SEER® for Manufacturing: Parts, Process & Assembly

SEER project estimation and management solutions significantly improve success rates and reduce costs on complex projects. Based on sophisticated modeling technology and extensive process data, SEER solutions help organizations assess up-front project feasibility, optimize project costs and schedules, assess risk, and develop detailed project plans.

All SEER solutions are built on the same design principles, incorporating the following application elements:

- Annotated and guided interface for defining projects
- Parametric estimating engine
- Extensive, project-applicable Knowledge Bases
- Numerous standard and custom reporting options

Open architecture and APIs ensure that SEER applications can be easily integrated with productivity solutions and enterprise applications.

A DIFFERENT KIND OF PROJECT PLANNING

The best design in the world is destined to fail if it can't be efficiently and reliably manufactured. Where CAD and PDM tools focus on *product* features and function, SEER for Manufacturing (SEER-MFG) formerly SEER-DFM, focuses on simulating, estimating, and optimizing *process* options (cost, schedule, labor, material and tooling), and can be used to model virtually any manufacturing operation, including customer-defined processes. More than 75 manufacturing processes are pre-configured in the core SEER-MFG solution. Design engineers, manufacturing engineers, procurement specialists, finance and others can assess costs and ways to reduce cost.

NOT-SO-BEST PRACTICES ELIMINATED

For many companies, product costing is a fragmented activity calculated across multiple departments, using different levels of automation and different costing tools. Lines of Business managers provide cost targets based on customer demand and competitive constraints. Design engineers work from CAD-generated bills of materials. Shop-floor managers base cost estimates on actual materials inventory, acquisition costs, labor costs, factory availability and overhead, and tooling and production costs. And if prototypes are involved, this process will often have to be repeated a number of times before a product is ready for production.

Not only is this process expensive time-consuming, and error-prone, it also misses opportunities for design and manufacturing to work together as early as the conceptual design phase to expedite go/no-go decisions and optimize design for manufacturability and production costs.

SEER for Manufacturing parametric models enable organizations to model and test manufacturing processes and trade-offs when the design is very preliminary and little detail is known, and to refine process plans as information becomes available (*pro-active* vs. *reactive* product costing).

WHAT IS PARAMETRIC MODELING?

Parametric methods are very useful for subjecting uncertain situations to the rigors of a pre-defined and proven mathematical model. They can usefully embody a great deal of prior experience and are less biased than human thought processes alone.

Parametric modeling takes its name from the project parameters or variables that are modified during the project simulation process. Parametric models are built from sets of mathematical equations.

It is the sophistication of the data analysis methods and the extensiveness of the underlying project data which determine the effectiveness of the modeling solution. And since every manufacturing organization has custom processes, SEER-MFG provides significant capability to add those unique processes to the model.

Snap fit versus screw fit, aluminum versus titanium, manual versus automation, ... all these decisions can be quantified and traded-off to ensure the most cost effective design and lowest manufacturing cost.

DEVELOPING AN ESTIMATE

SEER-MFG enables both casual and advanced users to evaluate process options and tradeoffs impacting such factors as cost of manufacture and assembly, materials selected and the process being used. As with all SEER solutions, users can optimize their manufacturing strategy by performing extensive trade-off analyses – varying assumptions and options to determine which approach is likely to produce the best outcome.

SEER technology provides project results by generating a virtual project based on:

The SEER Modeling Engine:
SEER mathematical models are derived from extensive project histories, behavioral models, and metrics. The SEER-MFG solution employs a multi-faceted approach to project estimating, leveraging industry standards based upon time and motion studies and/or company project histories and proven formulaic

