



G A L O R A T H



The SEER Requirements Based Costing Project

© Galorath Incorporated 2007

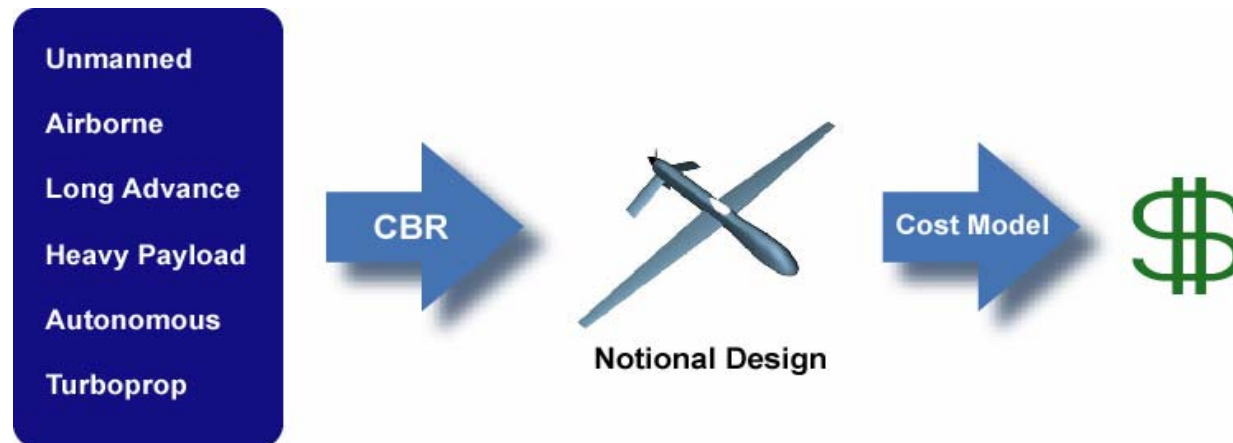
SEER® is a registered trademark of Galorath Incorporated

SEER-SEM™, SEER-H™, SEER-DFM™, SEER-AccuScope™, SEER-PPMC™, SEER-ProjectMiner™, SEER-DB™, SEER-RDB™, SEER-CriticalMass™, SEER-ScatterPlot™, SEER-SEM Client™ for Microsoft Project™, SEER-IC™, SEER-Spyglass™, & SEER-RateMaker™ are trademarks of Galorath Incorporated.

Microsoft Project is a trademark of the Microsoft Corporation.

Imagine Obtaining Cost Directly From Limited Requirements

Implement a prototype Case Based Reasoning system that can transform high level requirements and specifications into a cost modeling workup within a sophisticated cost estimating tool.



This approach can provide even concept planners with an advanced understanding of the cost of potential designs.



G A L O R A T H

How Case Based Reasoning Works

Case-based reasoning (CBR) is the process of solving new problems based on the solutions of similar past problems.



Combined based
on similarity



***Many tanks contributing
to a new design.***

CBR In Detail



G A L O R A T H

Case-based reasoning has been formalized as a four-step process:

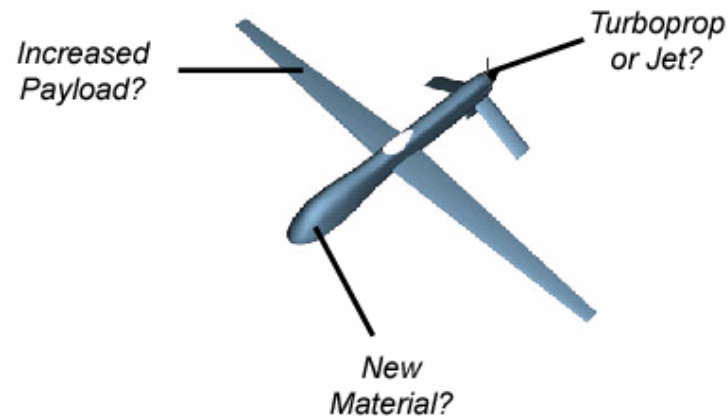
- **RETRIEVE** the most similar case or cases.
- **REUSE** the information and knowledge in that case to solve the problem.
- **REVISE** the proposed solution.
- **RETAIN** the parts of this experience likely to be useful for future problem solving.



