



**32<sup>nd</sup>** Annual **INCOSYMP**  
international symposium

hybrid event

Detroit, MI, USA  
June 25 - 30, 2022

The V-model as a Passport to Engagement

# Mindful Maturation Matters

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# Introduction / Purpose



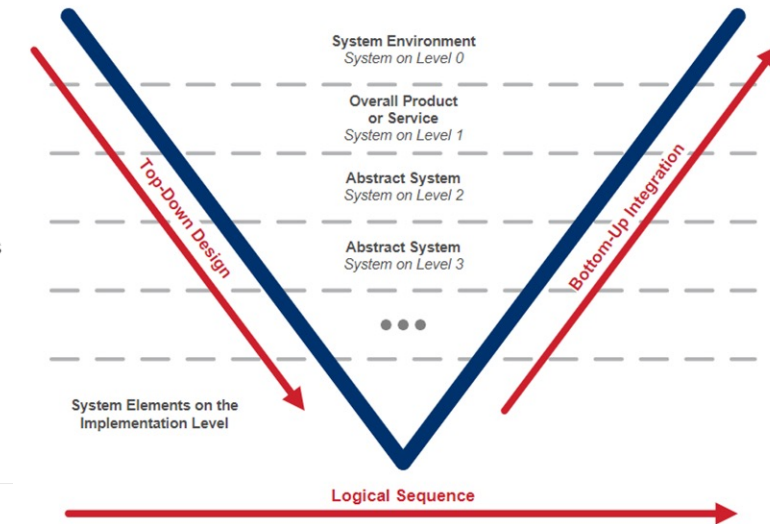
Systems Engineering increases probability of “right first time” system delivery



Achieved by enquiry into situation, and mindful maturation of understanding



From “Engineering Better Care” – Royal Academy of Engineering  
See [Engineering better care - Royal Academy of Engineering \(raeng.org.uk\)](http://Engineering better care - Royal Academy of Engineering (raeng.org.uk))



