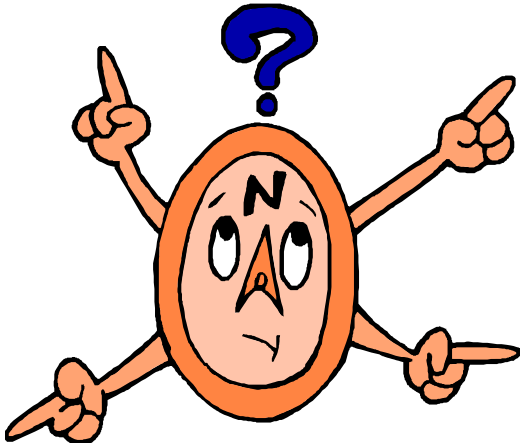
Validation: Losing its Differentiation



Jim Armstrong

Verification and Validation

- **Verification – Did you test what you were supposed to test?**
  - To establish the truth of correspondence between a product/system and its specification
  - Based on Requirements Database, Traceability
  - *Are We Building the Product/System/Service Right?*
  - The comparison of a module's code against its technical design specifications document is one example

- **Validation – Did you test the right things?**
  - The act of ensuring compliance against an original requirement. An example is the comparison of the actual system response of an on-line transaction to what was originally expected, requested, and finally approved
  - Based on Operational or Field Testing
  - *Are We Building the Right Product/System/Service?*

