National Shipbuilding Research Program
Advance Shipbuilding Enterprise

LARGE SCALE COMPUTER SIMULATION MODELING SYSTEM FOR SHIPBUILDING

Deliverable 2.0
Functional Requirements Document

Prepared by:
General Dynamics NASSCO

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APPENDICIES

1 INTRODUCTION

This section provides the background on the Large Scale Computer Simulation Modeling System for Shipbuilding project, describes the purpose and scope of this document, and details the references, assumptions, constraints, and methodology used in its development.

1.1 Background

In general, the Large Scale Computer Simulation Modeling System for Shipbuilding (LSMS) project sets out to develop and implement a yard-wide computer simulation modeling system that will be useful for performing analyses of the effects of current and new ship production work on the shipyard's operations. In addition to new business scenario analyses, the system will be employed to evaluate proposed process and facility improvements. The system will include: 1) the yard-wide simulation model application, 2) user utilities to easily (re)define facilities, schedules, processes/routings, and interim products (both currently in production and proposed new work), and 3) automated links to product design and planning/scheduling data. It is intended that the user base will be a broad group of Planners, Managers, and Analysts, rather than a limited group of specially trained Industrial Engineers. This system will utilize defined work content metrics and process maps to quantify the requirements for each stage of construction and major "gateway" processes. It would provide output information that would enable shipyard management to quickly determine such things as:

- Major process throughput requirements
- Target durations and process cycle times
- Labor efficiency requirements to achieve cost goals
- Manning requirements by Stage of Construction (SOC)
- Balanced level loading strategies between Stages of Construction
- Material and interim product transportation and storage requirements to support level loading strategies
- Assembly and Outfitting area requirements
- Suitable multiple ship construction schedule overlap

The initial goal for the use of this analysis technology will be to investigate several potential scenarios, targeting one or two of the best for application of current capacity analysis methods and refinement. Eventually, the modeling system could replace the current methods entirely; significantly reducing expended labor and decision-making durations for shipyards evaluating new ship production work.

1.2 Functional Requirements Document Purpose

The purpose of this Functional Requirements Document (FRD) is to describe the end-use requirements and system development approach for the LSMS. It is the foundation for the development of the Initial Design Specification, and is written from the user's perspective. It is therefore not intended to detail the specifics of the software architecture/programming development or testing/validation process beyond that specified by the system users. These details will be covered in the later Initial Design and Final System Design Specifications.

1.3 Functional Requirements Document Scope

The FRD was developed with input from the Master Planning, Engineering, and Industrial Engineering departments of the initial implementation shipyard, General Dynamics NASSCO (GD NASSCO), along with input from project team members - Bender Shipbuilding and Repair Company, Atlantec Enterprise Solutions, ShipConstructor Software, and TranSystems|Automation Associates. The FRD represents the agreed upon assumptions, constraints, and requirements that will be utilized in the development of the design specifications, prototypes, and ultimately in the final implementation and use of the LSMS.

1.3 Functional Requirements Document References

1. LSMS Task 1.1 Notes from LSMS Kickoff Meeting Working Sessions.doc
2. LSMS Task 2.1 Functional Requirements Mtg Planning 2008-05-27.doc
3. LSMS Task 2.1 Functional Requirements Mtg Engineering 2008-06-03.doc
4. LSMS Task 2.1 Functional Requirements Mtg Planning 2008-07-10.doc
5. Simulation Project Definition Template LSMS - Combined.doc

1.4 Functional Requirements Document Assumptions

1. Phase II of this project to build and install the final system will be funded at the full amount.

1.5 Functional Requirements Document Constraints

1. The LSMS will be implemented within the scheduled project timeframe.
2. The LSMS will be implemented within project budget.

1.6 Functional Requirements Methodology

This FRD was developed through a two tiered process. First, surveys were given to the potential users of the LSMS. This survey, called the Computer Simulation Project Definition Template, was meant to structure the respondents' ideas and understanding of the requirements necessary to successfully complete a simulation modeling project. An example of this survey, summarizing the team's combined responses, is shown in appendix A. Information from the surveys was complied for the next tier, meetings with the potential users. From these meetings, a list of functional requirements was developed and reviewed by the team. The final list of functional requirements is summarized in this FRD.

