AUTONOMOUS MANUFACTURING · TELEOPERATION

DataBahn AM

The integrated platform for autonomous manufacturing and teleoperation

Connecting shop-floor expertise to manufacturing AI agents. Data gathered by patrolling robots trains itself, and the whole floor is linked through digital twin and teleoperation — a data intelligence service for autonomous manufacturing.

VERSION 3.0 · 2026-09-03

Partridge Systems · contact@partridgesystems.com · www.partridgesystems.com

This white paper is a general introduction to the DataBahn AM platform and product family. Matters of individual project execution — quotations, schedules, deployment procedures — are handled through separate consultation.

CONTENTS

0. Terminology 3
1. DataBahn AM — The Integrated Platform for Autonomous Manufacturing and Teleoperation 4
    1-1. Vision — from shop-floor expertise to manufacturing AI agents 4
    1-2. Six core platform capabilities 4
    1-3. Executive summary — application in advanced manufacturing 5
2. Background — the Limits of Floor Inspection and the Data Bottleneck 6
    2-1. Why now — three limits of manual patrol inspection 6
    2-2. Three data bottlenecks in advanced manufacturing 6
    2-3. The DataBahn AM approach 6
3. Solution Architecture 7
    3-1. Data interfaces — digital twin and teleoperation integration 7
    3-2. Data pipeline 8
4. The Autonomous Manufacturing Data Flywheel 9
    4-1. The six-stage cycle 9
    4-2. Turning the loop into intelligence — scenario discovery and instruction updates 10
    4-3. Expected outcomes 10
5. Product #1 — DataBahn AM Rover 11
    5-1. Overview — the collection unit that captures the full physical truth of the shop floor 11
    5-2. Core Components 12
    5-3. Key specifications 12
    5-4. Flexible sensor placement and configuration 13
6. Product #2 — DataBahn AM License (Software) 14
7. Service Model — FDE (Forward Deployed Engineer) 15
    7-1. Engagement model by phase 15
    7-2. Making the floor manager's work more effective 15
8. Deployment Models 16
    8-1. Single-line configuration 16
    8-2. Multi-line configuration — distributed capture, central training 16
9. Scaling Strategy — the Three-Track Autonomous Manufacturing Accelerator 17
    9-1. The three-track roadmap 17
    9-2. Digital twin — a live mirror of the floor, built from patrol data 17
    9-3. Teleoperation — see it on the twin, confirm it on video, intervene remotely 18
    9-4. Asset reuse and transition matrix 19

0. Terminology

This white paper distinguishes the service category, the DataBahn AM platform brand, and the roles of the products that make up the platform, as follows.

Area	Term	Definition and notes
Service category	Autonomous Inspection for Advanced Manufacturing	Autonomous Inspection for Advanced Manufacturing. The service area in which autonomous robots and AI take over the patrol inspection people perform on the floor.
Platform brand	DataBahn AM	The integrated platform for autonomous manufacturing and teleoperation. Spans capture, asset creation, training, evaluation and deployment, together with digital twin and remote operations.
Mobile collection system	DataBahn AM Rover	One complete on-site data collection system integrating the mobile base, AM Logger and Camera Kit.
Core edge data module	DataBahn AM Logger	The core module responsible for AGX Orin-based edge compute, multi-sensor synchronization, data packaging and on-device inference.
Standard sensor package	DataBahn AM Camera Kit	A standard sensor bundle built on four around-view camera channels plus a depth camera.
Software platform license	DataBahn AM License	A software license covering the data pipeline, curation, training, evaluation and deployment runtime.
Mobile base	Mobile Platform	The mobile platform that makes up the Rover at the initial deployment stage. Can be replaced by the customer's own platform at later stages.
Live floor mirror	Digital Twin	A live mirror of the floor, 3D-reconstructed and synchronized from patrol data (SLAM · nvblox · Omniverse).
Remote operations	Teleoperation Console	A remote monitoring and intervention console based on the digital twin map and live or replay video.

In this white paper, DataBahn AM Rover refers to one complete mobile data collection system, ready to operate from the earliest stage of deployment. Within it, the AM Logger is the core module responsible for multi-sensor synchronization, data packaging and edge inference; it can be extended to the customer's own mobile robots, AMRs, humanoids and fixed installations under the same data collection standard.

1. DataBahn AM — The Integrated Platform for Autonomous Manufacturing and Teleoperation

1-1. Vision — from shop-floor expertise to manufacturing AI agents

So that workers are safer and the floor more automated, and so that manufacturing AI robot agents can move through it with everyone at ease — DataBahn AM captures the expertise the shop floor has built up layer by layer, turns it into data assets, clears the barrier to adopting autonomous manufacturing, and brings collaboration with AI agents forward.

This transition also changes the role of people. The floor manager evolves from someone who walks the rounds and inspects into someone who operates robots and data. Alongside more efficient use of inspection staff, judgment criteria and know-how accumulate in the system rather than in individual experience.

