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Case Study

Infrastructure, Environmental, and Sustainability Engineering Sector

Client background

The hundred year old PE backed engineering firm is a long-standing leader in coastal and offshore engineering, known for tackling some of the world's most complex environmental and infrastructure challenges. Its geoscience teams collect and interpret sub-bottom seismic (SEG-Y) and related ocean-floor datasets to map key geologic features that inform permitting, engineering design, environmental compliance, and risk assessment.

The firm provides engineering, construction, environmental, sustainability, resilience, and infrastructure solutions to government agencies as well as commercial, industrial, and energy clients. Over more than a century, it has delivered tens of thousands of projects globally—spanning oil and gas, industrial facilities, coastal infrastructure, environmental restoration, and disaster-response—and has made continuous reinvention a defining part of its DNA: "After 104 years, we're just getting started."

With a workforce numbering in the thousands and offices across North America, the firm brings deep expertise in geotechnical and marine engineering, infrastructure asset management, and large-scale subsurface surveys for energy and offshore exploration sectors.
Given the growing complexity and scale of ocean-floor and sub-bottom datasets, encompassing seismic acquisition, geologic interpretation, and risk modeling, the manual process of labeling and classifying geologic features had become a critical throughput bottleneck under private equity ownership, directly impacting speed, margins, and scalability.

The problem

Manual labeling of complex ocean-floor datasets required teams of PhD geologists up to six months per project.

- Each survey line contained thousands of traces with dozens of possible reflectors and geomorphic features to identify and trace as polylines.
- Consistency and auditability were hard to maintain across regions and projects, slowing approvals and creating rework.
- Throughput was the bottleneck for revenue: every incremental project required more expert headcount.

ADDITIONAL CONSTRAINTS

- **Label variability & noise:** Some feature picks were faint or inconsistently visible (e.g., channels that appeared only sporadically), creating ambiguity for both humans and machines.
- **Heterogeneous nomenclature:** Equivalent features carried different names across regions (e.g., Valley vs. Valley Fill; Seafloor_ASC vs. Seafloor), complicating training and QA. SEG-Y/CSV alignment: Feature CSVs and SEG-Y traces used different primary keys. Reliable alignment required matching FFID ↔️ Ping (not simple trace indices) and honoring polyline continuity rules across gaps.
- **Time/depth semantics:** Picks were stored as two way travel time; horizontal exaggeration and display scaling made visual QA error prone without normalization.
- **Geodesy differences by region:** Surveys spanned multiple NAD83 State Plane zones in US survey feet, with negative source/group scalars in SEG-Y headers, each requiring precise conversion to WGS84 Lat/Lon for mapping and downstream tools.
- **Operational integration:** The solution had to export predictions into the client's workflow (e.g., SonarWiz polyline CSV) and import cleanly on seismic images, with no off-ramp to "demo-only" artifacts.
- **Speed to value:** As a PE backed business, the firm needed a defensible MVP fast, showing measurable throughput and margin impact with minimal lift from already stretched geoscience teams.

What We Did

DISCOVERY & LABEL SOURCING

- Partnered with the client's geoscience leads to enumerate high-value features for sub-bottom interpretation: Seafloor, Ravinement Surface (RavSurface), Texas Mud Blanket (TMB), Valley/Valley Fill, Northern/Southern Delta Lobes, Laminated Muds, Faults, Channels, Gas.
- Organized a three-tier feature taxonomy by continuity, aligning model difficulty with geologic expression:
    1. Continuous: Seafloor, RavSurface, TMB (present across entire lines).
    2. Semi-continuous: Valley Fill, Northern/Southern Delta Lobes, Laminated Muds.
    3. Sparse/episodic: Faults, Channels, Gas, etc.
- Codified polyline continuity rules: gaps between clicks should render as a single continuous line unless a new header segment denotes a distinct feature.

