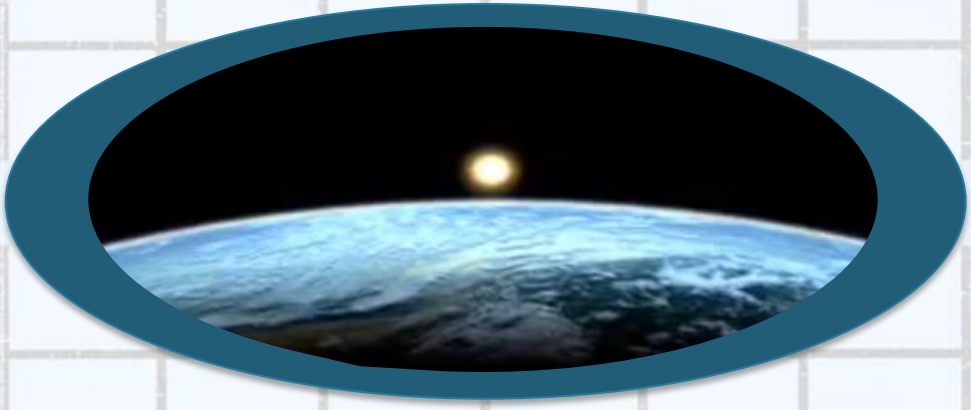
A Fresh Approach to Simulation Education

Why the focus on Education ?

- Courses in simulation are increasing
- First impressions are important
- Educators are looking for a change
- The more students learn about simulation, the more *Flexsim* is appreciated
- Simulation education can be a key to success in today's market

Challenges for simulation software/service providers and users



- Environment: dynamic, lean, flexible, economics driven
- Management: increased recognition of simulation's value
- Skills: problem solving, not programming, rewarded
- Individuals expectations: use simulation or contribute on a team

Trying to meet the challenges through software

xj technologies

witness

SIMUL8® CORPORATION

FlexSim

Simio
Forward Thjnking

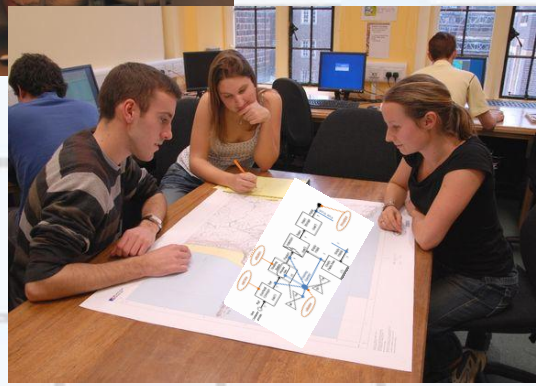
"Ease of Use" is commonplace

“Ease of Use” implications

“Push one button and simulate” mentality

- **Difficult to manage expectations**
- **Overconfidence**
  - **Simulating without understanding**
  - **Misinterpreting results/ Wrong conclusions**
  - **Loss of confidence in simulation technology**
- **Roles of software/service providers and users changing**
- **Education is critical to leverage ease of use**

Challenges for simulation education

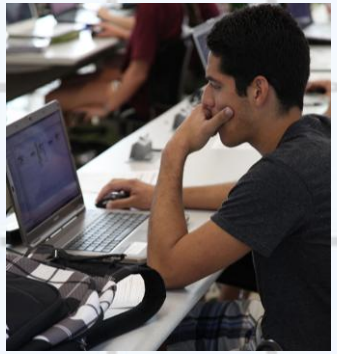


- Provide a broad application base
- Teach a structured process
- Address multiple user levels
- Maintain a systems focus
- Blend fundamentals and theory with applications
- Utilize simulation application software

Finding the time to do all of this!

Teaching simulation and operations

- Systems Design
- Applied Statistics
- Communication
- Resource Requirements
- Control Mechanisms
- Logistics
- Manufacturing Processes
- Service Operations
- Scheduling
- Reliability
- Engineering Economics
- Project Management
- Information Systems

