

System Interface

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SFBAC Meeting

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Agenda

- Introduction
- Types of Interface
- System Interface Development
 - Interface Development Process
 - Interface Anatomy
 - Interface Design
 - Interface Analysis
 - Interface Compatibility
 - Interface Management
 - Interface Control
- Interface Verification
- Interface Documentation
- Interface Tools
- Summary

Introduction

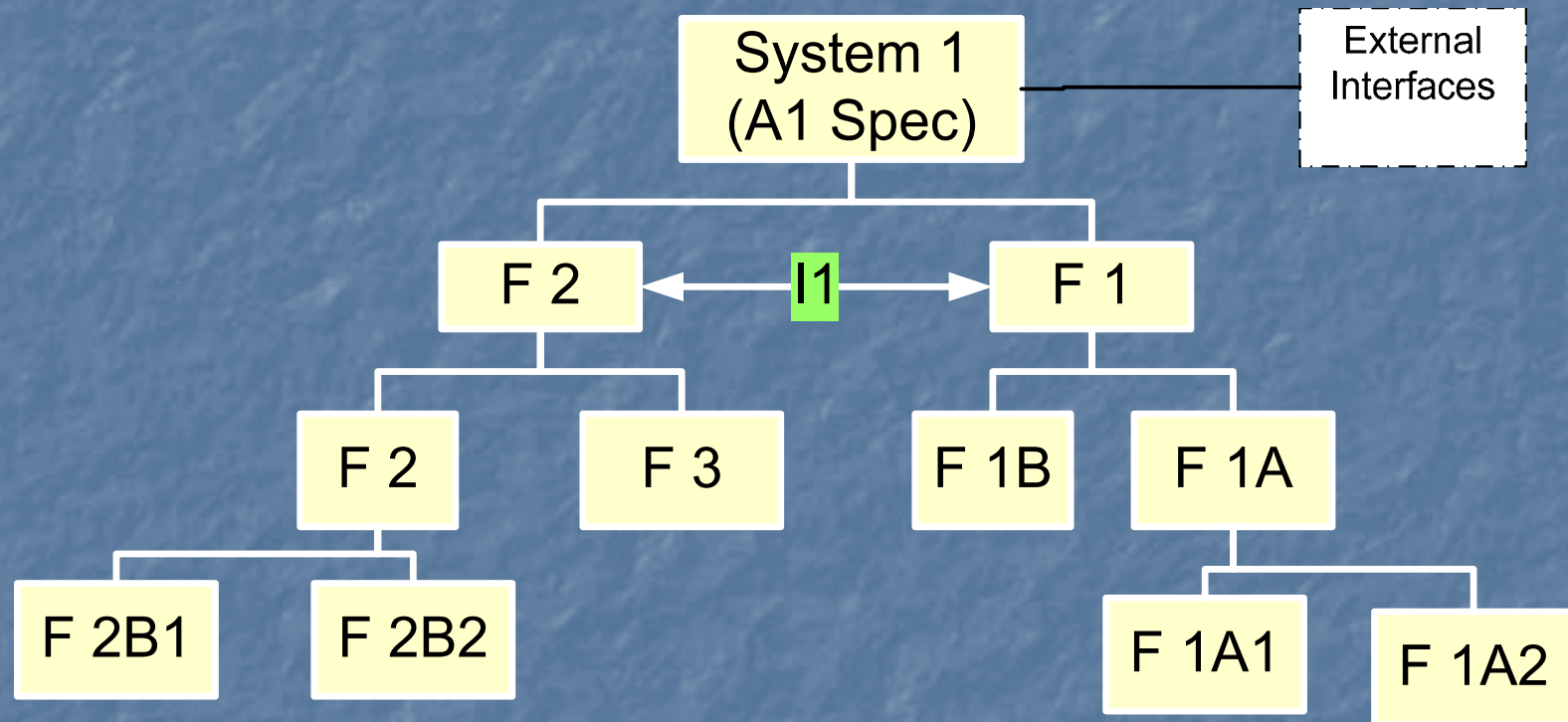
Systems engineering is a discipline that concentrates on the design and application of the whole (system) as distinct from the parts. It involves looking at a problem in its entirety, taking into account all the facets and all the variables and relating the social to the technical aspect. – INCOSE System Engineering HDBK V3.1

