

Winter Simulation Conference 2021

Challenges in Satisfying the Need and Promotion of Modeling & Simulation Workforce

Edward J. Yellig Ph.D.

Edward.J.Yellig@Intel.com

Technology Development Engineering Manager



intel[®]

Introduction and Background

Bachelor's of Industrial Engineering Purdue University, 1988

Master's of Industrial Engineering Purdue University, 1990

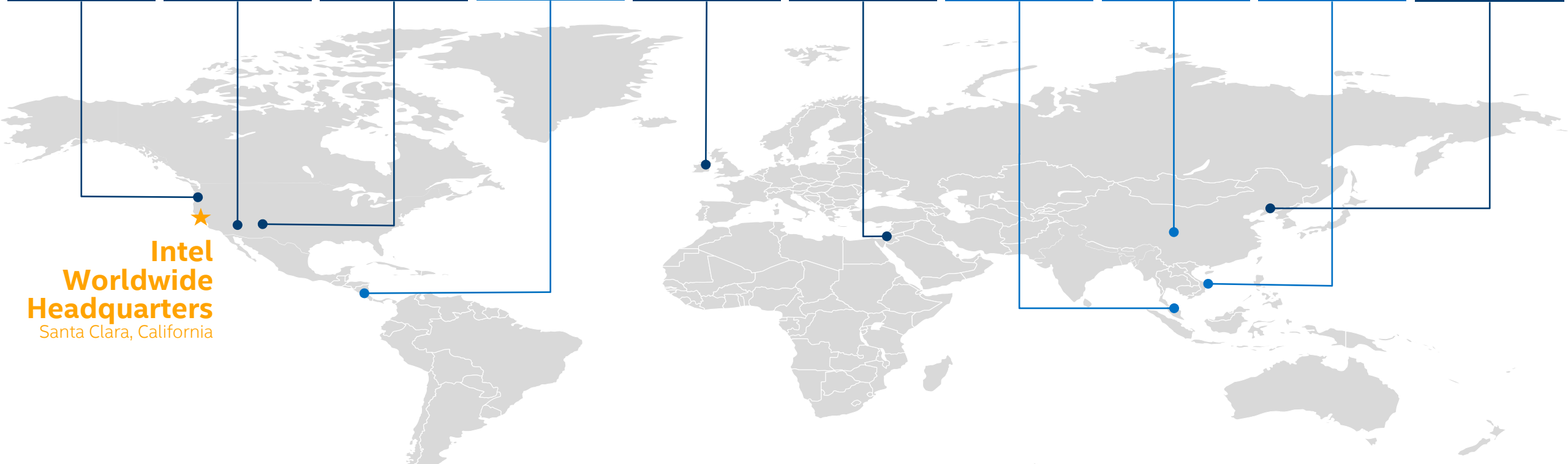
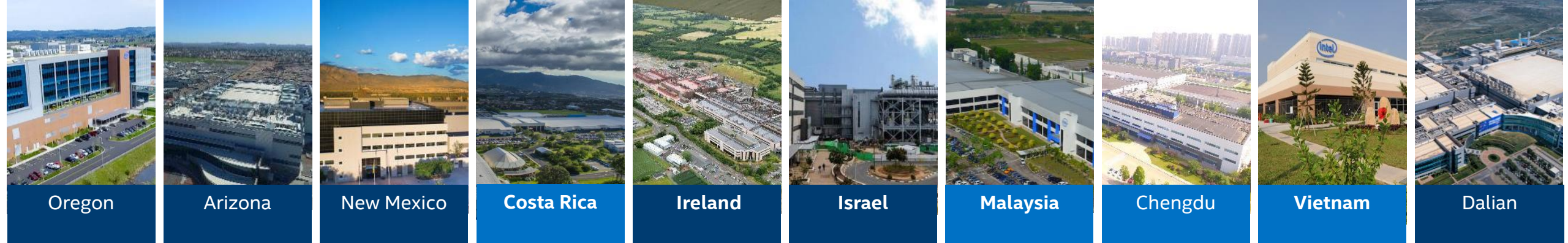
Pritsker Corporation – discrete event modeling for capacity planning and scheduling

Ph.D. Department of Industrial Engineering Arizona State University, 1996 –

“Robust Deterministic Scheduling through Capacity Hedge Points”

Intel Corporation – 1997

- Discrete Event Simulation
- Full Factory Modeling
- Big Data
- Digital Twin
- Predictive Analytics
- Prescriptive Analytics