From Scheithauer, D. and Forsberg, K., 2013, *V-Model Views*. INCOSE IS 2013



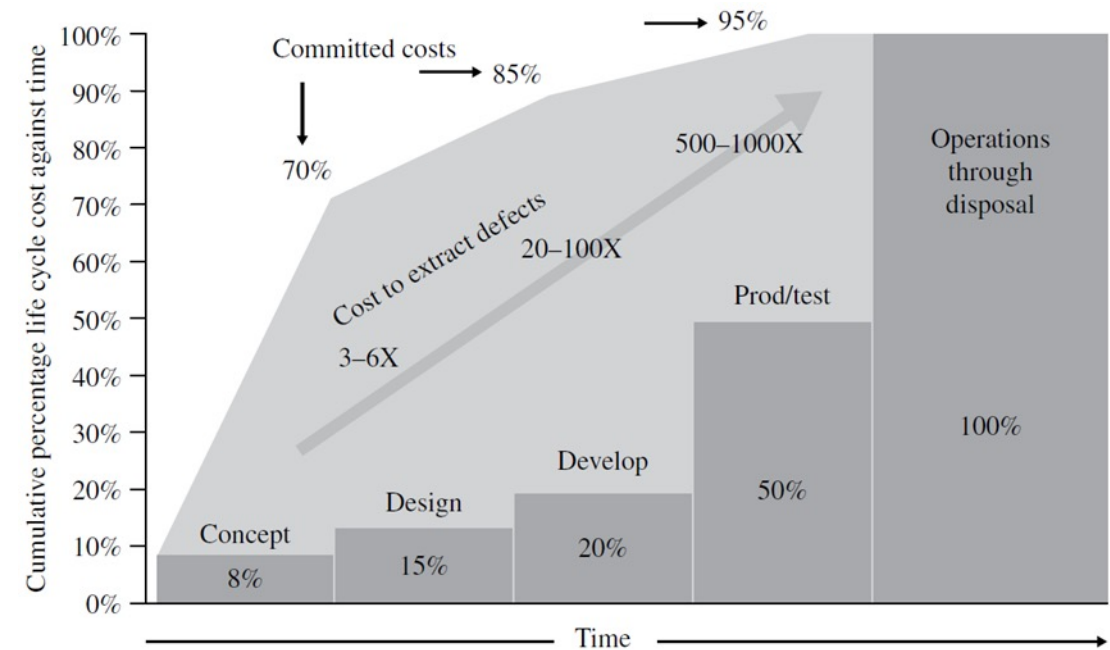
# Data management challenges

Finding problems early is the value of SE

SE practice iterates between

- solution and requirements
- solution elements, and layers

All of this inherently means a high level of change early in the lifecycle



Cost of changes – extract from INCOSE SE Handbook V4

**“No plan survives first contact with the enemy”**

(Helmuth von Moltke, 1871)





... a bit like a model

# Analogies

# Picture Building Analogy

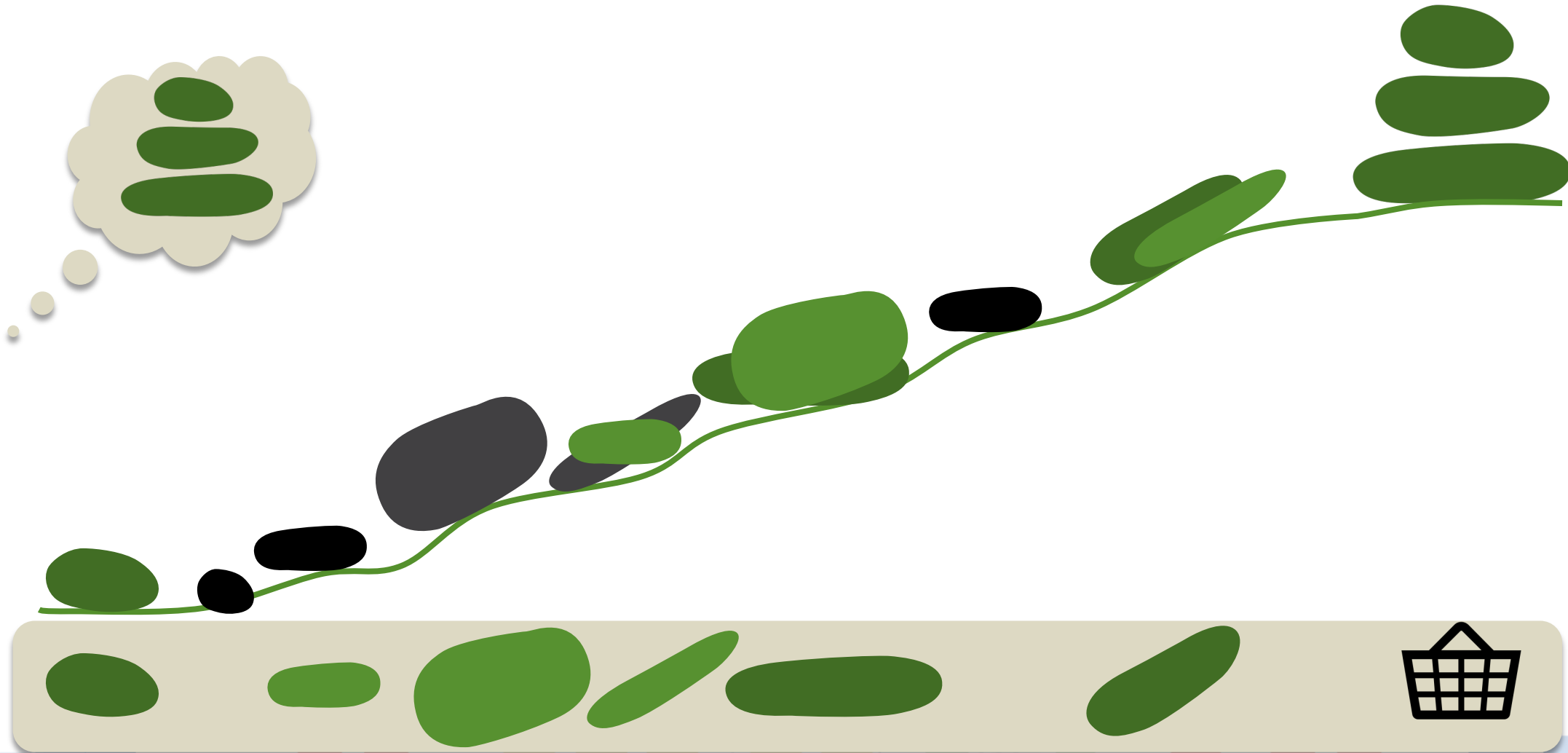


# Sketching

Jean-Auguste-Dominique Ingres, *Sketch for Madame Moitessier and Madame Moitessier* (1851)



