**Name:** **GREG L. OWEN, P.E.**

**Title:** **Cleanroom Design Principal, GLO Consulting**

**Education:** B.S., 1974, Mechanical Engineering, Purdue University

**Registration:** Professional Engineer, Pennsylvania, Maryland
Professional Mechanical Engineer, Idaho, Oregon, Washington,

**Affiliations:** American Society of Mechanical Engineers
National Society of Professional Engineers

Greg has over 40 years' experience in project management, engineering management, design and construction of facilities in the semiconductor, food, pharmaceutical, industrial, and advanced technology areas. He has held design and construction positions as Project Engineer, Project Manager, and Engineering Manager.

Representative assignments include:

- University of Glasgow Clyde Waterfront Innovation Campus Cleanroom consultant for the multi-national design team that developed the Stage 1 and 2 design briefs for the relocation of the James Watt Nanotechnology Centre and QuantiC facilities and operations into a premier sustainable, adaptable, robust nanofabrication and research centre for technology incubation and acceleration. The Stages focused on developing a programmatic requirements and a schematic design for the facility accompanying cost opinion to be used for acquiring the requisite project funding.
- University of Colorado Anschutz Building Compounding Pharmacy Cleanroom: Cleanroom consulting assisting the project Architect in development of cleanroom design concept in compliance with the criteria as prescribed in USP General Chapter 800, Hazardous Drugs – Handling in Healthcare Settings. Differential pressure control in an operating facility where access in an on-going event was a primary concern.
- Carnegie Mellon University Hamerschlag Hall Level F "Old" Cleanroom renovation Cleanroom Consultant for the project Archtect / Engineer developing schematic design and cost opinion for the renovation of the 1980's vintage cleanroom into a undergraduate instructional Cleanroom and non-clean research laboratories. Project focused on replacement if the cleanroom air management system.
- University of Chicago Pritzker Nanofabrication Facility, part of WERC Institute of Molecular Engineering, Chicago, Illinois. Project Engineer. A design-build research cleanroom project with a local contractor. Jacobs provided full tenant improvement design for a 10,000SF cleanroom with 6,000SF of support area within a multi-story research facility being designed concurrently by others. A BIM based design was developed over a five month period in close cooperation with the user group and base building design team. Responsible for providing design guidance for Jacobs' design leads as well as the client user group from experience on many other similar projects. Overall responsibility for including contract scope into the design, coordinating design between disciplines and quality control. This Design-Build Project included a bay-and-chase, low wall return design cleanroom with over 12,000 GSF in area and ranging from class 1,000 to class 100 performance

- Carnegie Mellon University (CMU), Nano-Bio-Energy-Technologies Building (NBET), Butler, Pennsylvania. Cleanroom Consultant for tool support systems and tool engineering services. Provide industrial interior design for the cleanroom and chemical and gas storage and dispensing rooms with incidental engineering. This included cleanroom recirculation air system – ceiling plenum and recirculation fans; gas distribution devices (gas cabinets, VMBs, gas panels, and cylinder restraints); ultrapure stainless steel piping specification and line sizing – cleanroom cylinder gases only. Provide design support for the development of the shell and allocation of footprint during schematic design, moving to more detailed work products in design development and then to detailed construction documents. Support during the bidding phase of the project and during execution of construction.

- Princeton University, Princeton, New Jersey, Andlinger Center for Energy and Environment. Consulted with the Lab Planner, Project Architect and Mechanical Engineer in the design and construction of the facilities Silicon and Organic substrate Material Science research cleanrooms and Instructional Cleanroom for Semiconductor processing. The 22,000 square foot plus cleanrooms ranged from Class 100 to Class 10,000 and included tools ranging from simple table top equipment to e-beams and EUV Steppers. Activities included Development of cleanroom concepts and air management systems, Tool Utility Matrix development, draft HMMP Preparation and development of design approaches to address HPM delivery, storage and dispense with-in the confines of the Campus setting. Served as the third party reviewer of the Mechanical / Electrical / Process detailed design for the project

- Khrisna P. Singh Center for Nanotechnology, Philadelphia, Pennsylvania. Design Manager. Architectural and engineering peer review of new 65,000 SF, 3-story and basement nanotechnology facility consisting of 6,200 SF research and development labs, 9,200 SF cleanroom area (bays and chases), HPM storage rooms, atrium (galleria), lobby areas, conference rooms, and office support areas. Responsibility included performing comprehensive technical reviews of the A/E design, with emphases on code compliance, constructability, and cost reduction of the Design Development documents.

- Rice University, Houston Texas: Architectural and Engineering peer review for new Nanofabrication cleanroom suite and associated areas to be constructed in the Space Science & Technology building on the Houston Campus. The cleanroom suite and associated spaces occupy 5,900 SF of the building, including 2,500 SF of “B” Occupancy Class 1000 cleanroom area located in the basement of the building and 535 SF of ground floor level HPM storage rooms. Responsibility included performing comprehensive technical reviews of the A/E design, with emphasis on Value Engineering, Function capabilities, code compliance, constructability, and energy efficiency of the design as indicated in the Design Development documents. Served as the third party reviewer of the Mechanical / Electrical / Process design development construction documents for the project.