2 LSMS CONTEXT

This section defines the context of the LSMS including the functional concept, system scope, and roles and responsibilities.

2.1 LSMS Functional Concept

The LSMS is separated into the three functional layers shown in Figure 1. Each layer contains the software and interfaces necessary to perform specific tasks within the system. The three layers are:

Definition Layer: Utilizing the software and interfaces in this layer, information defining the facilities, processes, products, and routings is input into the LSMS. Current and new facility information, in addition to, data on products for future vessel types is included.

Synthesis Layer: The software and interfaces in this layer allow users to blend data for current and future build schedules, and merge product model information for current ships with family type information of future ships. The information, typically at different levels of detail, is normalized in this layer for use in the LSMS. The product, schedule, and facilities information is then used to build scenarios to be analyzed in the LSMS.

Simulation Engine: The simulation engine includes the software and interfaces to perform the calculations using the data from the synthesis layer and create output reports for use in the analysis.

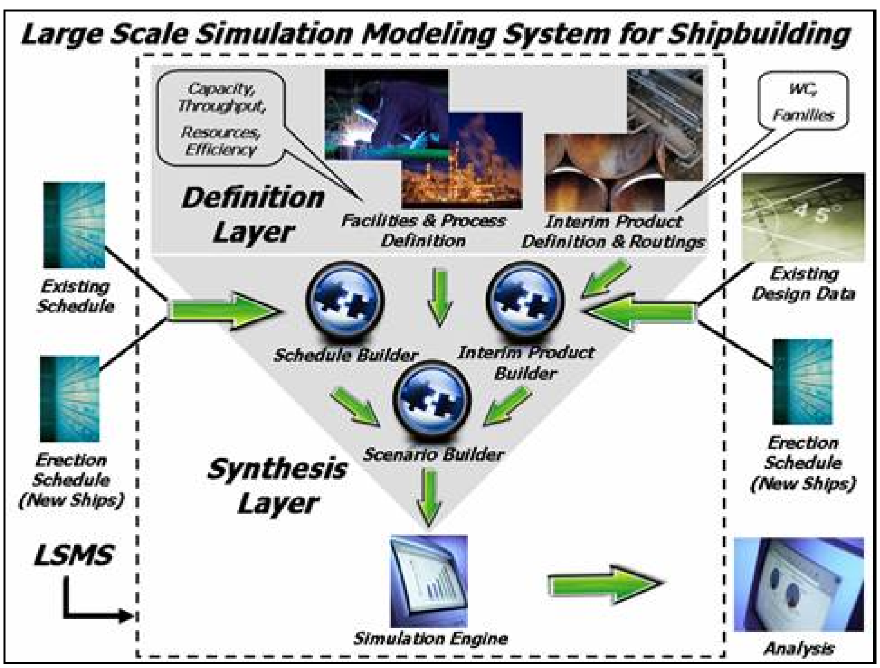


FIGURE 1: Functional Concept for the LSMS

2.2 LSMS Scope

The LSMS will include steel and outfitting processes within GD NASSCO's shipyard from the steel yard through pier side outfitting. Outfitting and steel processes outside this boundary will be introduced to the model through scheduled delivery times for low volume major items. High volume items will be considered available at the time of installation.

The LSMS will be organized at the work center level for each SOC. The work centers can be organized into the functional groups shown below:

SOC	WORK CENTER FUNCTIONAL GROUPS
Steelyard	• Steelyard
1	• Plate burning (Oxy-Fuel and Plasma) • Plate forming (rolls, line heating) • Profile fabrication line • Profile forming (blacksmiths, bulldozer, line heating) • Manual profile fabrication • Transverse manufactured tee line
2	• Moving subassembly line • Major subassembly • Subassembly storage • Outfitting unit assembly
3	• Flat tables (Table 1, Table 3, and Table 11) • Pin jig tables (Table 2 and Table 1) • Panel line • Block Assembly Line (BAL) • Storage in SOC 3
4	• Blast and paint facility • On block inverted work • Storage in inverted work area
5	• On block area (F, G, H, L, and M lanes) • Storage in on block area
6	• Building dock • Ways 3 • Ways 4 • Storage on ways 3 & 4 • Storage in building dock
Pier Side	• Pier side work

In addition to the process work centers, subassembly and block storage will be included. As indicated above, storage of major products can occur in SOCs 2, 3, 4 and 5, on Ways 3, on Ways 4, or in the Building Dock.