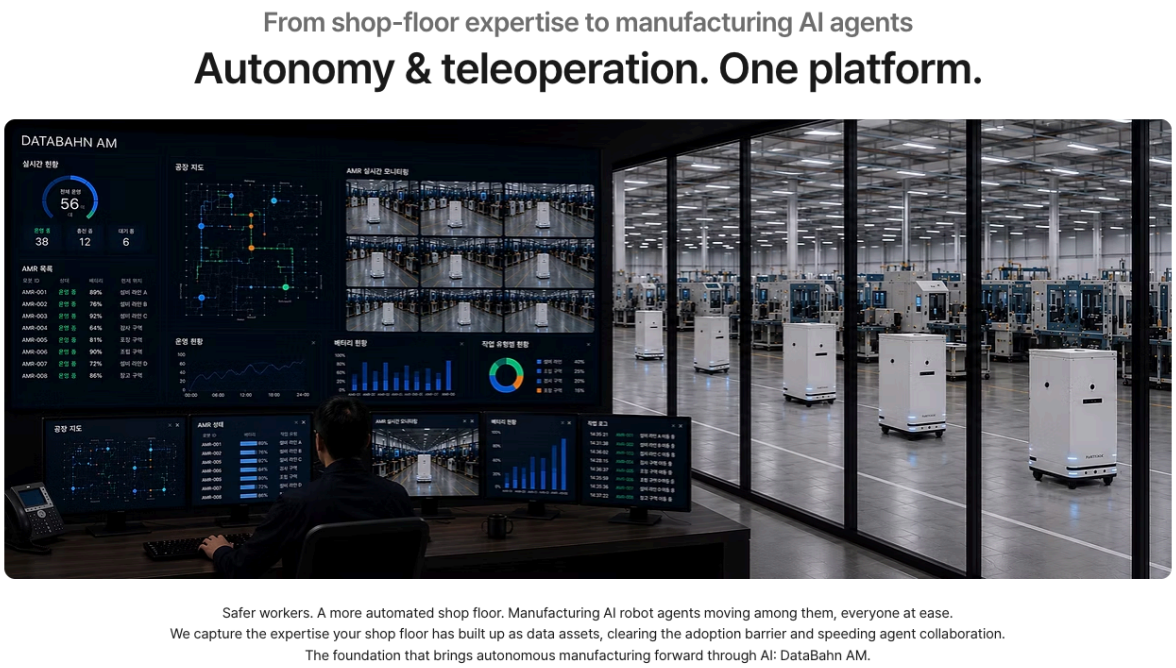

Figure 1-1. DataBahn AM — the integrated platform for autonomous manufacturing and teleoperation

1-2. Six core platform capabilities

Capability	Role
Reasoning model	Understands and reasons over sensor, time-series and situational information to support decisions and prediction
Embedding model	Vectorizes text, image and sensor data to support meaning-based search and similarity analysis
Natural language interaction	Supports natural language search, filtering, review and summarization of

Capability	Role
	data
Visualize, Filter, Review	High-speed streaming visualization, filtering and review of real-world data
Synthetic data	Works with synthetic data generation tools to augment scenarios and enrich datasets
Expert labeling	Supports expert labeling and review workflows for high-value datasets

1-3. Executive summary — application in advanced manufacturing

Advanced manufacturing sites, semiconductor fabs foremost among them, are the hardest environments in which to apply automation and AI. Cleanroom classification, particulate, ESD and EMI constraints, 24/7 operation and per-line security isolation accumulate until standardized collection of on-site data and the construction of a training pipeline become the single largest bottleneck to AI adoption. The same structural bottleneck is common across precision manufacturing generally, including display and battery production.

DataBahn AM resolves this bottleneck at three layers. On the floor, the Rover patrols and collects standardized data. On the platform, the data flywheel runs the capture–train–deploy loop automatically. In operation, the digital twin and teleoperation extend the entire floor into a space that can be monitored and controlled remotely.

2. Background — the Limits of Floor Inspection and the Data Bottleneck

2-1. Why now — three limits of manual patrol inspection

- **Manual patrol and inspection** — walking the rounds and checking by eye produces omissions and variance, and cannot avoid blind spots on night shifts and in elevated areas.
- **Dependence on veterans' tacit knowledge** — judgment criteria live in individual experience rather than in documents, so inspection know-how leaves with the people who hold it.
- **Inspection model decay** — once built, an inspection model loses accuracy over time, and the longer retraining is delayed, the wider the gap grows.

2-2. Three data bottlenecks in advanced manufacturing

- **No data standardization** — camera specifications, calibration and logging formats differ line by line and machine by machine, so training data is inconsistent across lines.
- **Capture and training run separately** — as data collected on the floor moves to an external training environment, metadata, synchronization information and calibration files are easily lost.
- **Integration burden at the operations stage** — models from early validation do not connect naturally to the floor's operational network, to industry standards, or to the deployment runtime, so integration cost is incurred again and again.