Introduction (Con't)

- 3 Basic System Descriptors
 - Elements (Function)
 - Architecture (Elements relationship)
 - Interface (Tie elements together)
- Importance of System Interface
 - Failures occur across the interface
 - System Interface is the foundation for System Integration
- System Interfaces need to be developed at the beginning of the System Life Cycle

Develop the system as a whole (all three descriptors)

System Architecture



Type of Interfaces

- Vertical vs Horizontal Interfaces
 - Relationships
 - Mechanical
 - Static (load, access, mounting alignment...)
 - Dynamic (frequency, load ..)
 - Thermal (exposed vs generated, tran vs sta)
 - Electrical
 - Power
 - Signals
 - Others
 - Software
 - Operation
 - Organization
 - Human (Social)
 - Unintended Interfaces
 - Environmental Condition
 - Constraints
 - Energy (light, Noise, EMI, NBC, etc..)
 - Interrupts (accidents, resets)
 - Restricted Interfaces (Operation)
- } Governed by Law of Physics
- } Governed by Rules and Constraints
- } Standards

Interface Development

- Interface development process
- Interface Anatomy
- Interface design / analysis
- Interface compatibility
- Interface management
- Interface control

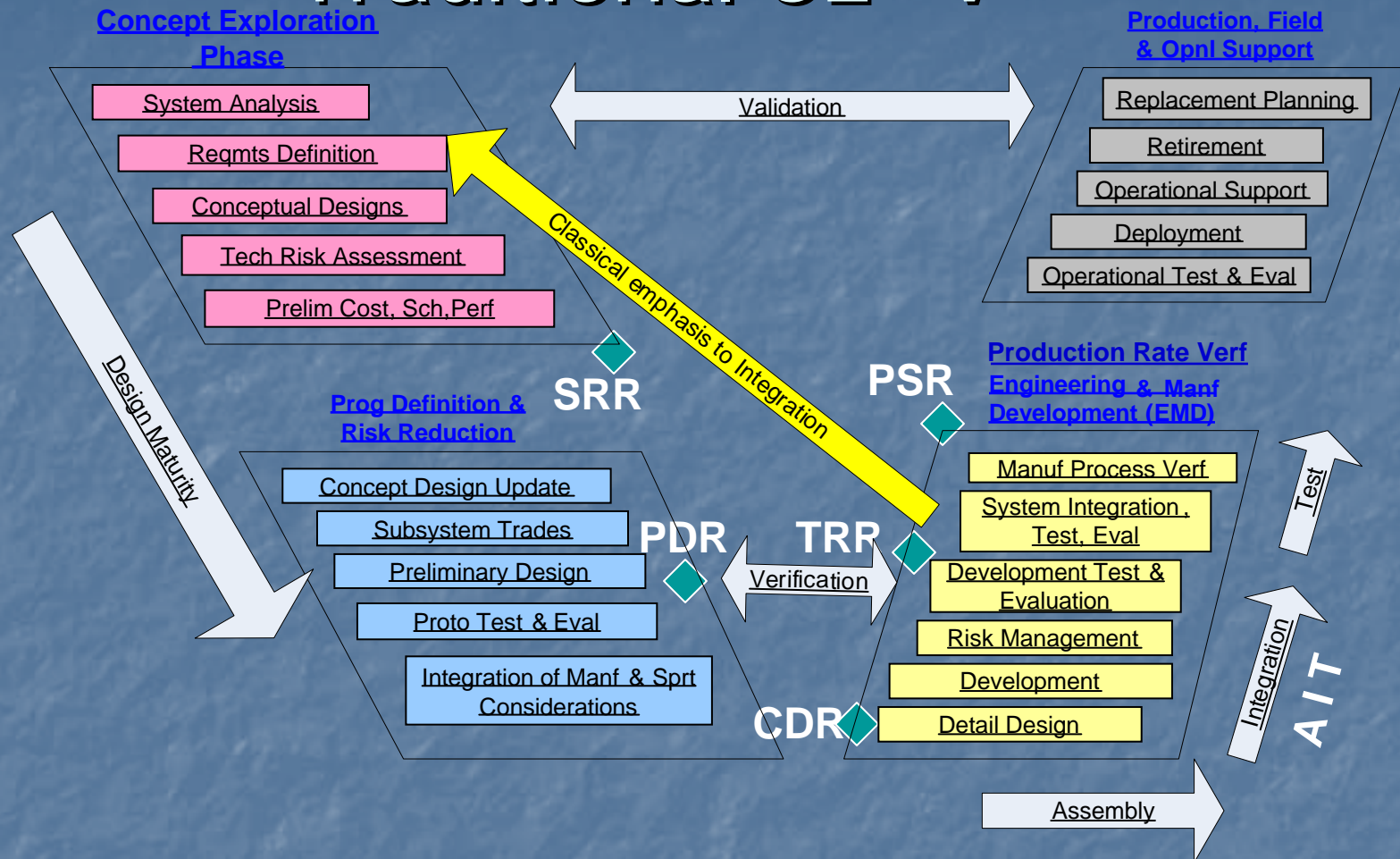
Interface Development Process

- System Interface development starts at the Con-ops
