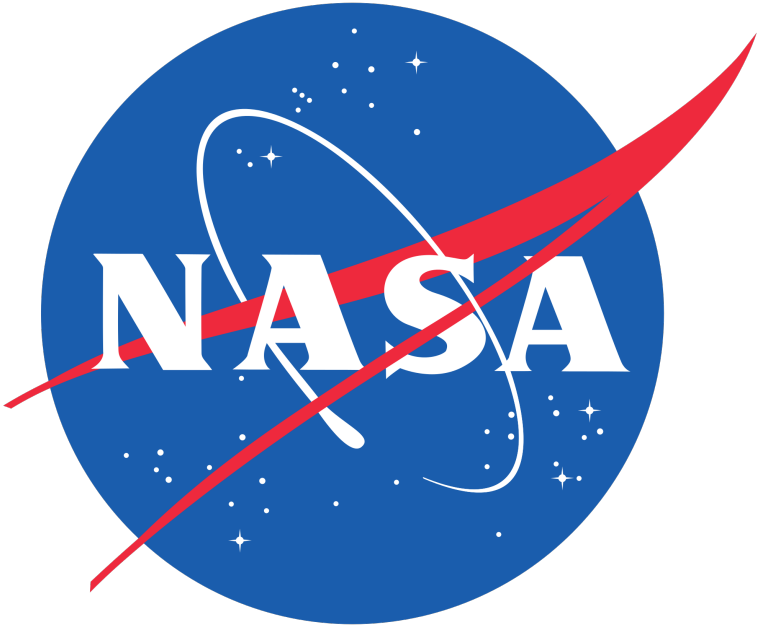
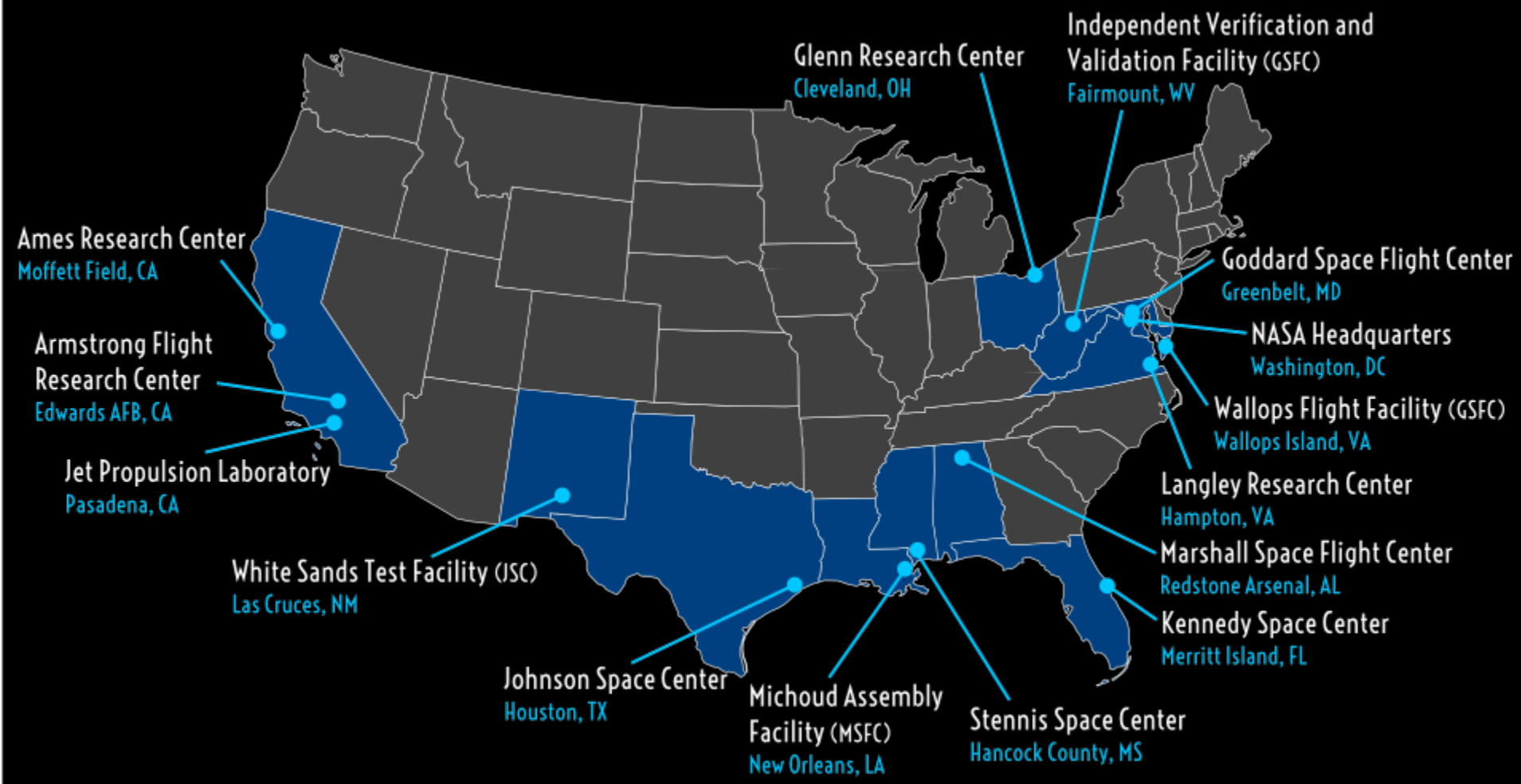