2-3. The DataBahn AM approach

- **Standardized capture** — a standard data package built on the AM Logger and Camera Kit: camera, depth, IMU, time synchronization, calibration and metadata bundled into one standard package.
- **Capture and training as one** — the AM software stack on the customer's operational infrastructure ingests the data package the Rover and Logger produce, exactly as it is.
- **A scaling path designed in from the start** — begin quickly with the Rover, then extend the core components (Logger, Camera Kit, SW Stack) onto the customer's own robots and operational infrastructure.
- **Role transition by design** — support for restructuring the work itself, so that floor managers review and approve inspection results and take charge of robot operation and scenario management.

3. Solution Architecture

3-1. Data interfaces — digital twin and teleoperation integration

Built around the spatial and terrain characteristics of the shop floor, the system captures and transmits data reliably and without gaps. The architecture consists of three kinds of flow. The device interface gathers drive control and telemetry, together with video, depth and IMU inputs, into the Rover's AM Logger. The data uplink sends telemetry and events (real time) and the 3D map (periodic update) to the digital twin, and the video stream (live) to the teleoperation console. The control and interaction channel completes a closed loop: selecting a zone on the twin calls up video, and remote control commands from the console return to the Rover.

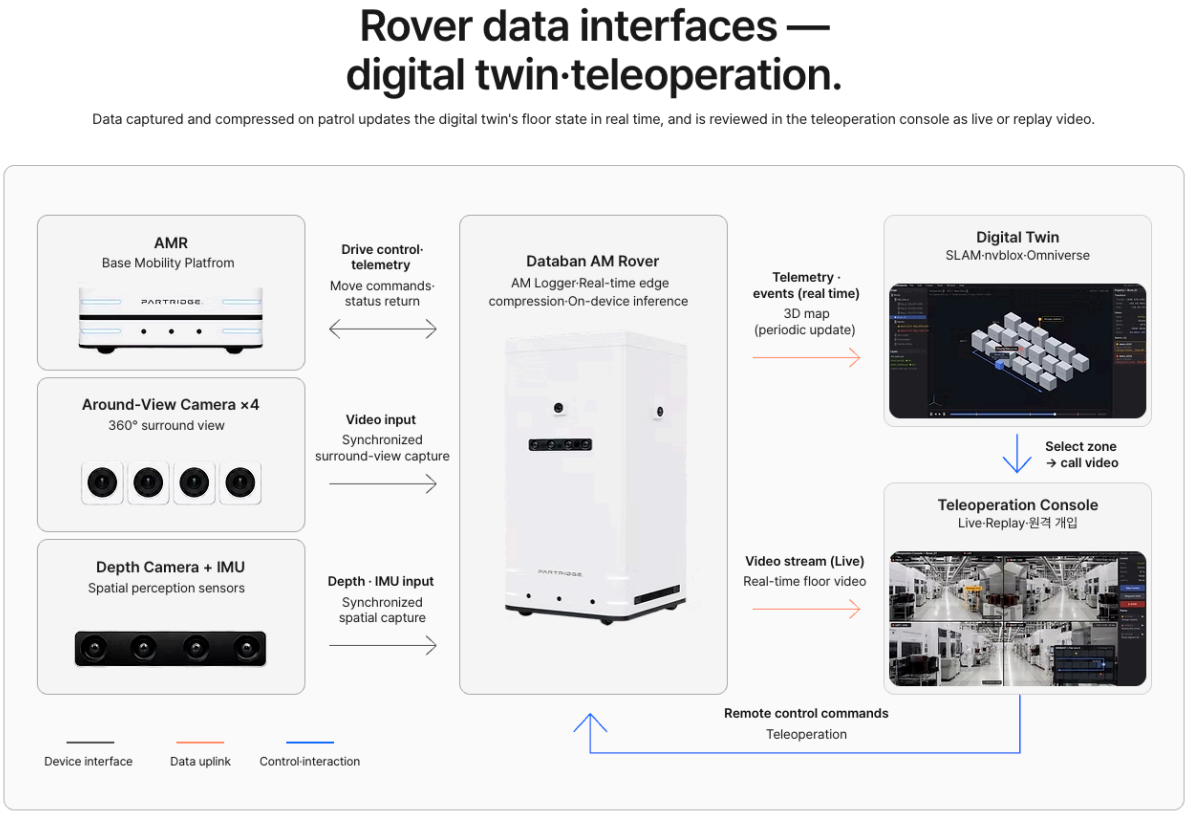

Figure 3-1. Rover data interfaces — digital twin · teleoperation

3-2. Data pipeline

Stage	Location	Responsibility	Output
Capture	AM Logger	Synchronized camera, depth and IMU capture; local buffering	RAW image + depth + IMU + calibration package
Transfer	AM Logger → training infrastructure	Daily upload over the network or by physical disk	Daily data bundle
Curate	DataBahn AM Platform	Labeling, filtering, and organization of defect and anomaly scenarios	Training dataset
Train	Customer VM · on-prem GPU · cloud	Model training on PyTorch/CUDA	Model weights
Evaluate	DataBahn AM Platform	Per-line and combined evaluation, confusion matrix, threshold setting	Evaluation report
Deploy	Floor / operational network	Inference engine, model slots, edge node monitoring	Deployment runtime and pass/fail signal

4. The Autonomous Manufacturing Data Flywheel

From capture through assets, training, evaluation and deployment — a data operations service run quickly against site requirements, and a self-evolving data flywheel for autonomous manufacturing. Vague standards, fragmented data and expertise that is hard to secure are the hard problems of adopting autonomous manufacturing; the flywheel solves them while the customer stays fully focused on its own field of expertise.