2.3 LSMS Roles and Responsibilities

Although it is anticipated that the LSMS will be rolled out to larger group of users, for the execution of this project the following implementation roles and responsibilities apply:

Master Planning: Tasked with the development of what-if analysis, the Master Planning Department of GD NASSCO will be the initial users of the simulation technology. They will also be tasked with the maintenance of the scheduling products necessary as inputs to the LSMS.

Engineering: The Engineering Department of GD NASSCO will have the responsibility of maintaining and uploading the product information, both current and future vessel types, used in the LSMS. They are potential future users of the simulation technology in the development of design contract analysis and change order requests.

Industrial Engineering: The Industrial Engineering Department of GD NASSCO will also utilize the simulation technology to perform various what-if scenarios. The IE Department will also be responsible for inputting facilities information necessary to the system, and will be the lead in overseeing system development, implementation, and use.

TIS/ISD: The Technical Information Systems and Information Systems Departments of GD NASSCO will be responsible for the installation of the software associated with the LSMS as well as working with outside developers in the troubleshooting process.

3 FUNCTIONAL REQUIREMENTS

This section defines the LSMS functional requirements for the system in general, definition layer, synthesis layer, and simulation engine.

3.1 LSMS General Requirements

The General Requirements described in this section are those that apply to the overall LSMS.

The LSMS shall:

1.	Be modular in nature in accordance with the layers indicated in section 3.1 to facilitate building, troubleshooting, modification, and use
2.	Support the ability to run scenarios using: • Default data entered as approved corporate information for use in scenarios • Local user inputs for what-if scenarios • A blending of the two

3.	Indicate on outputs what category of data, approved corporate information, or local user input, was used in the scenario
4.	Support the ability to phase in or discontinue use of facilities or products during the running of a scenario
5.	Support a tiered structure to accommodate different levels of detail as the design progresses through: • Rough estimates in contract/initial design • Takeoffs and early product modeling in functional/transition design • Final design in detailed design/production
6.	Be protected from unauthorized system use or viewing of data
7.	Be designed with an operational lifetime that extends into the foreseeable future through the use of open architecture features
8.	Be designed for use by small groups of trained users with little or no initial simulation modeling experience
9.	Utilize electronic downloads and uploads of data where feasible to reduce manual input
10.	Have a user's manual describing typical functions and their use
11.	Support the user installation of the application and subsequent updates through GD NASSCO's intranet without administrator intervention
12.	Support application version checking and automatic updating to latest version through GD NASSCO's intranet
13.	Initialize the model with current production Work In Process (WIP)
14.	Be utilized for verifying potential detail schedules and their effects on upstream and downstream SOCs
15.	Support identification and development of top performing schedules
16.	Support the ability to define a different process capability for at least a first and second shift
17.	Support electronic document file formats where data can be generated, shared, and utilized for shipyard reporting capabilities (ie .xls, .doc, .pdf, html)

3.2 LSMS Definition Layer

In addition to the general requirements, the definition layer has the following specific requirements for the facilities and process definition utilities and the interim product definition and routings utilities.