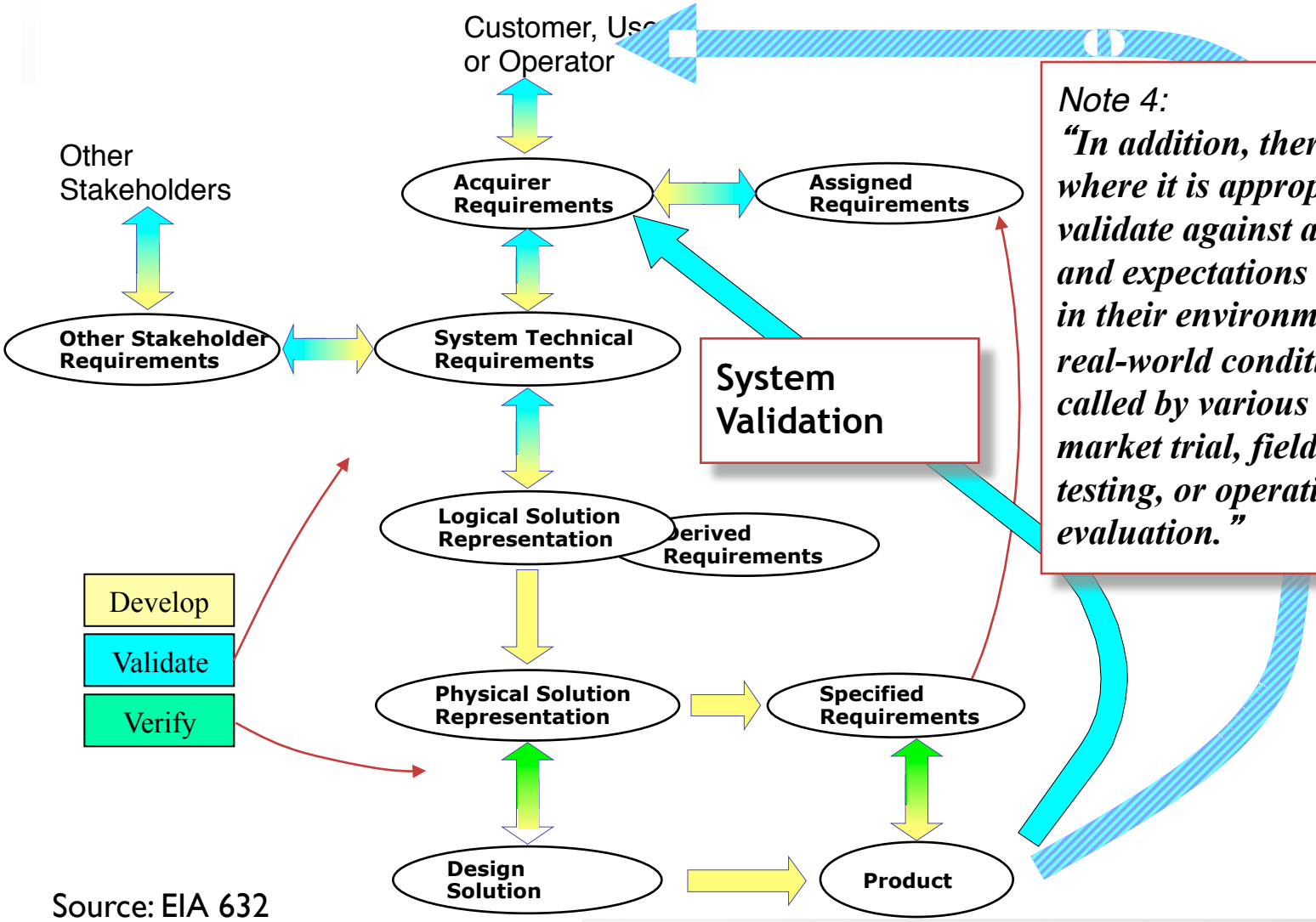
ISO Definitions

- Verification: Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled.
  - Note 1: In design and development, verification concerns the process of examining the result of a given activity to determine conformity with the stated requirement for that activity.

- Validation: Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
  - Note 1: In design and development, validation concerns the process of examining a product to determine conformity with users' needs.