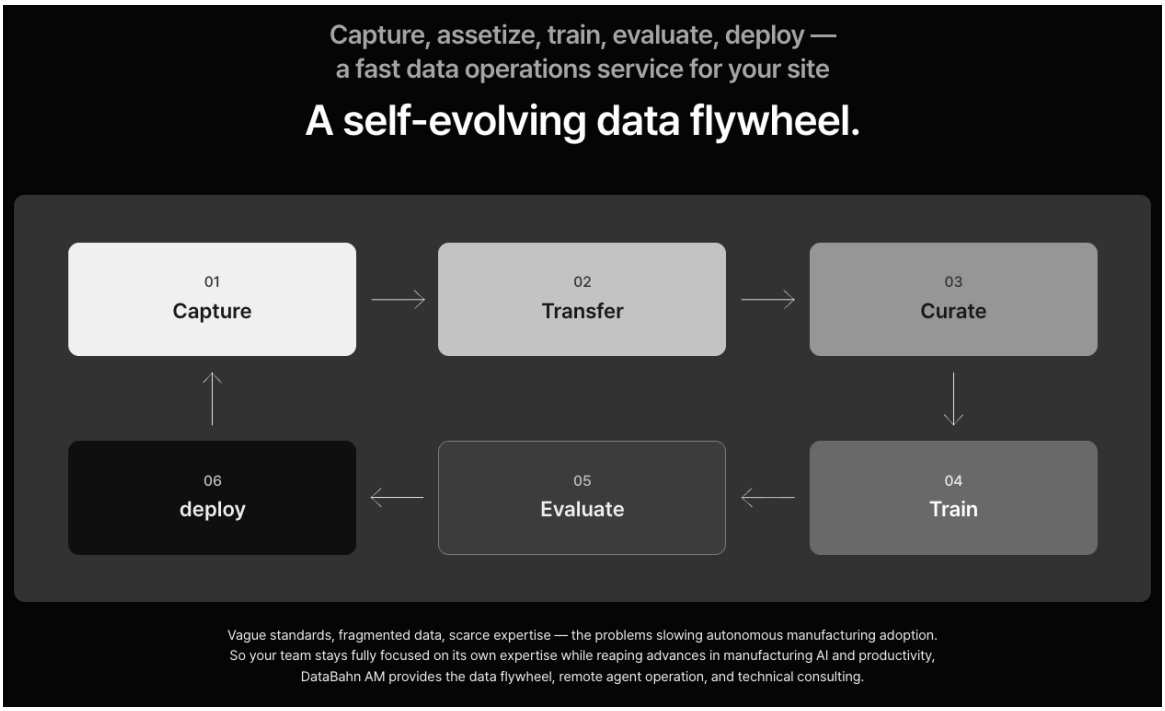

Figure 4-1. The autonomous manufacturing data flywheel — Capture → Transfer → Curate → Train → Evaluate → Deploy

4-1. The six-stage cycle

- ① **Capture** — the Rover patrols, time-synchronizes multi-camera, depth and IMU data, and writes it into a standard package.
- ② **Transfer** — after real-time compression at the edge, data is delivered reliably to the platform over 10GbE or by physical disk.
- ③ **Curate** — Smart auto-label cuts manual labeling effort, and defect and anomaly scenarios are organized.
- ④ **Train** — detection models are trained, with accuracy managed against quantitative metrics such as mAP.
- ⑤ **Evaluate** — per-line and combined evaluation, together with threshold management, determines whether a model is ready to deploy.

- ⑥ **Deploy** — the trained model is deployed to the floor to detect anomalies in patrol video in real time, and the results define what is captured next.

4-2. Turning the loop into intelligence — scenario discovery and instruction updates

VLMs and LLMs interpret the inference output of the deployed model, discovering — against a stated objective — inspection situations that people missed, and the scenarios they surface are written automatically into the work instructions (a RAG corpus). The updated instructions change what the robot inspects next, and the loop closes: an inspection loop that never stops and grows more accurate on its own.