3.2.1 LSMS Facilities and Process Definition

The facilities and process definition utilities shall:

1.	Support the definition of current and new facilities and processes at the work center level, including at least the following parameters
	- Key capacities including, but not limited to:
	    o Plate burning and forming - Plate parts / shift
	    o Profile fabrication line and forming - Profile parts / shift
	    o Manual profile fabrication and forming – Profile parts/ shift
	    o Transverse manufactured tee line – Transverse MTs / shift
	    o Moving subassembly line – Weld length / shift and Manning
	    o Major subassembly area – Weld length / shift, Area, and Manning
	    o Flat tables – Area and Manning
	    o Pin jigs – Area and Manning
	    o Panel line – Panels or blocks / shift
	    o Block assembly line – Blocks or panels / shift
	    o Outfit unit assembly – Area and Manning
	    o On block inverted work – Area and Manning
	    o On block area (lanes) – Area and Manning
	    o Blast and paint facility – Blocks / shift
	    o Building dock, ways 3, and ways 4 – Manning
	    o Pier side - Manning
	- Key resources including, but not limited to:
	    o Steel fitters
	    o Steel welders
	    o Outfit fitters
	    o Outfit welders
	    o Layout
	    o Painters
	    o 507 crane
	- Applicable rates, which may include
	    o Machine rates
	    o Travel rates for moving lines and transportation
	    o Work content labor rates (e.g., weld feet / hour)
	- Operating schedule for at least a 2-8-5 shift scenario
	- Process type definition for locations of moving line vs. stationary, independent space

2.	Include functionality to allow the user to define new or change existing work center capacity metrics
3.	Support the general definition of “flat space” areas, which can be used for a variety of purposes, including block storage, block production, and hull erection

4.	Support the definition of various material movement capabilities within the ship yard, including • Overhead cranes • Gantry cranes • Transporters This definition may include • Maximum lift capabilities • Empty and loaded travel speeds • A matrix of movement time distributions between various from/to pairs of work centers.
5.	Support the definition of labor pools of trade resources (welding, fitting, etc.) as well as labor schedules for those pools

3.3.2 LSMS Interim Product Definition and Routings

The interim product definition and routings utilities shall:

1.	Maintain a library of generic ship types used to identify and generate product information for new ships used in the model
2.	Maintain a library of generic interim products and generic product structures (family trees) for developing the products used for new ship types in the model including: • Grand blocks • Blocks • Subassemblies • Panels • Parts • Outfit unit assemblies • Outfit subassemblies
3.	Generate a description of work content for the new ship used in the simulation model based on the interim products developed by the system
4.	Support the definition of a primary and secondary routing for all defined products at the work center level based on the interim product work content developed by the system
5.	Support definition of product data (at the appropriate level of detail) for all defined products, including: - Product geometry - Product weight

3.4 LSMS Synthesis Layer

In addition to the general requirements, the synthesis layer has the following specific requirements for the schedule builder utilities, interim product builder utilities, and scenario builder utilities.

3.4.1 LSMS Schedule Builder

The schedule builder utilities shall:

1.	Develop all lower level stage of construction (SOC) schedules for interim products of new ship types using a notional erection schedule with initial product setbacks and sequence
2.	Develop a schedule for subassembly and fabrication products for ships currently in production from the SOC 3 laydown schedule, initial product setbacks, and sequence
3.	Maintain a knowledge of SOC 3 and above schedules for comparison to simulation results at the end of the run
4.	Normalize the schedules for current and new work to the same level of detail for use in the simulation model
5.	Be capable of assigning maintenance schedule timeframes for major equipment and routine yearly facility shutdown periods

3.4.2 LSMS Interim Product Builder

The interim product builder utilities shall:

1.	Extract data for the interim products of new ship types from the interim products and routing utilities of the definition layer using a notional erection schedule developed for the new ship
2.	Extract data for current vessels in production from the product modeling system
3.	Assign type, routing, and other production information to the interim product details from the product model for the current vessels in production
4.	Normalize the interim product information for current and new work to the same level of detail for use in the simulation model

3.4.3 LSMS Scenario Builder

The scenario builder utilities shall:

1.	Allow users to create what-if scenarios using either approved default data, local manual input data, or a combination of the two
2.	Prepare schedule, product, and facility information (current and new, default and local) for use in the simulation engine
3.	Be the main user interface to the simulation engine
4.	Support the ability to save input information for up to 5 separate scenarios for reuse & future modification (library of simulation scenarios)
5.	Support the ability to save the output results for up to 5 separate scenarios which could later be combined for side-by-side scenario comparisons (these could be time/date-stamped scenario Jun 08, scenario Aug 08; or just scenario #1, #2)

3.5 LSMS Simulation Engine

In addition to the general requirements, the simulation engine has the following specific requirements.