  - Note 2: Validation is normally performed on the final product under defined operating conditions. It may be necessary in earlier stages.

- ISO 8402

Government vs Commercial



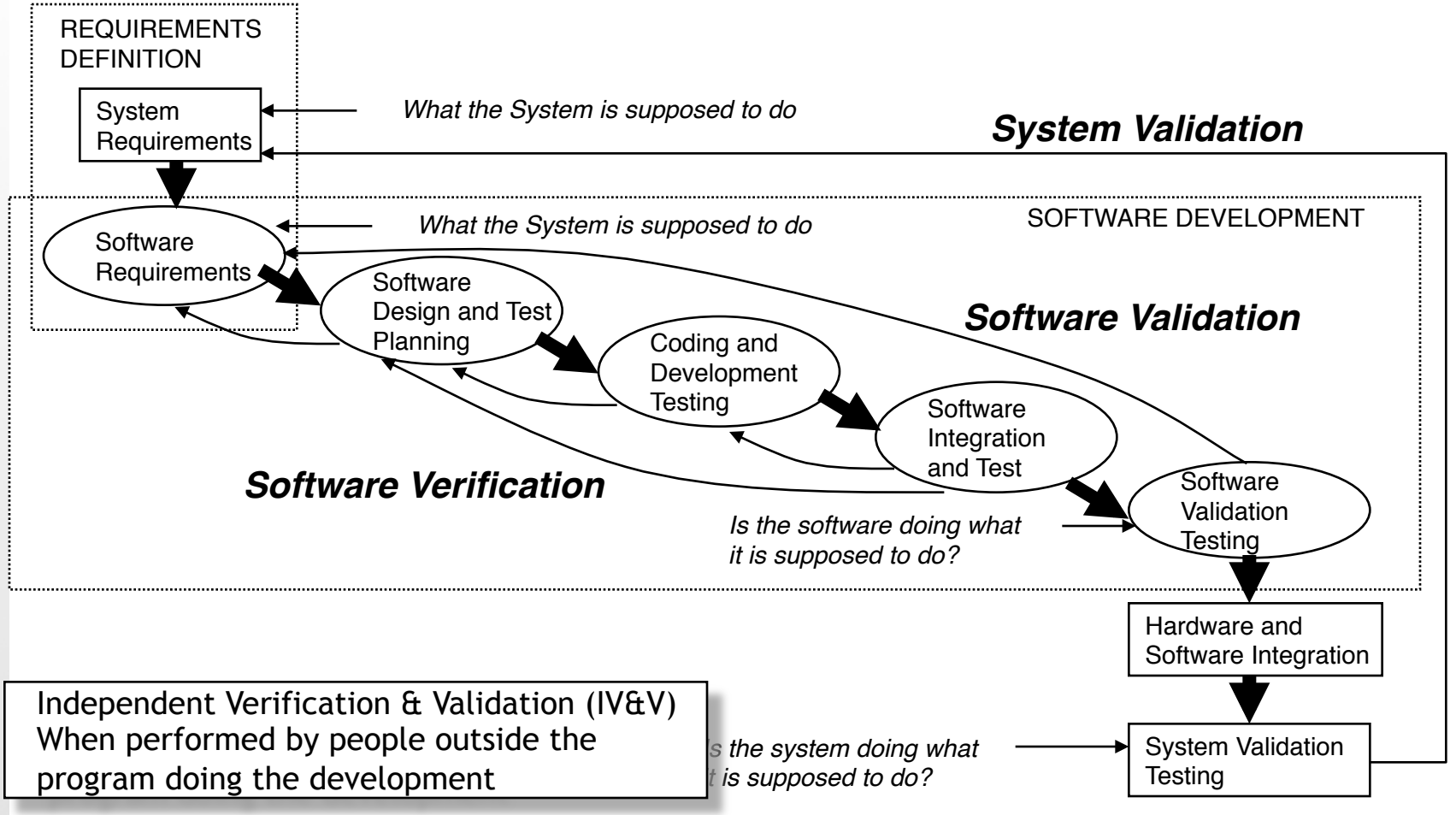
Note 4:
"In addition, there can be cases where it is appropriate to validate against actual needs and expectations of end users in their environment under real-world conditions. This is called by various names: market trial, field testing, beta testing, or operational test and evaluation."

