



HYBRID IoT • Whitepaper – agriculture

Connected intelligence for remote operations

How Edge AI Vision and Hybrid IoT can
transform decision-making beyond
traditional network boundaries

Featuring the Twinberry Farms field
validation initiative with M2M Tech
and Terrestar Solutions



Core theme

Connected
intelligence for
remote operations

Proof point

Twinberry Farms
field validation

Technology model

Edge AI Vision +
Hybrid IoT

Audience

Growers, remote
operators,
innovators and IoT
ecosystem partners

Executive summary

Remote operations are becoming more data-driven, more automated and more dependent than ever on precise and timely information. Yet many of the places where operational data is generated have unreliable connectivity coverage: farms, forests, mines, construction sites, energy infrastructure, transportation routes and other distributed environments.

This whitepaper introduces the concept of Connected Intelligence for Remote Operations: an operating model where cameras, sensors and a variety of machines collect field data. Edge AI transforms that data into actionable insight close to the source, while Hybrid IoT connectivity helps deliver the right information to operators, dashboards and business systems beyond traditional network boundaries.

The Twinberry Farms field validation initiative provides a practical proof point. In this initiative, M2M Tech's MEA platform brings Edge AI Vision to blueberry harvesting operations, while Terrestar's Hybrid IoT connectivity extends the reach of data-driven insight through cellular and satellite connectivity. Together, they demonstrate how connected intelligence can improve visibility, decision-making speed, productivity and confidence in remote operations.

“Every little bit of insight is going to help us grow as a business.”

Newton Sahota

CEO, Twinberry Farms

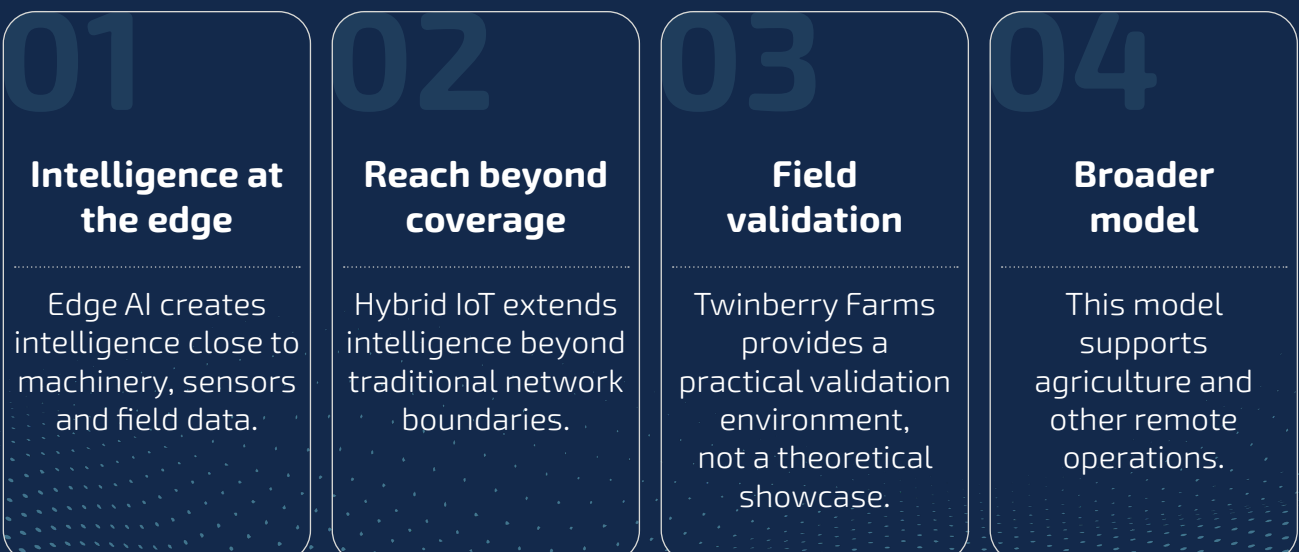
“Farmers will always adopt something when they can see the value it brings to them.”

