



**32**<sup>nd</sup> Annual **INCOSE**  
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



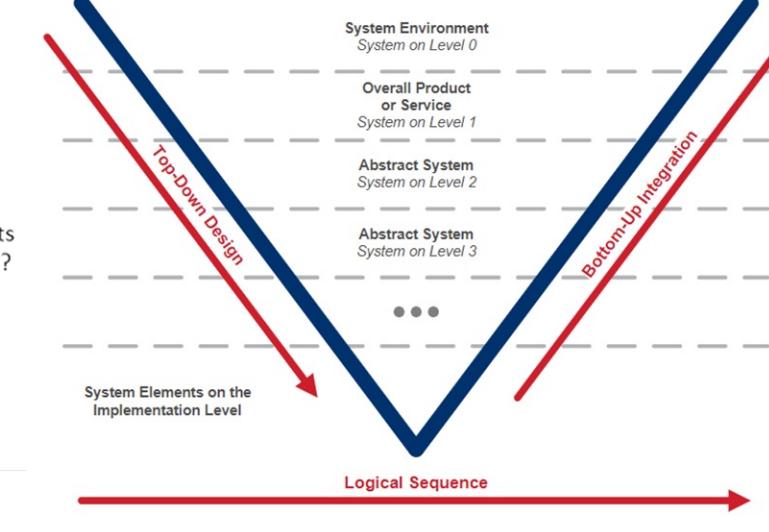
 Systems Engineering increases probability of “right first time” system delivery

 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.raeng.org.uk)