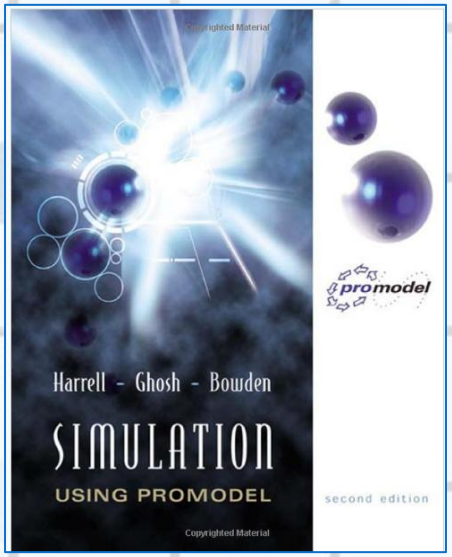


Trying to meet the challenges through software + traditional textbooks

Arena® Simulation Software

Simio
Forward Thjnking

ProModel
Visualize Analyze Optimize VAO



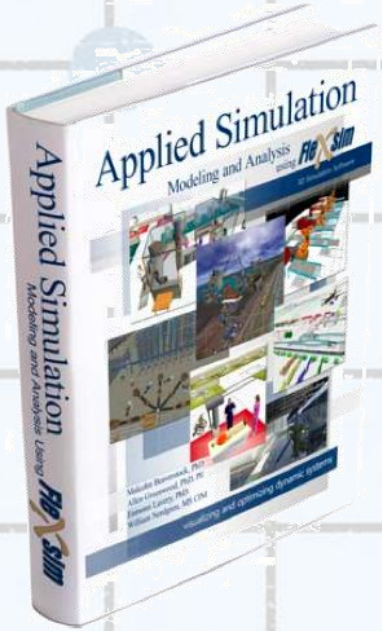
Our philosophy:

Simulation is…….

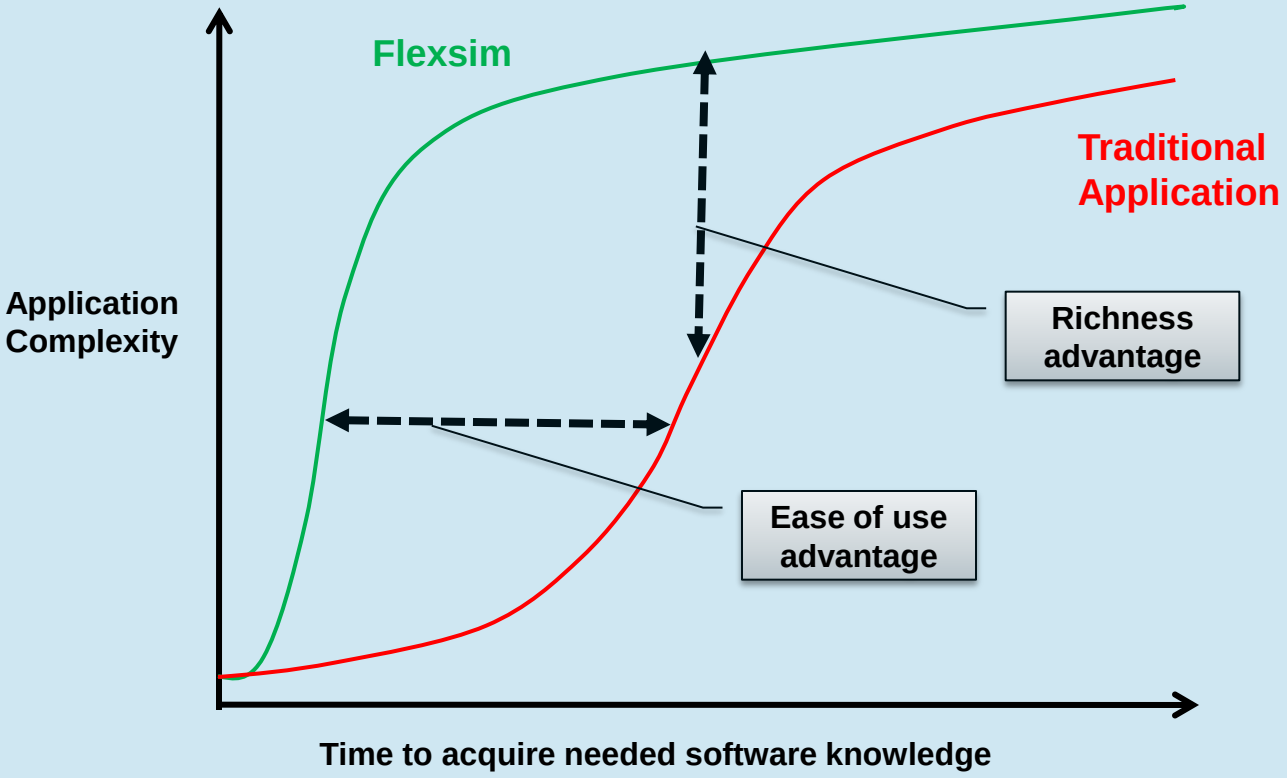
- meant to solve problems and support decisions.
- (should be) moving from a specialty to a common tool.
- both an an art and a science.
- based on foundational methodologies.
- a process.
- model based. Models are:
  - tools to support and extend the power of thinking. (Pidd)
  - wrong, but hopefully useful. (Box)
- meant to be applied through technology.