UX Usability Methods for Enterprise/Expert Systems

Matt Sharpe Matt Guibert

NASA Ames Research Center
Human Computer Interaction Group
October 2015

NASA Centers

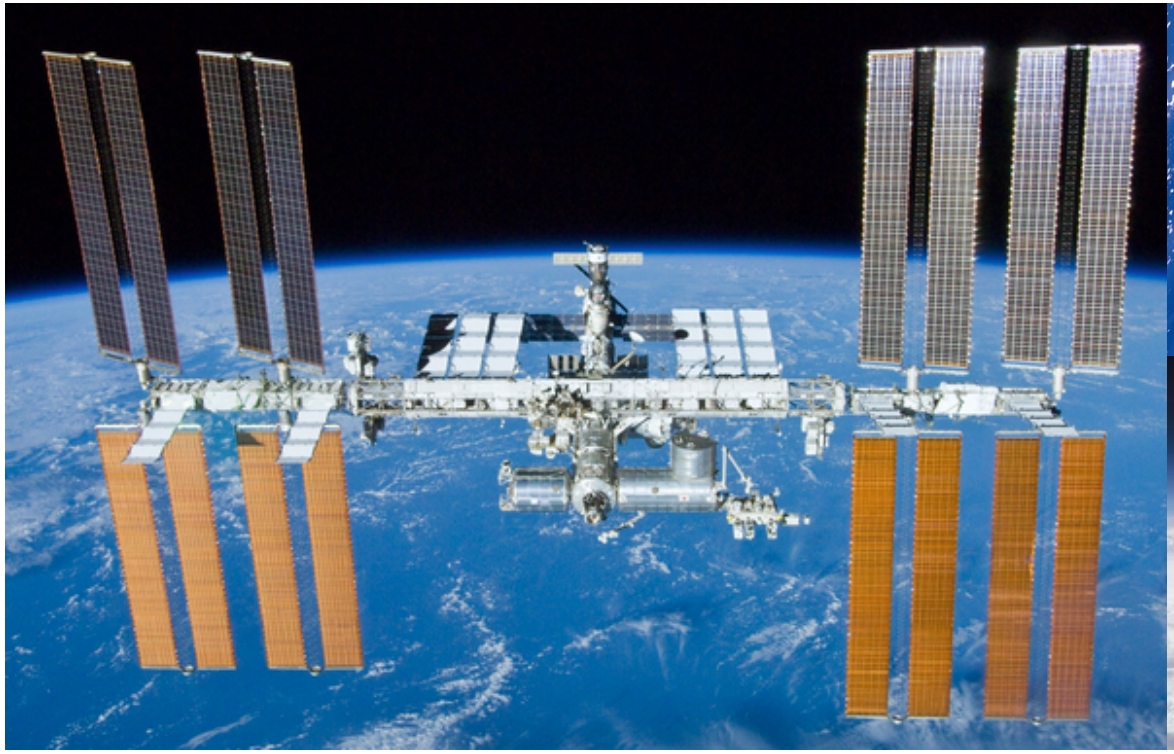


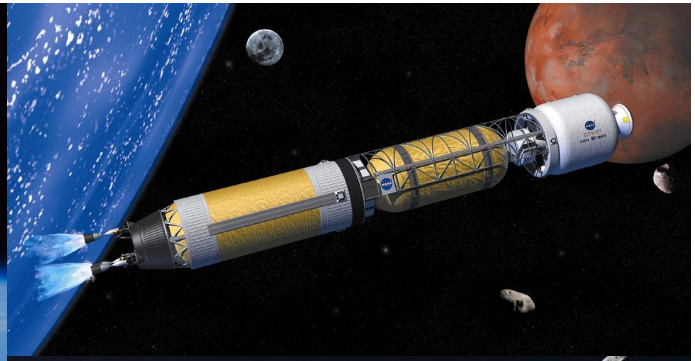
NASA Ames Research Center

The HCI Group

- We are an *applied* HCI group.
  - 18 production systems
  - 19 production integrations

- We build engineering data systems and integrations:
  - Web systems
  - Mobile applications
  - Data integrations





Expert Users

via NASA (51L-S-012)

Representative System Example

Operations Task: find all analyses related to an anomaly.

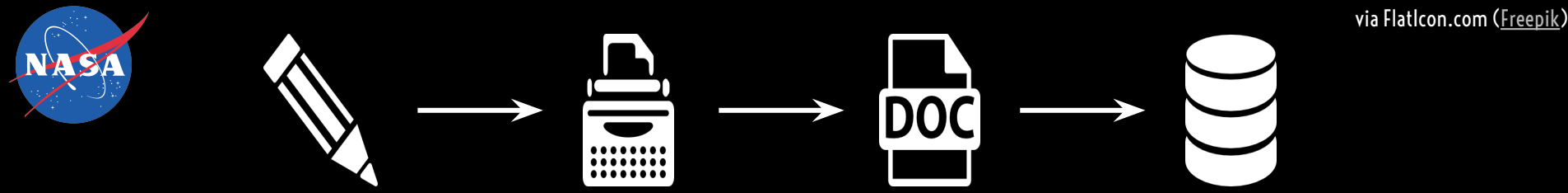
Historical Process: With no search capabilities, analysts used prior knowledge/trial and error to browse through the available flight folders (48 total) to find when the affected hardware flew to ISS. Once the flight is found where the analysis is located, open each MS Word document in the folder and scan through to find the applicable analysis (one document in particular was 1719 pages long).

Operations estimated this process took ~3 days.

"Spent a lot of time collecting data, and spent little time analyzing it"

"Got a lot of data, but very little information"

"If the [legacy] system had the searching capability that the [new] system did, this would've taken a few hours"



via FlatIcon.com (Freepik)

HAZARD
CROSS-PROGRAM

matthew.d.sharpe@nasa.gov

Search: Title enter keywords, record ID, etc. Search

Home | Charts | Advanced Search | Help | Signatures | Saved Searches | Whining | Prefs | Admin

Hazard
[Hazard] Record 5720 - INWORK
(MPCV-XXXX-001) Ignition of Flammable Atmospheres (edit)

Save Changes

- Basic Information
- Causes
- Controls
- Verifications
- Supporting Information
- Related Documents
- Approvals and Concurrences

Causes

CAUS1. Introduction of a Flammable Atmosphere

Causes ID: CAUS2 (Delete)

◇ **Cause Title:** Arc / Spark Ignition Sources

Full Transfer: No

◇ **Severity:** Catastrophic definitions

◇ **Likelihood:** Low definitions

Fault Tree Reference:

◇ **Cause Description:** The ignition/explosion of a flammable atmosphere in MPCV

◇ **Effect(s):** Creation and subsequent ignition of a flammable atmosphere may cause catastrophic damage to vehicle structures, safety critical systems, damage to launch processing facilities, or injury

◇ **Likelihood Justification:**

Related Controls:

1 CTRL2 Edit
Design • EGSE hazard proofing
provided EGSE that is to be operated in locations where fire or explosion hazards may exist, as defined by Code, Article , are listed by a nationally recognized testing agency for use in that location in accordance with or are purged and pressurized in accordance with the requirements of

2 CTRL3 Edit
Design • Prop Provisions for Electrical Grounding
The spacecraft design includes provisions for electrical grounding to the hazardous panel and associated Ground Systems-provided propellant loading equipment and facilities.

3 CTRL5 Edit
Design • MGSE IAW 72506
provided EGSE electrical systems and their grounding / bonding complies with in accordance with Standard for the Design and Fabrication of Ground Support

4 CTRL7 Edit
Hazard transfer • XFER to FLT- (ignition sources)
No information listed

Add Controls – or – Reuse Controls

Add CAUS3

Created:2014-08-20 17:03 PDT by
Modified:2015-09-28 14:12 PDT (History)

Save Changes

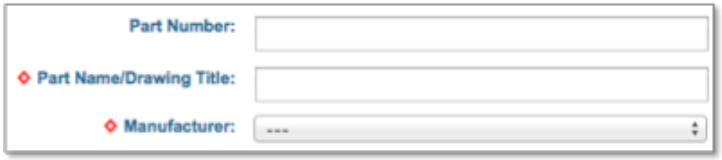
Hazard PDF - Create Record Snapshot - XML - Transfers

System Benefits

- **Streamlined, consistent data entry** — provides in context training and help documentation for process compliance.
- **Structured searching** reduces search time and ensures that engineers find the *complete* set of records efficiently.
- **One consolidated system** reduce overhead/maintenance and ensures configuration control while providing a single entry point for Ops use.
- **Full change history** provides tracking of updates to individual aspects of a report (e.g. severity changed from moderate to catastrophic).
- **Complete version tracking** ensures that each version has the full analysis available in one place.
- **Robust security model** supports participation of International Partners, Universities, etc while protecting proprietary and ITAR data.