4-3. Expected outcomes

Outcome	Detail
Less inspection effort	24/7 unmanned patrol reduces inspection headcount and night-shift burden
Tacit knowledge digitized	Veteran know-how stays continuously current in the work instructions
Self-improving models	Data accumulates with every patrol, so detection accuracy keeps rising
Unbounded scaling	A proven loop is replicated line by line and site by site

5. Product #1 — DataBahn AM Rover

5-1. Overview — the collection unit that captures the full physical truth of the shop floor

Every successful autonomous manufacturing foundation starts from rich, precise on-site data capture and standardization. DataBahn AM begins with the DataBahn AM Rover, which reflects the customer's process structure, characteristics and task requirements without gaps to build datasets optimized for AI training.

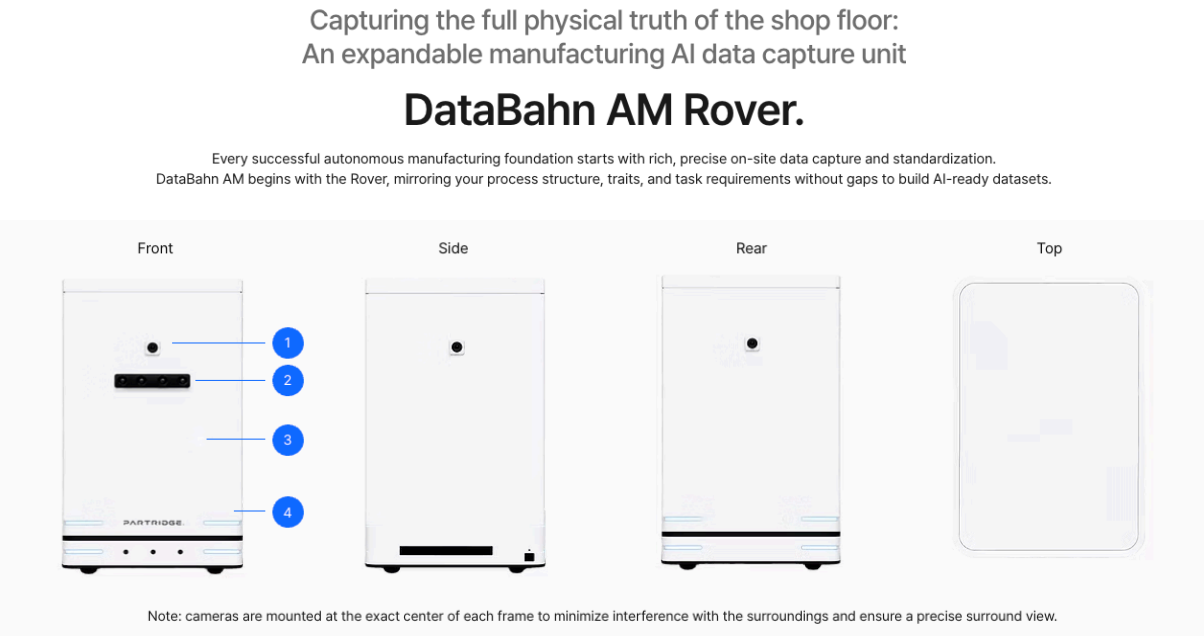

Figure 5-1. DataBahn AM Rover — front, side, rear, top

5-2. Core Components

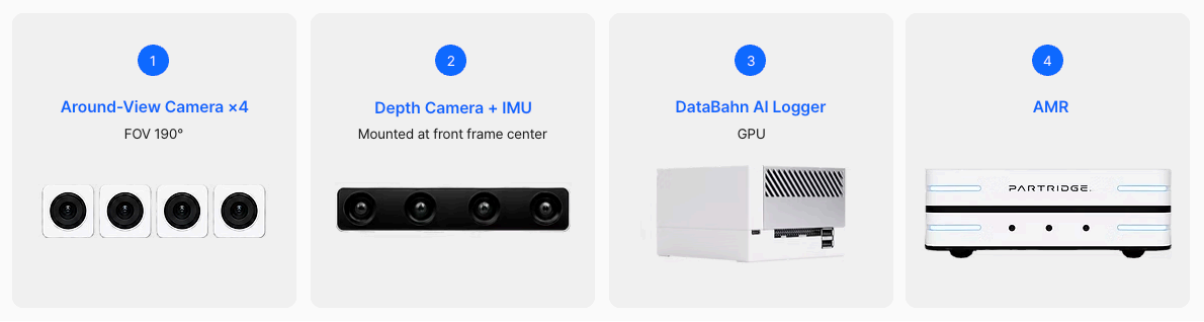

Figure 5-2. Components — Around-View Camera ×4 · Depth Camera + IMU · AM Logger · AMR

#	Component	Qty	Role
R1	Mobile base (AMR)	1	Mobile platform carrying the AM Logger and Camera Kit
R2	DataBahn AM Logger	1	Core module for multi-sensor synchronization, data packaging, NVMe buffering and edge inference
R3	DataBahn AM Camera Kit	1 set	Standard sensor package built on four around-view camera channels plus a depth camera
R4	DataBahn AM License	1	Runtime software for capture, curation, training, evaluation and deployment