# Carrying Rocks Uphill





# Lava Flow





# Jigsaw Analogy



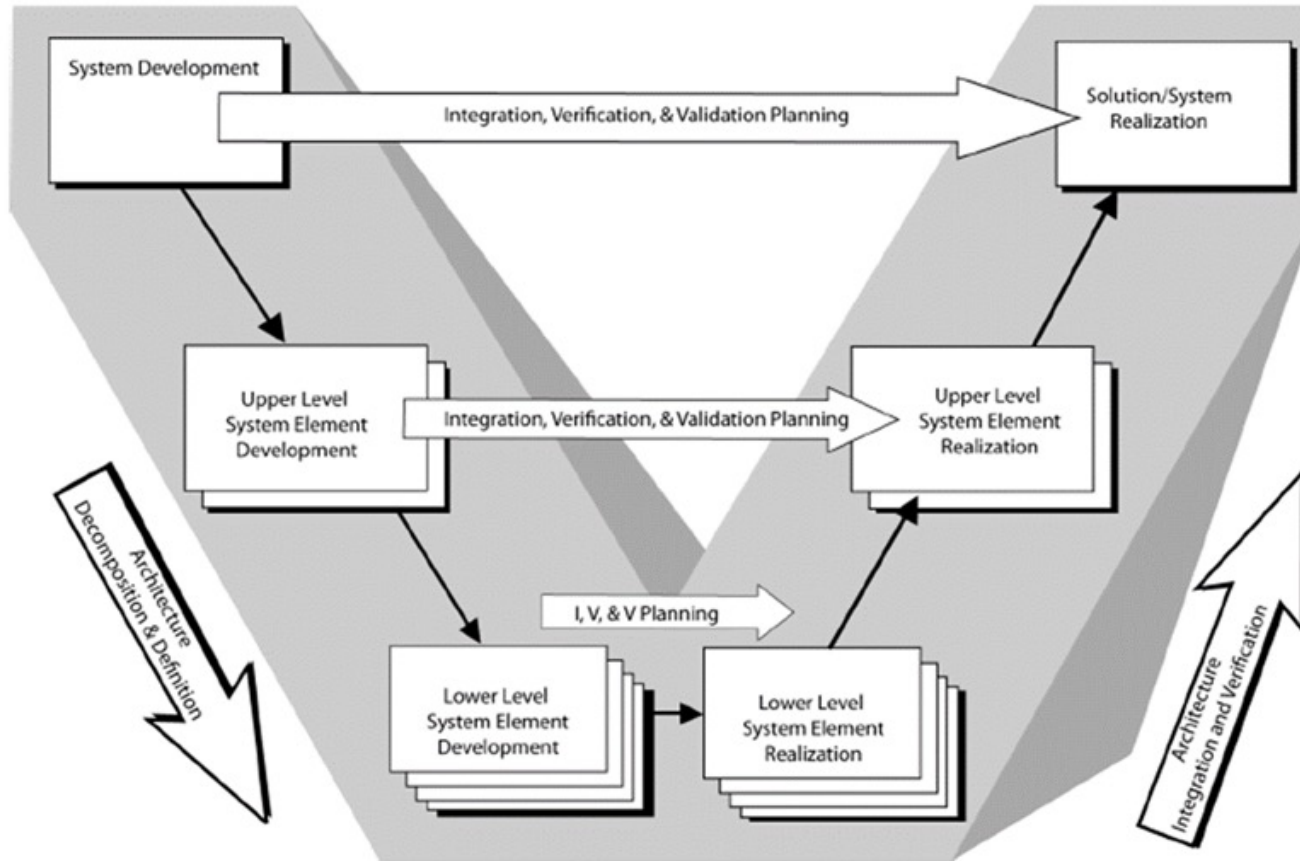




... A model for data (not process)

