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, 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.

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*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 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.