Professional Licensure: Examples of ISE Experience

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Education
- BS Industrial Engineering, Northeastern University
- MS Systems Engineering, University of Maryland

Licensed & Certified
- Licensed Professional Engineer, Maryland DLLR, License #42915
- Certified Project Management Professional (PMP)

Experience
- Navy, Coast Guard, and Army engineering acquisitions
- NCEES ISE Exam Development Committee
3 steps
Getting from point A to P.E.
Education

- Get an engineering degree from an EAC/ABET accredited program.
  - Bachelor’s or master’s (or both)
  - The Engineering Accreditation Commission of ABET accredits college engineering programs.

- Some states allow engineering technology degrees (TAC approved ABET degrees)
- Work under the supervision of a P.E.
  - Or have a PE attest to your work
- Four years, progressive experience
- Keep track of all experience in a supplemental experience record
  - Use engineering verbs, not administrative verbs
  - Don’t focus on titles – focus on the work and how it relates to ISE
Pass the FE exam in your senior year of college (or shortly after graduation).

Pass the PE exam in your engineering discipline.
Qualifying Engineering Experience

- ISE Field
- Progressive
- Supervised
- Well Rounded
- ISE Skills & Judgement
Tips

- More than a resume
- Divide work into Tasks, Duties, and Projects
  - Include level of responsibility and complexity of work performed
  - Be specific about YOUR duties – not the “team”
- Avoid terms like “involved”, “participated”, “managed”, “oversaw,” “coordinated”
- Specific terms are better: “I designed”, “I reviewed”, “I recommended”, “I developed”
- No gaps in experience
5 common mistakes

- Relying on Job Titles
- Being Vague in Work Descriptions
- Being Vague about Time Spent on Tasking
- Trying to Hide Deficiencies
- Modesty
PE Industrial and Systems: Exam Specification

- Systems Definition, Analysis, and Design
- Facilities Engineering and Planning
- Supply Chain and Logistics
- Work Design
- Quality Engineering

https://ncees.org/engineering/pe/industrial-systems/
Supply Chain and Logistics

- Forecasting methods (e.g., exponential smoothing, moving averages, seasonal)
- Production planning methods (e.g., aggregate, MRP, MRPII, ERP, JIT, Kanban, lean manufacturing)
- Engineering economics (e.g., break-even analysis, technical capability assessment, ROI)
- Costing systems (e.g., activity-based costing including cost drivers, guidelines for overhead)
- Production scheduling methods (e.g., shortest processing time first, due date order)
- Inventory management and control
- Distribution methods (e.g., transshipment, routing)
- Storage and warehousing methods I. Transportation modes (e.g., truckload [TL], less than truckload [LTL], air, rail, ship, special requirements)
Supply Chain and Logistics Example

Task and Duties

Industrial Engineer responsible for performing spend analysis of utility company financial data.

Spend data was reviewed, categorized, and classified to provide a breakdown of company expenditures. Data was then used to develop strategic sourcing recommendations to reduce company waste and increase company buying efficiency (implementation/operation).

Industrial Engineer responsible for documenting Spend Analysis processes and provided user training and testing. Trained new hires and interns on the Spend Analysis process and using the tool, BIQ Power Tools for Data Analysis (operation). Training Leader for Should Cost Analysis client training. Taught 20 individuals how to use market data and historical cost data to purchase items or equipment at the best price. Conducted training at Detroit Edison (operation).

Developed datasheets and coordinated bid response evaluations. Ran bids with over 50 vendors in order to assist clients with obtaining the best priced equipment and services (operation).

Representative Projects

I performed spend analyses (engineering economy) of multiple U.S. utility companies (i.e. PG&E, Entergy, Detroit Edison) and their spend data, uncovering equipment and engineering service trends and identifying savings opportunities. My engineering analysis and recommendations resulted in improved supply chain performance. My role was focused on the utility operations and lasted approximately 7 months.

I conducted spend analysis (engineering economy) for Eskom, South Africa’s public electricity utility. I evaluated their spend data and categorized based on plant, equipment, and engineering services. My role was focused on the utility operations and lasted approximately 7 months.