The simulation engine shall:

1.	Perform calculations in a constrained (resources capped) and unconstrained (certain resources such as manning having unlimited availability) modes
2.	Show key output metrics in real time during the scenario run
3.	Determine the earliest build schedule based on product sequence, work content, and resources levels
4.	Include the effects of a learning curve over multi-ship contracts
5.	Include restrictions on breaking time-fence rules
6.	For each major work center determine: • Throughput • Man hours consumed (if applicable) • Area used (if applicable) • Resource utilization (time idle, time in use, time blocked from continuing processing).
7.	Share trade resources (fitting, welding, etc.) across work centers using a common pool
8.	Dynamically track and manage the defined flat space areas within the ship yard, tracking which areas are being used for block storage, block production, and hull erection.
9.	Allow blocks being moved to an area for storage or production to be able to claim a contiguous area of sufficient size to place or build the block
10.	Output usage statistics for gantry cranes and transporters
11.	For a scenario, output: • Ships/year • Average days early/late to schedule
12.	Utilize run-time graphics for visual testing of model or ideas
13.	Generate text, graphs, and tables that could be utilized in business reports
14.	Model transport time for key material movement resources

4 SYSTEMS DEVELOPMENT APPROACH

This section describes the approach used to develop the LSMS from establishing requirements through implementation.

4.1 Requirements Definition and Prioritization

The functional requirements described in this document were developed through the methodology described in section 1.6. They are, for the most part, general in nature to summarize the operational intent of the LSMS and understand initial scope of the system. While the project team agreed that these requirements carried equal weight initially, the constraints listed in section 1.5 may require a prioritization of features, with a limited number of features being developed in the final system. This prioritization can only occur with an additional detailed understanding of modeling strategies, system architectures, and available input information. These are the focus of the process steps described in sections 4.2 and 4.3 below.

4.2 Researching and Evaluating Modeling Strategies and Architectures

Concurrent with the development of an Initial Design Specification described in section 4.3, modeling strategies and architectures will be researched and evaluated for application in this project. These functional requirements, in conjunction with the detailed information developed during the creation of the Initial Design Specification, will be used to target and evaluate certain modeling and architectural approaches. The evaluation process will conclude with the selection of a target strategy based on the functional requirements and discussion with the system users and project team.

4.3 Design

An Initial Design Specification will be created during the design process. The Functional Requirements Document and evaluated modeling strategies and architectures will be key inputs to the specification. While the Functional Requirements Document deals with the "what" of the LSMS, the Initial Design Specification will explain the "who, where, when, and how" of the system. It will be developed to a level of detail that will facilitate:

- The project team's ability to implement the LSMS functional requirements within the constraints listed in section 1.5
- The prioritization of the functional requirements should implementation not be possible without a reduction in scope
- The development of prototype elements of key system functions
- An understanding of the expectation for testing and validation of the system
- The development of a Final Design Specification for the LSMS

The Final Design Specification will detail the design of the LSMS with specifics on software, architecture, programming, database design, modeling approach, testing, and model validation. Its development will be based upon the Initial Design Specification and results of the prototype elements created.

4.4 Construction and Testing

Prototype elements of key LSMS functions will be developed prior to the building of the final system. These prototypes will demonstrate the feasibility of the modeling and architectural concepts. Programming of the prototypes will be done in a way to facilitate their possible use in the final construction of the LSMS. Selection of the key functions to be prototyped will be made upon completion of the Initial Design Specification. It is anticipated that the user group will have the opportunity to see demonstrated, or preferably, operate the prototype elements to better understand and provide input on the programmed functions. The Final Design Specification, and possibly the prototype elements themselves, will be used in the construction of the implemented version of the LSMS.

Testing of the LSMS will occur through a multi-layered approach consisting of unit testing, an alpha system test, a beta system test, and model validation. Unit tests are conducted by the software developers during programming to ensure bugs in individual modules have been identified and corrected.

