

Bartlett Bay Consulting^{LLC}

A Full Range of Contamination Control Services including trouble shooting and problem solving difficult contamination problems, ISO certification, testing/measurements, cleanroom and minienvironment design, training and auditing

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SUMMARY:

- **Self-motivated senior engineer with over 30 years of experience**
- **Cleanroom and minienvironment contamination control experience >15 years**
- **Semiconductor experience spanning 25 years**
- **Technical management for over 15 years**

CONSULTING CLIENTS

- **Philips Advanced Metrology Systems, Inc**
- **IBIS Inc**
- **Brooks Automation, Inc**
- **Rudolph Technologies, Inc.**
- **ADE, Inc**
- **Varian Semiconductor Equipment Associates, Inc**
- **Aixtron, Inc**
- **Thermo-Electron Corp.**
- **Laurier**
- **Semiconductor Diagnostics, Inc**
- **DCI Automation**
- **Waters Corp.**

SPECIFIC SKILLS:

- **Problem-solving of Contamination Control issues**
- **Minienvironment design, analysis, certification and testing**
- **Cleanroom analysis, measurement, and certification**
- **Airflow Analysis using Computational Fluid Dynamics (CFD)**
- **Semiconductor Processing**
- **Electron Beam Lithography (Mask and Direct-Write)**
- **Project Management**

Consulting Objective:

To use my technical and project management skills, background, and expertise for companies needing contamination control expertise; cleanroom analysis; minienvironment design, analysis, certification, measurement; and long-term continuous contamination monitoring.

EXPERIENCE

BROOKS AUTOMATION (Formerly Jenoptik Infab) 1995- August 2001

(Note: Brooks Automation is a world-leader in semiconductor wafer handling robotics and software)

Manager of Contamination Control/Minienvironments*Job Assignments*

- Contamination Control Strategy for Integrated minienvironments
 - Involved numerous presentations to management and customers.
 - Wrote specifications and certification documents for Brooks Automation Minienvironments
 - Project Manager of first Integrated 300mm minienvironment Shown at Semicon West Show July 1996.
- Designed/Tested/Analyzed/Marketing Minienvironments.
 - Involved travel worldwide for particle testing, analysis, consults & measurements
 - Member of semiconductor industry 300mm wafer marketing team
 - Performed first 300mm wafer particle testing
- CFD Analysis for Customer Applications.
 - Involved highly technical, detailed analytical problem solving.
 - Used CFD to show first results of front-opening 300mm FOUP airflow.

EXPERIENCE (cont.)

IBM CORPORATION

1964-1994

Numerous/Various Assignments

Site Contamination Manager, IBM Essex Junction, VT (1990-1994)

- Team Member of First Minienvironment Task Force.
- Wrote specifications and certification documents for IBM Minienvironments
- **Team Member for Sematech S49 Study: Benchmarking Minienvironments**
- **Team Leader Electron Beam Proximity (EBP) Project**, Sindlefingen, Germany (1988-1989)
- Assignment at IBM Research in Sindlefingen, Germany.

Electron Beam mask-Making Team Member (1984-1989)

Team Leader Electron Beam Direct-Write Project (1978-1984)

IBM Memory Marketing (1977-1978) (1-year assignment)

Manager, Semiconductor Reliability Failure Analysis Laboratory (1968-1976)

Failure Analysis Team Member (1964-1967)

EDUCATION

BS, Physics, UNIVERSITY OF MASSACHUSETTS, MA, 1964

24 Credits Toward master's Degree, Physics, SYRACUSE UNIVERSITY, Syracuse, NY
numerous Courses in Advanced Mathematics, Engineering, and Statistics.

PUBLICATIONS AND ADDITIONAL INFORMATION

Published over 20 papers on minienvironment technology/contamination control conferences (IEST, Cleanrooms, Semicon, Brooks, etc.) and technical journals.

