

T2 SQUARE

# UNLOCKING THE HIDDEN CAPACITY

Advanced Intelligence for  
Semiconductor Manufacturing

- Tool-to-Tool Matching with ML
- Process & Recipe Optimization
- Throughput Maximization
- Predictive Maintenance (PdM)

*"We don't supply parts.  
We supply Perfection & Predictability."*

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# Paradigm Shift in Semiconductor Manufacturing:

## The Beginning of Intelligent Control

**The Problem:** Even with state-of-the-art equipment, performance variations occur depending on the operating environment. Many fabs suffer from a 'Matching Problem' where yield and availability differ between identical equipment models.

**Our Solution:** T2 Square doesn't sell parts. We analyze equipment sensor data (nano-second resolution) to unlock 100% of the equipment's potential, delivering '**Perfection & Predictability**'.

### Key Business Value

#### Yield

**2~3% yield improvement**  
through inter-equipment variation  
elimination

#### Availability

**5%+ availability increase**  
by preventing unexpected failures

# Why Hardware Isn't Enough?

## The Double Dilemma of Legacy Fabs

The traditional reliance on 'Breakdown Maintenance' and 'Engineer Intuition' has reached its limits.

### 1. Limitations of Simple Hardware Replacement

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Part replacement alone cannot address minute process variations. Equipment aging-induced variability cannot be resolved through physical repairs alone.

### 2. Grey Tsunami (Skilled Labor Shortage)

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Equipment supply difficulties and skilled worker retirement have led to an explosion in demand for maximizing existing equipment efficiency and systematizing know-how.

#### "The T2 Square Way"

Intuition → **Quantified Data**

Reaction → **Prediction**

# 6 Key Solutions for Fab Efficiency

Top 3 solutions from our 6 core modules that maximize fab operational efficiency.

Solution	Features & Expected Impact
<b>01. Process &amp; Recipe Optimization</b>	Beyond standard recipes, we integrate process results (CD, Thickness) with sensor data to maximize yield and propose optimal recipes for chamber condition recovery.
<b>02. Tool-to-Tool Matching (ML)</b>	Using machine learning to learn 'Golden Tool' patterns and automatically calibrate parameters for other equipment. Synchronize all chambers without engineer intervention.
<b>03. Throughput Maximization</b>	Precisely analyze idle time (transfer, pumping, etc.) to eliminate bottlenecks and increase wafers per hour (WPH) with the same equipment.

**Note:** We also provide 04. Defect Reduction, 05. PM Recovery Optimization, and 06. Predictive Maintenance modules.

# Systematic 10-Step Workflow

## **01 Inquiry & Intake**

Receive requirements via web/email and assign dedicated engineer

## **02 Site Visit & Problem ID**

On-site fab visit, listen to pain points, and diagnose operational status

## **03 Data Check & Scoping**

Identify key challenges through sample data review

## **04 Proposal (Cost/Roadmap)**

Proposal briefing including costs, resources, and full schedule

## **05 Contract & Scope Align**

Finalize target equipment, timeline, KPIs, and sign contract

## **06 Data Collection**

Secure in-depth data including equipment sensors, process parameters, PM cycles

## **07 Technical Meetings**

Share analysis progress and discuss issues through weekly/monthly meetings

## **08 Sample Run Test**

Apply optimized model (Recipe) to actual equipment for performance testing

## **09 Quality Review**

Final verification of target KPI achievement based on test results

## **10 Closing & Handover**

Deliver final report, transfer solution technology, and close project

07

## 3-Phase Growth Strategy

1

### **Phase 1: Process Doctor (Entry)**

Focus on intensive engineering consulting. Leverage government support programs to reduce customer's initial cost burden and secure references.

2

### **Phase 2: Connected Expert (Expansion)**

Package proven solutions and sell modules (Pay-Per-Module). Transition to remote monitoring system to improve profitability.