- City University of New York, Research Building, Nanotech Research Cleanroom. Cleanroom Consultant with the University, Lab Planner, Project Architect and Engineering consultants on the design of the Nano Science cleanrooms (Class 1000 / 100). Activities included Development of cleanroom concepts and air management systems, Tool Utility Matrix development, Conceptual development of Process Support systems and development of design approaches to address Code Compliance, HPM delivery, storage and dispense with-in the confines of the new CUNY building being constructed in Manhattan.

- University of California, Los Angles, California Nanosystems Institute, Court of Sciences, Los Angles, California. Cleanroom Consultant with the Lab Planner, Project Architect and Mechanical Engineer in the design and construction of the facilities Material Science

and Biological cleanrooms (Class 10 / 100). Activities included Development of cleanroom concepts and air management systems, Tool Utility Matrix development, draft HMMP Preparation and development of design approaches to address HPM delivery, storage and dispense with-in the confines of the UCLA Campus setting.

- University of Houston, Science and Engineering Classroom Building, Nanotech Research Cleanroom. Cleanroom Consultant with the Lab Planner, Project Architect and Mechanical Engineer in the design and construction of the facilities Material Science cleanrooms (Class 1000 / 100). Activities included Development of cleanroom concepts and air management systems, Tool Utility Matrix development, Conceptual development of Process Support systems and development of design approaches to address HPM delivery, storage and dispense with-in the confines of the U of H Campus setting. Site observations during construction and cleanroom specific contractor submittals were reviewed and final facility acceptance recommendations were provided.
- University of Texas – Austin, Engineering Education and Research Center. Cleanroom Consultant providing full, all discipline schematic design and design review for the 1400sf class 1000 and 10,000 Instructional Cleanroom.
- University of KwaZula – Natal, Durban, South Aftica. Cleanroom consultant providing full, all discipline schematic design, design development and design review for a 700sf class 10,000 Soft Litho / Microfluidics cleanroom located in the K-Rith Medical Research Building. The construction documents were completed by an iun country AE firm. Also provided were construction specifications based materials easily obtainable in South Aftica
- Mechanical / Cleanroom Reviewer, Argonne National Laboratories, Argonne, Illinois, Center for Nanoscale Materials for the Title II review of the A/E's design. This review focused on the cleanroom Air Management System, Clean Classification and responsibility for coordinating the Title II review, including report preparation.
- Linear Coherent Light Source (LCLS) Project, U.S. Department of Energy (Stanford Linear Accelerator Center), California. Cleanroom Consultant and Engineering Manager for preliminary design, development of construction documents, and construction support services associated with construction of a $250 million facility that delivers coherent laser radiation in the x-ray region of the electromagnetic spectrum ten billion times greater in peak power and peak brightness than any existing x-ray light source. The LCLS facility includes extensive site modifications, along with an underground research tunnel in excess of 1000 meters long. Along the tunnel are research hutches, administrative space for 200 scientists and support staff, and utility systems required to maintain tight temperature tolerances (±0.2°C) in portions of the underground facility. As a result of the intended use of this facility, tight seismic and radiological design criteria was followed in conjunction with design activities.
- Chamber A Clean Air System, Johnson Space Center, Houston, Texas. Cleanroom Consultant and Project Manager for Chamber A modifications for testing the James Webb Space Telescope including design and testing activities performed under a phased approach in order to modify and utilize Chamber A HVAC Systems located in Building 32 of the Johnson Space Center. The Project involved development of a system to provide Class 3 cleanliness inside an existing cryovac test chamber under atmospheric conditions.
- United States Department of Agriculture (USDA) Research and Development (R&D) Facility, Albany, California. Project Manager for South Wing Renovations. Verified program

needs and prepare construction documents for a five-phased tenant improvement and renovation project to the R&D facility's south wing, built in the 1930s. In addition, perform a seismic study for the south wing to determine its adequacy to support the additional seismic loading imposed by structural alterations required to support program requirements. Code compliance studies, estimate evaluations, and scoping efforts to tailor packages to client budgets. Provided commissioning services and site surveys.

- Nexolon Cell Module Project, Nexolon America, San Antonio, Texas, Project Manager. Full architectural and engineering services for new solar panel production plan. Collaboration and work-share with Jacobs San Antonio office. The project has a total installed cosgt (including equipment) of approximately $100 Million. it will include a 276,000 SF manufacturing plant and administrative building; a 10,000 SF warehouse; an 8,000 SF chemical storage building; an 8,000 SF waste storage building; and expansion space for two future buildings.
- SunPower Line 1 Building 1, SunPower Corporation, Philippines. Responsible for Programming and concept development for a PV production Line in an existing building in the Philippines. The work included P&ID development, and specifications for tanks, pumps and chemical distribution systems