Rahul Singh

Director, BC Centre for AgriTech Innovation at SFU

Key takeaways

Connected intelligence turns remote field data into practical, timely operational insight.



1. Why connected intelligence matters now

Remote operations no longer suffer from insufficient data. Cameras, sensors, machines and field systems are already capturing what happens on the ground. The real challenge is turning those signals into precise, timely, actionable intelligence, especially in places where connectivity is unreliable, operations are mobile and decisions cannot wait for perfect network conditions.

That's where Terrestar's Hybrid IoT becomes a strategic enabler. By combining cellular and satellite connectivity, organizations can now extend the reach of operational insights beyond traditional network boundaries. When paired with M2M Tech's Edge AI, intelligence is created closer to the source, transmitted more efficiently and delivered where it can support decision-making and action.

For Canadian industries such as agriculture, forestry, mining, energy, transportation and northern operations, this model is becoming essential, as it helps reduce blind spots, improves responsiveness and makes advanced technology usable in the field, not only in controlled environments.

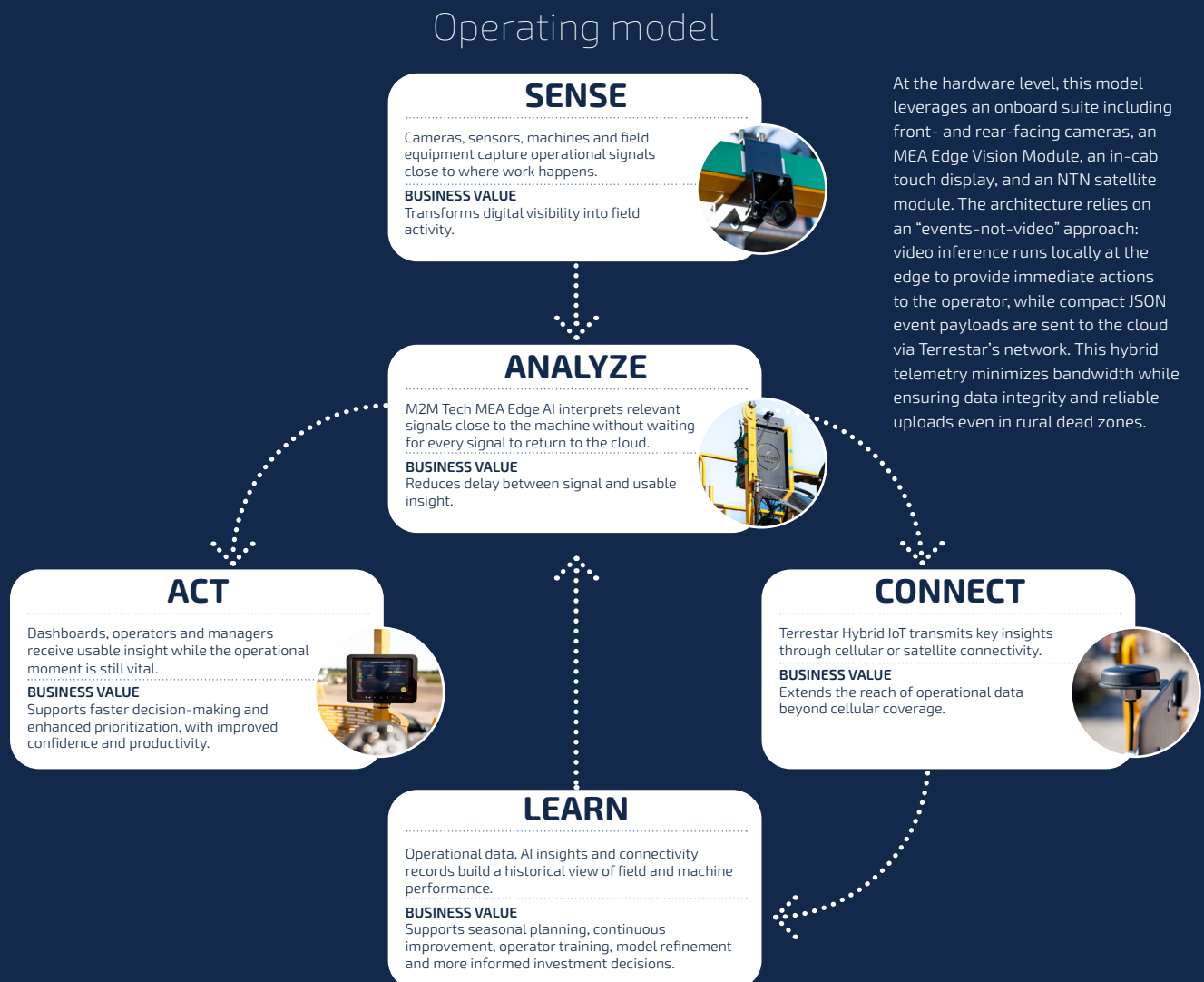
The Twinberry Farms initiative brings this model to life. Edge AI Vision interprets what is happening on the harvester. Terrestar's Hybrid IoT helps move key insights across cellular and satellite networks. Together, they show how Connected Intelligence can support real-time decision-making in real-world operating conditions.



