

# CRATUS TECHNOLOGY

## Engineering Capabilities Summary

*Physical | Digital | Connected*

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### Who We Are

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CRATUS Technology is a full-spectrum IoT engineering company headquartered in San Jose, California. With approximately 25 engineers, software developers, and technicians distributed across multiple locations, we bridge the physical and digital worlds through custom-engineered hardware, firmware, software, and AI-powered systems. We take pride in building solutions where speed, precision, and reliability are non-negotiable.

From concept to production, CRATUS supports the complete product lifecycle: R&D studies, proof-of-concept builds, design verification, scalable manufacturing, and — when clients need it — full Managed IoT Services for field deployment and ongoing system management. Our multidisciplinary team brings together electrical, mechanical, and software engineering under one roof to deliver integrated solutions that meet the most demanding industry requirements.

Backed by deep expertise in sensing, communications, energy, and AI, CRATUS serves partners across industrial automation, defense, construction, energy, transportation, logistics, smart buildings, and beyond. We are proudly Made-in-USA and support domestic manufacturing wherever possible.

### Core Capability Areas

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#### 1. Physical AI & Sensing Systems

CRATUS designs and deploys multi-sensor perception platforms that translate the physical world into real-time digital intelligence. Our ASSET-Rx RTLS (Real-Time Location Services) platform is the cornerstone of this capability — a manufacturing execution system (MES) that simultaneously fuses Bluetooth, UWB, RFID, and GPS technologies to deliver unmatched location and context awareness.

##### ASSET-Rx — Operational Intelligence Platform

- Real-time tracking of inventory, assets, and personnel across manufacturing, warehouse, and field environments.
- AI-powered context engine that goes beyond raw location data — extracting operational context, interaction patterns, and predictive KPIs.

- Chain of custody tracking with optional blockchain-based immutable records for regulatory compliance.
- Interfaces with scanners, tablets, NFC tags, RFID, barcodes, and QR codes for a single point of operational truth.
- Cloud-to-edge architecture: connect shop floor to top floor with real-time dashboards, historical analytics, and prescriptive alerts.
- Industry verticals served: aerospace composites (prepreg Out-Time monitoring), food & beverage, battery manufacturing, logistics, facilities management.

### Sensor Fusion & Perception

CRATUS integrates and engineers with a full suite of sensing modalities, including:

- LiDAR (distribution and design partnership with HESAI and SEYOND; handheld scanning systems)
- Camera-based machine vision with AI overlay for collision avoidance, zone monitoring, and object classification
- Radar and Thermal imaging
- Inertial Measurement Units (IMU) and Encoders
- Proximity and light detection
- UWB anchors and tags for centimeter-accurate positioning (see UWB section below)
- Environmental sensors: temperature, humidity, gas, pressure, shock, ambient light, and motion

**Key Product:** ASSET-Rx Edge — our AI and edge-processing platform for deploying massively distributed detection and inference workloads across industrial environments, with no cloud dependency required.

## 2. Ultra-Wideband (UWB) Communications — Hardware & Software Systems

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Ultra-Wideband (UWB) is a radio technology that uses extremely short pulses across a wide frequency spectrum, enabling sub-meter, often centimeter-level, real-time positioning in complex, metal-rich, and GPS-denied environments — exactly the conditions found in crane yards, port facilities, warehouses, and industrial plants. CRATUS has developed deep expertise in UWB from the silicon and hardware level all the way through to fleet-management software.

### UWB Hardware Design & Integration

- Custom-designed UWB anchor infrastructure (fixed reference nodes) and mobile tags worn by personnel or mounted on equipment.
- Hub-and-spoke network topology design optimized for large-area industrial deployments — minimizing anchor count while maximizing coverage and accuracy.
- Ruggedized hardware enclosures engineered to survive vibration, dust, moisture, and the electromagnetic interference inherent in heavy industrial environments.
- Low-latency real-time ranging — enabling updates fast enough for active collision avoidance and e-stop triggering.
- Multi-protocol tag hardware: UWB combined with Bluetooth and RFID on a single device, supporting hybrid localization strategies.