Source: EIA 632

Related Software Term

- Independent Verification and Validation (IV&V)
  - Verification is confirmation that an individual step in the development process meets its requirements
  - Validation is confirmation that the software product meets its requirements
  - Independent means V&V not performed by those who developed the software
    - Originally not the same company
  - Originated in DOD-STD-2167

Early Software Definition

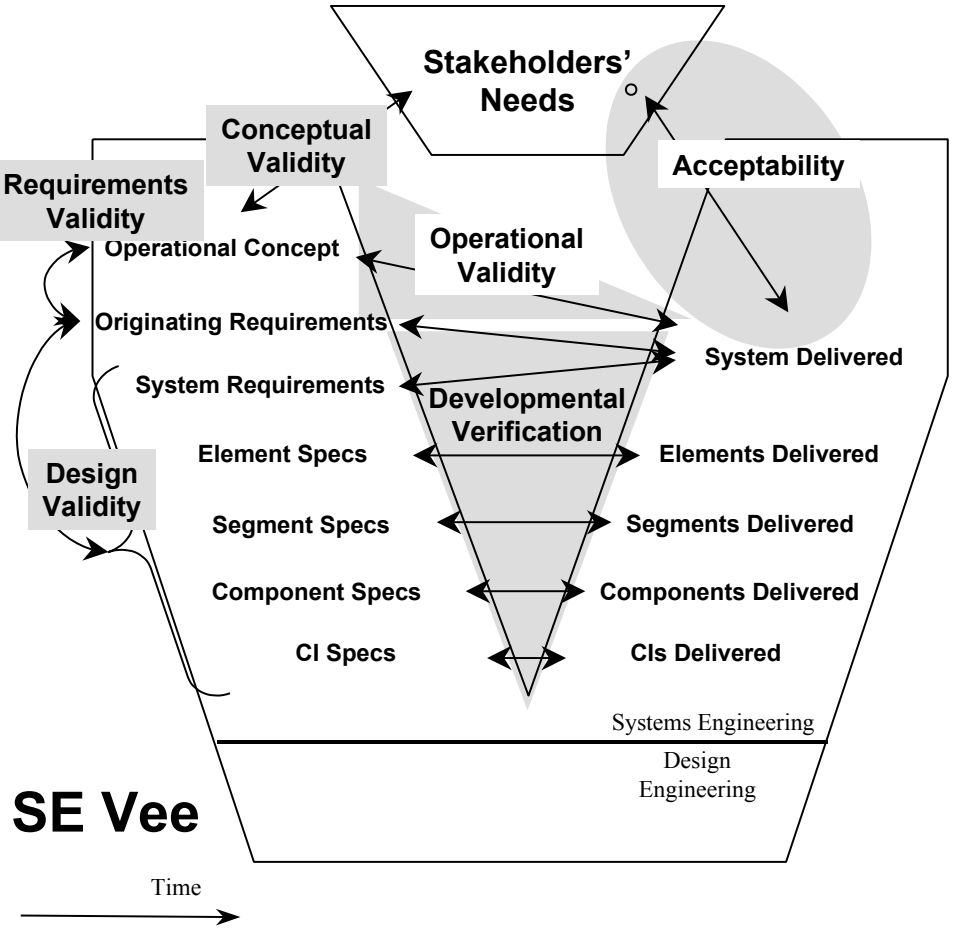


Independent Verification & Validation (IV&V)
When performed by people outside the program doing the development

