



Lessons Learned For Cx PRACA

**Constellation Program Problem Reporting,
Analysis & Corrective Action Process & System**

CONSTELLATION

The Presidential Commission on the Space Shuttle Challenger Accident Report



FINDINGS

- ***Problem reporting requirements are not concise and fail to get critical information to the proper levels of management.***
- ***Little or no trend analysis was performed on O-ring erosion and blow-by problems.***
- ***Five weeks after the 51-L accident, the criticality of the Solid Rocket Motor field joint was still not properly documented in the problem reporting system at Marshall.***

(June 6, 1986 p.152, p161)



CAIB Report Finding



F7.4-9

NASA information databases such as The Problem Reporting and Corrective Action and the Web Program Compliance Assurance and Status System are marginally effective decision tools

F7.4-11

The Space Shuttle Program has a wealth of data tucked away in multiple databases without a convenient way to integrate and use the data for management, engineering, or safety decisions.

F6.1-10

NASA failed to adequately perform trend analysis on foam losses. This greatly hampered the agency's ability to make informed decisions about foam losses.



Other Lessons Learned

- ◆ **Lesson Learned Shuttle, ISS, Orbiter**
- ◆ **Experiences during RTF after Challenger and Columbia**
 - **Significant cost incurred attempting to locate & capture H/W and S\W life-cycle failure history**
 - **Multiple databases with little or no access and no common terminology**
 - **Significant cost incurred in trying to trend, (data-mining by several multiple organizations, produced marginal results)**
 - **Multiple instances of innovative ways to not report problems (i.e. “in-family” vs “out of family” ; reporting start at ATP and then only at highest level assembly.)**

How the Cx PRACA Requirements Respond

- ◆ Defines PRACA PROCESS first then identifies tool needed
- ◆ Requires a Single Tool for Managing the PRACA Data & Process
 - Allowing data to be collected in different tools significantly complicates the process.
- ◆ Clearly defines the Scope of PRACA Applicability and What “Problems” Must Be Reported
 - The PRACA requirements specify those items to which the PRACA reporting and management process applies.
- ◆ Clearly defines when the PRACA Process and Requirements become Applicable
 - The PRACA requirements define the point in time during HW/SW development that reporting and managing problems is required.
- ◆ Clearly defines Ownership and Responsibility for Managing the PRACA Process, Including Disposition Authority
 - Although all “problems” should be reported, not all problems warrant NASA disposition approval; those that do may warrant approval at different levels.

Critical Success Factors

- ◆ **Support, involvement and ownership by Program and Project Management**
- ◆ **Important aspects for success of closed-loop corrective action systems:**
 - **Enforce Accountability (NASA and Contractors)**
 - **Require thorough analysis and approval before deviating or allowing deviation from requirements**
 - **CxP PRACA is a Process, not a Database. The database is intended to support the tactical implementation of the process.***
 - **Rigorous training on process and/or CxP PRACA Module**
 - **Ensure communication (NASA ↔ NASA || Contractor ↔ NASA).**
 - **Ensure appropriate resources through the life of the program**
- ◆ **Understanding of economic case as well as technical (safety) case for requirements.**

**CxP PRACA is a process, supported by a single information gathering data module which will be integrated with a single CxP Information System, providing interoperability, import and export capability making the CxP PRACA a more effective and user friendly technical and management tool.*



Key Lessons Learned

CXPRACA DATA SYSTEM



Software System Key Requirements



◆ Process

- Single, centralized data set
- Expanded definition of the types of captured problems (e.g., non-conformances)

◆ System

- Tactical support for analysis and investigation
- Workflow support
- Highly modifiable, especially with respect to data collected and workflow
- Interoperability with related systems (e.g., Parts list, PRACA, FMEA/CIL, Hazards, GMIP, CRADLE, etc.)
- Attachments (any number, any size, any type)
- Cross-platform, Cross-browser



Broad System Solutions/Issues



- ◆ **Paper->Digital = New capability and options = Process changes**
- ◆ **Should collect low-level non-conformances**
 - What seems like a small problem when looked at from a trending perspective may be a large issue.
- ◆ **Manage hardware, software, process problems together**
 - Creates environment for analysis across all problems.
 - The line between software and hardware is blurry and process connects to both.
- ◆ **Adaptable for future technology**
 - Protect the data, the software will change
- ◆ **Open standards, focus on web services and interoperability**



Links to Relevant Data



- ◆ **One linked PRACA data set across centers**
 - Across Centers and workgroups
 - Linking dependencies in work process steps
 - Tying together related problems and parts
- ◆ **Access from and to multiple related systems,**
- ◆ **Attaching, accessing relevant files, e.g., diagrams, spreadsheets, telemetry**



Searching



- ◆ **Flexible & powerful searching within the system**
- ◆ **Types of Search**
 - **Keyword (Google style)**
 - Records which mention Newton
 - **Filtering (most valuable for quality)**
 - **Every record ever entered pertaining to part SB00001, sorted by criticality and date entered**
 - **Suggestive Filtering**
 - All records matching a set combination of fields in an opened record, automatically provided for review.
 - **Relational Filtering**
 - Comprehensive results utilizing correlated links between related problems
 - **Integrated system supported search**
 - Every record pertaining to a part included on the official flight manifest



Validation and entry



- ◆ **Providing definition of fields and code values in context with their use.**
 - Clickable field titles with definition provided.
 - Value definition lists
- ◆ **Validate data on entry against authoritative source**
 - Part numbers checked against Product Data Structure
 - Invalid entrees stored but marked for evaluation
- ◆ **Codes and Trending data need to be consistent and reliable**
 - When possible have codes managed in an authorities, sharable source
 - Ensure consideration has been made for evolution of coding schemes (merging values, splitting values up)
 - Valuable for closed records to maintain original coding but function in searches based on up to date coding schemes.