I conducted should cost analysis (engineering economy) with Detroit Edison. I evaluated market data and historical costs of equipment and engineering services to develop engineering estimates. My role was focused on the implementation of should cost and lasted approximately 1 month.

I developed spend analyst training processes and conducted training classes, focused on understanding the operations of different utility plants and the materials and equipment associated with each. Training enabled other engineers to better classify spend data into appropriate engineering categories, providing a full supply chain picture to the customer.
Supply Chain and Logistics Example

Task and Duties

Complete engineering economic analysis on potential commitments to Crude Oil supply and logistics. This includes quantifiable analysis of benefits, risks, and alternatives to the proposed commitment. In this role, I look at a 3 to 5 year time horizon and do the engineering work today and to provide recommendations that set the leadership team up to make decisions now that are directionally correct on a long term time horizon.

Representative Projects

One representative project includes the evaluation of the crude oil export market and the potential bottlenecks in getting the crude oil to that market. These bottlenecks could occur in production, in transportation such as through pipelines or at terminals along the coast, or could be on the demand side of the equation. As a Crude Oil Strategy & Analysis Engineer III, I evaluate these varying potentials on a 3 to 5 year time horizon, running multiple scenario analysis in order to determine the most likely outcomes, then provide this information (along with recommendations) to leadership. Leadership is then able to make decisions in regards to where the company invests our time and assets knowing that they have strong engineering economic analysis completed as an input to the decision making process.

A second representative project includes looking at a major investments the company is considering making, and determining whether the company can make the commitment to invest in that asset through further engineering economic analysis. I am fairly new to the Crude Oil Strategy & Analysis role, so the projects above are representative of the type of work I have been doing, and I anticipate this work will only continue to grow in responsibility and breadth as I grow my own abilities within this team.
Systems Definition, Analysis, and Design

- System analysis and design tools (e.g., flowcharts, Pareto charts, affinity diagrams, nominal group technique, input/output analysis)
- Requirements analysis (e.g., value stream mapping)
- Performance measures and applications (e.g., leading, lagging, structure)
- Modeling techniques (e.g., simulations, queuing, linear programming, Markov chains)
- Process types (e.g., discrete versus continuous, manufacturing, service)
- Model interpretation (e.g., sensitivity analysis)
- Model verification
- Model validation
- Bottleneck analysis (e.g., theory of constraints)
- Value analysis and engineering (e.g., risk analysis)
- Project management and planning (e.g., PERT/CPM; balancing risk, cost, scope, and time; Gantt charts)
Systems Definition, Analysis, and Design Experience

Tasks and Duties

Systems Engineer for U.S. Coast Guard (USCG) Acquisition Directorate, CG-9321 National Security Cutter (NSC) Project Office.

- Regular creation of CAD products in AutoCAD.
- Planned, prepared and facilitated Project Reviews, Acquisition Reviews, Technical Reviews and Integrated Product-Process Team (IPT) Working Group meetings.
- Tracked program performance measures, conducted engineering assessments, and developed plans for design improvements.
- Developed and established reporting standards for the project as well as online management reports and key performance parameters.

Representative Projects

- Systems Engineer responsible for project design activities related to Executed Sensitive Compartmentalized Information Facility (SCIF) drawing rework to ensure USCG drawing and CAD standards were met before submittal to Naval Engineering Technical Information Management (NE-TIMS) database. Completed technical reviews of USCG CAD standards and NE-TIMS requirements.
  - Developed QA processes for technical modifications before submission. Completed revisions based on results of drawing QA and coordinated the tech authority reviews, signatures, and submissions of SCIF drawings.

- Systems Engineer responsible for design and implementation of red, low leveling lighting for NSC-3 to meet Engineering Change Proposal (ECP) requirements. Developed drawing and installation specification outlining modifications. Performed shipchecks to resolve lighting related drawing issues in support of Time Compliance Technical Order (TCTO) development and update. Documented findings and updated drawings accordingly.