G A L O R A T H

Chosen Domain: UAVs

- Choosing a single domain allows us to focus on validating the prototype
- Of immediate use; demand for new UAVs is likely to continue
- Enough missions are available so that adequate knowledge elicitation can occur
- Sufficient cost and requirements information on each mission is available in the public domain



Target Cost Model: SEER-H

fx-222.har - SEER-H

File Edit Estimate View Reports Charts Tools Options Window Help

Work Elements

- Σ 1 FX-222 Estimate Baseline
 - 1.1 Aircraft Equipment
 - Σ 1.1.1 Wing Group
 - 1.1.1.1 Aerodynamic Wing Surf...
 - 1.1.1.2 Secondary Wing Struct..
 - Σ 1.1.2 Tail Group
 - 1.1.2.1 Horizontal Stabilization**
 - 1.1.2.2 Vertical Fin
 - 1.1.2.3 Rudders
 - 1.1.2.4 Support Structures
 - Σ 1.1.3 Body Group
 - 1.1.3.1 Primary Structure
 - 1.1.3.2 Secondary Structure
 - 1.1.3.3 Doors
 - Σ 1.1.4 Alighting Gear Group
 - 1.1.4.1 Main Landing Gear
 - 1.1.4.2 Nose Landing Gear

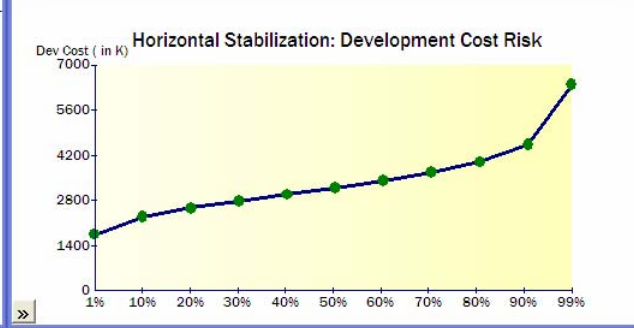
Parameters - MECH: Horizontal Stabilization

PRODUCT DESCRIPTION			
Weight (lb)	434.00	434.00	434.00
Volume (cubic feet)	0.00	0.00	0.00
MATERIAL COMPOSITION			
Percent Aluminum/Malleable Metal	70.00%	80.00%	100.00%
Percent Steel Alloy	0.01%	10.00%	50.00%
Percent Commrc Available Exotic	0.00%	0.00%	0.00%
Percent Other Exotic	0.00%	0.00%	0.00%
Percent Composite	0.01%	10.00%	25.00%
Percent Polymer	0.00%	0.00%	0.00%
Percent Ceramic	0.00%	0.00%	0.00%
Complexity of Form	Low	Nom	Hi+
Complexity of Fit	Low	Nom	Nom+
Construction Process	Nom	Hi	VHi
MISSION DESCRIPTION			
Operating Environment	Air		
Hardware Classification	Secondary Structure		
Operating Service Life	10,000	12,000	20,000
Internal Pressure (PSI)	0	0	0
PROGRAM DESCRIPTION			

Detail Estimate

PRODUCTION TOTAL COST	7,236,474
Material*	318,979
Fabrication	2,005,586
Integration and Assembly	2,437,264
Production Support	934,895
Sustaining Engineering	596,131
Program Management (Prod)	797,613
Tooling Maintenance	146,006
Total	

Development Cost Risk



Horizontal Stabilization: Development Cost Risk

Ready | Work Elements: 29

Demonstration

With these validation cases...