Geographically Diverse Manufacturing Capacity

■ Wafer Fabs ■ Assembly & Test

Growing Demand for Modeling

- Models are becoming much larger as we model end-to-end systems
- Complexity of the moving parts combined with uncertainty and variability make solutions highly intractable, but **ideal** for simulation modeling
- Highly competitive, highly dynamic business environment requires alternative scenario evaluation
- Expected precision for multiple scenario evaluation is very high
- Fast turn of results to enable time to react
- Quantitative evaluations
- Requires a department, not a team of 1 or 2 modelers (sitting in the corner)

Operations Research Engineer

1. Engineer – calculus, chemistry (lab), physics (lab), mechanics (static & dynamics), thermodynamics, linear circuit analysis, computer programming
2. Industrial Engineer – probability, statistics, computer programming, optimization, simulation, manufacturing process, integrated production systems, control systems, engineering economics
3. Model Developers – 1 and 2 are prerequisites to being model developers. Developing models: simulation, optimization and data model of systems for purpose of analysis. This is the key **differentiator** of an operations research engineer
4. Programming– delivering the software solution. Implement solutions that support the factory, in some cases 24/7 – 365.
5. Analyst – using experimentation, statistical methods and modeling intuition provide quantitative results for decision support.

Operations Research Engineers

- Bureau of Labor Statistics indicates a much faster than average growth 25%
- US News & World Report ranks the field as #4 Best Business Jobs, #10 Best STEM Job and #20 overall Best Job
- US News and World Report and Glass Door indicate pay good, low stress

Quick Facts: Operations Research Analysts	
2020 Median Pay ?	\$86,200 per year \$41.44 per hour
Typical Entry-Level Education ?	Bachelor's degree
Work Experience in a Related Occupation ?	None
On-the-job Training ?	None
Number of Jobs, 2020 ?	104,100
Job Outlook, 2020-30 ?	25% (Much faster than average)
Employment Change, 2020-30 ?	25,600

Google search for "operations research engineer simulation". The result is titled "Job Satisfaction" and describes the job as having a low stress level, good work-life balance, and solid prospects for improvement and promotion. The text states: "A job with a **low stress level**, good work-life balance and solid prospects to improve, get promoted and earn a higher salary would make many employees happy. Here's how Operations Research Analysts job satisfaction is rated in terms of upward mobility, stress level and flexibility." The URL is <https://money.usnews.com/careers/best-jobs/reviews>.

Google search for "operations research engineer salary". The result shows "About 41,400,000 results (0.51 seconds)" and a large salary figure of "\$101,932". The text below states: "How much does a Operations Research Engineer make? The national average salary for a Operations Research Engineer is **\$101,932** in United States." The URL is <https://www.glassdoor.com/Salaries/operations-research...>

Challenges in Satisfying the Need and Promotion of Modeling & Simulation Workforce

- What's the problem?

Quick Facts: Operations Research Analysts	
2020 Median Pay ?	\$86,200 per year \$41.44 per hour
Typical Entry-Level Education ?	Bachelor's degree
Work Experience in a Related Occupation ?	None
On-the-job Training ?	None
Number of Jobs, 2020 ?	104,100
Job Outlook, 2020-30 ?	25% (Much faster than average)
Employment Change, 2020-30 ?	25,600

Quick Facts: Software Developers, Quality Assurance Analysts, and Testers	
2020 Median Pay ?	\$110,140 per year \$52.95 per hour
Typical Entry-Level Education ?	Bachelor's degree
Work Experience in a Related Occupation ?	None
On-the-job Training ?	None
Number of Jobs, 2020 ?	1,847,900
Job Outlook, 2020-30 ?	22% (Much faster than average)
Employment Change, 2020-30 ?	409,500

- Competition for talent
- Demand is an order of magnitude greater, and pay is higher
- Pipeline is limited

Strategy in a Competitive Market for Talent

- Recognize the environment and the challenge
- Coordinate and communicate as a community with a common goal →
- Investment of time and money
- Develop a strategy as a community
 - Educate
 - Management as to the need to invest in DES modeling talent
 - Department heads at the university to support DES modeling classes
 - Differentiate
 - Operations research engineers vs. software engineers vs. programmers
 - Discrete event simulation vs. Machine Learning and Deep Learning
 - Advertise
 - Connect with faculty, fund basic research
 - Offer internships specifically in modeling
- Develop and grow a pipeline of talent for the modeling community