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



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



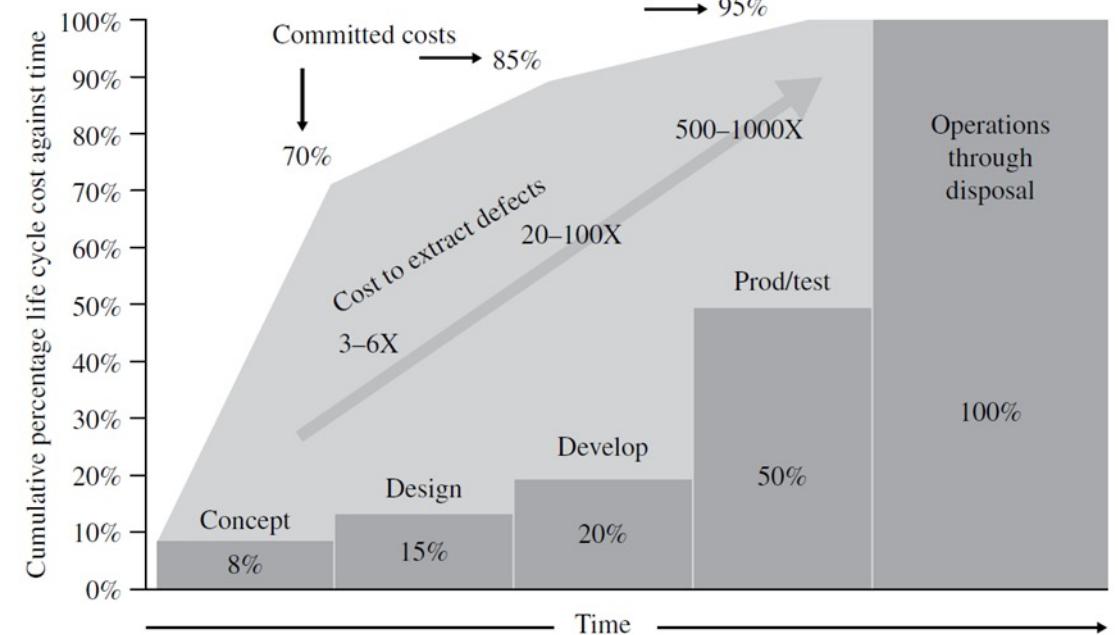
# Data management challenges

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