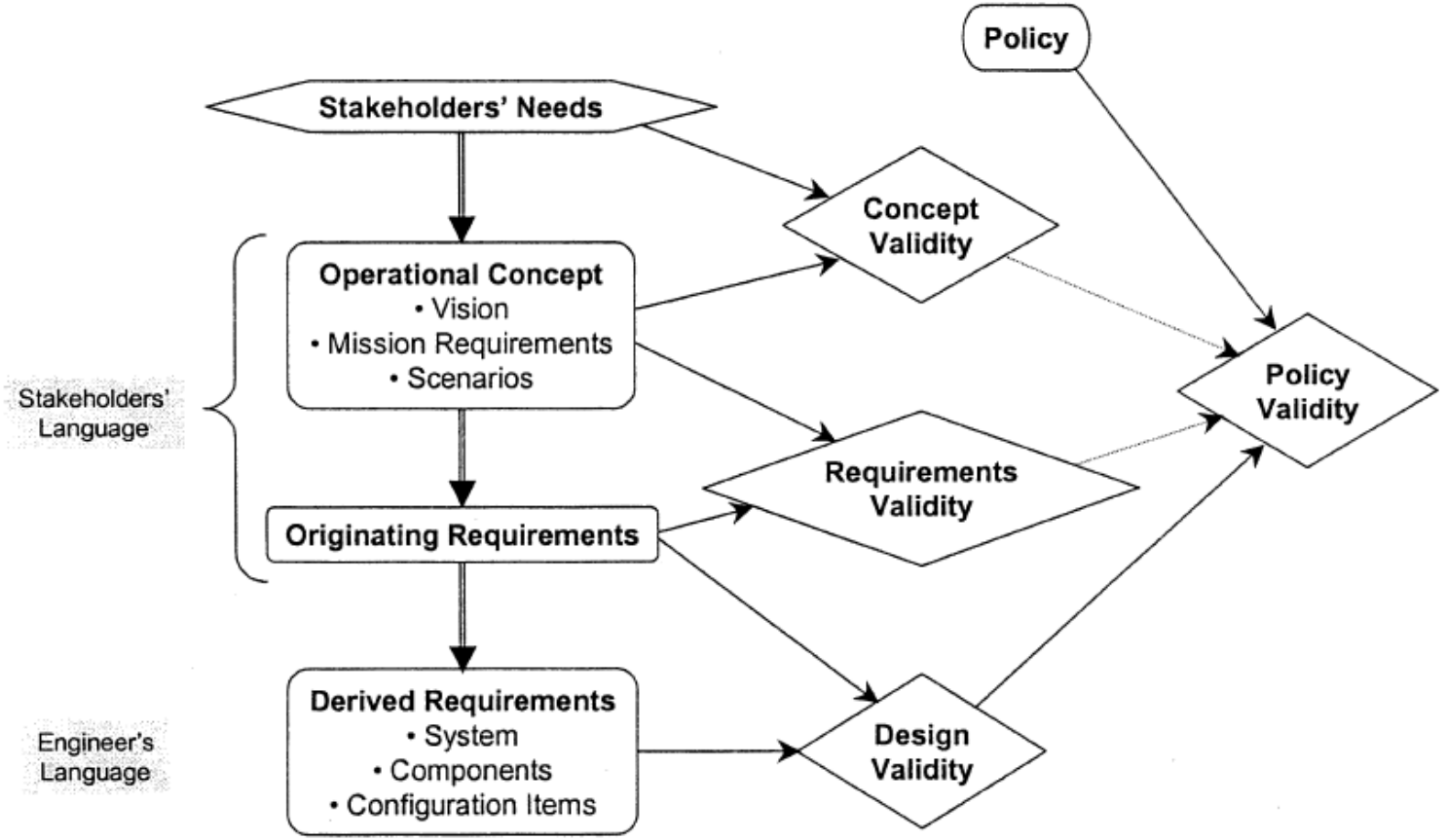
Text References

- Blanchard and Fabrycky: “the steps and the process needed to ensure that the system configuration, as designed, meets all requirements initially specified by the customer.”
- Kassiakoff and Sweet: “involves evaluation of the capability of the delivered system to meet the customer’s operational need in the most realistic environment achievable.”
- Stevens, Brook, Jackson & Arnold: “Actions to confirm that the behavior of a developed system meets user needs.” (end of program)
- Buede: A more expanded view

Buede


Stakeholders' Needs
Conceptual Validity
Requirements Validity
Acceptability
Operational Concept
Operational Validity
Originating Requirements
System Delivered
System Requirements
Developmental Verification
Element Specs
Elements Delivered
Design Validity
Segment Specs
Segments Delivered
Component Specs
Components Delivered
CI Specs
CIs Delivered
Systems Engineering
Design Engineering
SE Vee
Time

Larsen & Buede



Requirements Validation

- Is the requirement real?

- Confusion with requirements verification
  - Quality checks for requirements
    - Consise
    - Consistent
    - Traceable
    - Verifiable
    - Formal
    - Etc.

Example: validation of message maximum delivery time requirement

- Discussion of potential conflict with data reliability requirement
  - Some percentage of data can be lost – infinite delivery time
- No consideration of whether or not the time specified has an impact on operations

Scukanec and van Gaasbeek

	Requirements	Product
Verification	Are the requirements right? Do they meet the basic quality criteria (e.g., correct, complete)	Is there objective evidence that the product satisfies the requirements?
Validation	Are the requirements the right requirements, i.e., do they properly represent the customer need?	Does the product, when operated by representative operators, in the representative operational environment, satisfy the customer needs?

Manuals and Guidebooks

- NASA's Systems Engineering Guidebook
  - Meeting specifications - verification
  - Assuring that the system "accomplishes its purpose" – validation
- FAA's NAS Systems Engineering Manual (2006)
  - Limits the definition of validation to assuring that the requirements are correct and complete
  - Activities that are included in other definitions of validation are addressed elsewhere and with different vocabulary in this document
- Department of Health and Human Services Practices Guide for Independent Verification and Validation
  - An activity that "validates that the product conforms with client requirements"

RFP for IV&V Services

- RFP from the North Dakota Department of Human Services
  - "The validation services will ensure that the new Medicaid system will meet the current and planned business needs of Medical Services, and that all necessary training, policy, process and procedural changes have been defined and implemented within Medical Services."

INCOSE SE Handbook

- ISO definitions used
- Improved in consistency from earlier versions
- Some variation in detail sections

- Also includes validation of models and simulations.
  - Confirmation that the model or simulation correctly reflects the situation it is intended to model or simulate.

Observed Effects?