## UWB Software & Systems

- Proprietary hub-and-spoke RTLS software stack — handles anchor synchronization, time-difference-of-arrival (TDoA) calculations, and coordinate transformation.
- Fusion engine that combines UWB positional data with camera, LiDAR, and IMU inputs for higher-confidence location and motion context.
- REST/UDP/Modbus API outputs — allows UWB positional data to feed PLCs, SCADA systems, and third-party ERP/MES platforms.
- Configurable geo-fencing and exclusion zone management: define dynamic danger perimeters that trigger alerts or automatic equipment shutdowns.
- Currently developing a mesh-network UWB audio intercom for headset applications — combining precision indoor positioning with voice communications.

## Proven Large-Scale Deployment

**Case Study:** CRATUS designed and deployed a full RTLS crane yard safety system using UWB anchor-and-tag technology for the largest crane operator in North America. The system provides real-time personnel and vehicle positioning across vast outdoor yard environments, enabling proximity alerting and collision avoidance for crane operators, riggers, and ground workers.

## 3. Crane & Heavy Equipment Safety — AI-Powered EHS Systems

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Cranes and heavy machinery are among the most powerful — and most dangerous — assets on any industrial site. CRATUS has developed a dedicated AI-powered Environmental Health & Safety (EHS) product line, the SOHO platform, specifically engineered for crane yards, construction sites, ports, and industrial lifting environments. Our systems react faster than any human observer, continuously monitoring danger zones and automatically intervening before accidents occur.

### SOHO — AI Safety System for Cranes & Heavy Equipment

- Real-time AI detection of people, vehicles, and objects in configurable danger zones, with trigger latency under 300 milliseconds.
- Automated intervention: instantly halts machinery or activates alarms (lights, sirens, e-stop) when a safety threshold is breached.
- Fully configurable zone definitions — exclusion areas, dynamic danger zones, and proximity-based alerts adapted to each site layout.
- Industrial-grade, edge-based AI: all inference runs locally on-device with no internet required and no cloud latency.
- Operating temperature range of -20°C to +60°C; vibration-resistant design for crane-mounted scenarios.
- Power options: 24–54 VDC or 120 VAC; available in wall-mount or rack-mount enclosures.

### Supported Crane & Equipment Types

- Fixed cranes: Overhead (Bridge, Gantry, Monorail), Hammerhead, Tower, Stacker, Telescopic, Bulkhandler
- Mobile cranes: Crawler, Floating, All-terrain — with boom-collar camera mounting strategies that track danger zones as telescope sections extend

- Heavy construction equipment: Excavators, Backhoes, Trenchers, Hoisting equipment
- Retrofit installations onto existing cranes or pole/wall-mounted near loading zones — no equipment replacement required

### System Specifications & Integration

Specification	Details
Detection Range	Up to 150 ft (camera-dependent)
Field of View	108° per camera (camera-dependent)
Detection Types	Human, vehicle, object (customizable)
Trigger Latency	<300 ms
I/O Interfaces	GPIO, RS-485 / Modbus, HTTP/UDP API
Safety Standards	Designed for OSHA 1926, ANSI B30 compatibility
Deployment Modes	Standalone, PLC-connected, Software-integrated (SCADA/HMI)

### UWB Integration for Crane Yard Safety

CRATUS uniquely combines camera-based AI detection with UWB real-time positioning to deliver a layered safety architecture for crane yards. While AI cameras monitor local danger zones around the crane and its load, UWB tags on personnel and vehicles provide yard-wide positional awareness — alerting crane operators and supervisors to proximity threats even beyond the camera field of view.

## 4. Energy Systems — intercal8 Brand

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CRATUS' intercal8 brand represents our electrification and energy engineering division. As a system integrator, battery expert, and energy management software developer, intercal8 delivers solutions that span from custom battery cell-level management through megawatt-scale microgrid control — serving commercial, industrial, military, marine, aviation, and residential markets.

### Battery Management Systems (BMS) & Custom Battery Packs

- Custom BMS design and development from Wh to MWh scale: cell-level monitoring, protection, balancing, and state-of-charge estimation.
- Battery modeling and fuel-gauging algorithm development for accurate remaining runtime prediction.
- Granular temperature distribution monitoring enabling accurate battery models, extended cycle life, and enhanced safety.
- Manufacturing Execution System (MES) software for battery pack manufacturing lines — tracking each operational step from incoming cell inspection to completed pack.
- Applications: EV charging, military communications, industrial automation, marine propulsion, aviation, portable energy, and specialty vehicles.

