Teamcenter® for systems engineering (TcSE) Design for Six Sigma (DFSS) Template

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Agenda

- DFSS and Systems Engineering (SE)
- Teamcenter® for systems engineering (TcSE) DFSS Template
  - Product Description
  - UGS and Statistical Design Institute (SDI) LLC Business Relationship
- TcSE DFSS Template Tour
- 5 + 2 Summary
Design for Six Sigma

- Design for Six Sigma (DFSS) is a business process focused on improving profitability.
- DFSS has its roots in Systems Engineering
  - Perform systems engineering analysis with statistical methods to establish requirements and model them.
- DFSS enhances your product development process by changing it from a reactive, build-and-test mode to a predictive, balanced and optimized progression.

*DFSS generates the right product (or service) at the right time at the right cost*

Source: Brue
DFSS is where the leverage is...

DFSS is aimed early in product development where the greatest leverage is at...
DFSS Window of Opportunity

―Design in‖ quality early when costs are low
DFSS Best Practice Model

1. Define Design Problem
2. Capture Voice of Customer
3. Identify Critical Requirements
4. Generate Design Alternatives
5. Select Best Alternatives

DFSS or DMAIC?

- DFSS
  - Build Models
  - Optimize the Design
  - Verify and Validate Design
- DMAIC
  - Measure the Existing Design
Systems Engineering

Is A PROCESS – Not An Organization

• Led By Systems Engineers
• Must Be Rigorously Applied
• The Technical “Glue" Which Makes Separate Design Disciplines And Subsystems Function Together To Provide An Integrated System Which Performs A Specific Job.

SE Is A Systematic, Interdisciplinary Approach That Transforms Customer Needs Into A Total System Solution

Source: Noblin
Simplified Systems Engineering (SE) Process Pattern

- Needs
- Validate
- Analysis & Control
- Requirements
- Verify
- Architecture
- Design
- Sys. Solution
Comparing DFSS to SE Process

- Similar Process Steps
- Emphasize Cost Avoidance
- Center on Customer Needs & Requirements
- Support Model Based Design Approach
- Explore Design Space
- Trade-offs on Candidate Solutions
- Verify and Validate Solution

DFSS and SE process reinforce each other
Capture the Voice of the Customer and then echo it throughout the Product Lifecycle to influence stakeholders to make the right decisions.
Teamcenter® for systems engineering (TcSE)
DFSS Template
TcSE DFSS Template System Diagram

- Affinity Diagram
- What Importance
- QFD
- TRIZ
- Design Selection

Capture QFD → TcSE → TcSE Visio Diagram → TcSE Excel Report → TcSE Word Doc

Monte Carlo → Statistical Allocation → Sensitivity Analysis → Multi-Objective Optimization

Apogee Tools
DFSS Best Practice Model with DFSS Enablers & Tools

What Importance

1. Define Design Problem
2. Capture Voice of Customer
3. Identify Critical Requirements
4. Generate Design Alternatives
5. Select Best Alternatives

DFSS or DMAIC?

1. Measure the Existing Design
2. Build Models
3. Optimize the Design
4. Verify and Validate Design

DFSS

1. Statistical Allocation
2. Sensitivity Analysis
3. Multi-Objective Optimization
4. Monte Carlo
Simplified Systems Engineering (SE) Process with DFSS Enablers & Tools

- Affinity Diagram
- TRIZ
- Needs
- QFD
- Design Selection
- Multi-Objective Optimization
- Validate
- Statistical Allocation
- Sensitivity Analysis
- Monte Carlo
- Verify
- Architecture
- Analysis & Control
- Design
- Sys. Solution

What Importance

- Requirements

Needs

Validate

Verify

Architecture
DFSS Template Installation

- **Client Side**
  - TcSE 7.0 Client
  - TcSE 7.0 OfficeLive I/F (XP, 2003)
  - SDI Toolset (Triptych & Apogee)
  - TcSE Excel DFSS Addin (XP, 2003)
  - MS Office XP/2003 and Visio 2003

- **Server Side**
  - TcSE 7.0 Server

TCR207 Product P/N
UGS and Statistical Design Institute (SDI) Business Relationship

- UGS: Sell DFSS Template, Provide Consulting Services
- SDI: Preferred Training Supplier for DFSS Template, Provide DFSS Training and Consulting Services, UGS Partner
- Customer: The connecting partner between UGS and SDI
Some DFSS Template Mental Notes

- **SDI**
  - Provides primary authoring environment for the DFSS template
  - Performs various DFSS analyses
  - Conduct DFSS analysis activities independent of TcSE and capture results later

- **UGS**
  - Captures DFSS analysis results using UGS Excel Addin with SDI Toolset
  - Connects DFSS work products with other systems engineering activities
  - Provides persistent storage for DFSS analysis work products
TcSE DFSS Template Demos

- Affinity Diagram
- What Importance
- Quality Function Deployment (QFD)
  - QFD Traceability Report
Capture Voice of the Customer

- Use Quality Function Deployment (QFD) “House of Quality” to capture the voice of the customer (VOC).
- Translate customer needs in qualitative terms (horizontal axis) into quantitative technical requirements (vertical axis)
- Iterative QFD process through phase rotations
Capture QFD with TcSE Representation

- What’s are the “Defining” objects
- How’s are the “Complying” objects
- House 1 to House 4 Requirements Flow down Traceability via Complying Trace Links

- How’s flow into What’s of next QFD House as Shortcuts
- Connect DFSS Requirement trace to other TcSE traces and maintains trace flow consistency
5 + 2 Summary

• DFSS and Systems Engineering creates synergy in developing systems…that is their combined effect is greater than the sum of their individual effects.
• UGS and SDI have come together to bring their talents together to realize this capability for the system product lifecycle.
  • Capture and echo the voice of the customer
  • Connect requirements to influence stakeholders, so they can make the right decisions
  • “Do it right upfront” and avoid costs downstream, so you deliver robust/repeatable products that customers want to buy…more profit for your company.
  • Capture knowledge for re-use
References

- Chollar, George and Peplinski, Jesse and Cheek, Tom, StatistICAL Design Institute DFSS Training.
- Creveling, C.M. and Slutsky, J. and Antis Jr., D., *Design For Six Sigma in Technology & Product Development*
Thank You