- In appraisals
  - We don't do validation, the customer does
- In class
  - Difficulty identifying validation risks
  - Difficulty defining validation mitigations
- Class discussion question
  - Confusion with verification at work
- Natural forces at work?
  - Prevalence of convergent thinkers
  - Tendency to focus on target (spec)

Student Responses

Question: Identify validation risks and early mitigations

Responses:

- Mostly technical spec risks
- Few operational area concerns
  - Different environment
  - People issues, customs
- Mitigations are more verification
  - Extra testing to assure meeting spec
  - Design margin to reduce risk
- Few "go find out" options
  - Site visits
  - Prototypes to user/maintainer

Student Discussion

Question: What do people at work define as validation?

Responses:

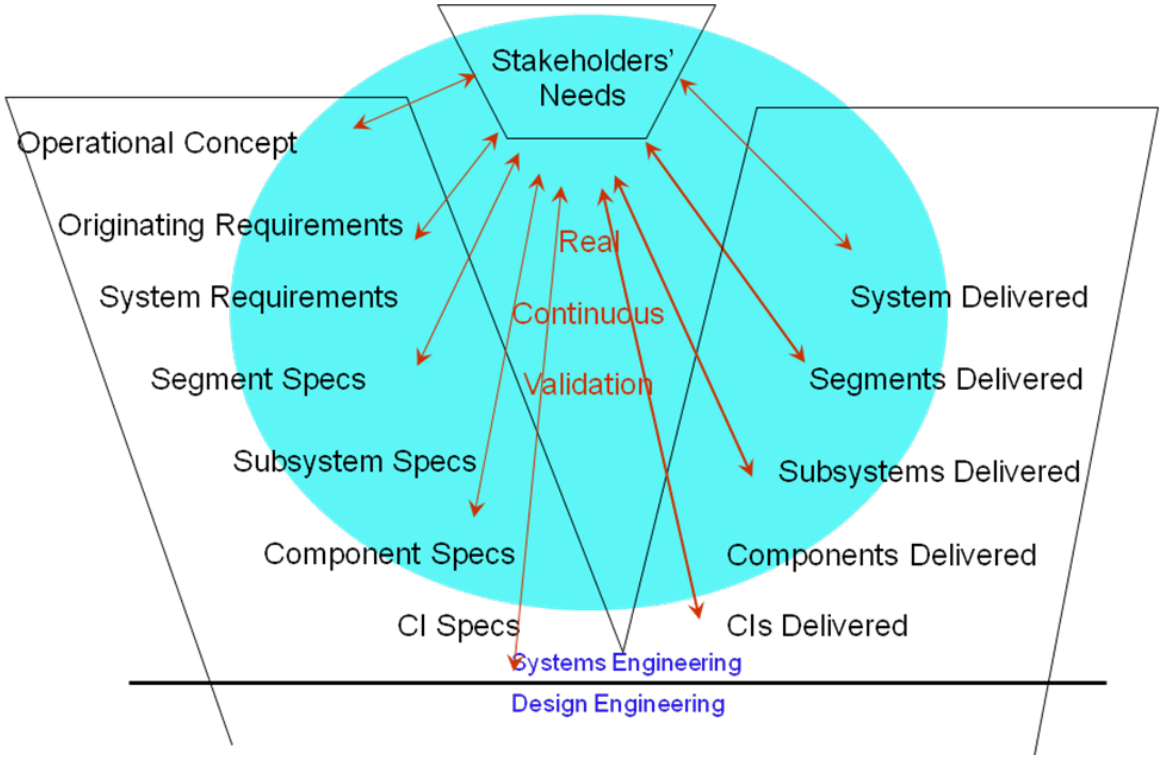
- Some good
  - Field testing
  - CONOPS as reference
- Some confusion
  - Subset of verification
  - "intended environment" gets lost

Net Effect

- Loss of real world customer focus during development
- Products that don't work in the real world
- Unhappy customers

Recommendation

- Ensure real world focus and checks at all points



- Don't forget site visits
- Use of models and prototypes with operators