5-3. Key specifications

Item	DataBahn AM Logger	DataBahn AM Camera Kit
Compute / sensors	NVIDIA Jetson AGX Orin 32 GB, 200 TOPS (INT8)	Around-view cameras ×4, depth camera ×1
Input / synchronization	GMSL2 8ch deserializer, CAN/UART, GPIO	190° FOV around-view, depth + IMU
Storage / transfer	M.2 NVMe 1 TB buffer, 10 GbE, USB 3	Packaged with calibration and metadata
Extensibility	Mountable on the Rover, customer AMRs, humanoids and fixed installations	Front, rear, left and right around-view plus forward depth as the baseline

5-4. Flexible sensor placement and configuration

Sensors can be placed and combined freely, and the quality of the AI training data collected is checked and optimized automatically in real time.

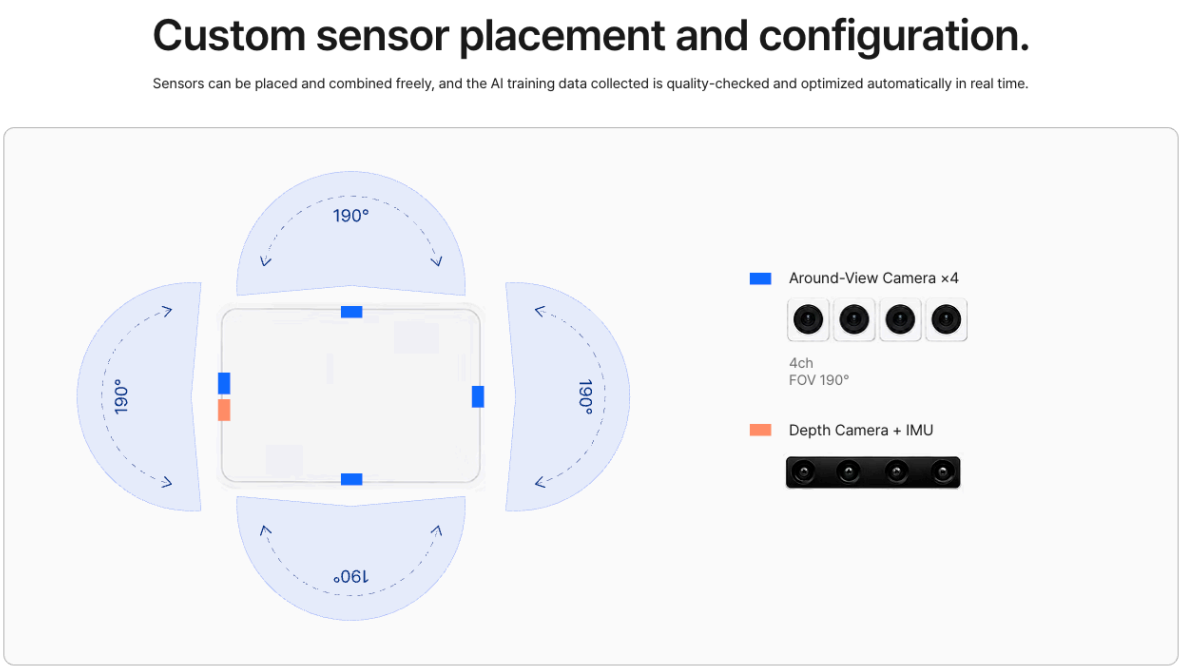

Figure 5-3. Sensor layout — 190° around-view ×4 plus forward depth

6. Product #2 — DataBahn AM License (Software)

DataBahn AM License is a software license bundling the data pipeline, curation, training framework, evaluation and deployment runtime. It is supplied pre-configured in a reference training and evaluation environment, and at the operations stage can be extended and deployed onto the customer's VMs, on-premise GPU servers or cloud environment.

Module	Role
Data Pipeline	AM Logger package ingestion, labeling queue, calibration validation, dataset versioning
Curate & Review	Labeling of defect and anomaly scenarios, data filtering, quality review, Coreset suggestions
Train Framework	PyTorch/CUDA training templates, MLOps hooks, experiment management
Evaluate	Per-line and combined evaluation, confusion matrix, threshold management, report generation
Deploy Runtime	Inference engine, model slots, edge node monitoring, deployment validation
Platform Services	User and permission management, logging and audit, API integration, version control

Licensing policy and commercial terms are outside the scope of this white paper and are defined through separate consultation.

7. Service Model — FDE (Forward Deployed Engineer)

The quality of data capture, training and deployment ultimately depends on how much of the field engineer's knowledge is worked into the system. DataBahn AM provides an FDE service alongside the product. FDE is not the secondment of resident staff; it is a knowledge-transfer acceleration service that transplants the floor's tacit knowledge — inspection scenario definitions, labeling criteria, pass/fail thresholds, work instructions — into the platform.