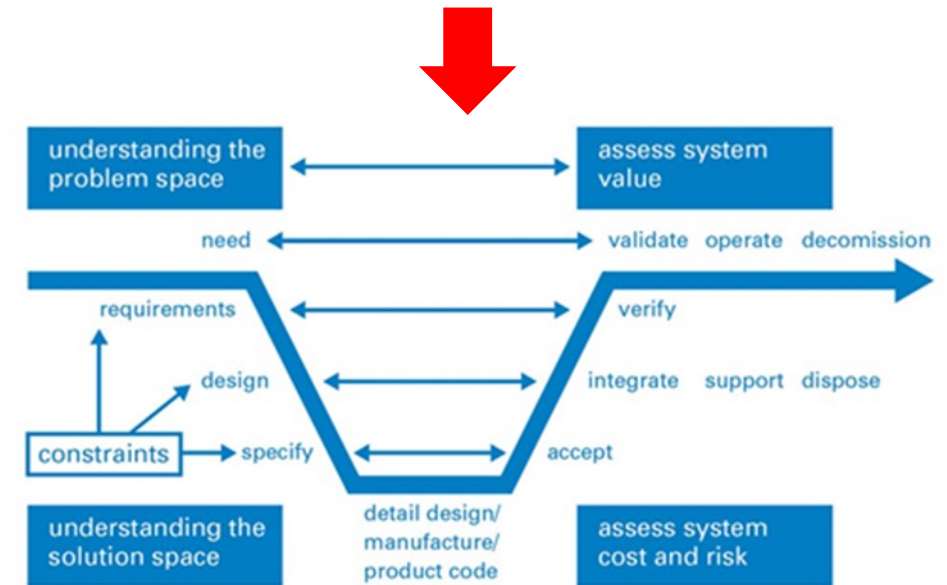
# V-model

# Introducing the V-model



From Chapter 7, Forsberg, Mooz, H., and Cotterman, H., 2005, *Visualizing Project Management* (3rd Edition)

