

# Company Profile: VanGuard Pipeline

**Summary:** VanGuard Pipeline Inspection LLC is a technology company serving the oil and gas industry by providing aerial tools for methane gas leak detection.

## Body:

VanGuard equips pipeline owners and operators with aerial tools to find methane gas leaks, ensuring regulatory compliance. They operate from Maple Lake Municipal Airport (KMGG) in Maple Lake, MN. Their technology is deployed on fixed-wing aircraft and helicopters.

## Key Personnel:

- **Nate Holmberg:** CEO
- **James Aarestad:** CTO
- **Tom Burling:** VP Ops

**Website:** <https://www.vanguardpipeline.com/about>

## Connections

- [2024-08-19-MOC-Pipeline-Threat-Detection-Project](#)

## Open Questions

- Who are the primary points of contact at VanGuard for this project?

# Concept: Computer Vision Class and Class List

**Summary:** This note defines the foundational concepts of "class" and "class list" for non-technical stakeholders in the context of this computer vision project.

## Body:

## What is a "Class"?

In computer vision, a **"class"** is simply a **category label** for a specific type of object we want the AI model to learn to recognize. It's the name we give to a group of objects that look similar.

- For example, if we want to find excavators, the class is `excavator`.
- If we want to find sections of pipe that have become uncovered, the class could be `exposed_pipe`.

The AI can only identify the specific classes it has been trained on.

## What is a "Class List"?

A "**class list**" is the complete list of all the classes the model is trained to detect. This list defines the entire scope of what the AI is capable of "seeing". If an object type is not on this list, the model will be blind to it.

## MVP Class List for This Project

Based on our [2024-08-19-Threat-Prioritization-Analysis](#), we have determined that the class list for the MVP will be focused on the two highest-risk threats:

1. excavator
2. exposed\_pipe

Focusing on this small, high-value list ensures the MVP delivers the maximum impact by solving the most critical problems first.

## Connections

- [2024-08-19-MOC-Pipeline-Threat-Detection-Project](#)
- [2024-08-19-Threat-Prioritization-Analysis](#)

## Concept: Geospatial Integration Strategy

**Summary:** This document outlines the strategic importance of integrating our computer vision system with VanGuard's existing geospatial data (GPS coordinates and KMZ flight maps). This capability is the key to transforming our system from a generic object detector into a high-precision, context-aware threat detection tool. It is the single most powerful way to compliment and enhance their existing operations.

**Body:**

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### 1. The Core Advantage: From Detection to Actionable Intelligence

VanGuard's current strength lies in its geospatial precision. The "autotrack" feature, which uses pre-loaded KMZ files and live GPS data to automatically aim the sensor pod, demonstrates a deep integration with the physical location of their assets. Our CV system must leverage this existing strength.

A standalone CV system would flag every excavator it sees. This is noisy. An **integrated CV system** would perform a second, critical validation step:

1. **Detect:** The CV model identifies a potential threat (e.g., an excavator).
2. **Locate:** The system tags the detection with the aircraft's current GPS coordinates.
3. **Validate:** The system checks if the detection's coordinates fall within a pre-defined "threat

corridor" (a geofence, or buffer zone, around the pipeline's known GPS path).

4. **Alert:** Only if the detection is **both** a visual match **and** within the threat corridor does the system generate an alert for the operator.

This two-factor approach is the key to achieving the low false-positive "Actionable Intelligence Rate" defined in our `Success-Criteria-MVP.md`.

## 2. How This Compliments, Not Competes

This strategy is not about replacing VanGuard's existing system; it is about adding a powerful new layer of data to it.

- **It Enhances the Existing Workflow:** The OGI sensor finds methane leaks. Our CV sensor will find the physical threats that *cause* future leaks. It is a proactive, rather than reactive, tool that fits perfectly into their mission of ensuring pipeline integrity.
- **It Leverages Existing Data:** By consuming the same KMZ and GPS data they already use, our system becomes a natural extension of their current data ecosystem. We are not asking them to collect new types of data; we are providing a new way to analyze the data they already have.
- **It Builds Towards a Unified "Digital Twin":** In the long term, this integration is the first step towards a unified view of the pipeline. Every methane alert and every physical threat alert can be logged with precise GPS coordinates, building a rich, historical "digital twin" of the asset over time.

## 3. Phased Implementation Plan

While strategically critical, this is a **Phase 2 (Operational MVP)** feature.

- **Phase 1 (Sign-of-Life MVP):** We will focus exclusively on validating the core visual detection capability. The system will be entirely geospatially-unaware.
- **Phase 2 (Operational MVP):** The primary goal of this phase will be to implement the "Detect, Locate, Validate, Alert" workflow. This will require:
  - A software module to parse KMZ files and create a geofence.
  - An interface to receive a live GPS data feed.
  - The core logic to perform the validation check in real-time.

By deliberately deferring this complexity, we can focus on getting the core computer vision working first, following our principle of validating one major hypothesis at a time.