7-1. Engagement model by phase

Phase	FDE role	Customer role
Onboarding	Leads inspection scenario design, establishes labeling criteria, validates the initial model, builds the work instructions	Provides floor knowledge, reviews results
Transition to operations	Hands over console operation, delivers role-transition training, standardizes operating procedures	Performs day-to-day operation as console operator
Steady state	Periodic review, support for model refinement and scenario expansion	Runs operations independently and defines new requirements

7-2. Making the floor manager's work more effective

As the FDE and the platform absorb inspection, documentation and model management, the floor manager moves away from walking rounds and recording results and concentrates on judgment and operation. The FDE is what carries out the role transition described in Chapter 2 — from inspector to robot and data operator — and the end point is a state in which the customer runs the flywheel without an FDE at all.

8. Deployment Models

8-1. Single-line configuration

One AM Rover, one License and a training and evaluation infrastructure carry out data capture, curation, training, evaluation and deployment validation on a single line as a closed loop.

8-2. Multi-line configuration — distributed capture, central training

When several lines are brought online at once, an AM Rover is deployed per line and the training and evaluation infrastructure is shared centrally, so that data from every line is trained together into a single model or a per-line family of models. Where lines come online at different times, the training infrastructure and the License are still shared and only the Rovers are added in stages.

Item	Single line	Multi-line
AM Rover	1 unit	N units (one per line)
Training & evaluation infrastructure	One instance	Centrally shared
License	1 unit	Shared, or expanded by seats
Simultaneous multi-line capture	—	Supported
Combined training	Single-line model	Combined multi-line model or per-line models
Scaling path	Initial validation	Add Rovers in stages and extend the software

9. Scaling Strategy — the Three-Track Autonomous Manufacturing Accelerator

An autonomous manufacturing accelerator service that brings precise teleoperation and full process autonomy forward. When manufacturing AI agents — the enterprise's digital nervous system — are linked in real time, powerful teleoperation-based manufacturing intelligence becomes possible. So that data from the floor and from the agents runs through the whole company, DataBahn AM builds autonomous manufacturing infrastructure specific to the customer.

9-1. The three-track roadmap

Category	Track 1 — Data assets (Start)	Track 2 — Manufacturing AI operations (Scale)	Track 3 — Teleoperation (Integrate)
Concept	On-site data capture and training, data standardization, per-line data assets	Scaling collaboration with manufacturing AI agents — AMR/AMMR/humanoid, autonomous movement and collaborative work on the floor	Floor–cloud linked control, autonomous operation and remote monitoring, faster data-driven decisions
Core components	DataBahn AM Rover — around-view and depth cameras, local data operations	Autonomous manufacturing agent platform — built on the customer's own robot platform, 3D perception and path planning	Central cloud control platform — unified training pipeline, real-time dashboards, AI model registry
Core capabilities	Multi-view camera data capture, high-precision data synchronization, standalone on-site logging and monitoring	Automatic navigation and autonomous movement, collaborative manipulation, collision avoidance	Unified data management and training, remote model deployment and updates, real-time monitoring

9-2. Digital twin — a live mirror of the floor, built from patrol data

The vision data accumulated as the flywheel turns is not used only to train inspection models. The same data is reconstructed in 3D with SLAM and nvblox to build a digital twin replicating the entire floor, synchronized to NVIDIA Omniverse. The Rover's position, status and detection events are overlaid on the twin in real time, and the 3D mesh is refreshed periodically. Simulation synthesizes hazardous situations that are rare in reality and accelerates training (sim-to-real).