Barriers to Success

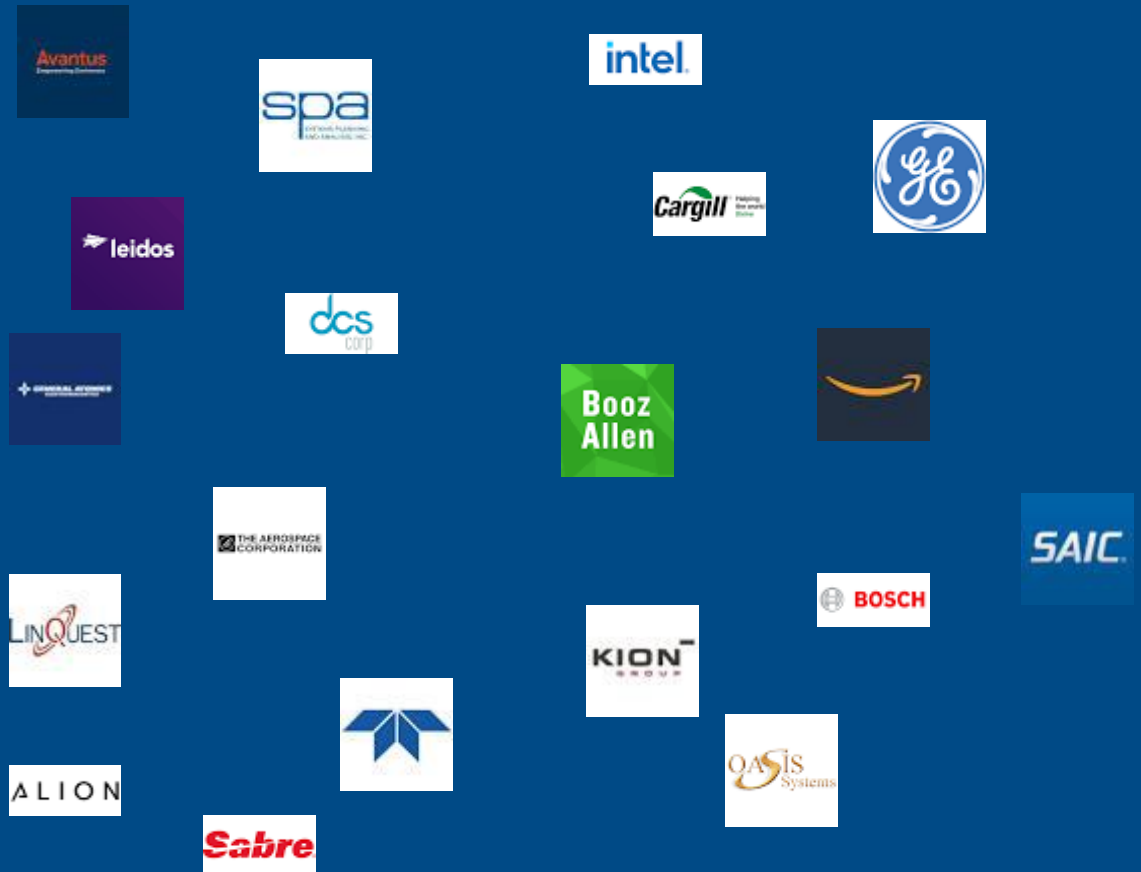
- Simulation modeling projects take too long to complete
 - Modeling must move into the cadence of the business cycle
 - Appropriate levels of abstraction, incremental improvement
 - Develop capability in advance of need
 - Automate components
 - Digital Twin
- Simulation models are rarely understood
 - Educate a senior advocate, be the business evangelist
 - Develop a track record of solutions to highly intractable problems
- Simulation is not used regularly (optional)
 - Connect your product to the business, making it mainstream
 - Factory – Digital Twin
 - Business – Quarterly demand forecast

Community with Simulation Job Openings on Google

Google search results for "operations research engineer simulation". The search shows approximately 200,000,000 results in 1.00 seconds. The "Jobs" section is active, showing results near Chandler, AZ. Filters include "Past 3 days", "Full-time", "Work from home", "No degree", and "Research engineer". Three job listings are visible:

- Operations Research Engineer** at Intel, Phoenix, AZ, via Jobs Intel, posted 24 days ago, Full-time.
- Operations research engineer** at Intel, Phoenix, AZ, via Tarta.ai, posted 1 month ago, Full-time.
- JR0170163 - Operations Research Engineer** at Altera, Phoenix, AZ, via Jooble, posted 6 days ago, Full-time.

At the bottom of the job listings, there is a link for "69 more jobs".



- Education or experience using discrete event simulation models or commercial simulation software such as Arena, Simio, ProModel, etc