Lessons Learned For Cx PRACA

Constellation Program Problem Reporting, Analysis & Corrective Action Process & System
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, p.161)
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
- **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
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 entries 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.