A fresh approach to simulation education

- **Focus on applications**
- **Balance theory and practice**
- **Address all user levels**
- **Highlight *Flexsim*'s capabilities**
- **Correctly leverage ease of use**



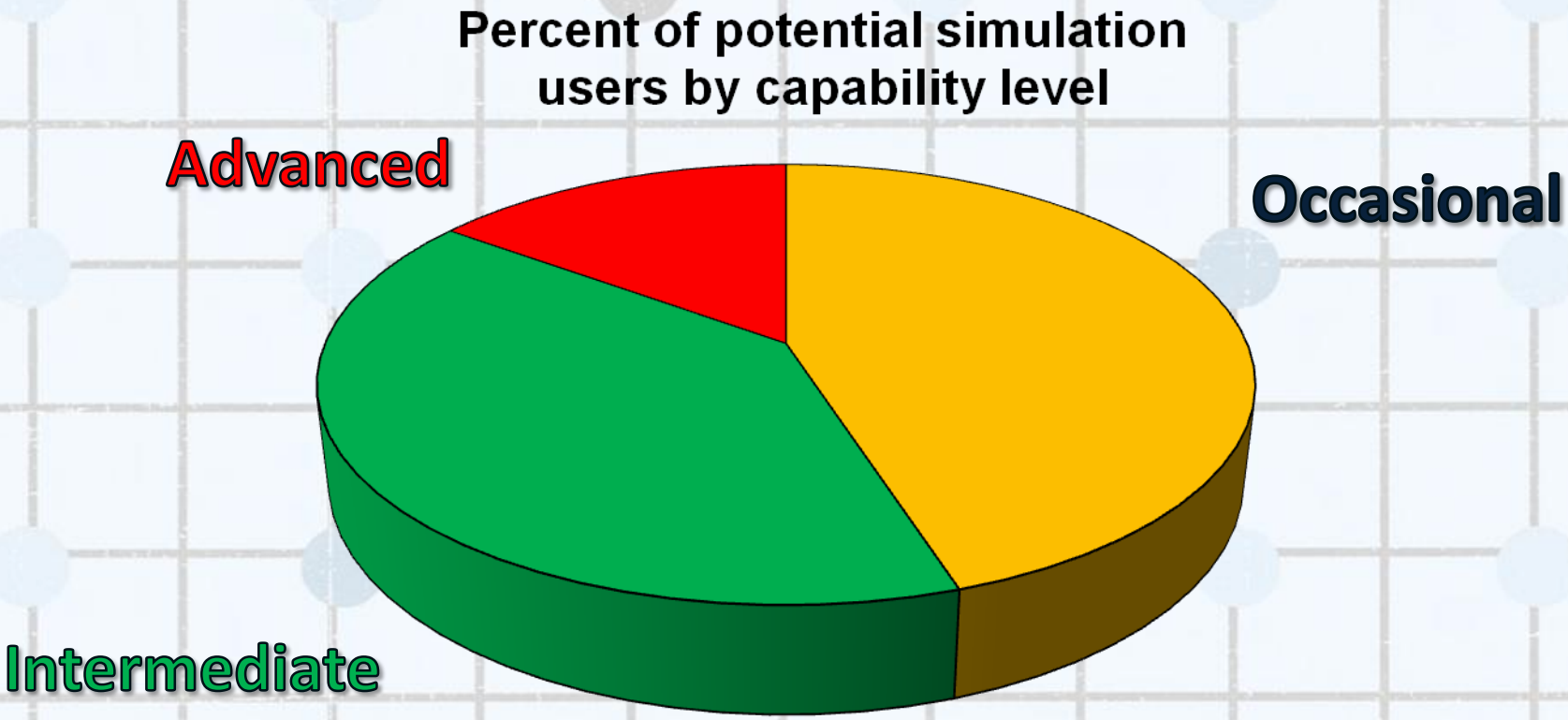
Flexsim learning advantage



This book is about using simulation to understand the dynamics of systems

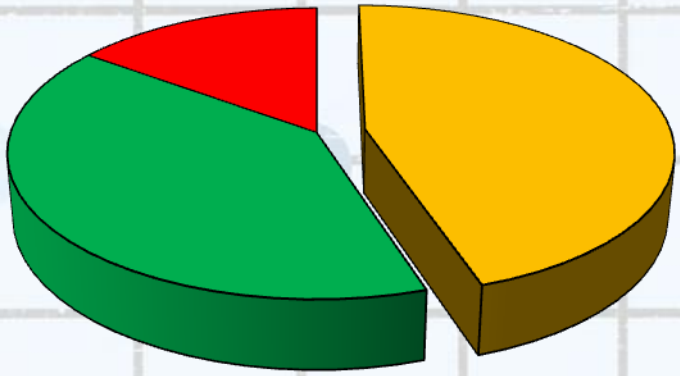
- Time-based activities
- Variability & randomness
- Sequential and parallel operations
- Interdependencies and interactions
- Reliability
- Event-based logic
- …