2. A new operating model for remote operations

Connected Intelligence combines sensing, analysis, connectivity, action and learning into a singular and highly powerful operating model. Cameras, sensors, machines and field equipment capture what is happening; Edge AI interprets relevant signals close to the source; Hybrid IoT carries the right insights through cellular or satellite connectivity; and operators, managers or business systems use those insights to act. The value lies not in the creation of more data but in shortening the path and the time from field signal to operational action.

This model is especially relevant for operations that are mobile, seasonal, remote, and safety- and/or time-sensitive. In environments like these, delayed information can translate into lost productivity, missed quality signals, avoidable travel, compromised employee safety, equipment downtime or slower response to field conditions. Over time, accumulated data can also help identify recurring patterns, improve machine configurations, support operator training and guide future operational decisions.



The model is the core architecture of the solution. It avoids treating AI, connectivity and operations as separate topics, presenting them instead as one connected workflow: sense what is happening, analyze what matters, connect the right insight, act on it and learn over time.

3. The Twinberry Farms validation: turning field data into field decisions

Agriculture is one of the clearest environments for validating connected intelligence. Field operations are spread across large outdoor areas. Work is seasonal and time-sensitive. Weather, labour, equipment performance and crop quality can change quickly. Producers need practical insights, not technological complexity.

Twinberry Farms provides an ideal example of that real-world validation environment. Harvest operations bring together machines, crews, weather, crop quality and tight delivery windows. A typical day can involve monitoring fields, assessing berry readiness, preparing harvesters, coordinating teams, responding to equipment issues and moving fruit quickly from the field to customers.

Our initiative connects this operating reality with M2M Tech's MEA Edge AI Vision platform and Terrestar's Hybrid IoT connectivity. The process is clear: a dual-camera AI vision system detects blueberry ripeness ahead of the machine and assesses post-harvest execution behind it. In the cab, a live touch display turns edge AI detections into immediate visual prompts, helping the operator adjust comb speeds and maintain precise bush alignment.

Terrestar's Hybrid IoT provides the reach layer. Cellular coverage is used when available, and switches to satellite connectivity when needed, helping move compact event data from field equipment to cloud dashboards and business systems beyond traditional network boundaries. A key design lesson from Twinberry is that intelligence must be both precise and usable. The MEA Edge Vision system continuously classifies ripeness and bush alignment, but the solution is designed so it doesn't overload the operator with every micro-variation. Instead, 20-second control loops and 30-second stability filters smooth the stream of edge AI inferences into stable, human-friendly guidance. This helps prevent over-correction, reduces operator fatigue and supports more consistent harvest execution in real field conditions.