DATA STANDARDIZATION & ALIGNMENT

- Established a deterministic join between SEG-Y and feature CSVs using FFID ↔️ Ping (page-accurate alignment), superseding fragile trace-index heuristics.
- Normalized two-way travel time (TimeFromTX) and corrected horizontal exaggeration to ensure apples-to-apples visualization during QA.
- Built a geodesy layer: honored coordinate_units = feet, applied source/group scalars (e.g., /100), and mapped SOU_X/SOU_Y (or GRP_X/GRP_Y) to WGS84 using the correct NAD83 State Plane zone per region (e.g., TX South vs. South Central, FL North, LA South, AL West, NC statewide).
- Unified naming conventions (e.g., Valley ⇢ Valley Fill) and reconciled region-specific CSV
- variants (e.g., Seafloor_ASC = Seafloor).

MODELING & ARCHITECTURE

- Built a **specialized AI model** trained to detect and label geologic reflectors and geomorphic features (faults, channels, delta lobes, etc.) directly from sub-bottom profiles.
- Designed feature-aware training guided by the continuity taxonomy: prioritized high-signal continuous reflectors for rapid gains; introduced semi-continuous and sparse classes with targeted augmentation to address class imbalance.
- Implemented polyline reconstruction to convert per-trace predictions into continuous, geologically plausible lines that respect the client's continuity rules.
- Exposed confidence scores and source citations (Ping/FFID + TimeFromTX) to support review, audit, and active-learning loops.

QUALITY, EVALUATION & HUMAN-IN-THE-LOOP

- Built per-feature evaluation harnesses (continuous vs. sparse classes assessed with different metrics and tolerances).
- Flagged low-confidence spans for targeted human review and rapid relabeling—tightening the feedback loop without broad geologist time sinks.
- Created validation checks to catch mis-scaled displays, out-of-CRS coordinates, or mis-joined lines before model training.

PILOT, INTEGRATION & ROLLOUT

- Delivered SonarWiz-compatible CSV exports of AI-predicted polylines. Initial imports revealed coordinate/CRS mismatches; we corrected scalars and CRS mapping so predictions plotted precisely on seismic images and in map view.
- Provided a lightweight run-book: CRS selection by region, field mapping, import steps, and a labeling QA checklist.
- Enabled a single-geologist review workflow: accept/edit AI polylines, push back to the training set, and re-export—all within the client's existing tool chain.

> "The XTAM team weren't geologists, but they learned our world faster than anyone we've ever worked with. They came into a 106-year-old business, understood a hyper-specific domain, and completely changed how we operate.
>
> By the time they walked out of the room, they were operating at the level of the top geologists in the industry."

— CTO of the 106 year old Engineering Firm

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Timeline of Results

Day 30

- Fully onboarded into the Geological domain and understood the context of the problem.
- Completed end-to-end data normalization: FFID ↔ Ping alignment, TimeFromTX handling, and horizontal scale normalization.
- Finalized the feature taxonomy and unified naming across regions.

Day 60

- The team shipped the first working prototype capable of producing AI-generated polylines on the Bay County and Texas datasets for internal validation. Early tests demonstrated that even a 20% labeling accuracy would have been transformational—reducing a six-month manual workflow to just weeks.
- Through rapid iteration, model refinement, and targeted augmentation of sparse feature classes such as faults, channels, and gas pockets, the system ultimately achieved ~70% labeling accuracy with high precision on continuous and semi-continuous reflectors. A game changer in this industry.
- This milestone enabled the firm to move from multi-geologist manual labeling to a single geologist production workflow, where experts now focus on rapid review and validation rather than repetitive drawing— effectively turning the primary bottleneck into a scalable quality-assurance process.

Companies We've Built

splice · The Athletic · CVSHealth signifyhealth · Legion · FINALSITE
careof · CredSimple andros* · Wunderkind · Handshake · TEEPUBLIC
grovo · Sealed · reonomy · RENT THE RUNWAY · applecart

Why XTAM

Proven Track Record

Multiple successful transformations and exits across SaaS, EdTech, enterprise software, and consumer tech.

Deep AI Expertise

10+ years deploying machine learning solutions even before AI went mainstream gives us an edge in knowing what works, what doesn't, and how to execute quickly.

End-To-End Approach

We combine strategic advisory, engineering execution, and product innovation under one roof ensuring accountability, speed, and ROI.

Flexible Structures

We meet partners where they are—whether that means a straightforward consulting engagement or an equity-based deal for deeper, long-term collaboration.

Contact Us

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