A book based on user capability levels



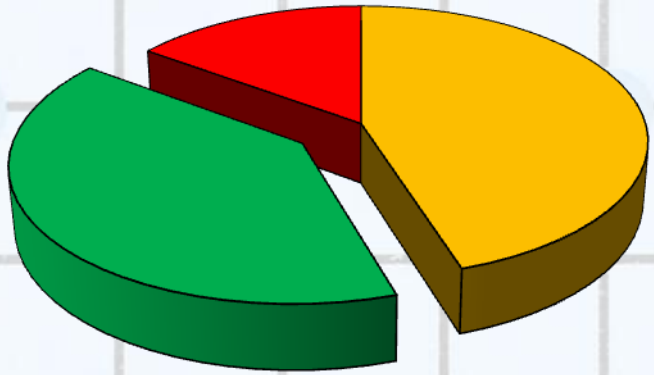
Occasional User

- **Uses pre-built simulations for analysis and decision making**
- **Can specify simulation requirements and understand simulation project requirements**



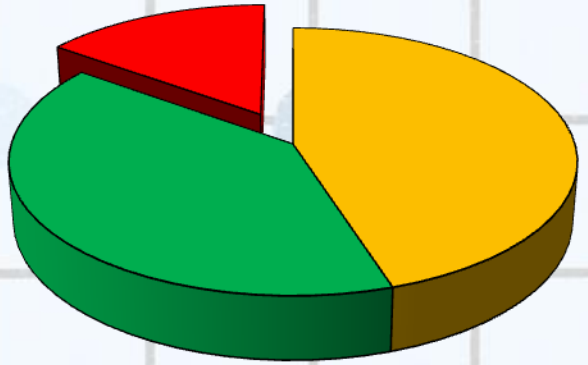
Intermediate user

- Understands the basic application software structure
- Builds simulation models using standard objects and logic
- Manages the placement and use of data in the simulation
- Is familiar with the theory and practice
- involved with input/ output analysis and reliability



Advanced User

- **Understands the underlying software and command structure of the application**
- **Can develop custom logic, messaging, and reports**
- **Helps other users**