“We bring sovereign edge AI as close as possible to the source of truth, which is the data itself.”

Ashok Kasilingam
CEO, M2M Tech

“I think the biggest difficulty is that we can't be everywhere all at once. Typically, there is a lot of information that we can't assess in real time, and we have to be physically in the fields. We would like to have data that is in our hands.”

Navdeep Middar
Operations Manager, Twinberry Farms

4. What connected Intelligence is designed to improve

The more compelling story isn't the technical architecture. It's the operational outcome. Connected Intelligence is useful when it improves visibility, responsiveness, productivity, quality, resilience and scalability for the people running the operation.

Rahul Singh's from the BC Centre for Agritech Innovation sees farmers and producers adopting technologies when the value is practical, visible and connected to ROI. In other words, the question is not whether AI or IoT is an innovation. It's whether the combined solution helps the operation perform better.

Connected Intelligence creates value on two different time horizons. The first is operational: helping teams make better decisions while the work is actually underway. The second is strategic: helping organizations learn from accumulated data over weeks, seasons and years. Real-time visibility can improve day-to-day execution, while historical data and AI-driven insights can support planning, investment decisions, operational improvement and long-term growth.

“AI and IoT on the harvester can improve efficiency, support increased production, reduce waste and help accelerate broader adoption across farms.”

Rahul Singh

Director, BC Centre for Agritech Innovation at SFU

OUTCOME AREA	OPERATIONAL VALUE NOW	STRATEGIC VALUE OVER TIME	TWINBERRY VALIDATION KPI
Visibility	Synchronizes continuous vision observations with GPS data to build density maps.	Managers leverage spatial evidence to guide targeted post-season decisions.	Block and row-level spatial mapping
Decision-making speed	Processes video directly on the harvester to provide immediate operator cues, bypassing cloud connectivity delays.	Ensures critical machine control and harvest decisions that are always driven by live field data, regardless of network availability.	Zero cloud-dependency for operator cues
Productivity	Actively tracks how much ripe fruit is successfully harvested alongside driver compliance.	Improves operator training and optimizes execution consistency over time.	Harvest & driver efficiency tracking
Bandwidth optimization	Transmits compact event payloads instead of raw video over Terrestar's NTN/cellular links.	Enables cost-effective, continuous cloud tracking without massive bandwidth demands.	>99.9% payload reduction (~20 bit/s vs ~3.6 Mbit/s)
Quality & resilience	Utilizes store-and-forward data buffering and hybrid cellular/NTN fallback to ensure continuous connectivity.	Guarantees complete data integrity for historical records, even across rural dead zones.	0 operational data loss
Scalability & learning	The core edge-to-cloud architecture provides a repeatable, hardware-agnostic foundation.	Readily adapts to support additional crops, varied machinery, and entirely new remote industries.	Extensible platform architecture

5. Beyond agriculture: a repeatable model for remote industries

Twinberry Farms is the proof point, but the operating model extends well beyond agriculture. Any organization that operates equipment, assets, people or infrastructure outside reliable network coverage can face the same challenge: field data exists, but it is delayed, fragmented or disconnected from the decision-maker.

By combining Edge AI and Hybrid IoT, organizations can reduce operational guesswork, improve visibility in field conditions and extend access to critical insights beyond traditional network boundaries. The same model can support agriculture, livestock, mining, construction, energy, utilities, forestry, wildfire monitoring, transportation, logistics, critical infrastructure and more.

For Canada, this is a practical innovation story. Many strategically important industries operate across rural, remote and hard-to-reach regions. Connected Intelligence makes advanced technology usable beyond urban centres by bringing intelligence closer to the worksite and extending the reach of that intelligence through hybrid connectivity.

“While this pilot focuses on agriculture, the solution was designed for any business that requires reliable and continuous connectivity.”

Stéphane Miljours

Director, Business Product - IoT,
Terrestar Solutions

**Let's
connect
the future,
together.**

Contact us



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