Representative Data Integration Example (1)

Historical Process



23% Completion

Current/Improved Process

86% Completion

Representative Data Integration Example (2)

ESD Requirements

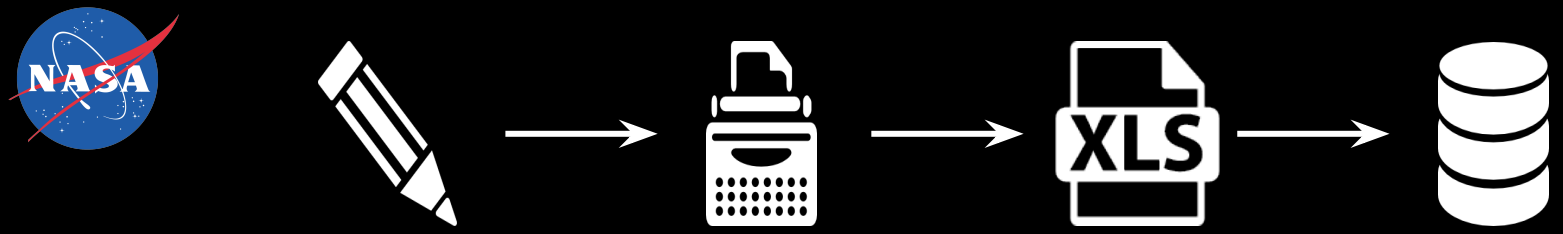
Program Requirements

Program Verifications

Assessment

		Req #	Requirement Title	Requirement Language	Requirement Rationale	Specified By	Allocated To	DVO ID	DVO Name	DVO Effectivity	DVO OBJECTIVE	DVO SUCCESS CRITERIA	DVO Verification Method	OPI V&V Plan Says and/or Alan Comments/Questions
38	R-6	734	Orion-CM Imagery	The LRE Descent Imaging Subsystem shall provide	Use recovery ship imaging assets to: provide optical data on post-	Landing and Recovery Element (LRE) EIT	Communication Systems (Comm) EIT	760		EFT-1	Review results of C3R verifications prior to operations.	Inspection complete	Inspection	sufficient for
39	R-6							7270		Orion EM-1	The LRE documentation will be inspected to verify that stabilized imaging assets are provided	Ensure imaging assets are provided that capture stabilized imaging of crew module, parachutes and forward bay cover.	Inspection	sufficient for
33	R-6	736	Recovery Team Communication	The LRE CM Recovery team shall	Use recovery ship communication capability to: transmit	Landing and Recovery Element (LRE) EIT	CM Recovery Ship	763		EFT-1	C3R methods associated with Underway Test to verify requirements are satisfied.	Inspection complete	Inspection	Is part of underway test? They are both involved but no mention here. If piece covered, then this would be sufficient for Would want to see involvement of in
34	R-6													
35	R-6						Command Control Communications and Range (C3R) IPT	###	01	EFT-1	data to Mission Control Center at JSC. (during Underway Test)	JSC receives data	Demonstration	sufficient for
36	R-6							###	02	EFT-1	recovery ship communications capability. (during Underway Test)	JSC receives file	Demonstration	sufficient for
37	R-6							###	03	EFT-1	Provide recovery team with internet access ship communications capability. (during Underway Test)	The analysis shows that provided is sufficient for	Analysis	sufficient for
38	R-6							###	04	EFT-1	Provide communications during underway test using the recovery ship communications and any	The analysis shows that team is sufficient for	Analysis	sufficient for
39	R-6	737	Video Uplink	The LRE Descent Imagery Subsystem	The includes footage from the	Landing and	Communication Systems (Comm)	766		EFT-1	Review results	Review complete	Inspection	Is the demo different than test? This is probably

via FlatIcon.com (Freepik)



Trace powered by Dig-IT

HOME REPORTS SEARCH BROWSE WORKSPACE

matthew.d.sharpe@nasa.gov

- ESD
  - Assessment
  - Requirement
  - DRM
  - show more
- GSDO
- SLS
- MPCV

EVAT Assessment [8]

Size	R-2 Crew Size
R-16	
Recovery	R-6 Nominal Post-Landing Crew Recover,
R-7	R-7, Post Landing Crew Survival
R-15_Assessment	R-15 Launch Rate
R-11_Assessment	R-11 Lift Capability
R-12_Assessment	R-12 Payload Dimensions
R-20_Assessment	R-20 Audio and Motion Imagery

ESD Cradle Requirement [1]

GSDO Cradle DVO [438]

GSDO Cradle Requirement [35]

65	ESD R-11: Lift Capability
84	Receipt of Flight Elements
89	Transportation of Flight Elements
90	Offline Operations
91	Integrated Operations
92	Integrated Testing
93	Integrated Stack Transportation
94	Pad Operations and Launch
95	Ground Element Refurbishment
97	Post-Flight Processing
104	Design Life Duration
106	Launch Ready State

ESD Cradle Requirement [1]

EVAT Assessment [1]

GSDO Cradle Change Notice [2]

GSDO Cradle DVO [1]

GSDO Cradle Equipment [2]

GSDO Cradle Requirement [36]

65: ESD R-11: Lift Capability

GSDO Cradle

Cradle ID: 65

Name: ESD R-11: Lift Capability

Frame: Requirement: The Architecture shall deliver a minimum of payload for the Tactical capability and for the Strategic capability to degrees inclination, with a demonstrable evolution path to metric tons.

CM Status: Baselined

Frame: Rationale: HEFT Design Reference Mission analysis indicates that launch vehicles in the metric ton class are necessary to enable Strategic missions. The metric ton Tactical requirement will provide the ability to path and is called for as part of the 2010. lift capability allows the architecture to conduct mission types from the Strategic DRM set. As more challenging missions are needed, the launch vehicle lift capacity needs to support a metric ton class. The launch system needs to consider this metric ton capability throughout its design to ensure that this capability can be achieved.