- "Meeting the contamination Challenge for the 0.13um Era and Beyond." Brooks Automation "Focus on Excellence" Conference: May 2001, Salt lake City, UT.
- "Tool Oriented Minienvironments for Advance 300mm Applications." Cleanrooms Conference, October 2000, Portland, OR.
- "Nitrogen Purge Simulation and testing of a 300mm FOUP" Institute of Environmental Sciences and Technology" Annual Technical Meeting, May 1999, Los Angeles, CA.
- "Nitrogen purging: a perspective and overview," I300I Suppliers Workshop, July 1998, Portland, OR.
- "PWP Results on 300mm wafers using a Front Opening interface mechanical Standard and an Integrated Minienvironment Phoenix, AZ.
- "Airflow Parameters for Control of Molecular Contaminants" (with Richard Wang and Michael Robinette) "Institute of Environmental Sciences and technology" Annual Technical Meeting, May 1996,
- Numerous customer presentations on contamination control/minienvironments.
- Chaired Conference Sessions and panels on Metrology, Airborne molecular Contamination, and Minienvironments.

PUBLICATIONS AND ADDITIONAL INFORMATION (cont.)

- Numerous Minienvironment task-forces (SEMI, Sematech, and ISO).
- Taught graduate level mathematics for 10 years to IBM Engineers enrolled in graduate school programs.
- Patent (1993): "Multiple Partition Staging Solid Gas Detectors."

Analysis/Testing/Certifying Minienvironments and Cleanrooms:

1. Specific Skills Needed:

- **Understand and Implement Proper Design Analysis:** Find and fix problems before testing begins
 - **My specific skill:** I have been used as a consultant on numerous minienvironment design projects; I designed and built the first integrated minienvironment for a 300mm product (KLA-Tencor's SP1)
- **Understand Basic Contamination Control Constructs:** Design and build minienvironments and cleanrooms to insure highest possible levels of particle control
 - **My specific skill:** the minienvironments and cleanrooms which I have designed have shown the state-of-the-art contamination control levels: better than the lowest ISO standard levels.
- **Understand and Utilize the Relationship of Measurements to Problem Areas:** Design the testing/certification to insure all potential contamination problem areas are "captured"
 - **My specific skill:** My knowledge of the measurement tools (see below) has provided both customer and suppliers an in-depth analysis of contamination control problems and solutions.
- **Understand Measurement Parameters:** Use proper measurement techniques to provide comprehensive analysis of minienvironment/cleanroom.
 - **My specific skill:** I am knowledgeable in the use of the measurement techniques and the statistical methods needed for accurate data analysis.

2. Specific Tool knowledge needed:

- **Airflow visualization (fogging with DI water mist):** Enables a qualitative analysis of the airflow design within the minienvironment/cleanroom; detects problem areas such as turbulence and vortices which are known to produce particle generation.
 - My specific knowledge: fogging is a subjective technique requiring years of experience. I have used this technique extensively.

- **Differential Pressure Measurement:** this important measurement technique provides key information regarding contamination control parameters; analysis of pressure levels is especially important for minienvironments used in a bay-chase configuration.
 - My specific knowledge: I have made pressure measurements on many types of minienvironments and cleanrooms and understand completely the use of this important tool.

- **Air-flow Velocity:** this critical element needs to be adjusted to insure adequate differential pressure (see above) but also to insure flow laminarity over the entire region.
 - My specific knowledge: I have made air-flow velocity measurements on many types of minienvironments and cleanrooms and understand completely the use of this important tool.

- **Particle Measurement:**
 - **Airborne Particles:** the de-facto standard for insuring the cleanliness of the environment; using laser particle counters to insure data that is statistically correct involves knowledge of ISO and Federal Standards, an understanding of statistical measurement techniques, as well as a knowledge of particle problem areas within the testing area (ie where to measure and what to measure).
 - My specific knowledge: I am very knowledgeable in use of laser particle counters having logged thousands of hours of measurement time using this valuable measurement tool. I have a deep and broad understanding of measuring particles.

 - **Wafer Particles:** while this test is hard to implement (requiring specialized equipment such as a KLA-Tencor 6200 or SP1), it is the final “arbitrator” regarding the cleanliness of the environment as it provides the supplier and the customer a definitive number of particles added to a wafer in a “real world” situation. Typically measured as “particles per wafer pass” (PWP), it can be used to compare to established specifications and testing.
 - My specific knowledge: PWP is a complicated and error-prone technique which requires many years of experience to insure accurate and conclusive results. I have been making PWP measurements since 1992, and probably have more experience than anyone else: I have published many papers on PWP measurements, and was the first to have PWP data on 300mm wafers.