 - Operational Interface
 - Major sub-systems
 - System Architecture

} FFBD, Sequence Diagram
Organization Chart
- System Requirements Development
 - Interface Requirements
 - Interface Constraints
 - Interface Definition

} N² Charts

Traditional SE "V"



Classical AIT results in higher risks, late verification, higher program costs, and late delivery schedule

Interface Anatomy

- Relationship (Parent-Child, Predecessor-successor)
- Governing Rules (& Standards)
- Formats (form)
- Protocols (handshake) (fit)
- Messages (function)
- Sequence (Operation or Procedure)

Interface Design

- Preferred Interface Practice
 - Shared Responsibilities
 - Common Interfaces
 - Standard Parts and Standards
 - Asymmetric or Keyed
 - Asynchronous
- Undesirable Interface Designs
 - Adapter
 - Double Standards
 - Complex Interface
 - Flexible Interface

Interface Analysis

- Compatibility Analyses
 - Dynamic
 - Thermal
 - Tolerance
 - EMC / EMI
- Operation
- Fault Detection, Isolation and Resolution (FDIR)

Interfaces Compatibility

JOURNEY OF A THANK YOU LETTER FROM WEST GERMANY BREAD COMPANY TO SALES DIRECTOR IN WICHITA, KANSAS

LAYER NO.

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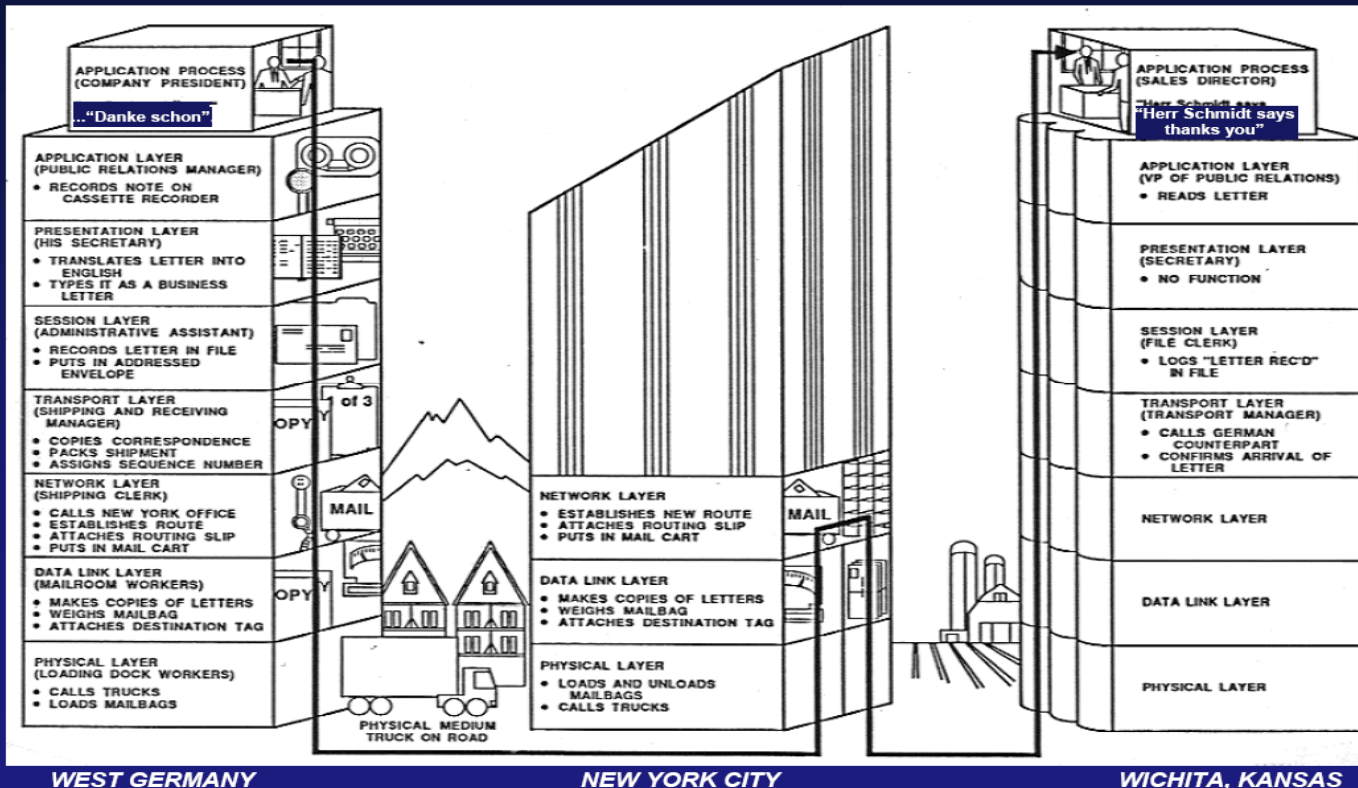
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Interface Management