- Systems Engineer responsible for the CG-9321 bi-weekly SCIF IPT and Engineering Integrated Product Team (EIPT), tracking both programmatic and technical risks and issues in preparation for USCG Cutter STRATTON’s Post Shakedown Availability (PSA). Included interfacing with Navy/SPAWAR representatives to track schedule changes and the effect on installation and testing.
Systems Definition, Analysis, and Design Experience

Tasks and Duties

Industrial and Systems Engineer with increasing levels of responsibility, ultimately leading project tasks and junior staff. Supported multiple industrial and systems engineering efforts for Coast Guard (USCG), SPAWAR, and Navy. Responsible for requirements development and review, configuration management, risk management, detailed design development, work package development, and cost estimate preparation.

Representative Projects

Developed and implemented procedure to integrate National Security Cutter (NSC) 4 & 5 SCIF and EXCOMMS design changes, including new installation and Selected Record Drawings (SRD) drawing development.

Supported development of maintenance and overhaul schedules for Navy’s 2/4/6 Cruiser Modernization Plan. Worked closely with NAVSESS SME’s and Tech Warrants to identify maintenance and test procedures.

Shipchecked and developed design package for WHEC Cutter’s fan coil condensate collection and secondary drainage reconfiguration. Developed Engineering Change Packages (ECP) and supporting technical documentation, including drawings, calculations & analyses, cost estimates, schedules for review and approval by USCG design authorities. System installation designs included Improved (Chemical Agent) Point Detection – Life Cycle Replacement (IPDS-LR) and Machinery Control System (MCS).

Developed quality assurance procedures for requirements, technical, and administrative modifications prior to Engineering Change Proposal (ECP) submission.

Provided systems engineering support services to Eastern Shipbuilding Group (ESG) during the maturation of their design bid for the U.S. Coast Guard’s (USCG) Offshore Patrol Cutter (OPC). Configuration Management (CM) Lead Engineer, developing and implementing the program CM plan and procedures. Responsible for the successful implementation of the plan by 20 subcontractors, ultimately resulting in USCG award of design contract to ESG.

Developed the ship design Master Equipment List and Bill of Materials, coordinating and QA-ing engineering data from 9 engineering teams. Performed requirements verification and validation using IBM DOORS software, creating a test procedure, CDRL, and design drawing index for ESG’s future use.
Facilities Engineering and Planning

- Process flow
- Network optimization
- Layout design techniques (e.g., systematic layout planning [SLP], affinity diagram, relationship diagrams, center of gravity rule)
- Space analysis (e.g., equipment needs, demand, location, footprint of the equipment/WIP sizing)
- Capacity analysis (e.g., calculation of personnel requirements, calculation of machine requirements)
- Cost-benefit analysis
- Site selection factors
- Site selection methods (e.g., prioritization, factor weighting)
- Unit load analysis
- Life cycle cost analysis (e.g., acquisition, implementation, sustainment, retirement)
- Material handling techniques and equipment (e.g., conveyors, industrial trucks, manual, overhead crane)
Facilities Engineering and Planning Experience

Tasks and Duties

The major branch of engineering skill sets I have applied and continue to apply are the application of Industrial and Systems Engineering principles. I have been applying these Industrial and Systems Engineering principles, and utilizing them to design, develop, and implement engineering solutions within the company, since I started with the organization full time in August 2012. Below is a list of the range of tasks and duties that I have utilized my Industrial and Systems Engineering background to design, develop, and implement engineering solutions within the organization (listed in chronology of job responsibility):

- Created requirements and value stream map of departmental operations
- Model verification and validation of value stream map of departmental operations
- **Application of Theory of Constraints** to alleviate bottlenecks in the capital project execution process flow
- Engineered departmental performance standards and applied them to the organization
- Calculated and implemented activity based costing system across company operations
- Created maintenance procedures used by the maintenance management team
- **Engineered improved office layout design** to enhance communication and information flow
- Enhanced the company’s ERP capabilities via constructing better production planning methods
- Ran equipment needs analysis on production tool crib
- Engineered and improved company’s manufacturing production scheduling methods
- Modeled and calculated organization’s labor capacity including a needs analysis
- Calculated organizational capital investment cost benefit analysis
- Improved labor capacity needs analysis to include the implementation of forecasting methods to meet seasonal workforce requirements
- Applied engineering economics to evaluation of new building/site acquisition
- Engineered **material handling equipment solutions** based on needs analysis from company’s clients
Facilities Engineering and Planning Experience

Representative Projects

The first project I took on was to create a value stream map of the company's operations. The company's leadership team (President, CFO, and Vice President of Operations) felt that there was waste in the company's operational process. I worked with each department manager to map how a client-project flows through the company, and then applied value stream mapping as a tool to identify waste in the process. Once the current value stream map was created and agreed upon, I worked alongside the Vice President of Operations to develop a future state map and implement those changes across the company accordingly. The major changes that resulted were alleviating bottlenecks in the operation which increased the throughput of capital project execution through the organization.