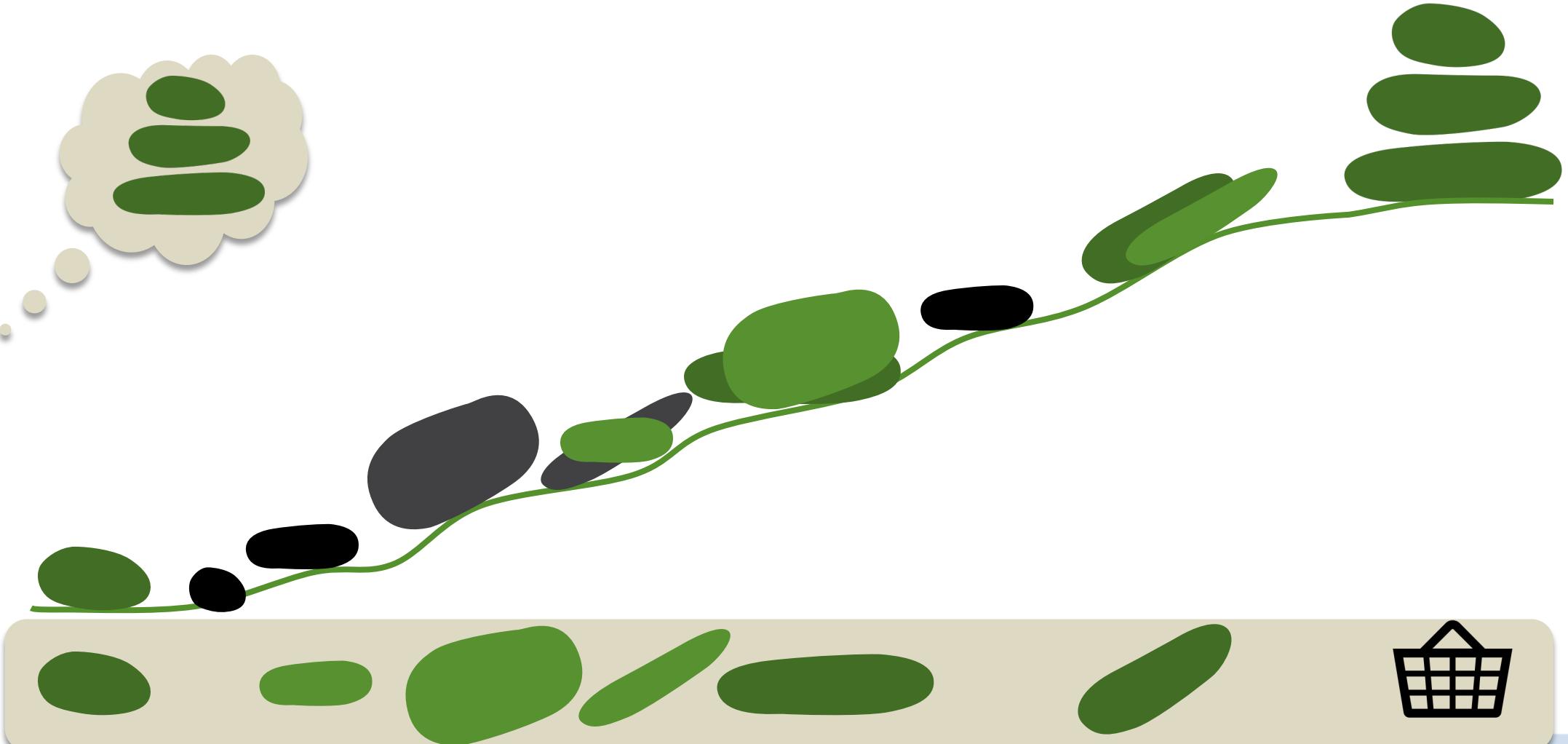
# Sketching

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





# Carrying Rocks Uphill



# Lava Flow





# Jigsaw Analogy

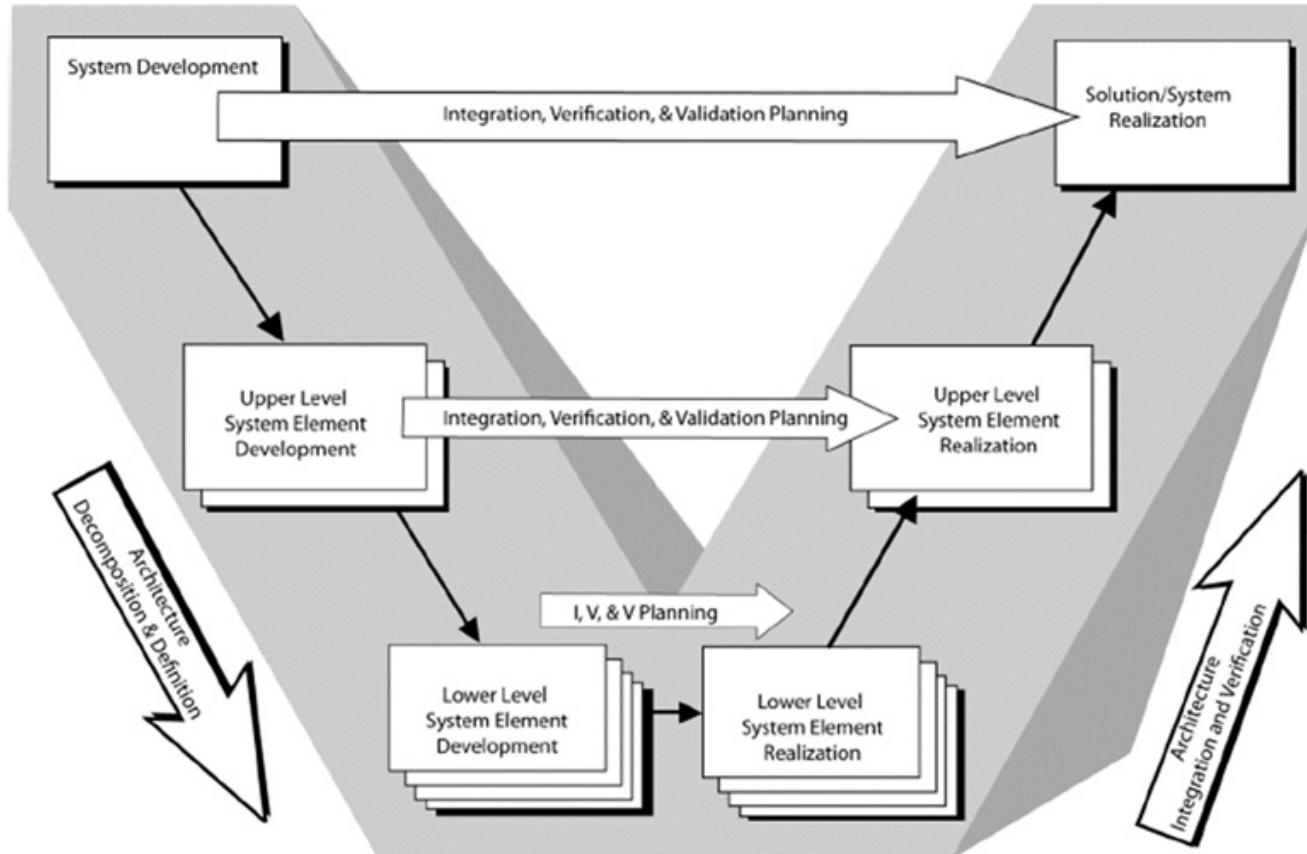




... A model for data (not process)