During the alpha system test, a small group of project team members will test the LSMS as a system to eliminate any additional bugs at the module level and to identify and correct issues at the module interfaces. As the alpha test team members identify bugs, they will communicate any issues discovered to the developers, through some electronic means (such as emails, word documents with screen shots posted into them, video screen capture, etc.), to be documented in a common project location (potentially the project website on GD NASSCO's eSupply Network (ESN). This common project location should be used such that users and programmers will visually see these issues and be able to replicate them for bug fixes or a possible future feature request. All alpha system test issues that are identified will also be tracked in a bug ID database in efforts to communicate between the test team and the developers who are assigned to fix the bug. In the beta system test, members of the user group will test the LSMS to identify issues at the user interface. Issues will be posted to the common project location as in the alpha system test, and will be tracked in the bug ID database.

In the model validation phase the LSMS will be tested in its ability to produce accurate forecasts of future production scenarios. The expectations for the testing and validation processes will be described in the Initial Design Specification. The test plans will be detailed in the Final Design Specification.

4.5 Implementation

Near the completion of the LSMS, user documentation will be developed describing the system, its use, and installation requirements. The LSMS software will be installed on the computers of the user groups at the implementation yard, GD NASSCO.

APPENDICIES

APPENDIX A

Computer Simulation Project Definition Template

For

The Large Scale Computer Simulation Modeling System for Shipbuilding Project

Industrial Engineering Department

June 9, 2008

Purpose of this Document:

Because of the nature of computer simulation modeling, it is very important to maintain a clear focus on the goals of the project. Many simulation projects fail due to a lack of clearly defined objectives created at the onset. These questions are meant to help solidify the goals of the project and to guide the modeler and customer in building a computer simulation model that will meet the needs of the project team.

Response Key

MASTER PLANNING DEPARTMENT Responses
INDUSTRIAL ENGINEERING DEPARTMENT Responses
TECHNICAL INFORMATION SYSTEMS DEPARTMENT Responses
BENDER SHIPBUILDING AND REPAIR Responses

Project Definition Assumptions

State any overall assumptions used in completing this template.

1. All responses based on system boundary of steel yard to hull erection, outfitting and steel processes.
2. While MACPAC and Total Schedules are available, first round responses were based on not using these detail planning tools since updating the model with the information on a regular basis may prove cumbersome without significant process and tool development.
3. Input and process data will include other aspects of the shipyard above and beyond that of just steel.
4. While the first iterations of the process and the model will use higher-level detail, it is assumed that as the model is tested it can be given further detail based on what the user can provide.
5. The model will be only providing detail at the same level as detailed as the rates and date provide.
6. That the different building blocks of the model will be kept separate and compiled before the run of a model. Which will allow the team members the greatest range of usability of the model.
7. Open source code for the model and process rates to allow future changes and growth of the model.

Simulation Objective(s):

Prioritize each objective by placing a number in the priority column (1 is the highest priority), and briefly specify the expected result for each category selected.

Priority	Type	Specify
6	Performance Analysis	
1, 1, 1, 1	Capacity Analysis	Develop a capacity analysis package for the yard with rules and logic to connect the influence of upstream and downstream work centers due to capacity constraints (area, manning, cycle time, etc.) and allow for secondary routing to alleviate bottlenecks automatically. Allow for drill down of information to investigate issues. Ability to identify bottlenecks and slack resources.
2	Capability Analysis	
3, 2, 5, 3	Comparison Study	Report on common metrics comparing the strength of several defined scenarios relative to each other. An example of such a metric is tons/year. Allow for the alteration of facilities, product, and/or schedule.
4	Sensitivity Analysis	
2, 3, 9, 4	Optimization Study	For a given scenario, determine the most acceptable level of performance for that system based on the defined criteria.
7	Decision/Response Analysis	
3	Constraint Analysis	
8	Communication Effectiveness	
2	Resource Analysis	Develop a resource analysis for the shipyard based on capacity, product flow and other related constraints.
	Other	

Simulation Objective Statement:

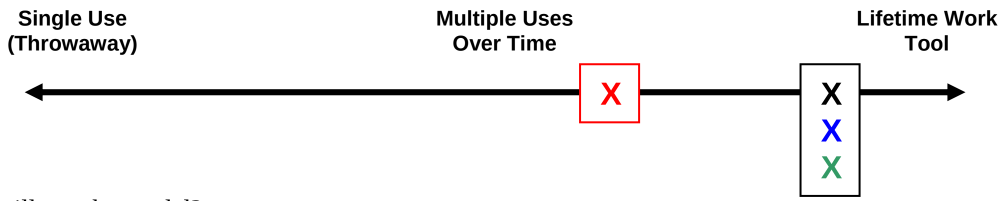
State the simulation objective based on the category responses in the text box below.