A dangerous oversimplification



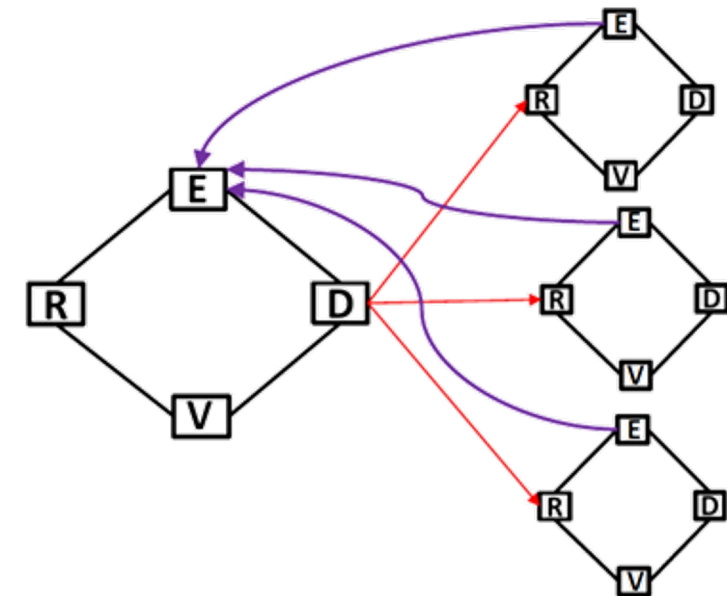
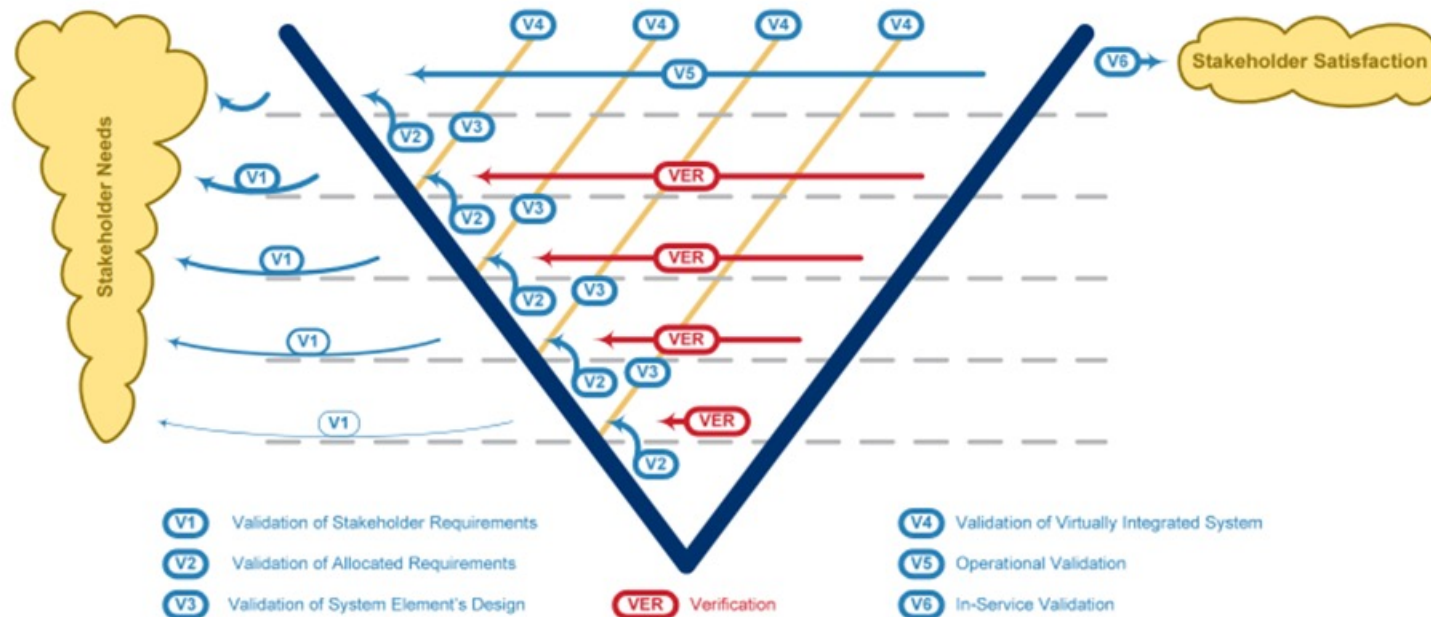
From INCOSE UK, 2020 Z1 – What is Systems Engineering? Creating Successful Systems

# More on the V-model



All data joined up  
Not just  
“Requirements Management”

