Estimarmine+ – Precondition Report

1. Company Information

Company Name: Machinavision Inc.

Primary Contact Person: Cedric Aymeric Niango (CEO)

Email Address: niangocedricaymeric@gmail.com

Website: https://www.linkedin.com/company/estimarmine/

Location / Time Zone: Longueuil, QC, Canada – Eastern Time (ET)

2. Team Structure & Required Skills

a. Team Composition

The Estimarmine+ project is designed for a full senior design team (8–10 students) and fits the expected 960–1,200 hours of effort.

Recommended roles:

- Team Lead / Scrum Master

- Desktop / UI Engineer (Qt)

- 3D Visualization Engineer (VTK)

- Explicit / Implicit Modeling Engineer (RBF, CGAL)

- XR Engineer (VR/AR full desktop implementation)

- QA / DevOps Engineer

- Documentation & UX Owner

Each student must:

- Submit ≥6 meaningful pull requests

- Complete ≥6 peer reviews

- Participate in requirements, design, CI/CD, testing, documentation

b. Required Baseline Skills

- Solid general programming (C++, Java, Python)

- Git/GitHub familiarity

- OOP + data structures

Nice-to-have:

- C++17, Qt6, VTK, OpenGL

- Exposure to CGAL or XR engines

c. Skills to Be Developed During the Project

Students will gain:

- C++17 professional development

- Qt6 scientific UI design

- VTK 3D rendering and 2D/3D geological visualization

- Explicit modelling (sections, meshes, clipping)

- Implicit modelling using RBF interpolation and CGAL geometric structures

- Desktop VR engineering using OpenXR + Godot/Unity

- Full AR asset pipeline engineering (GLTF/GLB + metadata)

- CI/CD automation

- Writing user + developer documentation

3. Project Title & Acronym

Project Title: Estimarmine+ – Desktop 3D/VR/AR Geological Modelling Core

Acronym: EMX

4. Project Overview & Problem Statement

Modern mining projects generate large volumes of drillhole, assay, and geological data. Without interactive modelling tools, geologists cannot validate data or visualize subsurface structures.

Estimarmine+ is a modular platform composed of:

- Module 1: 3D Explicit Modelling (drillholes, surfaces, sketches, triangulation)

- Module 2: 3D Implicit Modelling (RBF, kriging, scalar fields, block models) using CGAL + VTK

- Module 3: Full Desktop VR Visualization (OpenXR)

- Module 4: Full AR Asset Pipeline (GLTF/GLB + JSON metadata for future AR apps)

This senior design project delivers:

- Desktop geological modelling core

- Explicit visualization tools

- Implicit modelling prototype with RBF + CGAL data structures

- Full desktop VR viewer (OpenXR)

- Full AR asset export pipeline

5. Solution Overview & Core Components

1. Data & Project Management

- Import collar, survey, assay, lithology CSVs

- QA/QC checks: gaps, overlaps, invalid surveys

2. Explicit Modelling

- Drillhole trajectories (minimum curvature)

- Lithology/assay cylinders

- Clipping planes

- 2D sections + synchronized coloring

- Sketching + extrusion to solids

3. Implicit Modelling Foundations

Students implement:

- 3D grid

- RBF scalar field interpolation

- CGAL-compatible geometric structures

- Marching cubes iso-surface extraction

- Block model CSV export

4. Desktop VR Viewer (Full Implementation)

Using OpenXR (Godot or Unity):

- Load GLTF/GLB geological models

- Teleport / locomotion

- Controller selection

- Interactive clipping plane in VR

- Attribute display in VR

- Desktop PC only

5. AR Asset Viewer (Full Implementation)

- Export GLTF/GLB with proper units

- Metadata: legends, anchors

- Coordinate transforms

- Desktop AR preview mode

6. Technical Considerations

Tech Stack:

- C++17

- Qt 6

- VTK 9.x

- CGAL (geometric kernels, triangulation)

- RBF interpolation (custom or via SciPy-style implementation)

- Godot/Unity OpenXR (desktop VR)

- GitHub + CI/CD

Constraints:

- Desktop only

- XR is desktop VR only

- AR is asset pipeline only

7. Innovation & Competitive Advantage

Estimarmine+ unifies:

- Explicit modelling

- Implicit modelling (RBF + CGAL)

- VR immersive visualization

- AR field-ready exports

8. 12-Week Timeline

Weeks 1–2: Setup, architecture, CSV import, basic VTK

Weeks 3–4: Explicit modelling + sections

Weeks 5–6: Explicit solids + QA dashboard

Weeks 7–8: Implicit modelling (RBF, CGAL structures)

Weeks 9–10: Full desktop VR viewer (OpenXR)

Weeks 11–12: AR asset pipeline + testing + documentation

9. Deployment & Support

- Private GitHub repo

- Datasets provided

- Weekly meeting

10. Confidentiality & IP

All software, documentation, datasets, designs, modelling algorithms (explicit, implicit, RBF, CGAL workflows), rendering pipelines, VR/AR engineering work, and all related assets produced during this project are the exclusive property of Machinavision Inc. (Estimarmine+).

Students may use the work solely for academic evaluation, presentation, and course-credit purposes, but may not reuse, redistribute, publish, or commercialize any part of the system outside the course without prior written authorization from Machinavision Inc.

Students may include high-level descriptions, non-confidential diagrams, and screenshots in their personal portfolios only with written permission from Machinavision Inc., and only if these materials do not reveal proprietary algorithms, data structures, UI/UX designs, modelling logic, or XR pipelines.

All deliverables including source code, compiled binaries, documentation, diagrams, exports, VR/AR assets, implicit modelling prototypes, and any derivative works remain the permanent, exclusive IP of Machinavision Inc.

11. Success Metrics

- Imports multiple datasets

- Explicit + implicit modelling functional

- VR viewer loads models & supports clipping

- AR exports validated

- CI passing

- Positive geologist feedback

12. Mentorship & Communication Plan

Weekly 1-hour meeting with Cedric Aymeric Niango.

CEDRIC NIANGO

CEO