Category: ReqType: Performance

Category: Authority: Programmatic

Key: PROG

Version/Draft: 01

Modified Date: 2014-07-30 20:49:09 UTC

Created Date: 2012-03-01 20:25:13 UTC

Assessment

R-11_Assessment

Assess? Yes

Orig. ESD Trace

Assessment Result: Sufficient

Save

created by Nov 24 2014

ESD Assessment > R-11_Assessment > 65

Curator: Matt Guibert
NASA Official:

Trace v 1.8 r 997 master d89f159
Dig-IT v 2.8 r 1236 master 15404f8

Last Updated: Thu Sep 10 09:45:25 PDT 2015
Privacy Statement

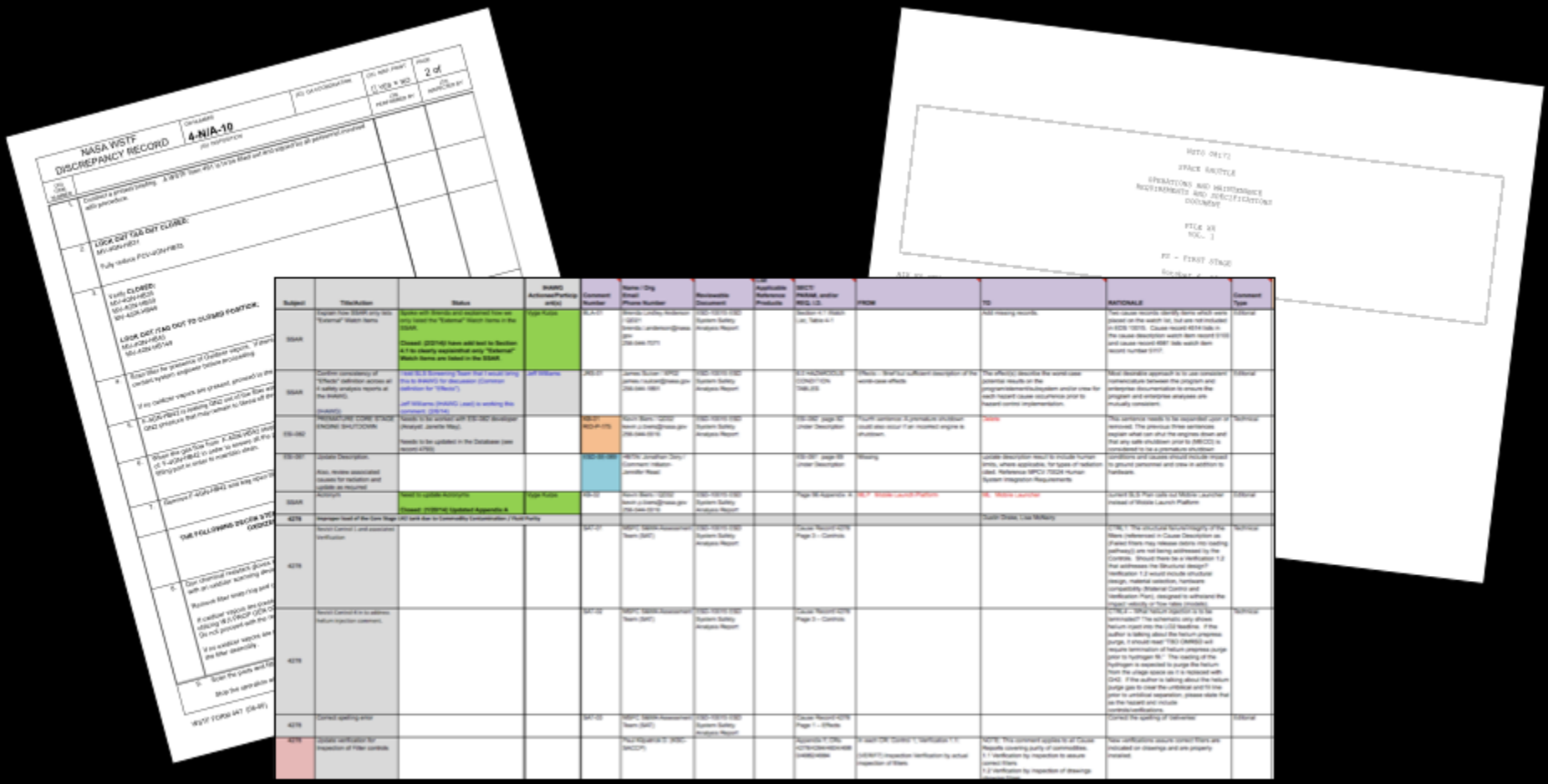
Integration Benefits

- **Structured searching** reduces search time and ensures that engineers find the *complete* set of records efficiently.
- **Improved efficiency in record creation** reduce overhead/maintenance in validation of information through baselining.
- **Automatically trigger notifications** provides notifications to individual aspects of a report.
- **Quick reference to integrated information** ensures that each reference goes to authoritative piece of information in other system.

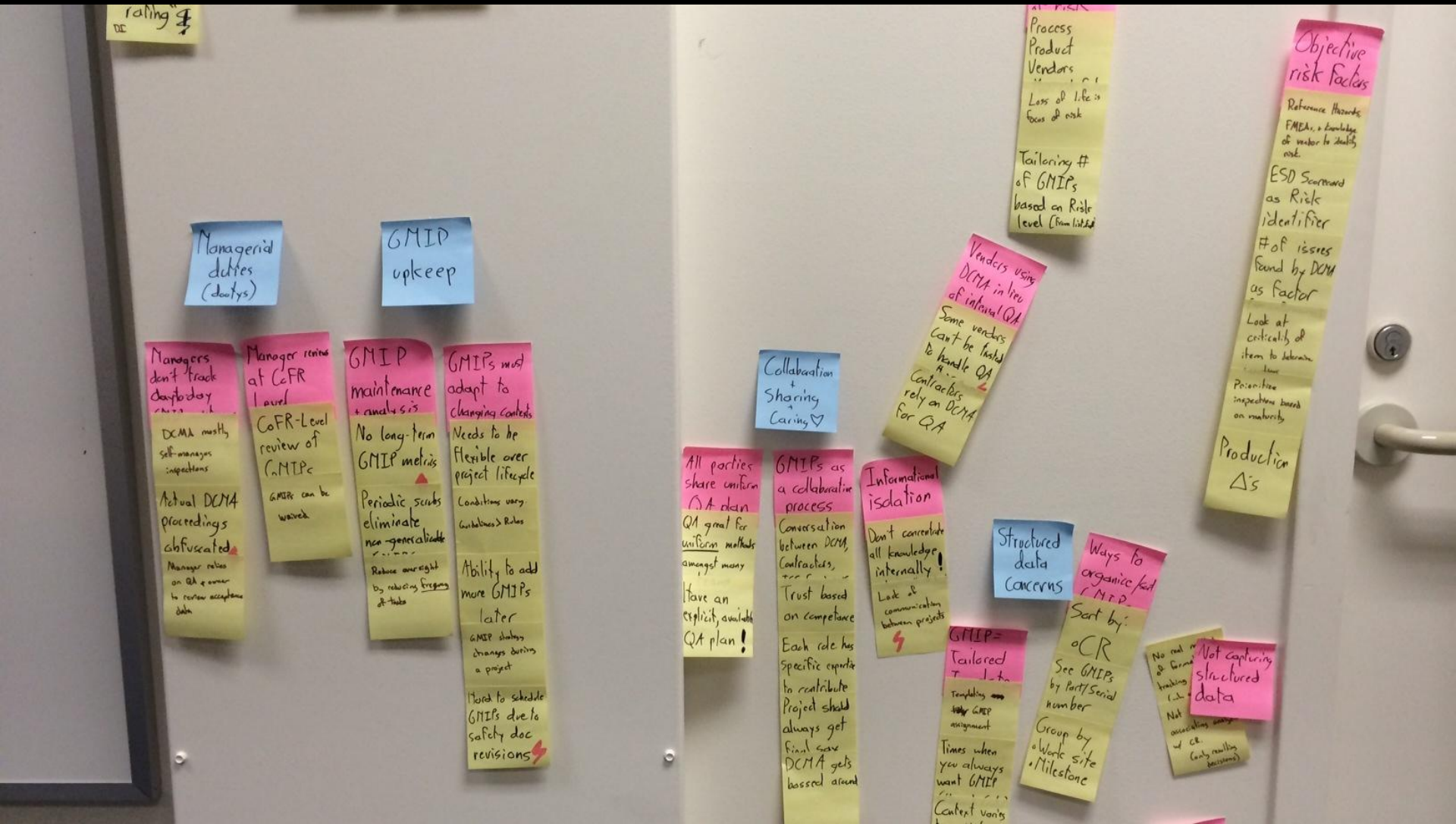
Integrated question: If a failure occurs on a piece of hardware, what similar problems have occurred in the past?