Assurance Activities in the V-Model: The Assurance V

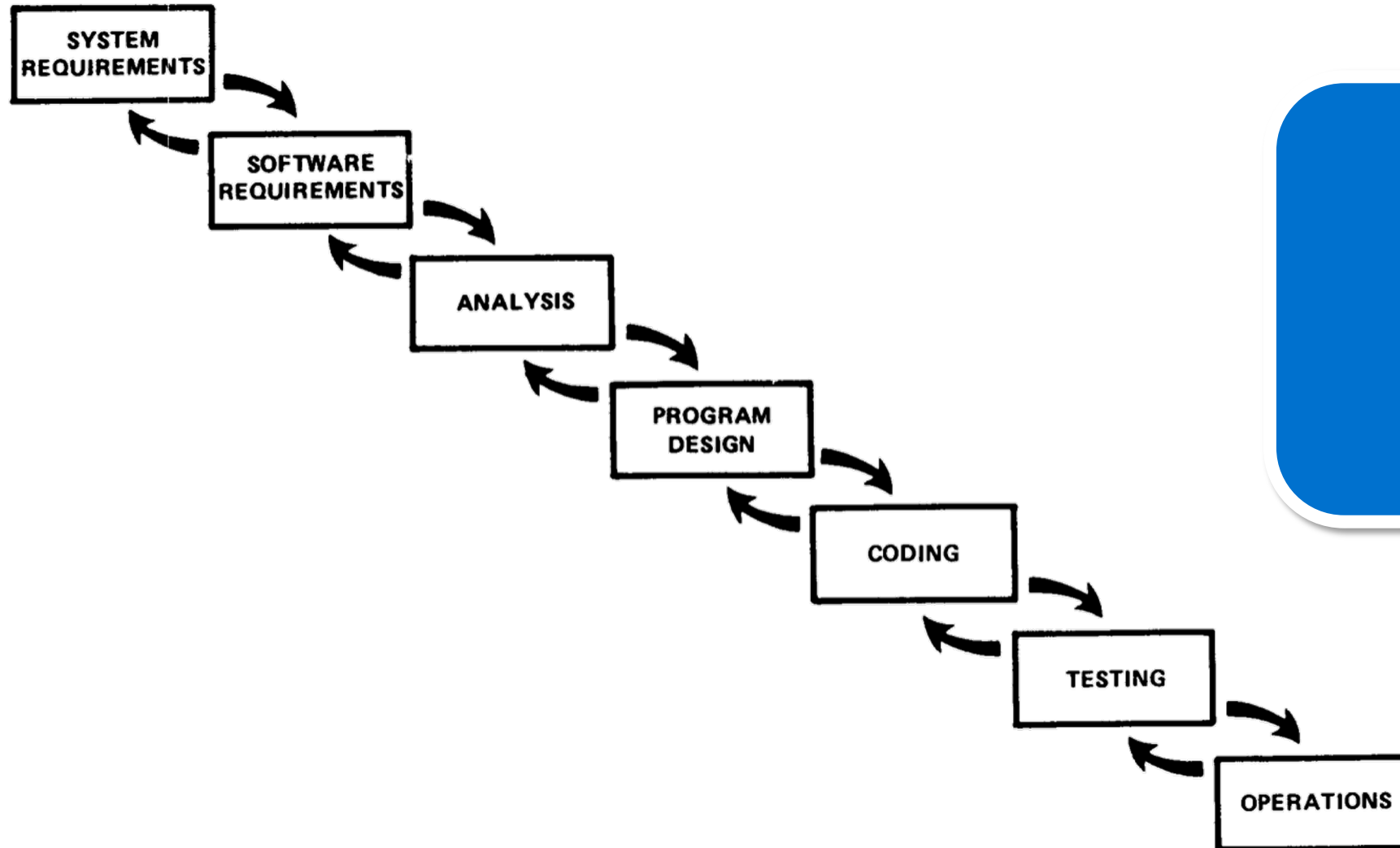


From Scheithauer, D. and Forsberg, K., 2013, *V-Model Views*. INCOSE IS 2013

From Beasley et al., 2018, *Requirements Management or Assurance Management? Keep the data integrated!*, INCOSE Is 2018