3

### **Phase 3: Autonomous Intelligence (Leap)**

Establish AI autonomous control and SaaS license model. Enter global market and achieve high profit margins.

# Advanced Intelligence: Physical Control Beyond Software

T2 Square's solution is not just software delivery. We provide customers with tangible results: **'Process Optimization'** and **'Predictability'**.

## Domain Specific AI

Not generic algorithms, but semiconductor domain-specific AI that understands plasma physics and thin-film deposition mechanisms.

## Human-in-the-Loop

AI-derived parameters are physically verified by Principal Engineers to propose the safest recipes to customers.

## Engineering Service (ES)

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We don't sell code, we sell tangible manufacturing results: **2~3% yield improvement, 5% availability increase.**

# Stability & Reliability Solutions

In addition to productivity improvement, we offer 3 additional solutions for stable equipment operation.

Solution	Features & Expected Impact
<b>04. Defect Reduction (FDC)</b>	Real-time detection and prevention of defect causes such as Micro-Arcing or particles through high-sensitivity sensor analysis to prevent yield loss.
<b>05. PM Recovery Optimization</b>	Dramatically reduce time from preventive maintenance (PM) to production deployment. Provide optimal seasoning and qualification guides.
<b>06. Predictive Maintenance</b>	Predict aging patterns of core components (Heater, ESC, MFC) and notify optimal replacement timing before failure to prevent unexpected downtime.

**"Zero Surprise, Zero Downtime"**

T2 Square's predictive maintenance technology provides engineers with accurate replacement timing through bathtub curve analysis.



# Target Markets & Customers

Optimized for Specialty Fabs that primarily operate AMAT and Lam Research equipment.

## 1. Domestic Specialty Foundries

**Target:** DB HiTek, SK Key Foundry

- **Needs:** Productivity (WPH) increase of 8"/12" legacy equipment directly impacts revenue.
- **Application:** Throughput Maximization for Producer equipment and reduced setup time for new processes (SiC/GaN).

## 2. Advanced Packaging OSAT

**Target:** Hana Micron, Nepes

- **Needs:** Solve specialized personnel shortage due to front-end equipment (RDL, TSV) adoption.
- **Application:** Acting as 'Outsourced Engineering Partner' for equipment setup and yield management.

## 3. Legacy Lines within IDM

**Target:** Samsung Electronics, SK Hynix (Legacy Fabs)

- **Application:** Reduce management burden of hundreds of chambers with Tool-to-Tool Matching solution.

# Trust-First Approach

## 1. Shadow Mode

Initially only monitor equipment without direct control. Prove through logs that "problems occurred when we warned" to establish adoption rationale without risk.

## 2. Synchronizing Engineer Language

Instead of saying "99% algorithm accuracy," use field language like "Detected heater aging 4 hours in advance" to build engineer trust.

## 3. On-Premise Security

Without forcing cloud, build servers inside client sites or use one-way gateways to provide secure analysis services with zero data export.

# Fab-Ready Security Architecture

Customized security architecture designed for semiconductor fab air-gapped network environments.

## **SEMI Standard Compliance**

Build systems compliant with semiconductor equipment security standards SEMI E187/E188 guidelines.

## **Security Operations Center (SROC)**

Establish infrastructure to remotely analyze and support logs without external leakage through Jump Server and VPN tunneling.

## **Local Server Analysis**

When external network connection is impossible, install high-performance analysis servers inside fabs to implement zero data export environment.

# Hybrid Retainer Model

Proposing a revenue model that grows together with customers.

<b>01. Setup Fee</b> (Initial)	Charge engineering costs for data pipeline connection, initial modeling, and on-site diagnostics to offset initial risk.
<b>02. Monthly Retainer</b> (Subscription)	Generate stable revenue for 24/7 monitoring system use and regular technical support.
<b>03. Performance Bonus</b> (Success Fee)	Share profits with customers through additional incentives when key KPIs (2% yield improvement, 5% availability) are achieved.