Design Process and Methods

Artifacts


NASA WSTF
DISCREPANCY RECORD
4-N/A-10
2 of
WSTF FORM 647 (04-95)
AUTO CAD(T)
SPACE SHUTTLE
OPERATIONS AND MAINTENANCE
REQUIREMENTS AND SPECIFICATIONS
DOCUMENT
FTA-2 XX
VOL. I
FT - FIRST STAGE

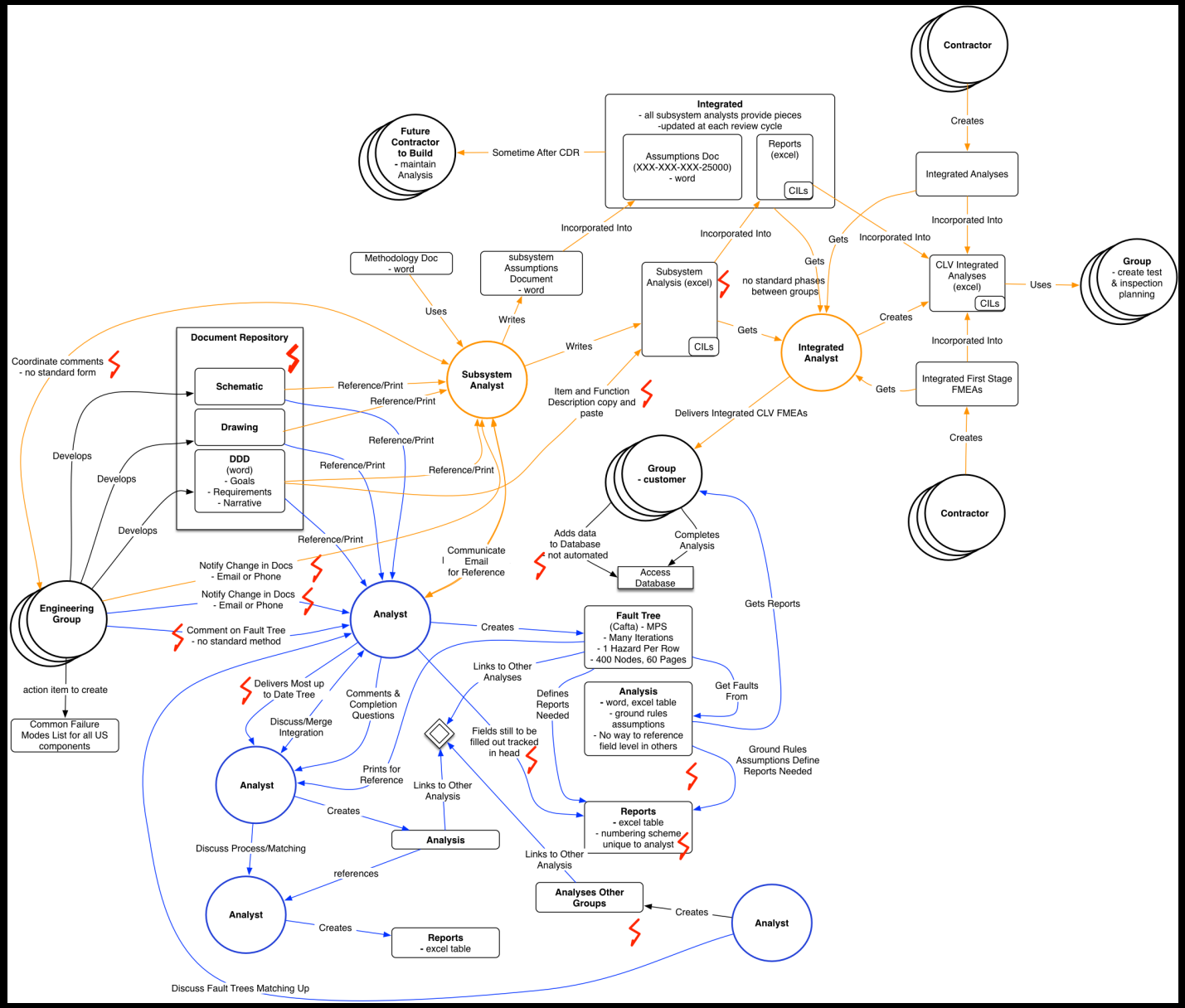
Affinity Diagrams



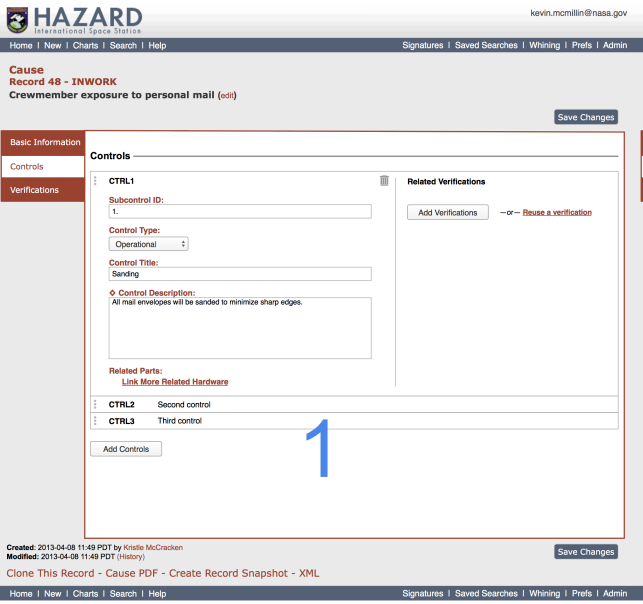
Contextual Inquiry

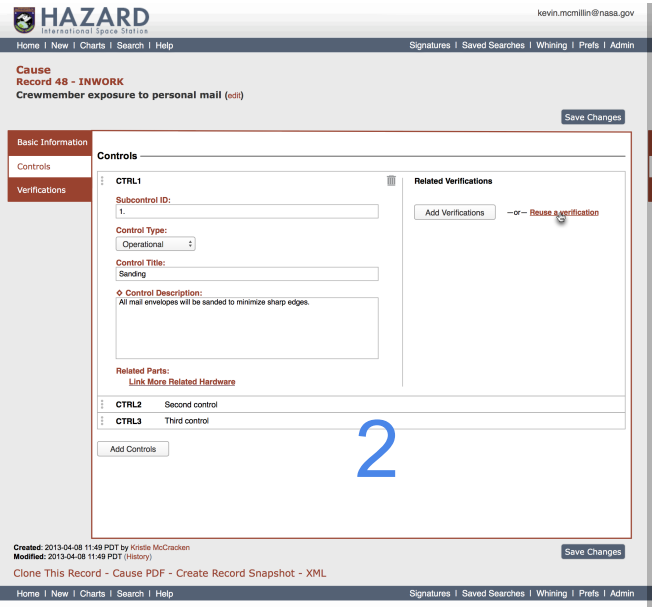
via NASA (Flickr 9773268932)