Create a simulation model that will utilize rules and logic to explore the upstream and downstream yard-wide effects of capacity constraints. Incorporate programming to allow for changes in facilities and process, as well as, the ability to drill down into information for detailed analysis. Include overall summary metrics for comparison of competing scenarios and the ability to identify the most acceptable level of scenario performance for a given set of inputs.

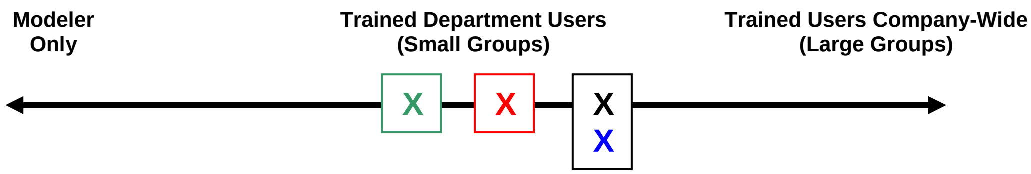
Questions about the Model:

Drag the "X" to the range on the arrow that best describes the question.

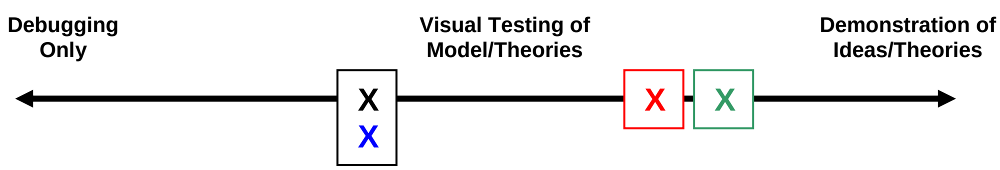
1. What is the lifetime of the model?



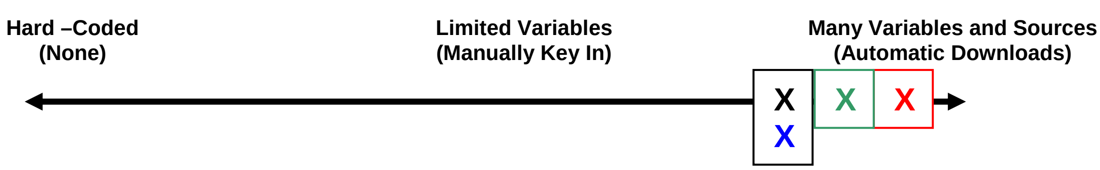
2. Who will use the model?



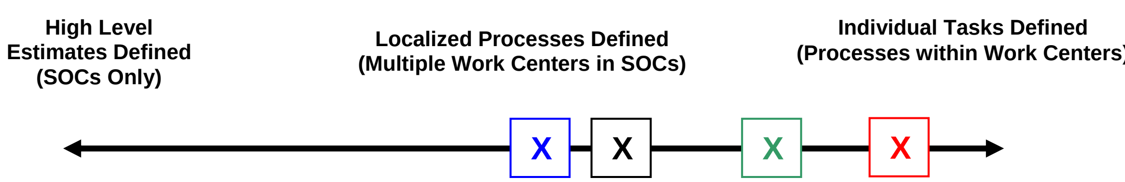
3. What will the graphics be used for?



4. What level of flexibility to change the model is desired?



5. What level of process detail is to be programmed in the model?



NOTES
I think the three key aspects are outputs, flexibility, and level of detail. Hopefully, as more detail is available it can be added to the current process detail level.

Questions About the Input Information:

Place an "X" in the text box next to the available information type. Drag the "X" to the range on the arrow that best describes the available information.

