026

Notices & Disclaimers
Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.
Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.
Your costs and results may vary.
Intel technologies may require enabled hardware, software or service activation.
Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.
Customer is responsible for safety of the overall system, including compliance with applicable safety-related requirements or standards.
Intel may change availability of products and support at any time without notice. Please contact your Intel account rep for additional information.
© Intel Corporation. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others.
Explore more about Kontron solutions powered by Intel® technology by contacting us today:

Kontron Sales • Intel® Sales