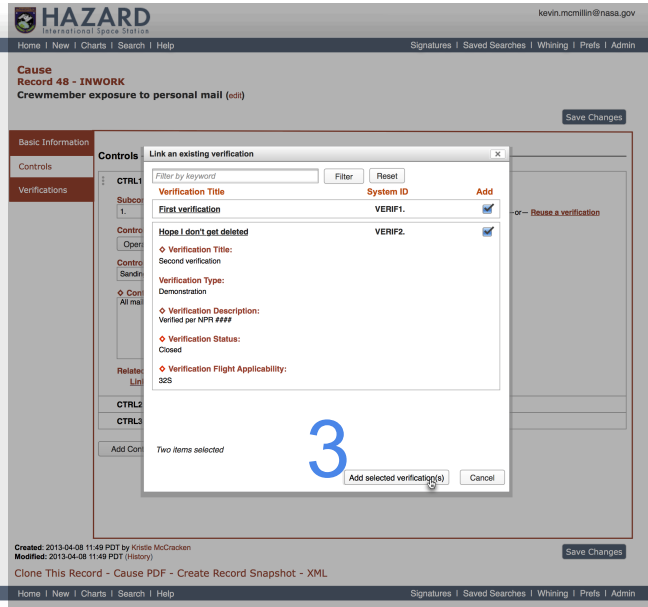
Models

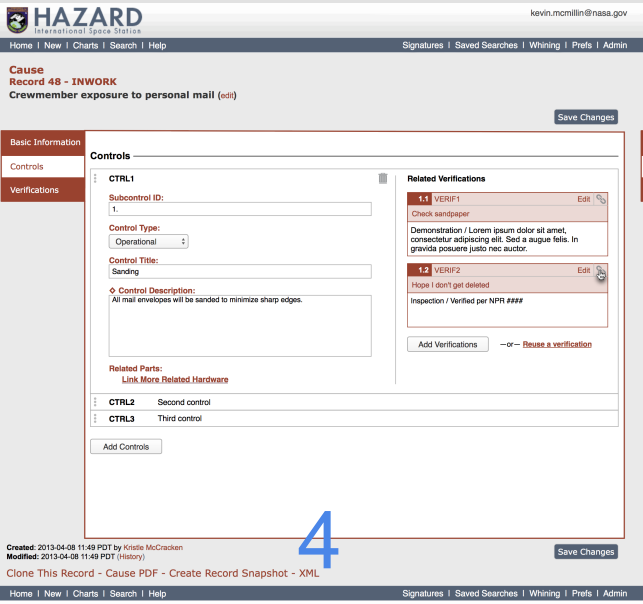

Contractor
Creates
Integrated
- all subsystem analysts provide pieces
-updated at each review cycle
Assumptions Doc
(XXX-XXX-XXX-25000)
- word
Reports
(excel)
CILs
Future
Contractor
to Build
- maintain
Analysis
Sometime After CDR
Integrated Analyses
Incorporated Into
Incorporated Into
Incorporated Into
Gets
Gets
Methodology Doc
- word
subsystem
Assumptions
Document
- word
Subsystem
Analysis (excel)
CILs
no standard phases
between groups
CLV Integrated
Analyses
(excel)
CILs
Uses
Group
- create test
& inspection
planning
Uses
Writes
Writes
Gets
Creates
Incorporated Into
Document Repository
Schematic
Drawing
DDD
(word)
- Goals
- Requirements
- Narrative
Subsystem
Analyst
Integrated
Analyst
Integrated First Stage
FMEAs
Gets
Coordinate comments
- no standard form
Reference/Print
Reference/Print
Reference/Print
Reference/Print
Reference/Print
Item and Function
Description copy and
paste
Delivers Integrated CLV FMEAs
Creates
Develops
Develops
Develops
Group
- customer
Contractor
Adds data
to Database
not automated
Completes
Analysis
Access
Database
Reference/Print
Notify Change in Docs
- Email or Phone
Notify Change in Docs
- Email or Phone
Communicate
Email
for Reference
Engineering
Group
Analyst
Gets Reports
Comment on Fault Tree
- no standard method
Creates
Fault Tree
(Cafta) - MPS
- Many Iterations
- 1 Hazard Per Row
- 400 Nodes, 60 Pages
Links to Other
Analyses
action item to create
Delivers Most up
to Date Tree
Comments &
Completion
Questions
Defines
Reports
Needed
Analysis
- word, excel table
- ground rules
assumptions
- No way to reference
field level in others
Get Faults
From
Common Failure
Modes List for all US
components
Discuss/Merge
Integration
Fields still to be
filled out tracked
in head
Ground Rules
Assumptions Define
Reports Needed
Analyst
Prints for
Reference
Links to Other
Analysis
Creates
Reports
- excel table
- numbering scheme
unique to analyst
Analysis
Discuss Process/Matching
Links to Other
Analysis
references
Analyses Other
Groups
Creates
Analyst
Analyst
Creates
Reports
- excel table
Discuss Fault Trees Matching Up