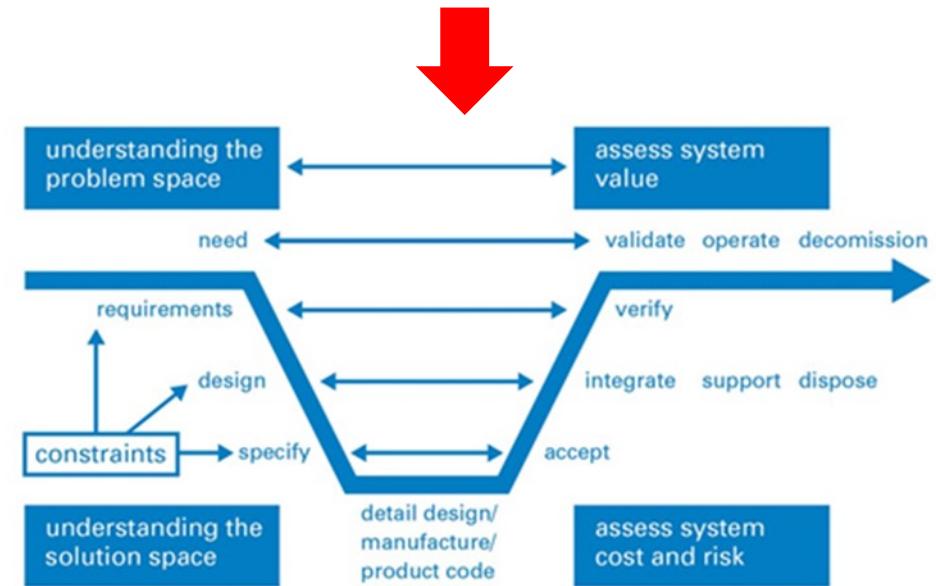
# V-model

# Introducing the V-model



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

A dangerous oversimplification

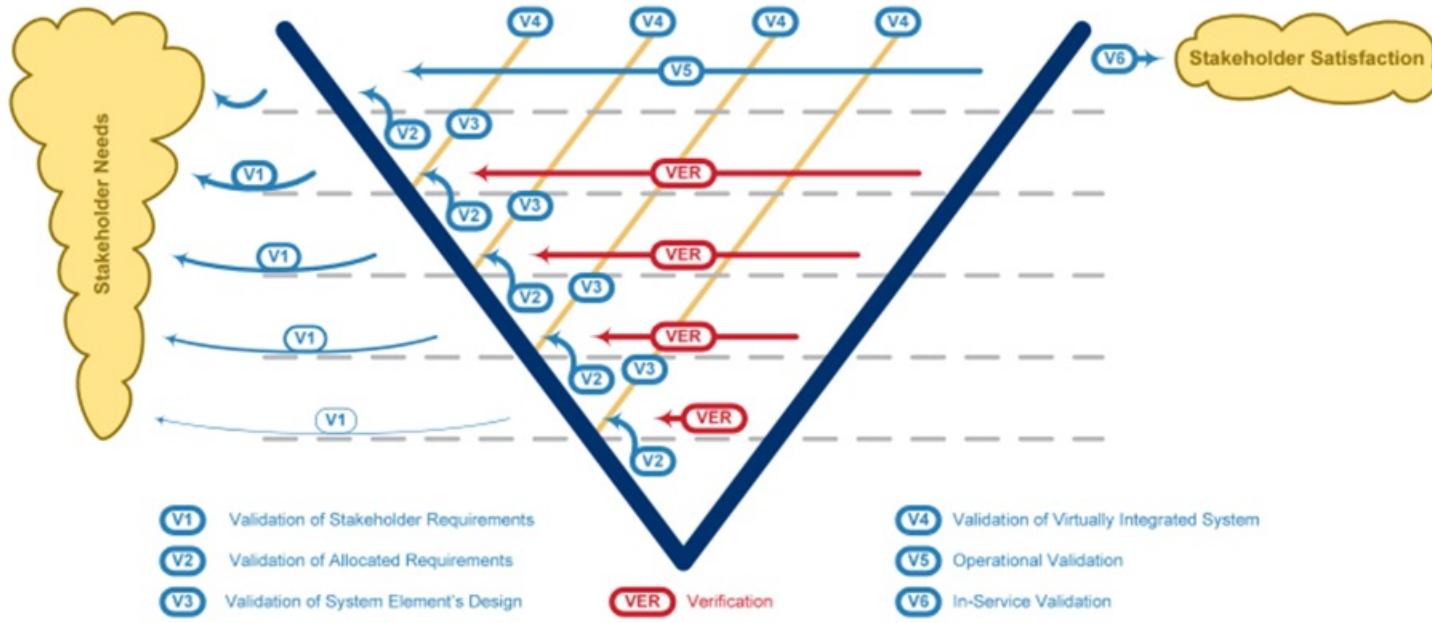


From INCOSE UK, 2020 Z1 – What is Systems Engineering? Creating Successful Systems