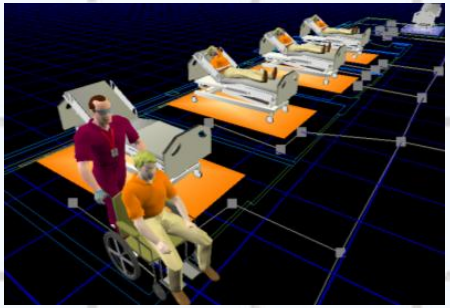
Establish relevancy through examples

Identifying where and how simulation is used

Lean manufacturing options

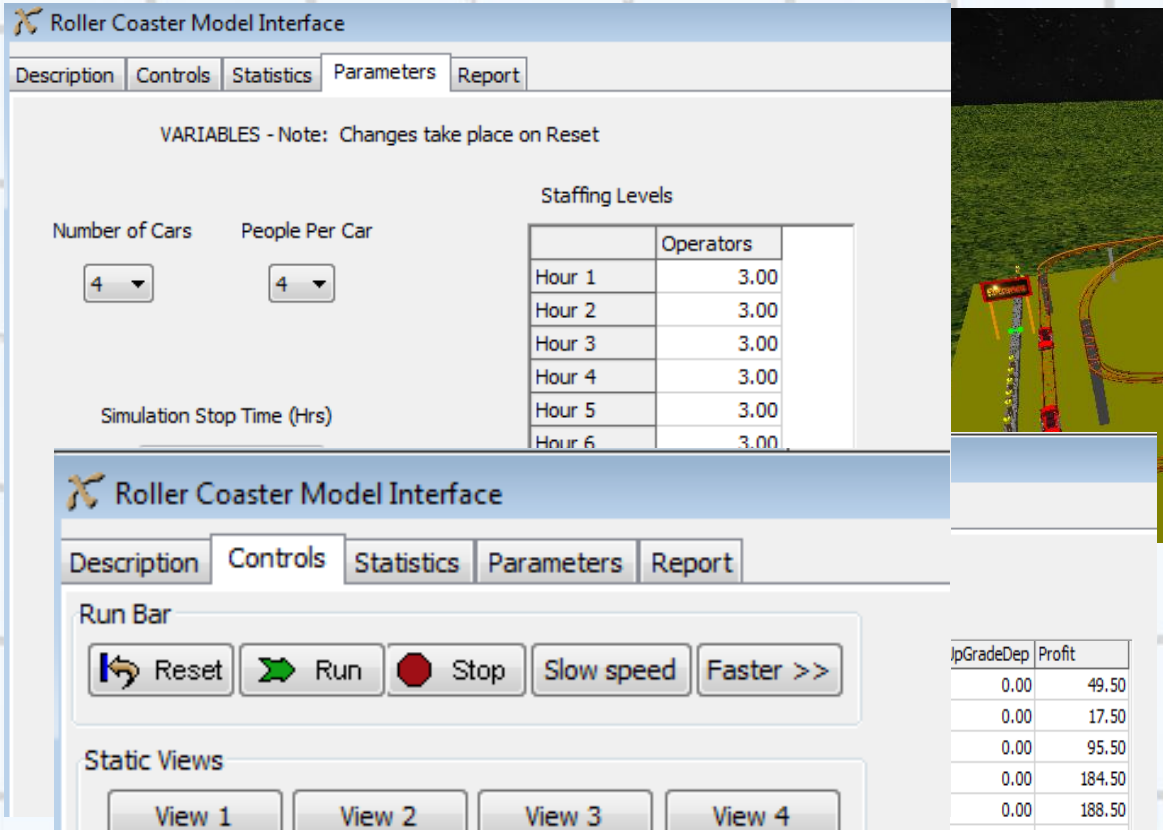
Material transfer systems

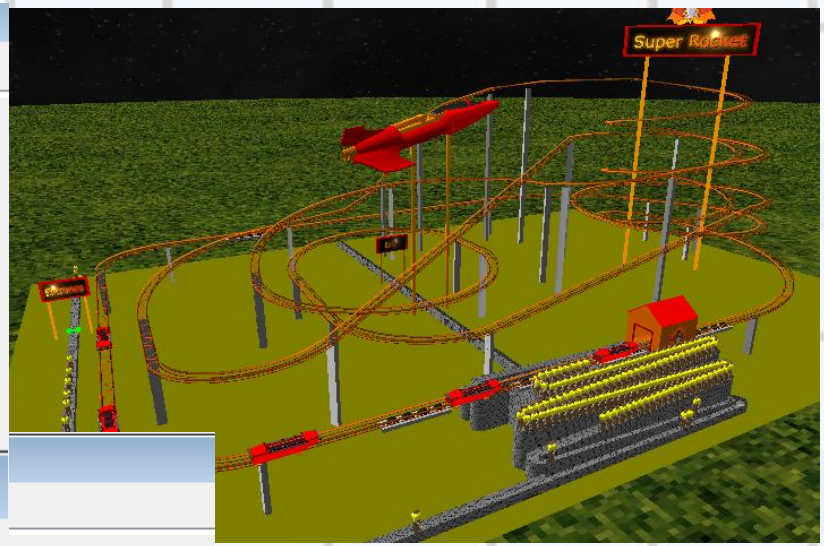
Container port operations



Health care facility design and analysis

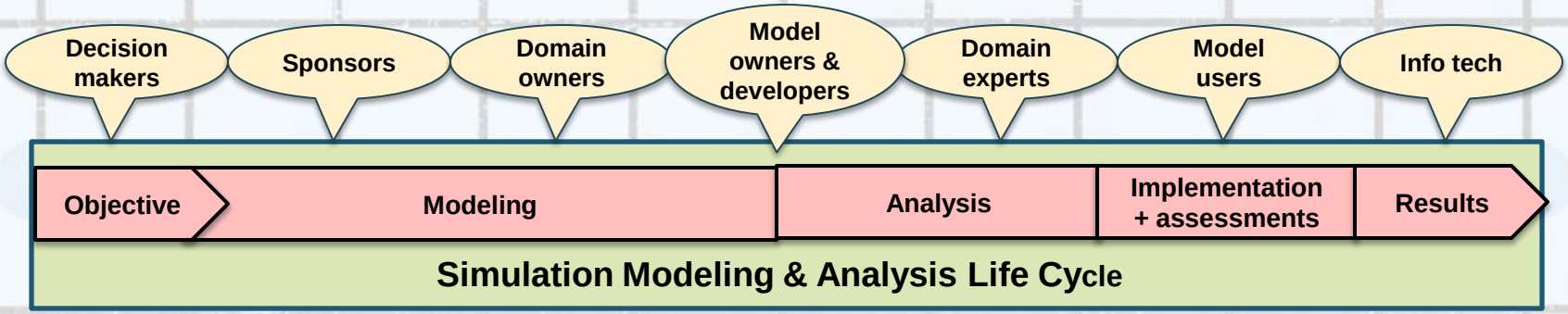
Quickly use simulation for decision making