# Waterfall versus agile





.... Its hard because it is

# Problems and solutions



# Why is managing data so hard

8

Trying to do Waterfall

Late Change Expensive

Traceability is Effort

Different Data Sources

Single Approach to Change

Sub-Optimisation

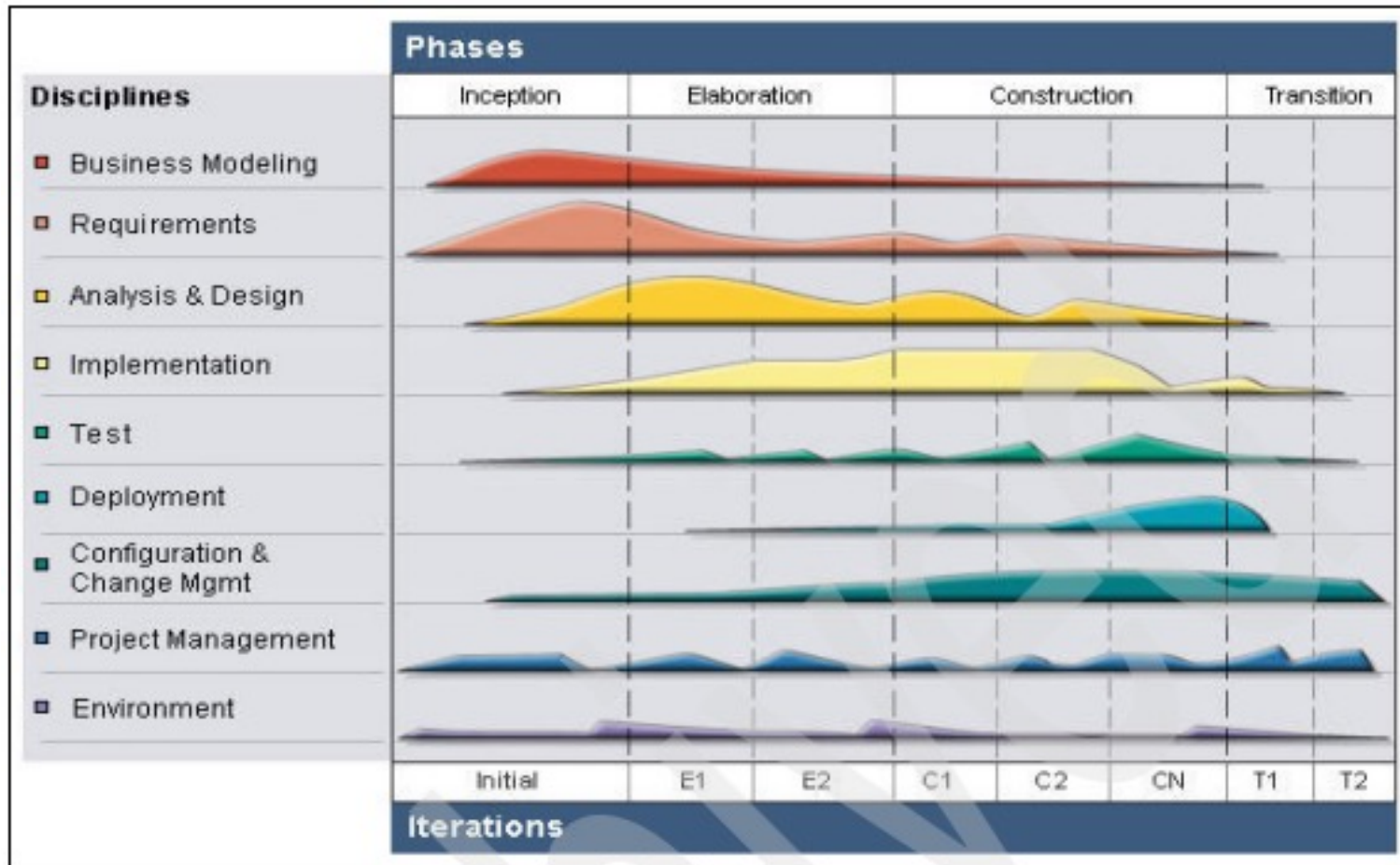
Aversion to Uncertainty

Rush to Solution

Preference for Simple, Linear Work



# Rational Unified Process



From Galic, M, Macissac, B., and Popsecue, D., 2006, *Using a Single Business Pattern with the Rational Unified Process (RUP)*



# Solutions mapped to problems

Trying to do waterfall  
Late change expensive  
Traceability is effort  
Different data sources  
Single approach to change  
Sub-optimisation  
Aversion to uncertainty  
Rush to solution  
Preference for simple, linear work

Understand Information Matures

Manage ALL solution information

Vertical and Multidisciplinary teams

Change attitude to change during  
lifecycle

Capture data then clean up

Authoritative source of the truth

Result is not the journey (hide the path)



# Solutions N-Squared

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Manage ALL  
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Vertical and  
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... a bit like a summary

# Conclusions



# Conclusions

With Systems Engineering it is getting the **first time solution correct**, not each interim step, that is important

Systems Engineering IS an ITERATIVE discipline, the **data matures during the iterations**, and needs to be managed appropriately