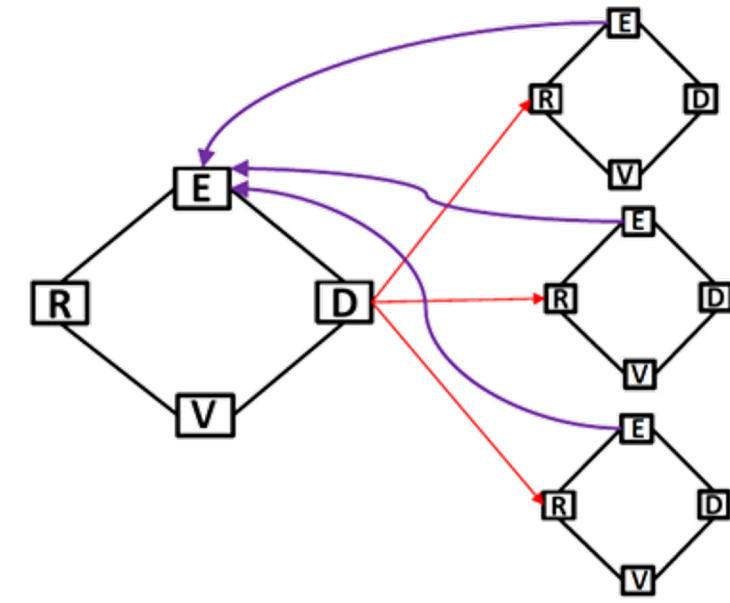
# More on the V-model

## Assurance Activities in the V-Model: The Assurance V



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

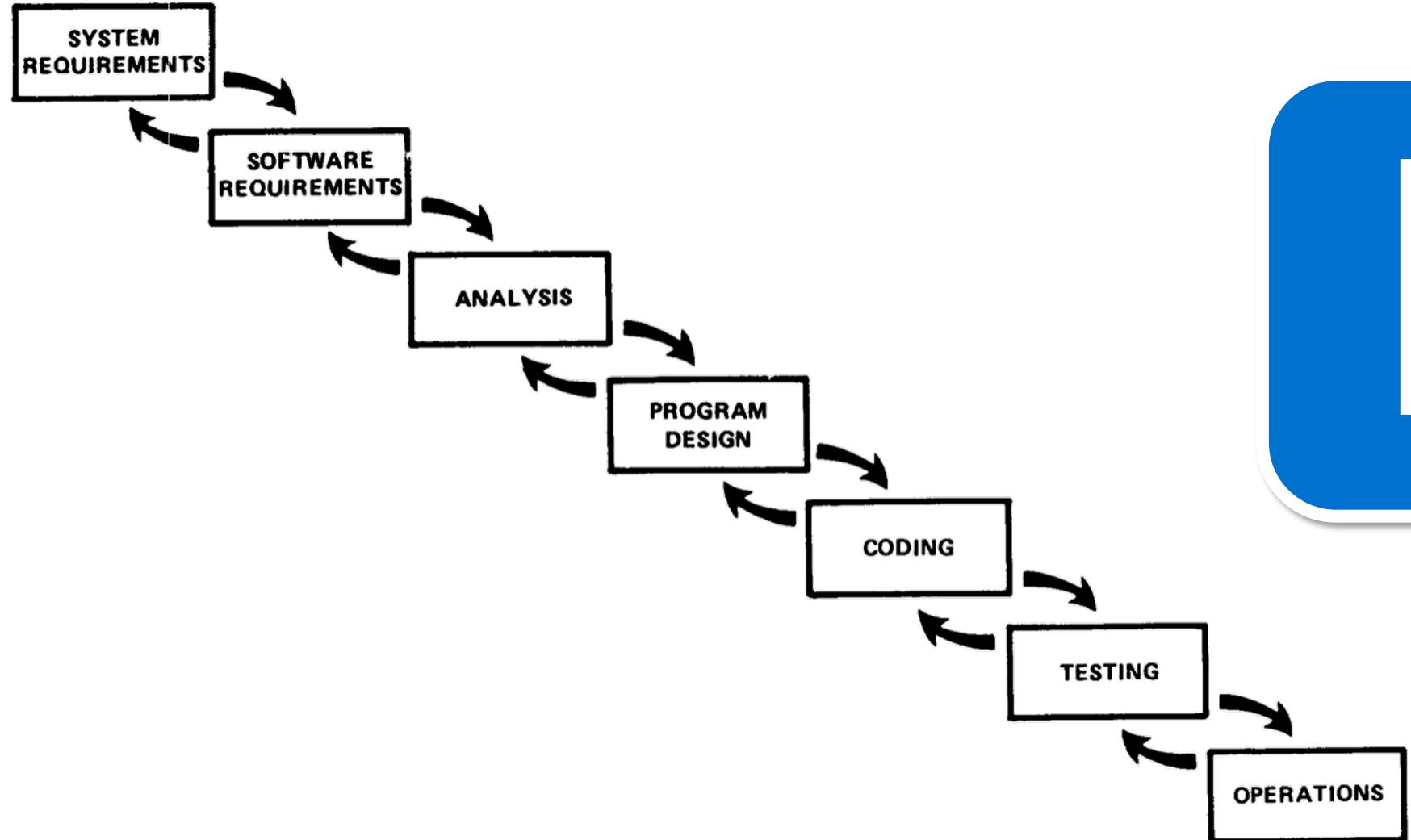
All data joined up  
Not just  
“Requirements Management”