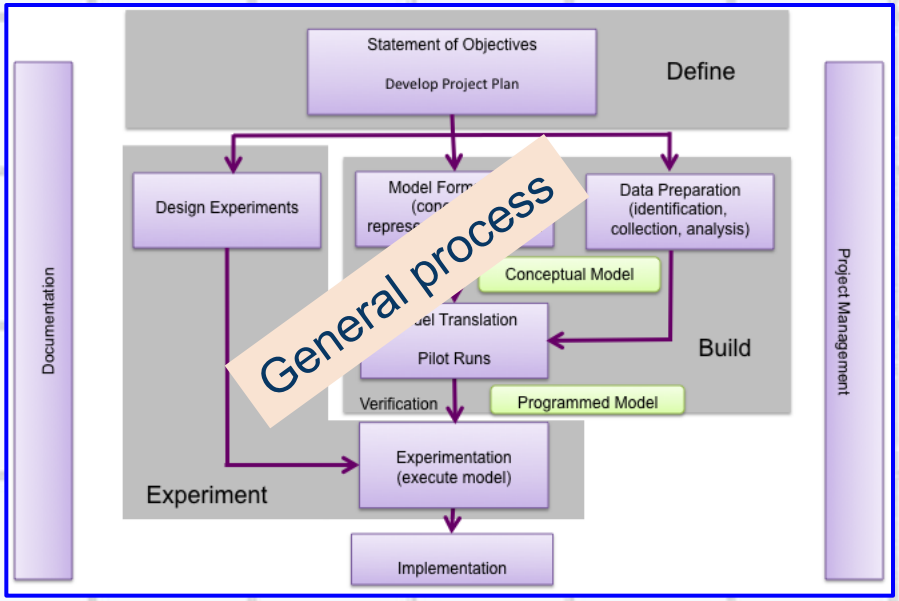


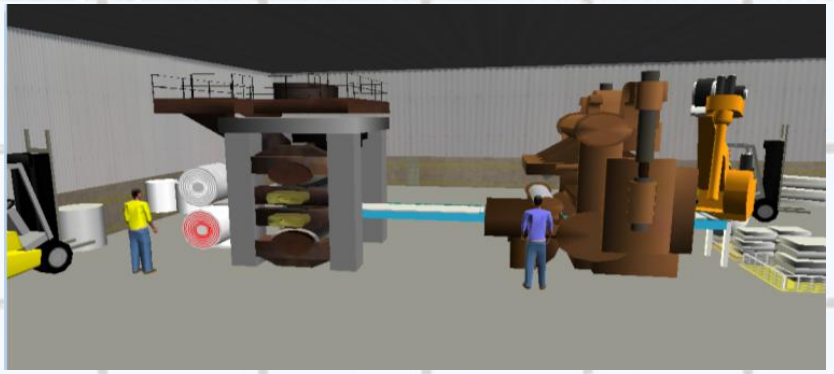
Realize simulation is a process

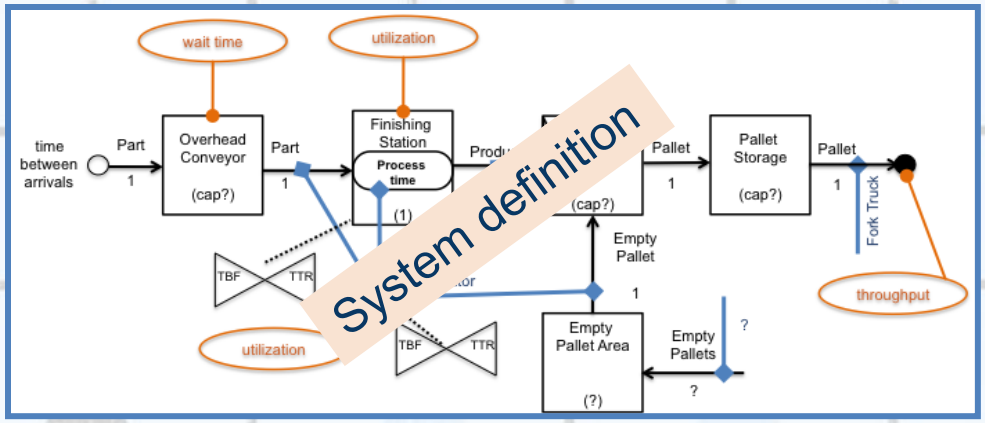
- View in an organizational context
- Manage as a project
- Use a structured methodology
- Understand the simulation life cycle
- Appreciate the various roles that exist