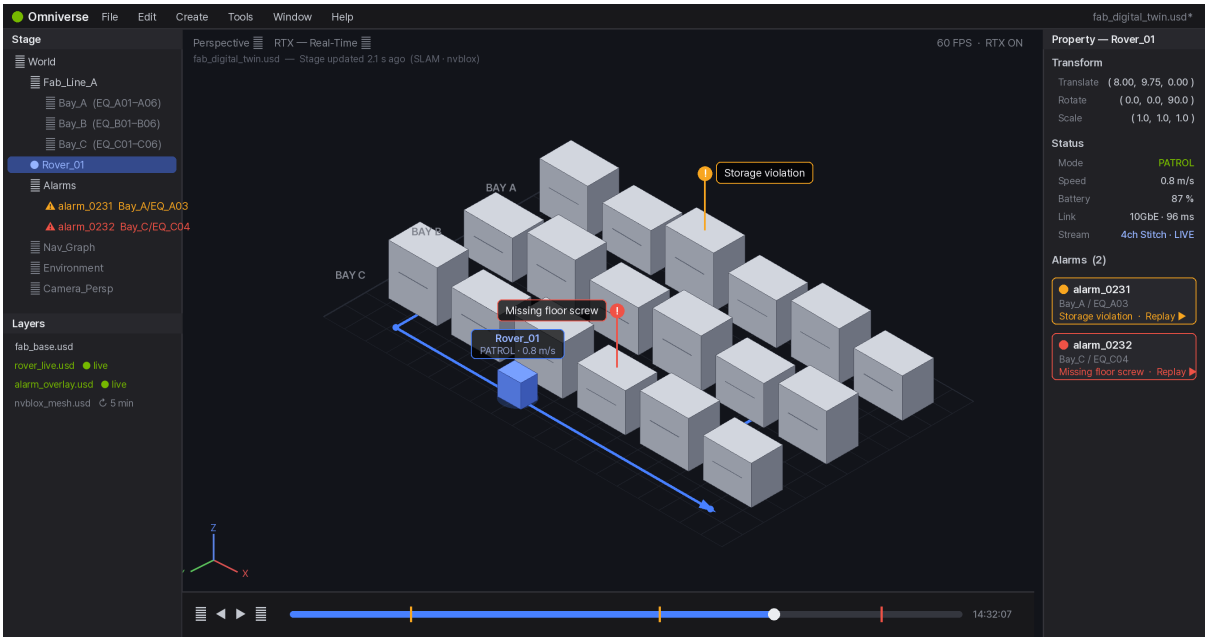

Figure 9-1. Fab digital twin — real-time synchronization of Rover path and status alarms (Omniverse)

9-3. Teleoperation — see it on the twin, confirm it on video, intervene remotely

The digital twin becomes the spatial UI for remote operations. The operator selects a zone on the twin map to call up live four-channel around-view video from that location, or clicks an alarm to replay the footage from that moment. Live video shows where the robot is now; replay draws on already-accumulated segment assets to show any location at any point in time — you can check the state of that zone yesterday without going to the floor. When something is wrong, the operator intervenes immediately by remote control, and real-time compression at the edge carries the high-volume video stream.

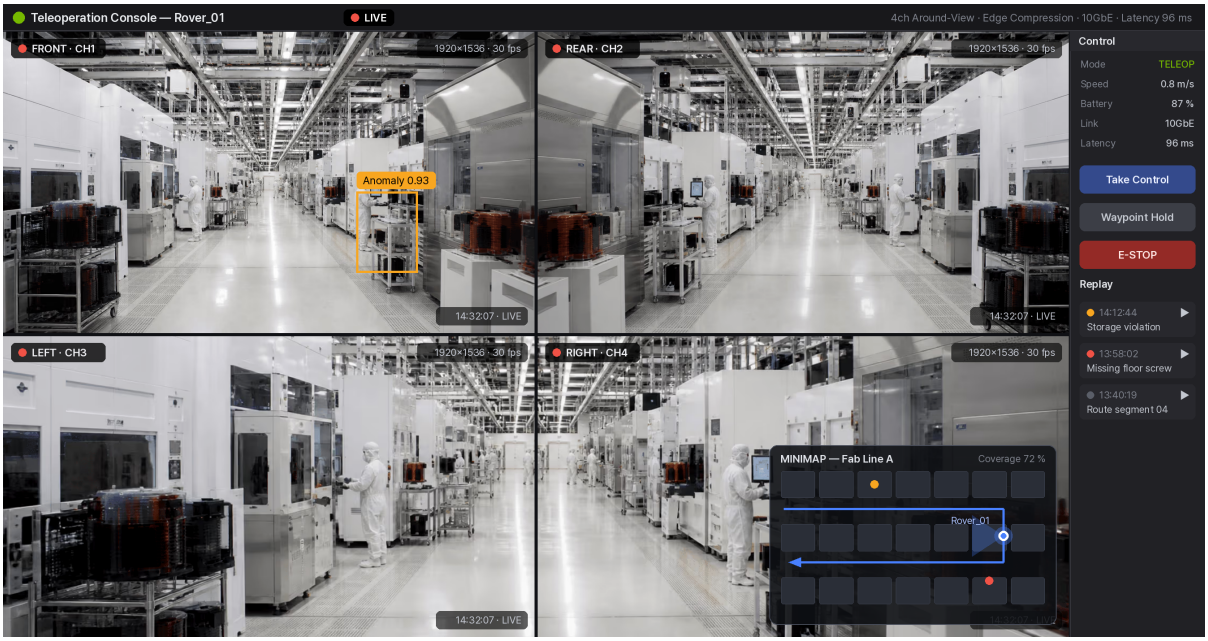

Figure 9-2. Teleoperation console — four-channel live video, replay, and current position on the minimap

9-4. Asset reuse and transition matrix

Asset	Rover	Customer's own AMR	Humanoid / AMMR	Operational infrastructure · digital twin
DataBahn AM Logger	◉	◉	◉	—
DataBahn AM Camera Kit	◉	◉	○	—
DataBahn AM SW Stack	◉	◉	◉	◉
Customer VM / GPU Infra	—	△	△	◉
Mobile base	◉	Replaced by customer platform	Replaced by customer platform	—
Collected data (standard package)	◉	◉	◉	◉ Source for 3D reconstruction and simulation

Key: ◉ core reuse / ○ reuse after some adjustment / △ optional / — not applicable