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



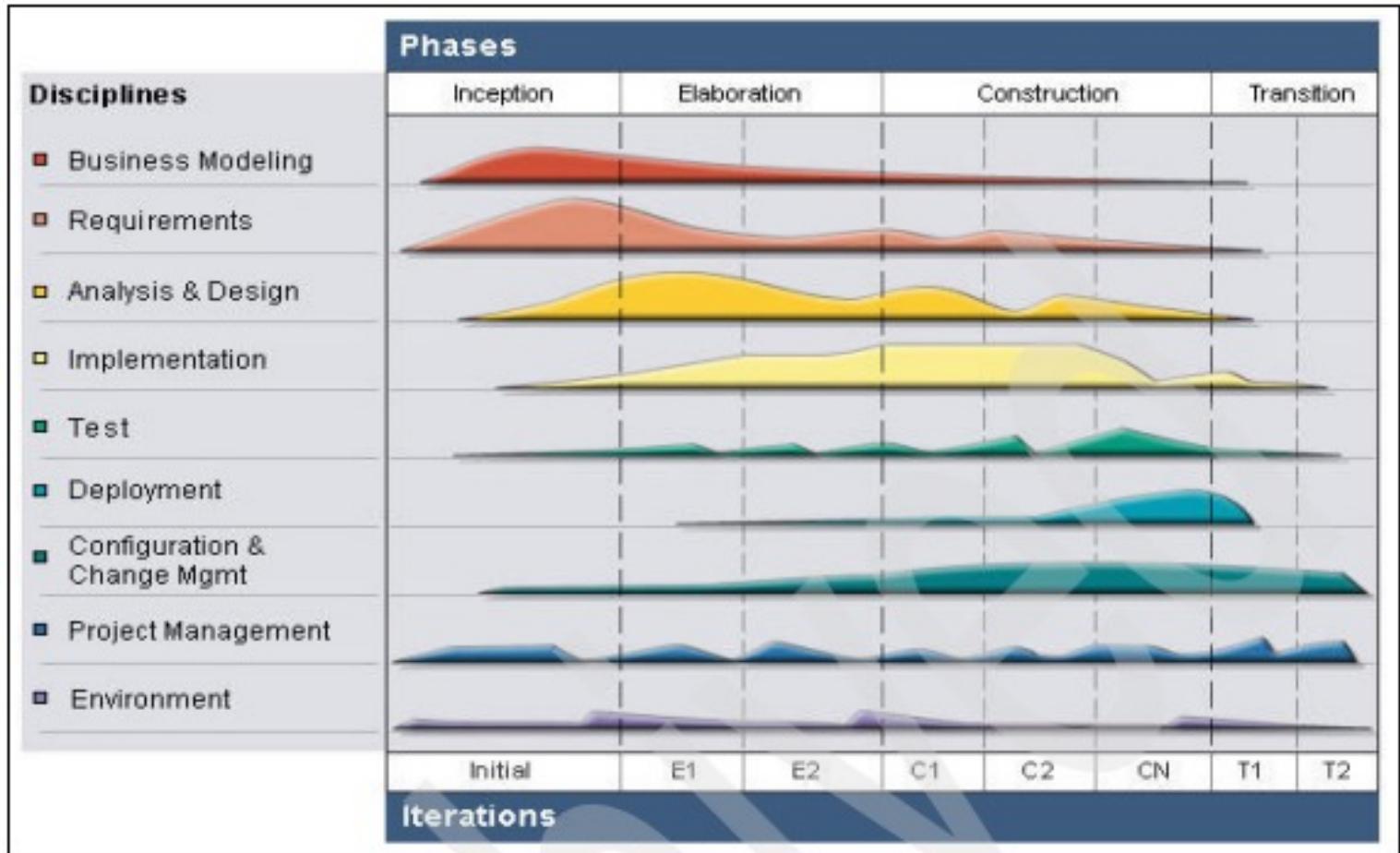
# Why is managing data so hard

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

	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)
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)							