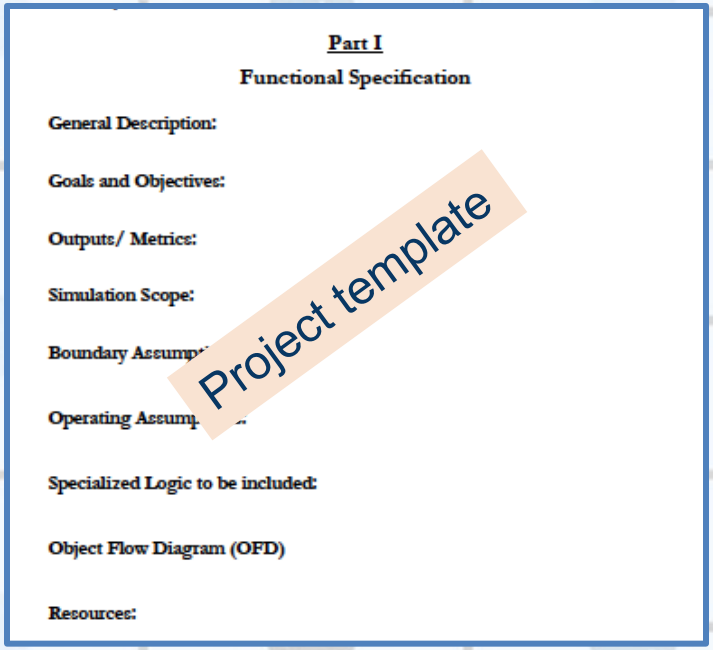


Manage simulation as a project



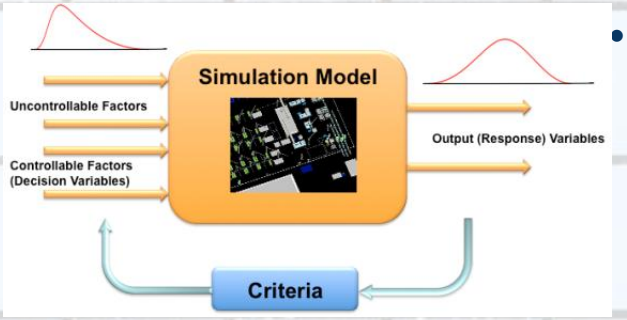




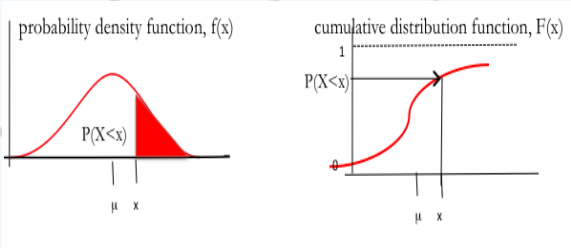


Blend relevant theory and application

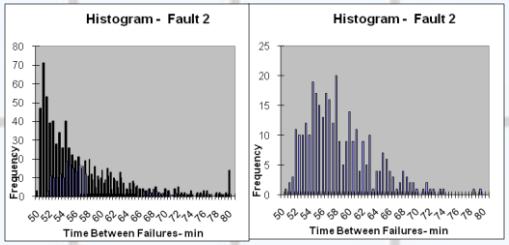
- **Modeling Randomness**
  - Obtaining samples from distributions
  - Generating random numbers
  - Distribution selection
  - Using *ExpertFit*

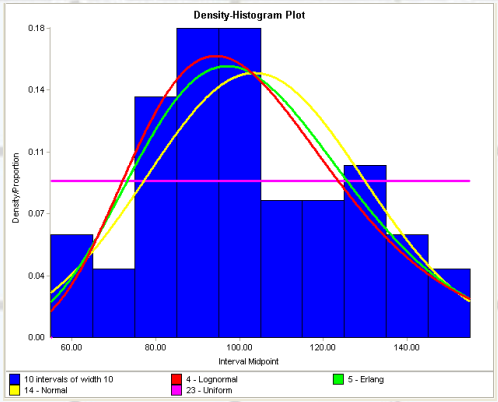


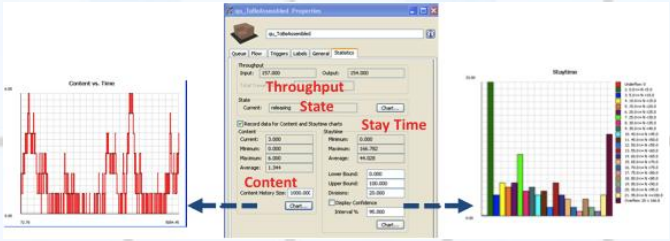
- **Reliability**
  - Downtime clock time
  - Downtime by state
  - Competing downtimes

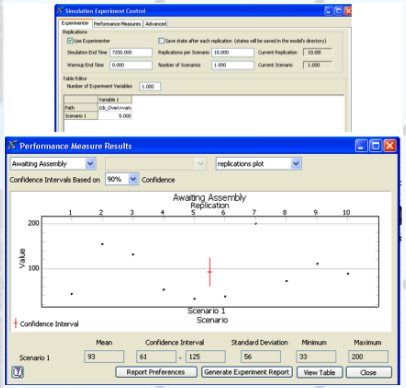


- **Output analysis**
  - Object statistics
  - Creating Experiments
    - Scenarios and replications
    - Performance measures
    - Comparing alternatives
  - Run length – terminating and non terminating systems









Reinforce holistic approach through exercises

Exercise Structure

- Background
- Problem statement
- Operational information
- Expected Results
  - Object flow diagram
  - Solution statement
- Modeling and Analysis Issues
  - Simulation scope
  - Assumptions
  - Data location
  - Required logic

Background:

Your cousin has a great idea to sell customized picture frames and wants to get set up in time for the Christmas holiday season. The store is a small location where customers can

Problem Statement:

Simulate the frame shop during a ten--hour period and help decide how to best utilize the three workers in the store.