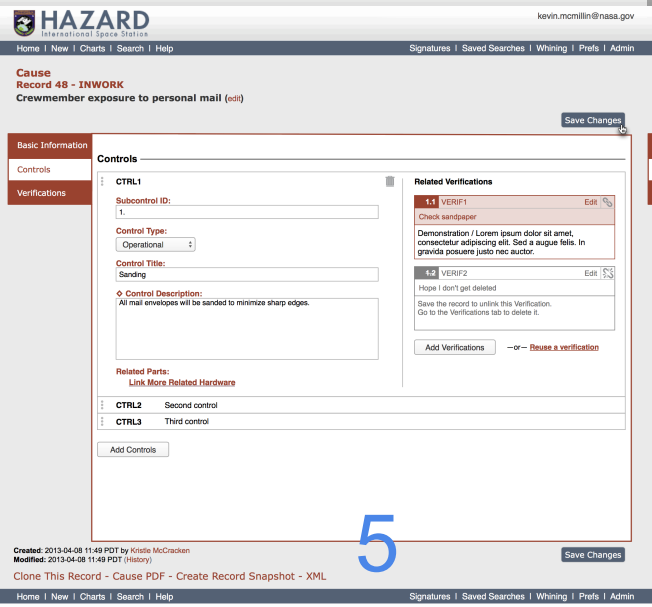
Wireframing/Storyboards

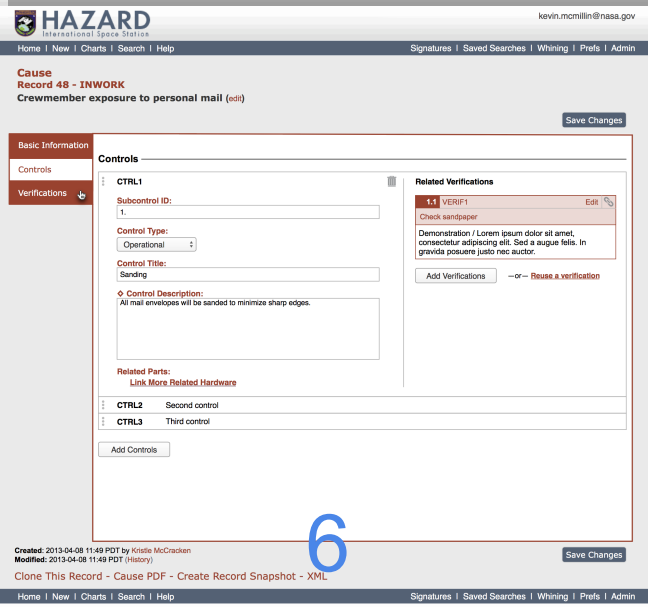




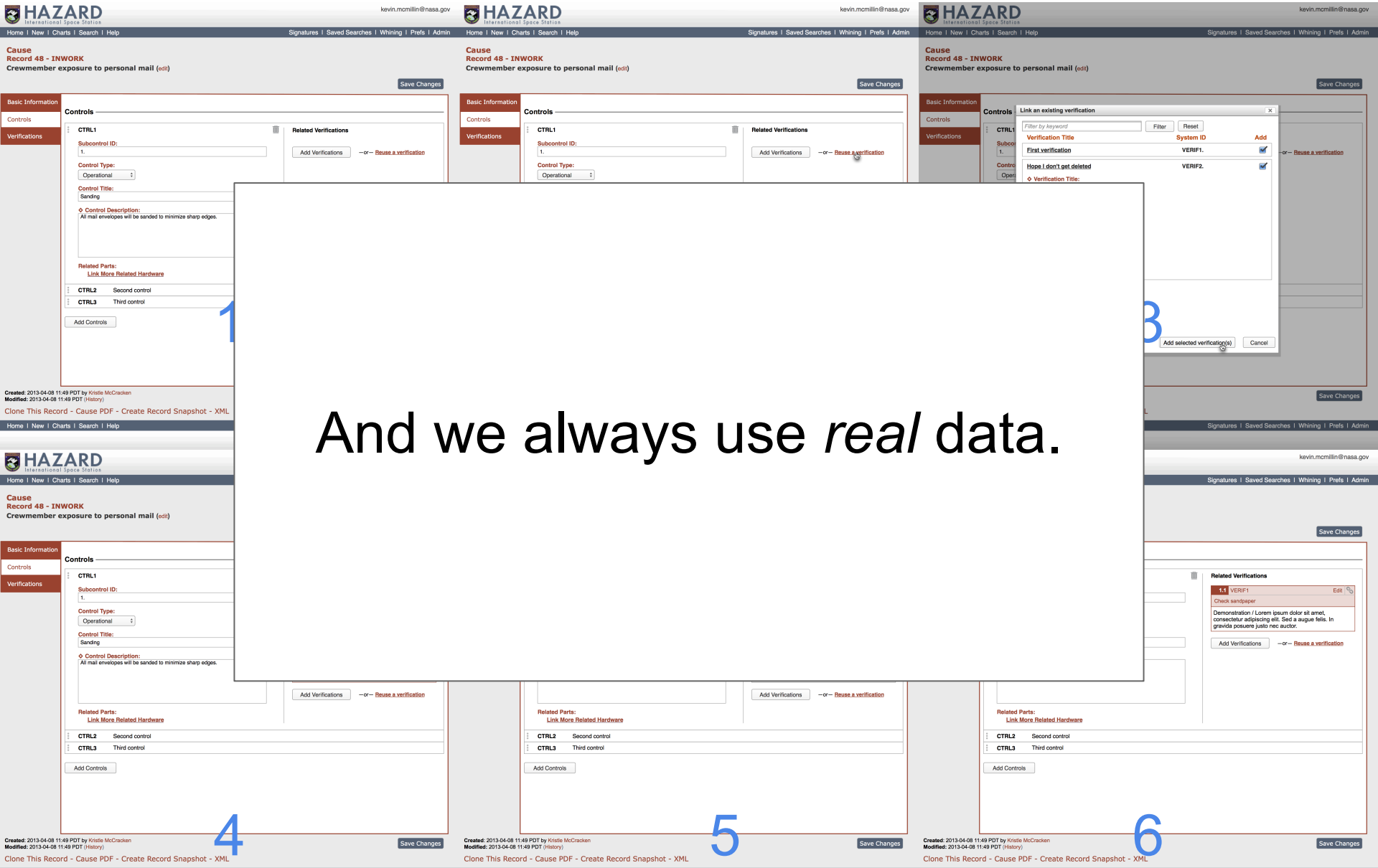








Wireframing/Storyboards



And we always use *real* data.

Usability Testing

- Informal, no usability lab.
- Scenarios need to be detailed and incredibly accurate