... 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

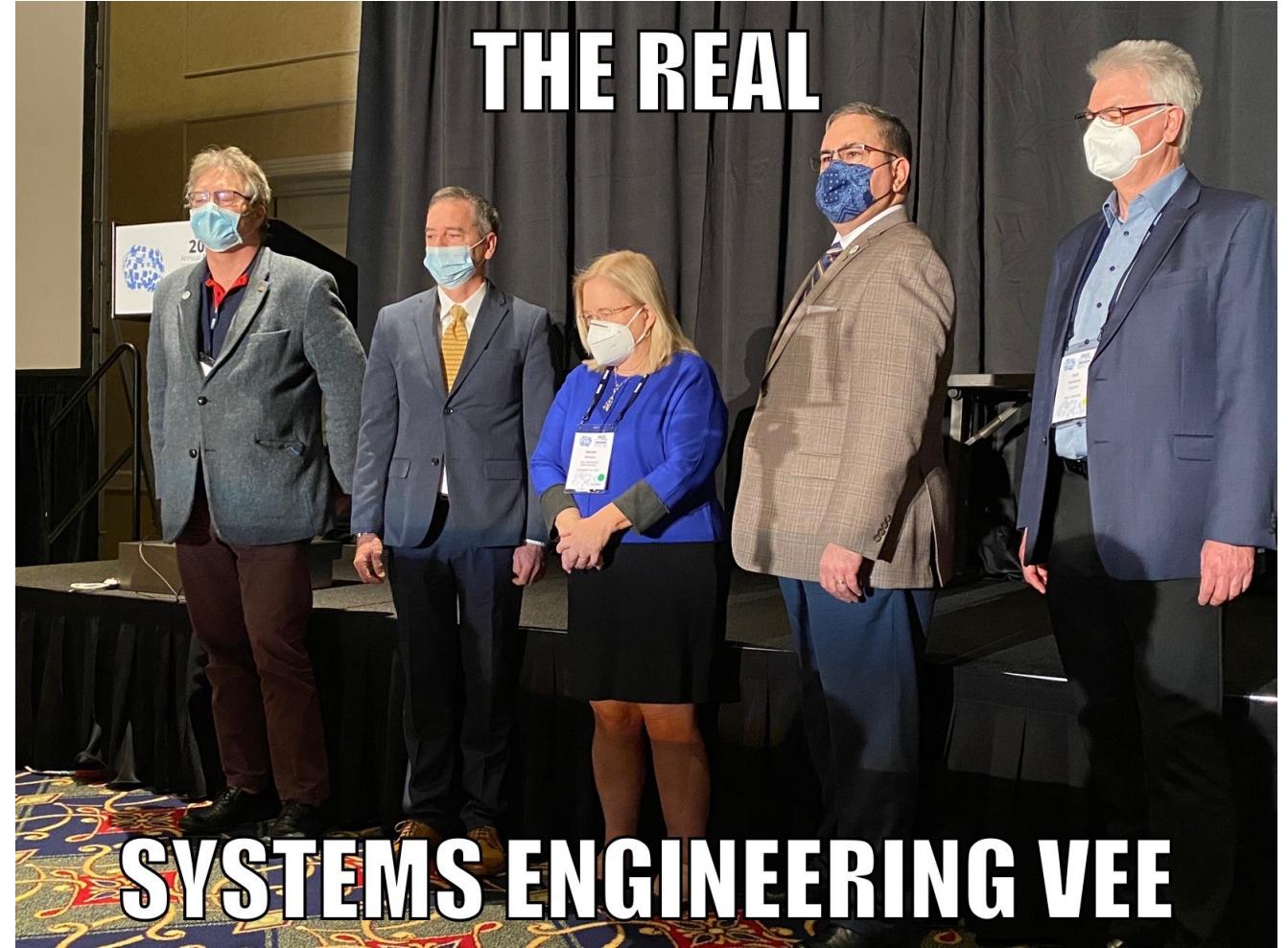
The V-model is **a model for structuring the data** coming out of the SE processes – NOT as a process model

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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