\* **Pay-Per-Module** option available for selective module subscriptions.



# Efficient & Scalable Operations

## 1. Leveraging Senior Advisory Panel (Grey Experts)

Recruit veteran engineers with decades of equipment experience from Samsung Electronics, SK Hynix, etc. as 'Technical Advisors' or 'Project Contractors'. Their field expertise and business network are T2 Square's core assets.

## 2. Government Support Program Leverage

Register as 'AI Voucher Supplier' and participate in 'Super Gap Startup 1000+' project to secure R&D funding and reduce customer's solution adoption costs.

## 3. Public Fab (MoaFab) Testbed

Utilize public fabs like National NanoFab Center (NNFC) to refine algorithms before commercial fab entry, minimizing trial and error during field application.

## Domain Expertise + AI Capability

Semiconductor process experts and data scientists work in pairs (2-person teams).

### Process Team (SME)

- **Principal Process Engineer:** Verify plasma/thin-film process mechanisms and approve recipes
- **Equipment Engineer:** Diagnose equipment hardware and interpret sensor data

### Data Team

- **Data Scientist:** Convert process data to machine learning models and develop anomaly detection algorithms
- **SI Engineer:** Integrate SECS/GEM communication protocols and build secure networks

# We Supply Perfection & Predictability.

T2 Square is the 'Explorer' and 'Problem Solver' uncovering hidden efficiency in semiconductor legacy processes. Transform your fab operations with our engineering intelligence.

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# Supported Equipment Portfolio

## (1) Applied Materials

We have complete analytical models for major platforms from **Applied Materials (AMAT)**, one of the two major players in the semiconductor equipment market.

### Applied Materials (AMAT)

Industry standard for deposition (CVD/Epi) and planarization (CMP) processes

Process	Platform	Features & T2 Square Solutions
<b>CVD</b> (Deposition)	<b>Producer</b> (GT/XP/V) Centura	Industry standard PECVD equipment. <b>Throughput Maximization</b> to maximize productivity.
<b>Epi</b> (Epitaxy)	<b>Centura Epi</b> Vantage	Core equipment for silicon growth. Support precise temperature control and film quality uniformity.
<b>CMP</b> (Polishing)	<b>Reflexion</b> (LK Prime)	Market-dominant planarization equipment. Provide consumable life prediction (PdM) and scratch prevention solutions.
<b>Etch</b> (Etching)	<b>Sym3</b> Centris	AMAT's next-generation etch platform. Matching optimization for fine pattern formation processes.



# Supported Equipment Portfolio

## (2) Lam Research

We support the latest equipment and specialty process solutions from **Lam Research**, the global leader in etch.

### Lam Research

Global No.1 in Etch & Specialty Deposition Solutions

Process	Platform	Features & T2 Square Solutions
<b>Etch</b> (Etching)	<b>Sense.i</b> (Flagship) <b>Kiyo</b> (Conductor) <b>Flex</b> (Dielectric)	Leading models for conductor and dielectric etch. <b>Tool-to-Tool Matching</b> eliminates inter-chamber variations.
<b>Deposition</b> (CVD)	<b>Vector</b> (PECVD) <b>Altus</b> (Tungsten) SPEED (HDP-CVD)	Real-time detection of micro defects in tungsten interconnect (Altus) and gap-fill (SPEED) processes.
<b>Specialty</b> (Special Process)	<b>Syndion</b> (TSV) Vantex	Optimize deep etch processes specialized for TSV and 3D NAND high-stack processes.



#### Quick Selection Guide

- **Need Etch?** Lam's *Kiyo/Flex* series are strong, with *Sense.i* for latest processes.
- **Need Deposition (CVD)?** AMAT *Producer* is standard, but for metal interconnect (W), Lam *Altus* is unrivaled.
- **Need Planarization (CMP)?** AMAT *Reflexion* series virtually monopolizes the market.