CASE STUDIES

ENGINEERING EXCELLENCE: REAL-WORLD PCB MANUFACTURING

A comprehensive analysis of technical challenges and high-performance solutions across global industries.

Case Study 1: Aditi Electronics Company Overview

SECTOR: CORPORATE PROFILE

Overview

Founded with a mission to bridge the gap between complex research and scalable manufacturing, AEARPCB has become a trusted partner for Tier-1 suppliers globally. We combine cutting-edge CAD/CAM tools with rigorous ISO-certified production lines.

CHALLENGES

Prototyping Speed

Meeting the demand for rapid prototyping in high-intensity R&D labs.

Mass Production Transition

Ensuring a seamless and error-free transition from initial design to large-scale manufacturing.

Global Compliance

Maintaining strict adherence to international IPC standards across all product tiers.

ENGINEERING SOLUTIONS

BEFORE

Customers faced high defect rates when moving from design to prototype due to fragmented review processes.

AFTER (AEAR SOLUTION)

AEAR's unified DFM review process reduced NPI (New Product Introduction) cycles by 30% while eliminating critical design errors.

Case Study 2: Automotive Engine Control Units (ECU)

SECTOR: AUTOMOTIVE ELECTRONICS

A European automotive client required 6-layer boards capable of extreme thermal cycling and vibration resistance for under-the-hood placement.

Challenge: Thermal Mismatch

Differential thermal expansion between components and substrate leading to joint failure.

Challenge: Vibration Fatigue

Mechanical stress-induced solder joint fatigue over the vehicle's lifespan.

ENGINEERING SOLUTIONS

BEFORE

Standard FR4 boards suffered from pad lifting and via cracking under extreme thermal stress.

AFTER (AEAR SOLUTION)

Implementation of High-Tg materials and localized copper coins for heat dissipation ensured 0% field failures.

PROJECT TIMELINE

Day 1: Material Validation

Selection and testing of Isola 370HR for superior thermal performance.

Day 15: Stress Testing

Completion of prototype stress testing with zero failures recorded.

Case Study 3: Industrial Automation Controllers

SECTOR: INDUSTRIAL AUTOMATION

Development of high-power PLC boards controlling robotic assembly lines, requiring stable operation in EMI-heavy environments.

Power Density

High current density requirements leading to significant heat generation.

Signal Integrity

EMI noise from nearby high-voltage motors interfering with control signals.

ENGINEERING SOLUTIONS

BEFORE

Control boards frequently overheated during peak operation, causing system downtime.

AFTER (AEAR SOLUTION)

Redesign using 4oz heavy copper layers and embedded heat sinks improved thermal efficiency by 45%.

Case Study 4: Medical Diagnostic Imaging

SECTOR: MEDICAL ELECTRONICS

Design of High-Density Interconnect (HDI) boards for portable ultrasound machines where signal clarity is paramount.

Signal-to-Noise

Extreme sensitivity to signal-to-noise ratio in imaging hardware.

Miniaturization

Micro-via reliability in multi-layer HDI stackups for portable form factors.

ENGINEERING SOLUTIONS

BEFORE

Signal noise interfered with imaging clarity, limiting the diagnostic capability of the device.

AFTER (AEAR SOLUTION)

AEAR's Class 3 medical stackup with buried via technology improved signal clarity by 22%.

Case Study 5: Consumer Smart Home Devices

SECTOR: CONSUMER ELECTRONICS

Creating a miniature IoT controller for high-end home automation systems with integrated wireless communication.

Footprint

Requirement for an ultra-small footprint to fit within designer housing.

RF Performance

Optimizing antenna gain within a highly congested PCB layout.

ENGINEERING SOLUTIONS

BEFORE

External antennas increased unit cost and size, compromising the product's industrial design.

AFTER (AEAR SOLUTION)

Embedded PCB antenna design within a 4-layer stackup reduced BOM cost by .85 per unit.

Case Study 6: Telecom High-Speed Switch

SECTOR: TELECOM AND NETWORKING

Development of a 24-layer backplane for high-speed network switching, handling massive data throughput.

Stub Removal

Requirement for precision back-drilling to remove signal stubs that cause reflections.

Impedance Control

Maintaining tight impedance control (+/- 5%) across all 24 layers.

ENGINEERING SOLUTIONS

BEFORE

Signal reflections limited data rates to 10Gbps per channel, causing network bottlenecks.

AFTER (AEAR SOLUTION)

Precision back-drilling and Rogers 4350B laminates enabled stable 40Gbps transmission.

Case Study 7: Challenges and Engineering Solutions

SECTOR: CROSS-SECTOR ANALYSIS

We frequently encounter 'Impossible Designs' that push the limits of physics, requiring creative engineering workarounds.

Complex Vias

Implementing blind/buried vias in complex rigid-flex designs for aerospace applications.

Biocompatibility

Specific Silver/Gold plating requirements for biocompatible medical implants.

ENGINEERING SOLUTIONS

BEFORE

Designers were restricted by 'conservative' design rules that limited innovation.

AFTER (AEAR SOLUTION)

AEAR's advanced engineering team creates custom DFM rule sets for each client's specific technology stack.

Case Study 8: Manufacturing Process Improvements

SECTOR: OPERATIONAL EXCELLENCE

Investment in LDI (Laser Direct Imaging) technology has eliminated the inaccuracies associated with traditional film masks.

Registration Errors

Minimizing registration errors on large panels for high-layer count boards.

Etching Consistency

Ensuring fine line etching consistency (down to 35µm) across the entire production batch.

ENGINEERING SOLUTIONS

BEFORE

Registration yield was stagnant at 88% on fine-pitch designs, increasing manufacturing waste.

AFTER (AEAR SOLUTION)

LDI implementation increased yield to 99.5%, significantly lowering per-unit cost and environmental impact.

Case Study 9: Final Project Results and Performance

SECTOR: KPI SUMMARY

Across all sectors, AEARPCB focuses on three primary metrics to deliver maximum value: Reliability, Scalability, and Value.

Primary Challenge

Consistent reduction of Total Cost of Ownership (TCO) while increasing technical complexity.

PROJECT PERFORMANCE METRICS

Metric 1: Quality

99.8% Quality Pass Rate across all industrial and medical Grade-3 production lines.

Metric 2: Speed

24-Hour Prototype Turnaround for urgent R&D requirements and critical mission repairs.

Metric 3: Logistics

Global Shipping within 3-5 Days, supported by a robust international supply chain.