cost relationships. Cost Estimating Relationships (CERs) are applied to the estimate to address organization specific factors such as experience levels, machine capability, tooling requirements, and product requirements, as well as project specific factors such as labor rates, quantities and learning curves.
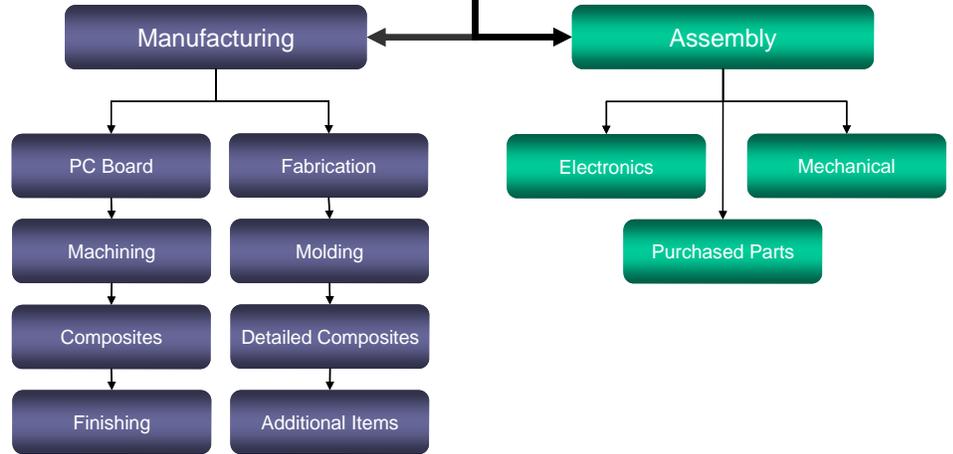
SEER Knowledge Bases:
Serve as a virtual "in-house expert," providing default process definitions, values, ranges, and calibrations based on manufacturing cost drivers.

Together, these capabilities enable users to develop first-look estimates when very little information is known, and to refine those estimates as details become available over time.

SEER-MFG was designed to enable project engineers to fully utilize the data they have available to produce an estimate that can be relied on when making important decisions. As more is known, the estimate can be refined and alternative manufacturing solutions explored without incurring significant time and/or cost penalties.
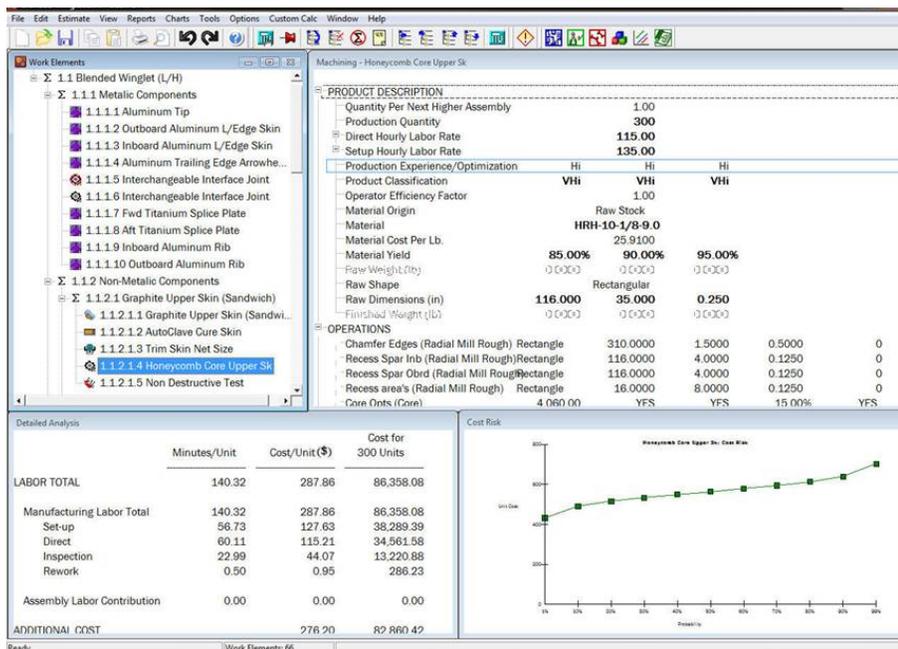
Pre-defined Manufacturing Processes in SEER for Manufacturing

MACHINING
* Conventional & High Speed
* Milling
* Shaping
* Turning
* Boring
* Grinding
* Screw Machining
* EDMing
* Drilling
* Reaming
* Tapping
* Sawing
* Broaching
* Gear Hobbing
* Deburring
* Coring
* Surface Skim (Face) (Rough or Finish)
* Profile (Edge) (Rough or Finish)
* Pocket (Rough or Finish)
* End Mill Slot Angled Faces
* T Sections
* Stringer Run Out

