Integrated Systems Engineering Tool Suite

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Agenda

- Purpose
- History
- Goals
- Solution
- Progress
- Benefits
Purpose

- To identify and use a set of tools that captures the design intent concurrently within a System of Systems or a complex design
- To capture and maintain the design understood by all stakeholders and not end up like this.............
- Design documentation is not to become stale and unmanageable
- To identify impact of change quickly and easily
- Ease of use to all users
History

- Concept used on new Ship Preliminary Design Phase
- Taken up by L3-MS UK for design of ship’s control systems
  - Successful at maintaining design intent for MoD
- In use on US Navy’s Ship to Shore Connector (SSC) program for C4N (Command & Control, Communications, Computers & Navigation) Design
  - Critical Design complete for Systems
  - Critical Design complete for Hardware
  - Supporting Software ICDRs
  - Used in Testing Phase
- Being used on Off Shore Patrol Cutter (OPC) Machinery Plant Monitoring and Control System Preliminary Design Preliminary and Contract Design Phases

**Opportunity for use in other military & commercial business areas and applications**
Goals

- Develop a method of maintaining the design throughout the Project Life Cycle with cost effectiveness in mind
  - To automate production of documentation
    - Update of design set documentation set at same time
    - Graphics and tables to be of a high resolution and format
    - Speed of document generation needed to be fast
    - Provision of document’s revisions page prior to start of auto generation
  - Must capture the impact of change throughout the design
    - ECPs, CRs from customer
    - Apply the ‘What If’ scenarios
  - Minimal training necessary for majority of users
  - Use an Open & Scalable architecture
  - Auto-generate Metrics
  - Benefit the whole project team
  - Limits number of expensive licenses required
Goals

Needs to be flexible enough to support Agile Software Development / iterative design and development cycles.
Software Tools Selected and Optimized:

- IBM Rational DOORS®: This tool is used as a Baseline CM tool and provides visualization of requirements traceability. It does require training. It can export data into usable MS Excel files.

- IBM Rational System Architect® (SA): This tool allows better visualization of data relationships but requires training. Function Block Diagrams of DoDAF models can be used. It can easily export data into usable MS Excel files.

- IBM Rational ClearQuest®: This tool allows Discrepancy Reports (DRs) to be entered in real time and addressed weekly at a Discrepancy Review Board (DRB).

- MS Excel®: Files are easily maintained and manipulated and require no special training. (Majority of Work conducted)

- MS Visio®: This tool is used to create or convert drawings and graphics and allows the customer to magnify figures without loss of resolution.

- MS Word®: Templates created for Automated documentation

- Databases: SA uses a SQL Server and links to other data through use of MS Access® Databases.

- MS SharePoint®: This site is used as a common development environment for team members and customer.

Tools have capabilities and limitations, but were able to develop a suitable tailored structure on the front end.
Customer Collaborative Environment (SharePoint)

DOORS Database
- Team Member DOORS Databases
- Allocated Requirements Characteristics Fields
- Links between levels of requirements

L-3 DOORS Database

Excel Spreadsheet
- With CCB Approval
- DRs
- ClearQuest

Project Issues

Document Templates with Macros
- Automatically create documents
- Standard formats
- Imports System Architect descriptions
- Imports Diagrams
- Imports Signal Data
- Imports Requirements text
- Imports Test Procedures
- Imports Test Steps

Signal Database
- Signal IDs
- Signal Type
- Serial Protocols
- Setpoints

Link Database
- Block Diagrams
- HWCIs & CSCIs
- Requirements
- Allocations

System Architect (SA)

Signal Data
- Signal Database

Images
- Meta Data File
- MS Visio CAD

SQL Server Database
- Visio Drawings

CDRLs
- System Architecture and Requirements Allocation Description (SARAD)
- Interface Design Description (IDD)
- Software Requirements Specification (SRS)
- Software Design Description (SDD)
- System Test Procedures (STP)
Able to investigate the System at any place of the design
Block diagrams can be used to help visualize data and requirements relationships.
Provides a structure that allows you to standardize and simplify data entry for every requirement or record.
Software Requirements Specification template conforms to Gov’t DID – DI-IPSC-81433A
System Architect – Interfaces

Able to create Interface Design Descriptions (IDD) – ties requirements to signals
System Architect – SDD Objects

Software Design Description is standardized
Test steps can be selected from a drop-down list.
System Architect – Cabling

Ability to tie together cabling information to requirements and signals.
Requirements Association

- Able to show the relationships between requirements, diagrams, applications, software units, signals and events tied together.

- Baseline Changes
  - Allows one to see what aspects of requirements will be affected (requirement text, allocation, signals, derived requirements, etc.)
  - DOORS supports Baseline Change comparisons
  - When a new DOORS module is received from customer, a baseline comparison is made and reviewed. When agreed by Change Control Board (CCB) all links are broken in the baselined modules and are re-linked up to the new DOORS module using the change process.

Requirements Association has a wide range of applicability to commercial and defense type contracts
Auto-Document Generation

Code scripts allow for automatic generation of multiple nested sections & tables in created documents.

**SET-UP**
Each document has a configured Macro with code strings and bookmarks to extract data from:
- MS Excel directly
- MS Sequel Server
  - MS Visio files
  - CAD files
- Adobe .pdf files
- MS Word files

Revision level & history, date & authors info entered into user forms prior to auto-

**DOCUMENT**
- Generated document requires no further editing for format
- Sections can be nested up to 5 levels deep (eg 4.1.1.1.1)
- Graphics can be embedded as a MS Visio file ensuring no resolution is lost
- Ready for peer review and release
Demonstration

Document Auto Generation will be provided at conference
Progress to-date

- Develop a method of maintaining the design throughout the Project Life Cycle with cost effectiveness in mind
  - Need to automate production of documentation
    - Update of full documentation set simultaneously
    - Graphics and tables to be of a high resolution and format
    - Speed of document generation needed to be fast
    - Update of document’s revisions page prior to start of auto generation
  - Able to capture the impact of change throughout the design
    - ECPs, CRs from customer
    - Apply the ‘What If’ scenarios
  - Minimal training necessary for the majority of users
  - Open & Scalable architecture
  - Auto-generated Metrics
  - Used across whole project team (Engineers to Program Managers)
Benefits

- Able to provide a complete baselined set of documentation for incremental design reviews
- Customer is able to read across the artifacts at same stage of design
- Design Team is able to see at a glance requirements that affect their own efforts
- Supports Agile Software Development
- Shorter time to generate and process documents
- Supports concurrent engineering
- Provides customer with a requirements trace tool suite (export file)
- System Architect export in XML requires no user license
Questions

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