Part 3

C·O·S·T ENGINEERING™

„Design and Marketing of Rockets"

Lecture Series given by Dr.-Ing. Robert Alexander Goehlich

- Part 3: Cost Engineering Tools -

Content

- **General**
- **Cost Engineering Tools**
  - TRASIM, TRANSCOST and FINANCE model
  - applications and limitations
  - bottom-up versus top-down cost estimation approach
- **Definition**
  - Cost Engineering (Practice III)
- **Requests from Audience for Lectures**

General
Goal of Today's Lecture

„You will learn about different kind of cost estimation models and their applications and limitations."

General
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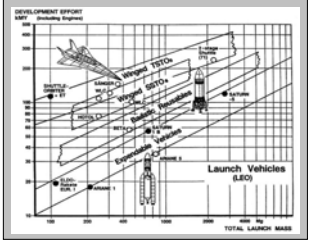
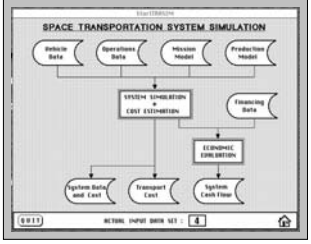
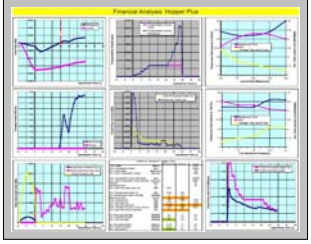
Simulation Tools
Overview

TRANSCOST 7.0 Model	TRASIM 2.0 Model	FINANCE 1.0 Model
A handbook containing 180 graphs and 30 tables to determine rough life-cycle costs on an average basis.	A program processing about 380 input values to determine detailed life-cycle costs on an annual basis.	A program to determine business performances of investigated vehicles.



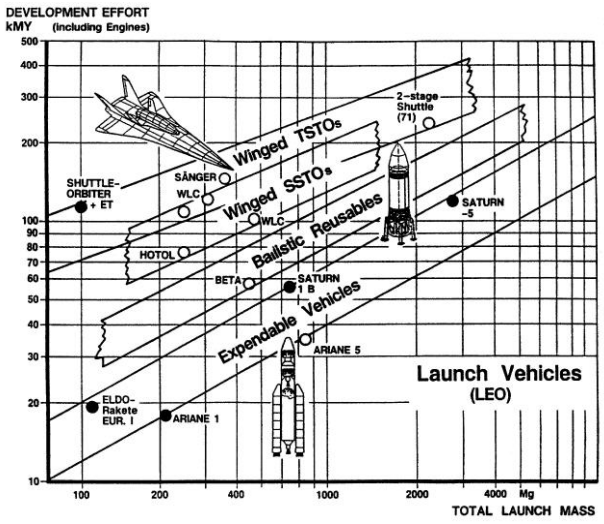




Cost Estimation Model
TRANSCOST

The TRANSCOST 7.0 model is a top-down cost analysis, which means that costs are determined on a system level. Its strength is to provide the user with a first order of magnitude of system costs with an accuracy of ±20 %.

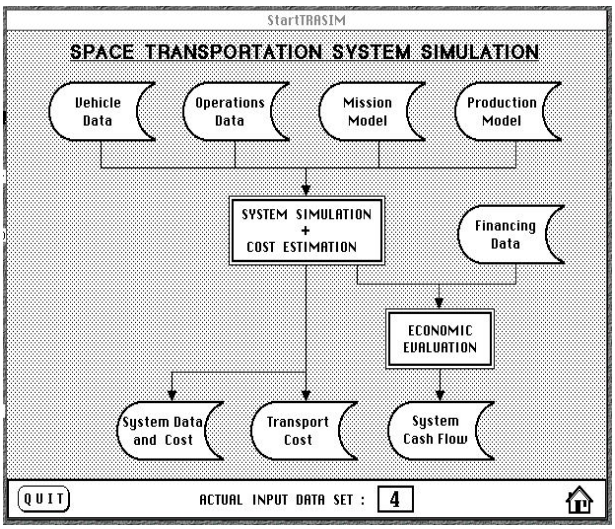
Example of a TRANSCOST Graph (D.E. Koelle)



Cost Estimation Model

TRASIM

The TRASIM 2.0 model is a bottom-up cost analysis, which means that costs are determined on a subsystem level. Its strength is the possibility for the user to identify the cost influence of each subsystem on the space transportation system.

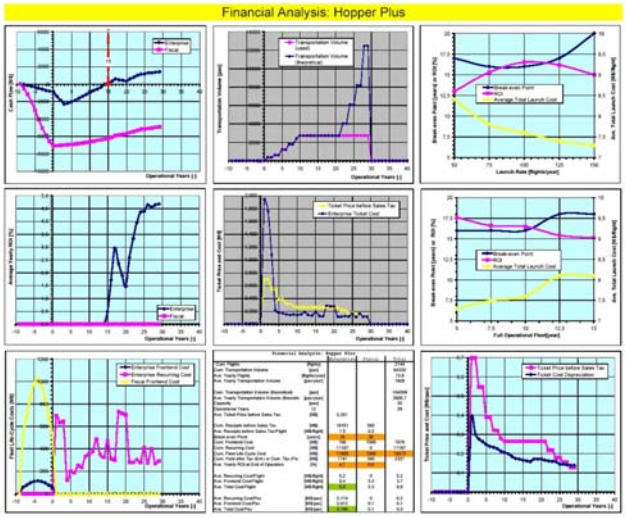


Trasim Main Input Mask (H.H. Koelle)

Finance Estimation Model

FINANCE

The FINANCE 1.0 model is a finance analysis to determine business performances of investigated vehicles. Its strengths is the capability to transform financial data rows into clear graphs and allows to check the sensitivity of each parameter to the overall performance.