MOLD/CAST/FORGE
* Injection Molding Rotational Molding
* Thermoform Molding
* Sand Casting Die Casting
* Investment Casting
* Forging Powdered Metals

FINISHING
* Air Gun Spray Thermal Spray
* Electrostatic Vacuum Metalize
* Dip Chromate/Phosphate
* Electrocoat Electroplate
* Brush

PC BOARD ASSEMBLY
* Board Fabrication
* PCB Assembly/Solder

ELECTRICAL ASSEMBLY
* Cable
* Harness

COMPOSITES
* Layup
* Filament Winding
* Pultrusion
* Composite Spray

DETAILED COMPOSITES
* Composite Processes
* Hand Layup
* Automated Tape Layup
* Resin Transfer Molding
* Liquid Resin Infusion
* Resin Film Infusion
* Hot Ply Forming
* Consumables
* Materials
* Curing
* Autoclave
* Oven
* Part Finish
* Trim
* NDT

MECHANICAL ASSEMBLY
* Fasteners
* Riveting/Staking
* Gas Flame Welding
* Arc, MIG, TIG Welding
* Electron Beam Welding
* Spot Welding
* Brazing
* Adhesive Bonding

FABRICATION
* Shears-Brakes- Punches-
* CNC
* Turret-Laser Cut
* Gas Flame Cut-Plasma Arc Cut -
* Dedicated Tool & Die
* Progressive Die -Spin Forming
* Tube Bending- Plate Roll Bending

TUBE, FAB, WELD & PROCESSING
* Cutting
* Bending
* End Prep
* Pressure Test
* Weld
* Finish

ROLLUP
* Aggregate Subordinate Work Elements
* Use for:
  * Organizing operations into routing steps
  * Separating alternative methods for comparison

PURCHASED PARTS
* Enables you to incorporate purchased parts into your assemblies, "Bill of Materials" items

ADDITIONAL ITEMS
* Model any operation in terms of:
  Setup Time
  Rework Time
  Direct Time
  Material Cost
  Inspection Time
  Tooling Cost
* Use custom calculations template to insert parameters and equations

AVAILABLE IN ALL PROCESSES
* NDT
* Part Mark & Package
* Setup & Run Labor Rates
* User Defines
* Tooling Inputs
* Inspection & Rework

USING & DOCUMENTING RESULTS

SEER for Manufacturing provides a common platform for both internal product assessment and for use across the extended enterprise and supply chain. Users can quickly evaluate top-level metrics such as quantity and rates, as well as drill down into detailed metrics such as tolerances and machining options. For specialized processes, users can define, modify, or enhance the SEER process library using the custom calculation functionality. A variety of charts, graphs, and reports are available for quickly summarizing and presenting SEER model outcomes and alternatives, as well as work-in-progress. Results can be documented and shared using SEER's

rich reporting capabilities, or can be exported to Microsoft Office, CAD, PLM, ERP and numerous other 3rd-party applications.

Portability ensures that users can exchange results with customers and suppliers and undertake trades studies in real time.

"SHOULD COST" MODELING FOR BEST PRICING

"Should cost" modeling (knowing what supplier's costs should be) ought to be a cornerstone when outsourcing manufacturing. SEER-MFG provides credible and defendable estimates of manufacturing and assembly costs, and allows for the evaluation of alternatives that directly impact the cost to manufacture. "Should cost" modeling with SEER-MFG facilitates proactive, real time cost impact assessments of design alternatives for today's global sourcing environment.

SEER-MFG provides the necessary knowledge, data and framework to empower a procurement organization with the necessary information to determine fair market pricing when negotiating a given commodity from a given vendor.

By arming the procurement personnel with SEER-MFG, procurement managers enhance supplier negotiations and maximize profitability through the optimization of different critical parameters, such as selection of optimum materials, manufacturing processes / operations, set-up and tooling amortization, lot sizes and automation levels. SEER-MFG provides the commodity managers with access to the necessary variables to increase the user's

ability to evaluate product pricing from different perspectives and interactively obtain the best price possible.