### **Battery Energy Storage Systems (BESS) & Microgrid Controllers**

- BESS integrations from 100 kWh to 5 MWh: grid-forming, grid-following, on-grid, off-grid, and Virtual Power Plant (VPP) configurations.
- Microgrid controllers with auto-switching between grid-former and grid-follower modes for seamless islanding and grid reconnection.
- Distributed Energy Resource (DER) management integrating solar arrays, battery storage, and generator backup.
- Applications: construction site generator replacement, C&I peak shaving, disaster readiness, data centers, port electrification, ADUs, and residential energy independence.

### **Energy Management System (EMS) Software**

- Remote monitoring and local control platform with real-time dashboards, energy data analytics, and carbon footprint tracking.
- Demand response, load forecasting, time-of-use optimization, and asset performance management.
- Billing and ROI monitoring for C&I deployments.
- Ecosystem integrations with grid operators, solar inverters, EV chargers, and building management systems.

### **EV Charging & Load Management**

- EV charger hardware and Charge Point Management System (CPMS) software enabling fast charging even under grid constraints.
- Bidirectional DC-DC converters and AC-DC converters optimized for EV charging applications.
- LOMA (Load Management) boards — proprietary intelligent circuit-breaker and load-management hardware for peak shaving and load shifting.
- Port electrification, crane electrification, and marine propulsion electrification projects.

### **Power Metering & Analytics**

- Power meters and analyzers for monitoring energy production and consumption in real time.
- Power quality monitoring as a leading indicator of asset health — predict failures before they occur.
- Uninterruptible Power Supply (UPS) solutions for mission-critical applications.

## **5. Hardware Systems Integration**

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CRATUS designs end-to-end hardware systems — from individual PCB assemblies and custom wire harnesses to integrated enclosures housing electrical, firmware, and electromechanical subsystems. We use a combination of commercial off-the-shelf components and our own proprietary boards to achieve optimal performance, reliability, and cost.

### **Electronics & Electrical Design**

- Schematic capture, PCB layout, and design-for-manufacture (DFM) for multilayer boards in industrial, military, and commercial grade.
- Custom LOMA (Load Management) boards for intelligent power distribution, protection, and switching.

- Wire harness design and fabrication for custom lab setups and production systems.
- CRIB Lighting brand: wired and wireless LED driver and lighting control systems, wall-mounted controllers, and building automation integration.

### **Firmware Development**

- Embedded firmware for microcontrollers and SoCs (RTOS-based and bare-metal) across industrial, IoT, and consumer platforms.
- Protocol stacks: Modbus, CAN bus, RS-485, RS-232, I2C, SPI, UART, Ethernet, Bluetooth, UWB, Wi-Fi.
- Firmware for battery management, energy monitoring, sensor acquisition, and machine control.

### **Representative Hardware Projects**

- Thermal Property Analyzer: precision soil analysis instrument for measurement of thermal conductivity in native soils, rock, and engineered thermal backfills.
- Military missile energy storage system: integrated BESS for powering guided-missile radar systems in remote, off-grid regions with demanding power delivery specifications.
- EHS manufacturing floor safety system: multi-sensor camera, LiDAR, and UWB platform tracking all movements on the manufacturing floor — the foundation of the ASSET-Rx RTLS platform.
- MAGIC8 infrastructure controller: central intelligence hub for ADUs, homes, hospitality, and office buildings — orchestrating energy, security, climate, and automation systems.
- Custom mesh-network UWB audio intercom for headset applications (in development).

## **6. Software Development & IoT**

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CRATUS builds user-centric software that drives the digital transformation of industrial and commercial operations. Our software engineering team works across IoT, IIoT, Industrial Automation, AI/ML, and UX/UI disciplines — delivering both proprietary platforms and custom client software.

### **Industrial IoT & Automation**

- Custom IoT and IIoT frameworks using commercial and proprietary integrations.
- Industrial automation dashboards, data historians, real-time monitoring, and control systems.
- Historical, real-time, predictive, and prescriptive analytics pipelines.
- API development for inter-system communication (REST, UDP, MQTT, Modbus).
- SCADA and HMI integration for industrial control environments.

### **AI / ML & Machine Vision**

- AI and ML model development for object detection, classification, and tracking in camera and LiDAR data streams.
- Data annotation services and AI model training pipelines for custom detection use cases.
- Edge AI deployment on embedded industrial processors — no cloud dependency.
- Sensor data fusion: overlaying camera and LiDAR fields of view to produce calibrated collision-avoidance information.

