Design Process Integration Overview

NASA Case Number KSC-12294

Outline

- Project Goal
- Description
- Competitive Advantages
- Technology
- System Operation
- Project Team
- Conclusion

Project Goal

- **To provide a fully integrated knowledge based system to control and document the design engineering process**

Description

- **Design Process Integration (DPI) is a systems engineering approach using an integrated database**
- **It provides a checklist type data input forms to assure compliance with contractual requirements**
- **It also provides a common database repository for the information “behind the released design drawings”**

Competitive Advantages

- **This database system methodology can be used by any design department**
- **Provides objective evidence of ISO 9001 design section compliance**
- **Enables the program to retain a critical knowledge database after personnel have retired or left the program**

Technology

- **The Design Process Integration database was created using Microsoft Access**
- **In a larger engineering organization a more powerful database such as Oracle is recommended to perform this function**
- **This methodology of controlling and documenting the design engineering process can be adapted by other diverse departments/organizations program wide**

System Operation

- **The requester enters a request for design services by submitting a Design Support Request (DSR) through the database**

System Operation

- **The cognizant design engineering manager opens and reviews the existing DSRs and assigns the DSR to specific members of the team for analysis and evaluation through the database**

System Operation

- **If the DSR is approved, it is sent to the Configuration Change Board (CCB) for funding**
- **If the DSR is not approved, it is sent back to the requestor with disapproval rationale in a timely manner**

System Operation

- **The following approval documents are available in Section 1.0 of the Product Approval Record (PAR) and are completed as required:**
  - **The Configuration Change Board Directive (CCBD)**
  - **The Logistics Change Board (LCB) records**
  - **The Engineering Design Change Proposal (EDCP)**
- **The approval documents provide implementation direction to all functional departments**

System Operation

- **Section 2.0 of the Product Approval Record contains:**
  - **Basic design flow process**
  - **Classification selection**

- **It is important to note that the design flow for Tooling is different from the design flow for Special Test Equipment which is also different from Flight Hardware**

System Operation

- **The Mechancial/Fluid/Electrical Design Requirements are entered by the Design Engineer in Section 3.0 of the Product Approval Record (PAR) as follows:**
  - **Section 3.1 - Design Cost Estimate**
  - **Section 3.2 - Functional Requirements**
  - **Section 3.3 - Program Requirements**
  - **Section 3.4 - Concepts/Schematics**
  - **Section 3.5 - Analysis and Calculations**
  - **Section 3.6 - Pressure Vessel Certification Requirements**
  - **Section 3.7 - Procurement**
  - **Section 3.8 - Reliability/Risk Assessment**
  - **Section 3.9 - Safety Statements**
  - **Section 3.10 – Design Verification**

System Operation

- **Each of the items listed in Section 3.0 of the PAR contains:**
- **A work sheet for the engineer to enter the required data**
- **A place to designate when in the design process each item will be completed:**
  - **Preliminary Design Review (PDR)**
  - **Critical Design Review (CDR)**

System Operation

- **The program documentation is recorded in Section 4.0 of the Product Approval Record (PAR) including:**
  - **The engineering log**
  - **The open communications folder where all correspondence regarding the project are kept**

System Operation

- **All of the engineering deliverable products are recorded by product number in Section 5.0 of the Product Approval Record (PAR) titled "Identified Products by Product Number". For example the Design Engineer enters the following items in section 5.0:**
  - **Section 5.1 – Top Assembly Drawing**
  - **Section 5.2 – Acceptance Test Requirements**
  - **Section 5.3 - Detailed Drawings**
  - **Section 5.4 – Procurement Specification**
  - **Section 5.5 – Schematic Diagram**
  - **Section 5.6 - Wiring Diagram**
  - **Section 5.7 - Pressure Vessel Certification Report**
  - **Section 5.8 - Safety Statement**

System Operation

- **Each of the items listed in Section 5.0 also contains a place to designate when in the design process each item will be completed (Preliminary Design Review (PDR) or Critical Design Review (CDR)**
- **The need for a software plan will be entered in section 6.0 of the Product Approval Record (PAR)**

System Operation

- **The bottom of the Product Approval Record (PAR) form contains a row of selection buttons which allows the Engineering Team to enter the following design review information:**
  - **Agenda**
  - **Minutes**
  - **Feasibility Assessment**
  - **Review Item Dispositions (RIDS)**
  - **Project Schedule**

System Operation

- **The Engineering Team can also enter the project data at the top of the form including:**
  - **NSLD CCBD Number**
  - **Charge Number**
  - **Assigned Design Engineer's Name**
  - **Assigned Project Engineer's Name**
  - **Change Description and Rationale**
  - **Design Review Dates**

Conclusion

- **Uses engineering personnel more efficiently and saves time and money during the design to build process**
- **Provides a surveillance tool and facilitates the development of design engineering metrics**
- **Systematic approach (i.e. common database) allows faster preparation of PDR/CDR materials**

Conclusion

- **Enables the program to retain a critical knowledge database after personnel have retired or left the program**
- **Overall retention of design knowledge (the facts and decisions behind the drawings) as objective evidence of the design process is improved**
- **Use of this integrated knowledge based database for design engineering documents gives ready access to project status for all levels of management**