As I worked with the Vice President of Operations and Department managers to implement the future state value stream map, the fact that the departments did not have engineering work standards led to the need for my next project at the company. I worked with key stakeholders in each department to gather the information required to design engineered work standards for each department. The development of the engineered work standards allowed the company to identify best practices in each function within the company, and utilize those standards as a means of working towards the future state value stream map.

Once the work standards were implemented throughout the organization, the foundation was set to engineer an activity based costing platform. I used the work standards to calculate overhead distributions and unit costs across all project tasks, and developed an activity based costing system used to assign costs to a project based on the activities performed to complete that project. This allowed the company to identify the tasks that led to the greatest organizational profitability, and focus efforts on re-working the engineered standards to come up with more efficient completion methods of those tasks to lower the unit costs, and thus reduce the overall project costs of the projects which utilized that activity.

As the unit costs of the activities reduced, the need then arose to reduce the overhead costs to decrease the burden being allocated to each activity. To accomplish this, I identified the maintenance department processes and the inefficiencies of the project workflow due to the inefficient office layout as two areas to reduce the overhead burden. I created maintenance procedures which are used by the maintenance management team to streamline their operations, and engineered a new office layout to enhance communication and decrease the cost associated with information flow.

With the activity cost and overhead burden decreased, the company's competitive advantage in the marketplace increased, and the demand for the company's products and services increased. With this increased demand came the new challenge of resource allocation. To address this need, I enhanced the company's Enterprise Resource Planning (ERP) system by constructing better production planning methods. Not only were labor resources a constraint, but so were tools and equipment, so I also ran an equipment needs analysis on the tool crib and calculated the appropriate tooling requirements needed to support the increased demand.

Once labor and tools/equipment resources were no longer a constraint, the constraint moved to capital resources. I calculated the cost benefit analysis of additional capital investment and shared the results with the leadership team, ultimately leading to increased capital investment by the organization.

In order to appropriately calculate the return on investment for the capital investment, I needed a forecasting tool for the future demand. I designed, developed, and implemented a resource planning and forecasting tool that ties into the company’s ERP system, which allows for not only better resource allocation and utilization, but also better capital investment decisions like that described above.
Quality Engineering

- Statistical process control (e.g., control chart construction and interpretation)
- Process capability analysis (e.g., Cpk, Cp)
- Acceptance sampling (e.g., single sampling, double sampling, MIL STD 105E, Dodge Romig, OC-curves)
- Continuous improvement methods (e.g., Deming, Kaizen, TQM, Six Sigma)
- Techniques for process improvement (e.g., design of experiments [DOE], Taguchi, FMEA)
- Reliability analysis
- Maintenance procedures (e.g., reactive, preventive, predictive)
- Quality management system (e.g., ISO9000, benchmarking)
- Root cause analysis
Quality Engineering Experience

Tasks and Duties

As an Excellence & Innovation leader, I accelerated innovation, leadership development, strategy execution, and value creation across the enterprise. The company leadership had a vision to re-imagine the company's Lean & Six Sigma program. The Vice President of Enterprise Business Improvement & Productivity called me and asked me to join the company to take that vision to execution. I joined the organization in April of 2018, and I used my Industrial and Systems engineering abilities to bring this vision to execution. I analyzed alternatives on how to implement that vision, and then designed a process flow via which these projects would be completed. In a sense, I used Lean and Six Sigma methodologies to reduce the variance and increase the throughput of completing Lean and Six Sigma projects themselves.