### Platform Products

- ASSET-Rx: full MES and RTLS platform (Bluetooth / UWB / RFID / GPS) with browser GUI, mobile interfaces, and open API.
- Workflow Studio: physical workflow planning and simulation tool for manufacturing and warehouse operations.
- MAGIC8: infrastructure controller software for smart residential, hospitality, and office environments.
- intercal8 EMS: energy management and monitoring platform for BESS, microgrid, and DER applications.

## 7. Product Development, Testing & Validation

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CRATUS follows structured, industry-standard development cycles to ensure every product is rigorously validated before production release. Our Team-in-a-Box model means the same cross-disciplinary team that architects your solution also builds, tests, and delivers it — ensuring continuity, accountability, and quality from concept through shipment.

### Development Process

- Product Requirements Document (PRD) definition and stakeholder alignment.
- Architecture and system-level design reviews.
- Proof of Concept (POC) build and feasibility validation.
- Design Verification (DV) builds with formal test plans and acceptance criteria.
- Pre-production and pilot builds with process documentation.
- Production release with manufacturing instructions and quality checkpoints.

### Testing & Validation

- Functional testing at component, subsystem, and system levels.
- Correlation testing across multiple units to ensure measurement and performance consistency.
- Environmental and stress testing (temperature, vibration, ingress protection) appropriate to the deployment environment.
- Field testing and validation planning, including managed field trials and data collection.
- Mock-up and simulation environments for system-level pre-deployment validation.

### Deployment & Scalability

- Deployment planning for single-site to global multi-site rollouts.
- Managed IoT Services: CRATUS manages deployed systems in the field on behalf of clients, including monitoring, maintenance, and software updates.
- Logistics management for domestic and international shipping and delivery.
- Contract manufacturing coordination with global partners for high-volume production.

## 8. Facilities & Production Capabilities

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CRATUS operates a dedicated R&D lab and office facility in San Jose, California, supplemented by warehouse space for medium and large-scale builds. Our flexible infrastructure scales from bench-top R&D through production assembly lines and contract manufacturing partnerships worldwide.

Scale	CRATUS Approach
Small R&D (Bench / POC)	In-house lab: component sourcing, assembly, test fixtures, and POC validation.
Medium R&D / DV Builds	Office lab for POC; warehouse space for DV runs and small production lines.
Large R&D / Production	Leased warehouse spaces with temporary assembly and test lines sized to the project.
High-Volume Manufacturing	Global contract manufacturing partner network — selected by technology type, geography, and market requirements.

## 9. Our Brands

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CRATUS Technology operates three product brands in addition to its engineering services:

### intercal8 — Energy Systems

The electrification brand of CRATUS. intercal8 delivers custom BMS, BESS integrations, microgrid controllers, EMS software, hybrid inverters, EV charging solutions, and load management systems across commercial, industrial, residential, military, aviation, and marine markets. Visit: [www.intercal8.com](http://www.intercal8.com)

### MAGIC8 — Smart Infrastructure Controller

MAGIC8 is a wall-mountable central intelligence controller for ADUs, homes, hotels, and office buildings. Unlike conventional smart-home hubs, MAGIC8 integrates energy, security, climate, lighting, and automation into a single coordinated platform — enhancing functionality, security, and efficiency across diverse living and working environments. Visit: [www.mymagic8.com](http://www.mymagic8.com)

### CRIB Lighting — Controls

CRIB Lighting offers wired and wireless LED driver and lighting control solutions. Universal LED Driver Controllers (ULDCs) for luminaires and lighting fixtures, wall-mounted controllers with clean aesthetic design, and building automation integration for smart, energy-efficient buildings. Visit: [www.criblighting.com](http://www.criblighting.com)

## 10. Partners & Customers

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CRATUS works alongside a globally recognized partner and customer ecosystem spanning technology, manufacturing, defense, and industry:

Apple · Bosch · Dell · Lenovo · Fujitsu · Cognex · FLIR · Olympus · LAM Research · Renesas · TDK · Eaton · HESAI · Endiatx · Joule Case · SK Inc. · Quality Circuit Assembly · Alpine · Xceltronics · ENTES

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