FINANCE Output Mask (R.A. Goehlich)

Finance Estimation Model

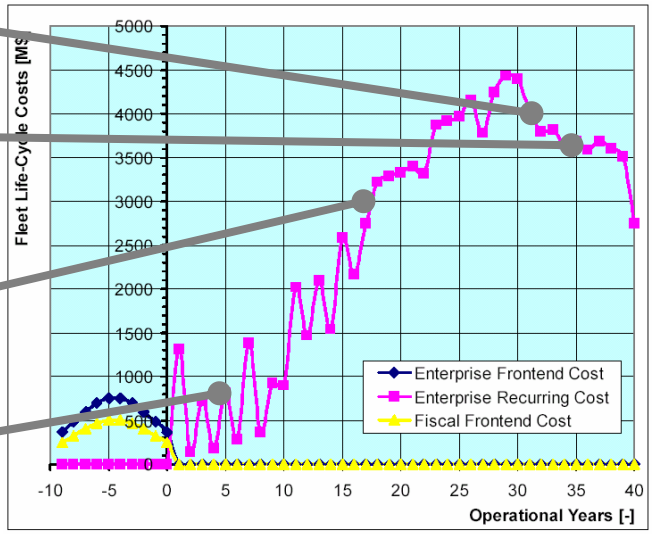
Example: Fleet Life-cycle Costs

Learning Effect

Spares Production

Increasing Number of Flights/Year

Vehicle Production

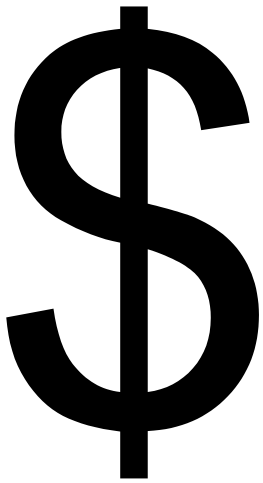


Simulation Tools

Man-Year

Employed cost models use Man-Year (MY) effort as cost value. This is transformed by using a cost conversion value d to equivalent US dollars for fiscal year 2000 concerning field of occupation:

- for development 1 MY is equivalent to $205 000,
- for production 1 MY is equivalent to $200 000,
- for operation 1 MY is equivalent to $220 000
- and for unknown data 1 MY is equivalent to $208 000.



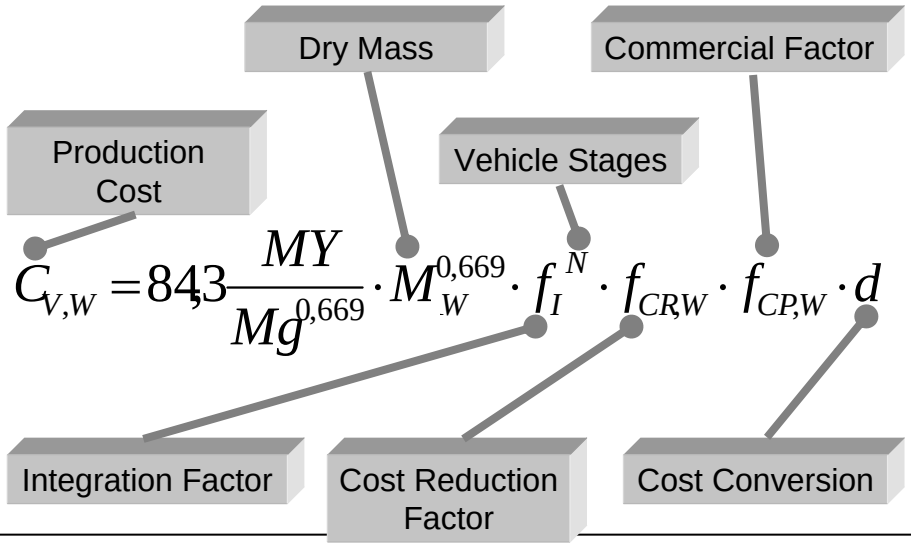
Simulation Tools
Basic Cost Estimation Relationship

The cost models are based on Cost Estimation Relationships (CERs) with the basic form shown here. CERs are equations, which are often mass-related and contain different parameters. These parameters have to be determined by the user. CERs are derived from actual costs including cost of unforeseen technical problems and delays.

$$C = a \cdot M^{x} \cdot \prod f_i \cdot d$$

C	[M$]	Cost
a	[MY/Mg^x]	System-specific constant value
M	[Mg]	Reference mass
x	[-]	System-specific cost/mass factor
f_i	[-]	Assessment factors
d	[M$/MY]	Cost conversion value

Simulation Tools
Typical Cost Estimation Relationship (CER)



Definition

Definition of Cost Engineering (Practice III)

Case C

- *Step 1: Build a Rocket within 15 minutes in a team by achieving minimum life-cycle costs.*
- *Step 2: Discuss within your team, how you can safe costs during development, production, operation and abolition and collect your facts on a flip chart.*
- *Step 3: Present your results.*

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