EXTENDED CAPABILITIES

The SEER-MFG product family includes options for extending the capabilities of the core SEER solution:

SEER Aerostructures

Provides additional process libraries and covers all types of composites:

- Part shape
- Build-ups and cores
- Materials and resins
- Material cutting and bagging processes
- Consumable materials
- Part shape
- Build-ups and cores
- Materials and resins
- Material cutting and bagging processes
- Consumable materials
- Hot-ply forming, curing, and trimming
- Other aerostructure-specific fabrication and assembly processes

SEER-Aerostructures was developed in conjunction with the U.S. aerospace industry's leading companies, with sponsorship and participation of the U.S. Air Force and Navy. At the CAI Final Technical Review, held in April 2006, SEER-Aerostructures was recognized as one of the three most significant technology transitions since the inception of the program in 1996.
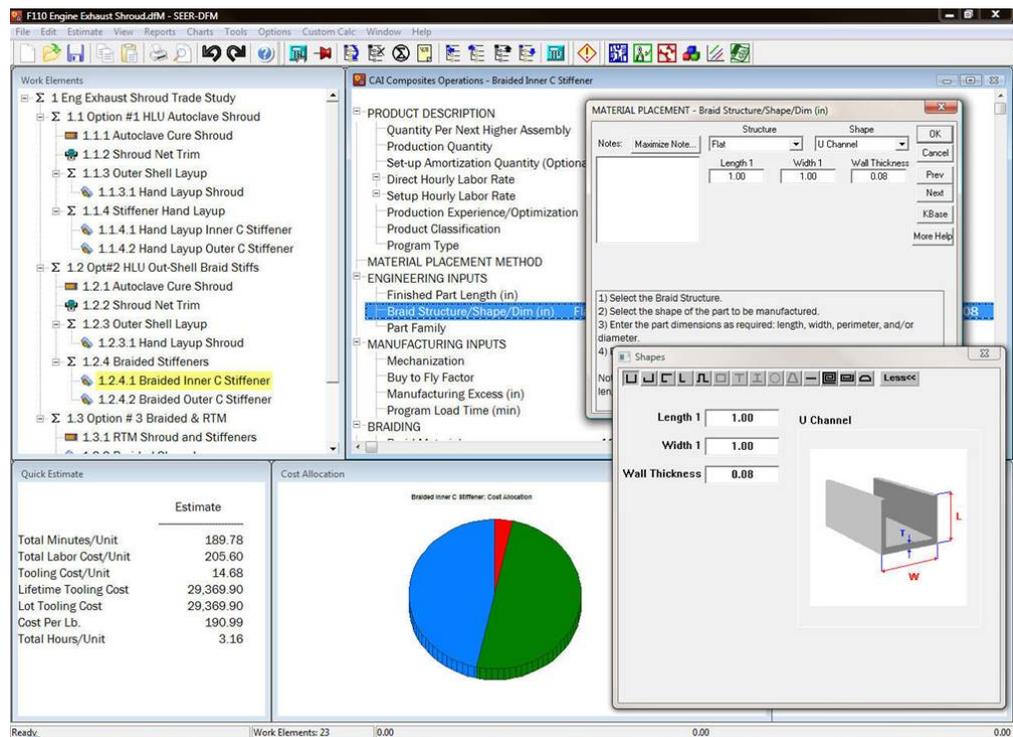
ABOUT GALORATH

Galorath has invested more than two decades developing solutions to help government and commercial organizations plan and manage complex projects. SEER solutions combine an intuitive interface, extensive project-applicable knowledge bases, sophisticated project-modeling technologies and rich reporting features to expedite the planning process and keep projects on track.

SEER solutions are employed by thousands of users worldwide in financial, manufacturing, high-technology and government institutions to obtain a rapid and powerful view of the critical factors driving program decisions and success.

- Ensures that all estimates are managed via a single estimation solution ensuring consistency, simplifying training, and reducing the effort needed to manage and maintain the estimation environment.

- Provides realistic cost estimates for labor, material, tooling, set-up, and re-work.

- Identifies costs drivers early in the design process.

- Evaluates parts, processes, and assemblies.

- Enables users to test, manage, and optimize manufacturing and assembly costs and risk trade-offs.

- Assesses both productivity and efficiency.

- Provides an objective basis ("should-cost" model) for evaluating supplier estimates.

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