1. What type of input information is available?

X	Schedule	Milestones	Blocks and Subassemblies	All Parts in Ship
X	Product Sequence	Random	Sequence Only	Scheduled
X	Work Flow	By SOC	By Work Center	By Machine or Process
X	Rates	Composite	Averages by Task/Type	Distributions by Task/Type
X	Work Content	By Work Center	By Product Type	For All Products
X	Layout	General Diagram	Basic Measurements	Actual Layout
X	Downtime	Summary	Overall Duration/Frequency	Distributions for Duration/Frequency
X	Products and Quantities	Blocks	Subassemblies	Fabricated Parts
X	Resource Quantities and Specs	Summary	Numbers by Resource	Numbers and Performance Details
X	Other			

Manhours for blocks and subassemblies.

2. Based on the above responses, what is the overall level of Input detail?

Drag the "X" to the range on the arrow that best describes the question.

High Level Rough Estimates ← X X → X X Detailed System Information

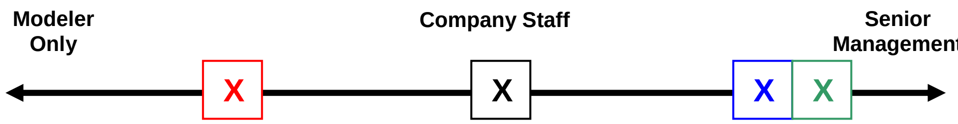
Averages and Constants

NOTES
The issue is that there will be some that is high level (forecast work) and some quite detailed (current work)

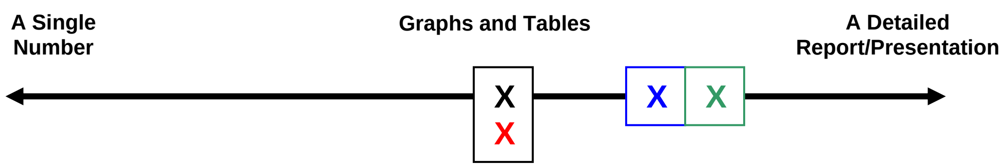
Questions About the Output Information:

Drag the “X” to the range on the arrow that best describes the question.

1. Who will the output results be presented to?



2. How will the information be presented?



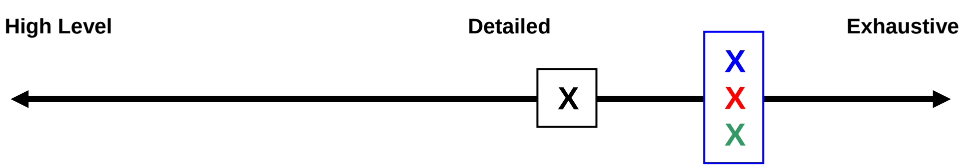
3. What is the level of output should be tracked by the simulation model?

4. What are the desired measurements?

Prioritize each measurement by placing a number in the priority column (1 is the highest priority), and briefly specify the expected metric for each measurement category.

Priority	Measurement	Specify
4, 1, 4	Utilization	Area utilization, summary manning utilization
1, 2, 1	Throughput	Tons/year, parts/day, SA/day, blocks/week
5, 7	Cycle Time	Possible both (actual work time and total idle/work)
2, 3, 4, 3	Manhours	Manhours by major trade / week
7	Work Load Targets	
6, 8	Duration	
8	Production Output Sequence	
3, 2, 3, 2	Area Use	Spaces/week in storage, SOC 3 and 5 Time in Storage and Production areas (day/area)
8	Handling	Amount and duration of handling (#/time/unit breakdown)
4, 5	Other	Crane lifts/day (not including “other work”)

5. Based on the above responses, what is the level of output detail desired from the model?



NOTES

Model/Input/Output Requirement Agreement:

Are the responses to “Model Question #5”, “Input Question #2”, and “Output Question #5” in the same range?

X, X	Yes	X, X	No

In order to fully achieve the objectives of the project, the ranges of these three questions should nearly match. If there are differences, the project should be re-evaluated based on the lowest level of detail.

NOTES
I think so.