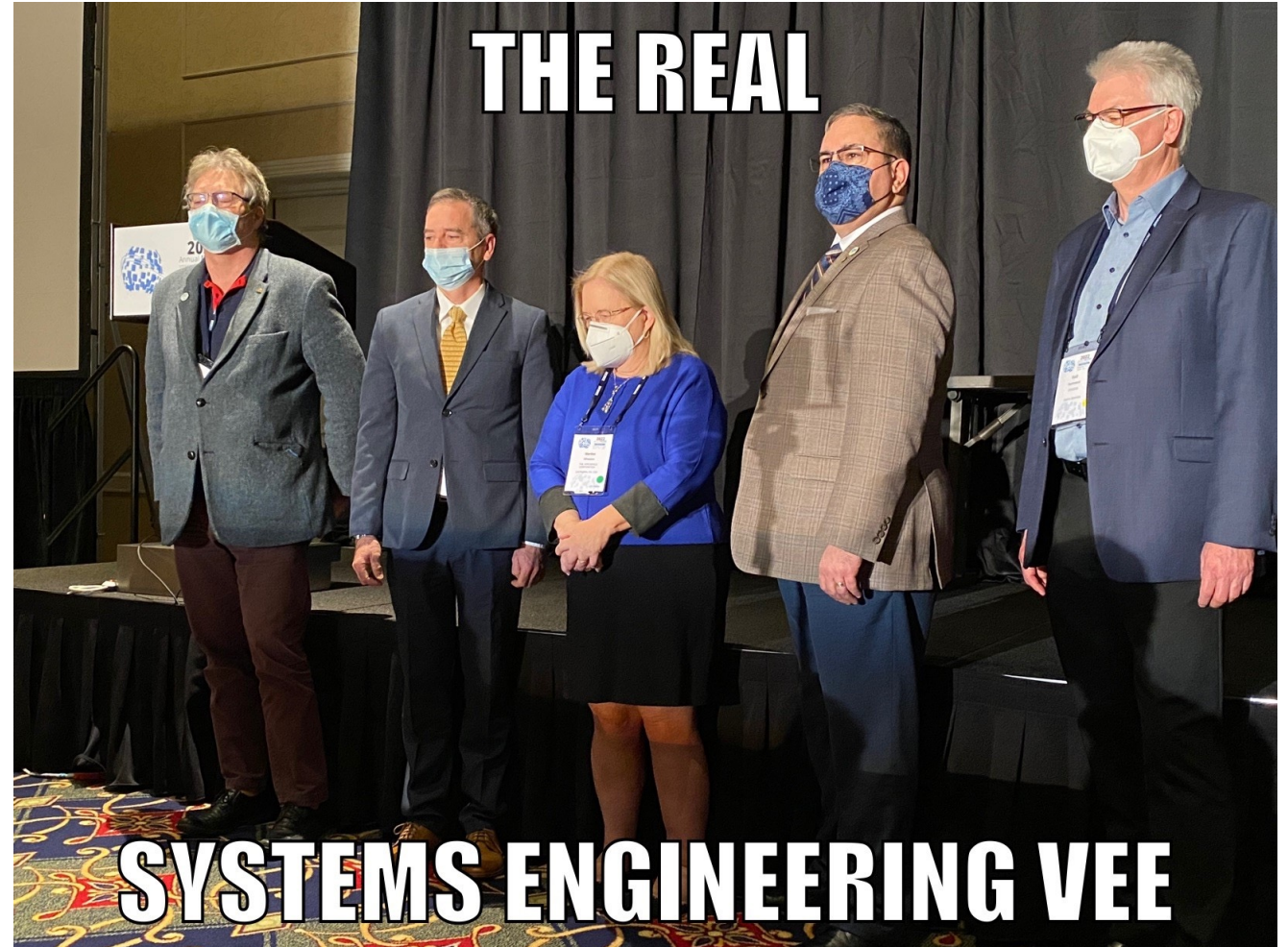
The V-model is **a model for structuring the data** coming out of the SE processes – NOT as a process model

Need **a changing attitude to change during system development**

Use the V-model to **present structure of data** without the confusion of showing the iterations

# Questions

- Thank you for listening







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[www.incose.org/symp2022](http://www.incose.org/symp2022)