Below is a list of the range of tasks and duties that I have utilized my Industrial and Systems Engineering Background on to design, develop, and implement engineering solutions within the organization:

- I designed the processes for the company’s Enterprise Business Improvement (Lean Six Sigma) projects
- I created the systems to track and share Business Improvement projects
- I completed engineering requirements gathering with project stakeholders, including the Green Belts, Black Belts, Process Owners, and Project champions
- I designed the project status tracking and information management system I implemented the objectives, policies, and procedures (i.e. work instructions) aimed at managing the Business Improvement project portfolio
- I analyzed the applicable company policies and procedures to ensure compliance of the program
- I improved Enterprise Business Improvement communication strategies, plans, and execution to effectively report results and recognize outstanding teams and/or individual contributors accelerating excellence and innovation
- I calculated the economic value of Lean and Six Sigma projects which delivered verified financial value to the organization
Quality Engineering Experience

Representative Projects

The major project I took on during my eight months in this role was to **re-design the companies Lean & Six Sigma project process** via the application of Lean & Six Sigma methodologies. The company’s leadership team, including the Vice President of Enterprise Business Improvement & productivity, felt that we should be able to complete more Lean Six Sigma projects in a shorter time frame and at a greater value to the organization. I worked with the Master Black Belt responsible for each area of the business to **map how a Business Improvement project flows through their business unit** within the organization. In addition, I gathered engineering requirements for how the Enterprise wide program needed to function from Project champions, Green Belts, and Black Belts in the organization. I analyzed these requirements against the broader company policies and procedures to ensure compliance of the system I was designing with the company policies. After completing the engineering ideation and documentation work, I used the Design, Measure, Analyze, Improve, Control (DMAIC) framework, to create a template through which these projects could be executed. I built the Enterprise Business Improvement process flow accordingly, which created a centralized framework for project execution and project presentation. I then designed a system that enabled this process to operate with a **reduction in non-value added activity**. This resulted in an increase in the rate of certification of Green Belts and Black Belts across the organization, as well as an increase in the certified value creation these teams could deliver to the organization.

With an increase in the speed at which the organization could deliver Green Belt and Black Belt projects, underutilized capacity was unlocked in the Business Improvement team. This created an opportunity to complete more Green Belt & Black Belt projects in a given time period. With that, the challenge shifted to **developing a systemic process that would attract and retain not only project ideas, but individuals willing to put their reputation on the line to see those projects through to fruition**. I designed a process flow through which the Enterprise Business Improvement team could effectively report results and recognize outstanding teams and/or individuals for accelerating excellence and innovation. In this way, the process I engineered became a magnet to other current and emerging leaders, who also wanted to take part in the program’s success.
How do ISE’s “Use” their P.E.?

- Consulting
- Expert Witness Testimony
- International Work
- Teaching
- Government Contracting
Consulting/ Expert Witness Testimony

- Scenario: P.E. required to consult on lawsuit
- Example: Retail store w/ large items stored in yard
  - Larger item storage was creating an unsafe working environment
  - P.E. provided solution focused on human factors and prevented a lawsuit
  - Change was implemented globally across all stores
Teaching Internationally

- Scenario: P.E. required to teach international continuing education (CE) courses
- Example: Chartered Engineering Society of Singapore requested P.E. to teach CE courses
  - Instructor had to be a P.E. in order to teach courses
  - Singapore is a member of International Engineering Alliance (IEA).
  - IEA has agreements between 36 jurisdictions within 27 countries, that recognize the engineering educational qualifications and professional competence – including the P.E.
Government Contracting

- Scenario: Government agency requires P.E. for certain contracts and positions
- Example: Department of Agriculture Energy Management Projects
  - Required a P.E. to be a member of the project
  - Contract would not have been awarded unless a P.E. was member of team
  - Expected P.E. to author and stamp report
- Example: USCG Red Low-Level Lighting Re-Design
  - Required P.E. to review and implement MIL-STD for lighting on ships
  - Human factors assessment to identify required lights
  - Expected P.E. to develop and sign ship design drawings
The big picture

- It’s tough—for a reason.
- Keep your eye on the target.
- There are resources that can help you get there.
LICENSURE

The next step is yours.
ncees.org

January 2019 Webinar Link:

Please visit us at ISE Annual 2019!