- **Squad-sized FW**

- Introduce tool
- Common case

- **Company-sized RW**

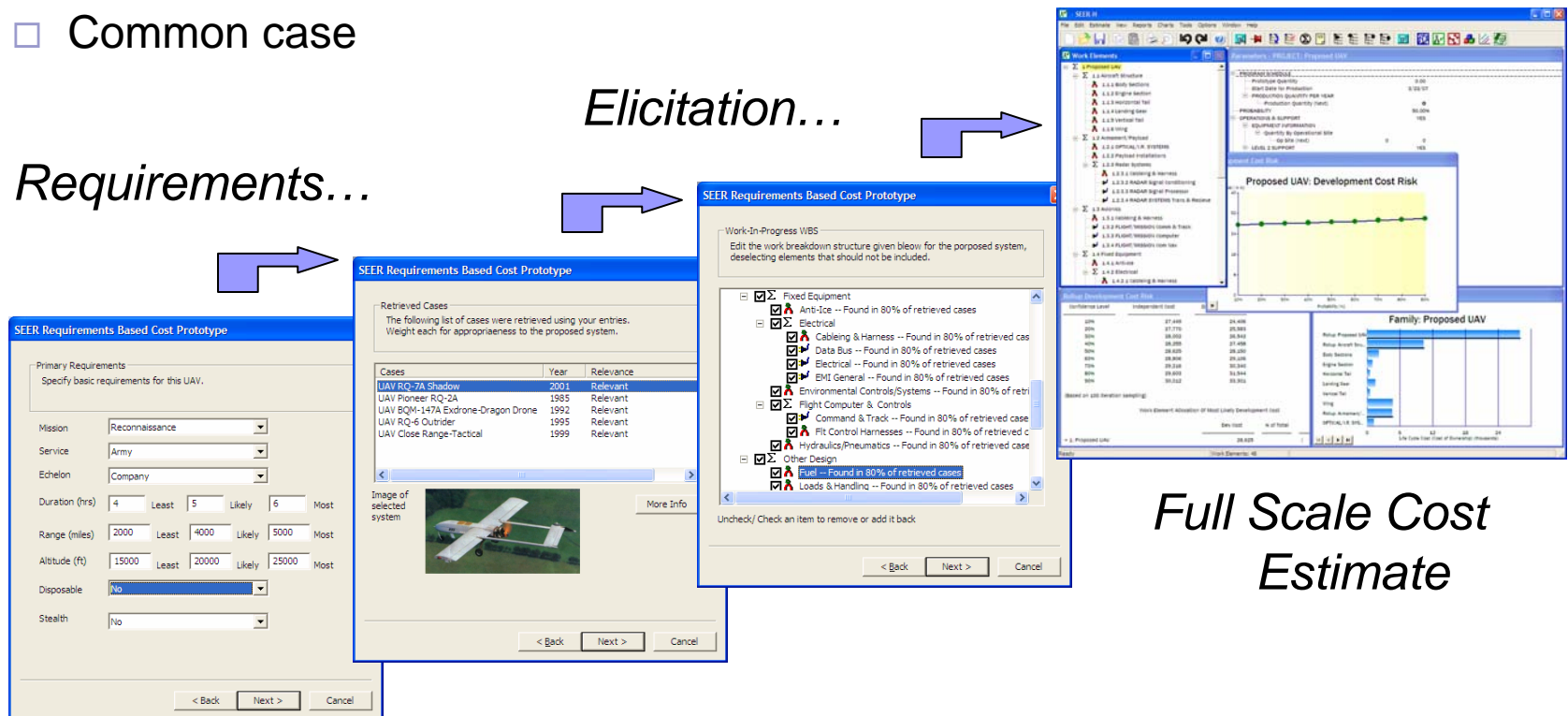
- Common case

- **Command-sized FW**

- Getting additional UAV information
- Refining the design with filters and weights
- Alternative SEER-H Projects

Requirements...

Elicitation...



Full Scale Cost Estimate



Resolving Concerns Over A Case Based Reasoning Approach

“Requirements give too little information for detailed costing”

ANSWER: NO! *The underlying cases used by the Requirements Cost Explorer are very detailed cost modeling projects, developed from prior systems. More and more detailed requirements to the CBR system, to produce results that are generated from any number of criteria. The user also can proceed into SEER-H for extremely detailed specification of the final estimating project.*

“It takes too many systems to train for new domains”

ANSWER: NO! *CBR distinguishes itself by not requiring too much data. As few as a half dozen may be enough prior cases to train a system.*

“New systems don’t look like past ones”

ANSWER: NO! *The user is given ample opportunity to determine relevance of prior systems and to include/exclude WBS elements on the basis of which best reflect the configuration of a proposed system. SEER-H’s many knowledge bases of alternative hardware configurations can also supplement the initial workup.*

“Users must be expert in SEER-H”

ANSWER: NO! *They need only understand the basic requirements of a new concept, in order to obtain a rough order of magnitude estimate. The expertise required for a detailed cost estimate is in all cases reduced over what previously would be required.*

“We want this to work out of the box, without training it”

ANSWER: NO problem! *Phase 2 activities will partially involve training the system to many different types of often-referenced hardware projects. In this way, users will very frequently be able to use the requirements-based costing tool ‘out of the box’.*