Operating Data:

he frame shop operates from 9am to 7pm. At 7pm the front door to the store locks. Customers in the store are serviced and the store cleaned until 9pm. The procedure is

Expected Results:

Create an OFD for the system
Simulate 5 days of operation
Where should additional workers be used – cashier or

Modeling and Analysis Issues

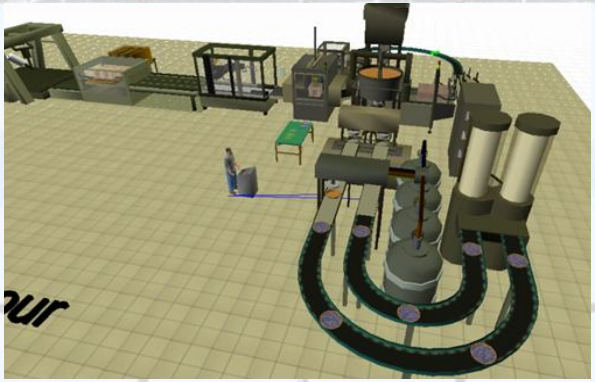
- How can you increase the number of people on the checkout or custom counter without having to add additional objects?
- What activities take place in the store?
- What logic can be used to get people to the right place after they are done shopping? After finishing shopping what decision will a customer make?
- Consider how an object like a queue, even though not a physical part of the simulation, can be used as a decision device to direct the flow using standard logic.

Beyond the basics

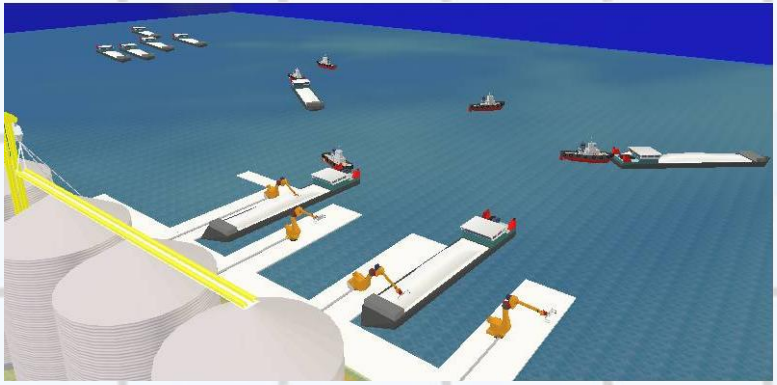
- Advanced logic and messaging
- Fluid/continuous flow
- Production schedules

Surgery Center Operations

Line Scheduling



Barge loading



Appendix

- Additional details of Flexsim software
- Exercise help
- Advanced Flexsim topics
  - Command list
  - Visualization techniques
  - Creating user interfaces
  - Building custom task sequences
  - Outputting AVI files
  - Data exchange with Excel and AutoCAD
- Overview of other Flexsim based applications
  - Health care
  - Container Terminal
  - Dryfork – presentation software

Helping the Education process

- Simulation application technique discussion topics for each exercise
- Review questions for each chapter
- Flexsim free evaluation license can be used for Chapters 1-6
- Student or full licenses available from Flexsim

About the Authors

- **Malcolm Beaverstock, PhD**

  Retired manger of Business Simulation at General Mills, Inc. Developed and led their simulation program which was involved with more than 300 projects and resulted in significant savings attributed to the use of simulation. Additional industrial experience as Research Manager at the Foxboro Company and Vice President of Technology at Automation Technology. Author of more than 200 papers on the application and use of advanced technologies.

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  Professor of Industrial and Systems Engineering at Mississippi State University (MSU) Allen teaching systems simulation, enterprise systems engineering, and project management. Research and consulting work includes the design and analysis of production and project systems; simulation modeling, analysis, and optimization; and the design and application of decision-support systems. Authored or co-authored over 100 creative works, including journal and conference papers, technical reports, software programs, etc.

About the Authors

- **Eammon Laverty, PhD**

  Joined Flexsim Software Products, Inc. in 1997 as the Chief Technology Officer. He is the author and architect of the Flexsim Software. Eamonn holds a Bachelor of Science in Mechanical Engineering and a Doctorate in Object Oriented Modeling and Simulation of Manufacturing Systems from Queens University of Belfast.

- **William Nordgren, MS CIM**

  President and CEO of Flexsim Software Products, Inc. Founded ProModel Corporation in 1988 and founded F&H Simulations, Inc. in 1993(now Flexsim Software Products, Inc.) where he introduced Taylor II, Taylor ED, and Flexsim into the simulation marketplace. Bill has authored several papers dealing with simulation project management and queuing theory, and has taught hundreds of classes in the use of simulation software.

Flexsim in Education initiative

- Textbook as the base
  - Hardbound
  - Spiral bound
  - ebook
- Primary focus on classroom use
  - Educator web site to download and share materials
  - Educator workshops
- Student license with watermark
  - Full version – 6-month, 100-object limit
  - Special arrangements for teachers using book
  - Case-based single-use for class/research projects
- Flexsim in Education coordinator

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