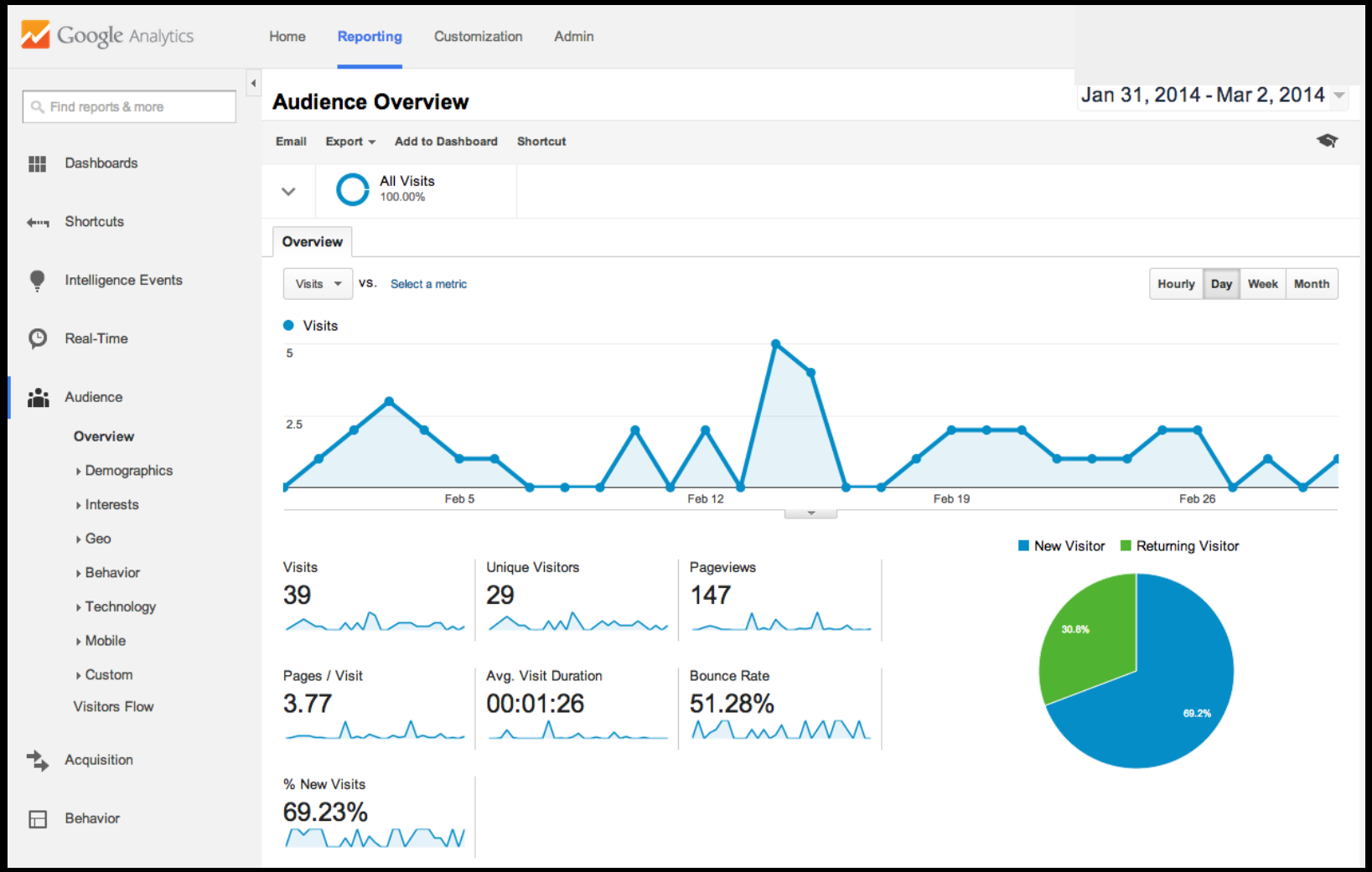
~~Personas~~

Typical persona:

- *"Angelline is a safety engineer who loves books about the beach."*

- *"Bob is a flight controller who watches a movie every Saturday."*

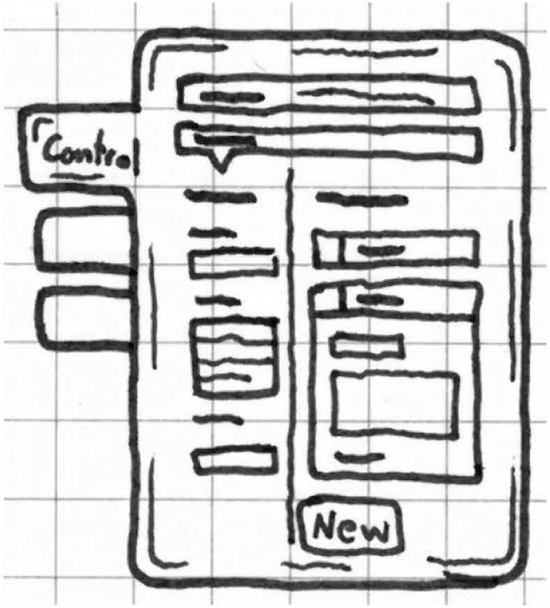
Web Analytics and A/B Testing



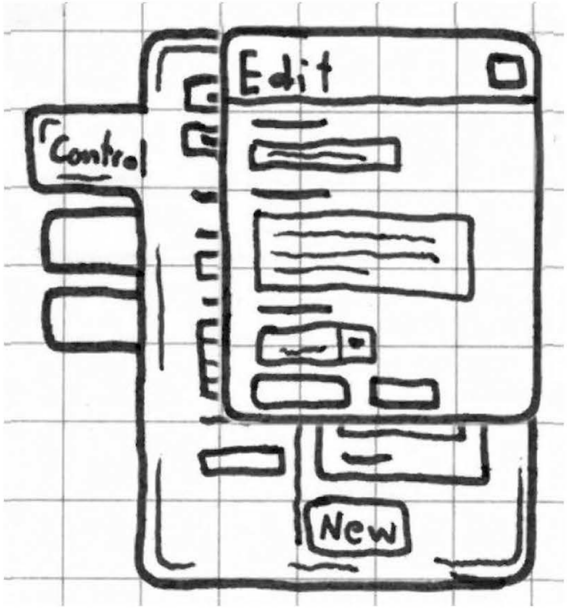
~~Speed Dating~~

Status Transition and Control

Have you ever had another author edit a cause that you had previously baselined?



Changes to the Cause record are indicated visually. You can also view the old and new versions



Changes to the Cause record are indicated visually. You can also view the old and new versions

Other Methods

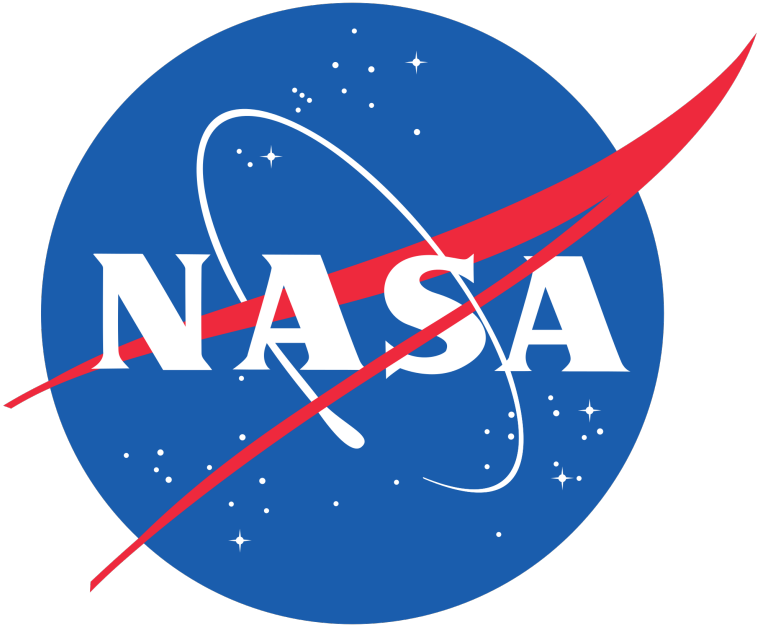
- ~~Heuristic Evaluation~~
- ~~Fitts Law Modeling~~
- ~~Surveys~~

Design(er) thoughts

Our designers:

- Write the initial test case
- Are first to run the test case
- Often double as software testers

Technology should conform to the process, and never a process to technology.



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