- Interfaces must be managed in the SE process
- Interfaces also need to be controlled to assure they are within the designated boundaries
- Manage Interfaces by designing and verifying them early in the product Life Cycle.
 - Design the interfaces into the program hierarchy
 - Plan interface activities (mechanical, thermal, etc)
 - Plan process ownership- use a database hierarchy
 - Develop Interface Control Working Groups (ICWG)
 - Identify the type of interface and responsibility.

Interface Planning

- Interface Management Plan
- Resources
 - Organization
 - Responsibilities
 - Metrics of shared resources (consumed and disposed)
 - Weight, Size, Power...
 - Other Shared Resources (Storage, CPU, etc.)
- Schedule
 - Receivable-Deliverable (Rec-Del)
 - PERT
 - Post delivery support
- Working Groups
 - WG charters
 - Interface Control
 - Scope change management
 - Documents
 - Conflict mediation and resolution process

Interface Control

- Interface controls are necessary to assure interfaces compatibility through out product design and production life cycle
- Interface control is a part of the Interface Management effort
 - Involves all interface stakeholders
 - Assign interface ownership
 - Baseline control of interfaces
 - Interface tolerances (margins), resources and analyses need to be performed and allocated from a higher (parent) level
 - Interface constraints must be clearly specified and agreed upon

Interface Verification

- Sub-system I/F verification needs to be performed prior to delivery for System Integration
 - Verify at lowest possible levels
 - Verify both positive and negative conditions (if feasible)
- System Integration
 - Supporting role to assure that limits & constraints are not violated during integration process
 - Provide special interface need for SI and System level verification
- Post integration verification (operation, GUI...)
- Validation

Interface Documentation

- System Architecture
 - Interface View
- Interface Standards
- Interface Requirements Specification
- Interface Definition (Design) Document
- Interface Control Document
- Interface Control Drawing

Interface Tools

- Architecture / Organization
 - Organization Chart
- Functional Flow / Operation
 - FFBD
 - Sequence Diagram
- Schedule / Interdependency
 - MS Project
 - Pert Chart
 - N² Chart
- Interface Design/Verification
 - Mockup / Simulators
 - Fixtures and Templates
- Interface Capture
 - N² Chart

Summary

- System Interface is the **Weakest Link** in the System
- System Interface needs to be developed in the beginning of life cycle
- Interface development is difficult because it involves multiple (independent) Sub-systems
- System Interface needs to be managed, controlled and verified

Develop the system as a whole (all three descriptors)