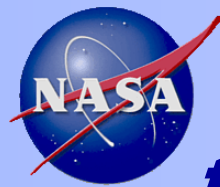


NASA Lessons Learned Program

Capturing and Disseminating Knowledge



Michael Bell, NASA Lessons Learned Program
Manager



Lessons are available through the public system and internal system

NASA ENGINEERING NETWORK

Find IT @ LLIS: + GO

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+ ABOUT NASA + LATEST NEWS + MULTIMEDIA + MISSIONS + MY NASA + WORK FOR NASA

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- + TOPICS
- + BY YEAR

Applying Past Knowledge for Current and Future Mission Success

NASA ENGINEERING NETWORK

IF IT'S NOT SAFE, SAY SO!!
Report any safety concerns to NASA

Welcome to the NASA Engineering Network, the integrated set of resources that facilitates sharing, learning, and communication in the engineering community.

OVERVIEW

Welcome to the NASA Engineering Network!

The NASA Engineering Network was created as a knowledge network to promote learning and sharing among NASA's engineers. Through engineering communities of practice, NASA Lessons Learned, agency-wide search, expertise locator, and training (APPEL), NASA's engineers are connected to engineering resources that help them effectively and efficiently solve problems and design solutions.

NASA's Office of the Chief Engineer and the NASA Engineering Network gives the public access to search the NASA Lessons Learned database system. The NASA Lessons Learned database system is the official, reviewed learned lessons from NASA program and projects. The information provided is a summary of the original driving event, as well as recommendations, which in turn, feed into NASA's continual improvement via training, best practices, policies and procedures.

To search the NASA Lessons Learned database system:
Click on one of the search options in the left navigation bar. Once you click, you will also have access to refine your search, using more advanced search features.

If you are a NASA employee, you may submit a NASA Lessons Learned from here.

NEN is sponsored by the NASA Office of the Chief Engineer.

FIRSTGOV
Your First Click to the U.S. Government

- + 2004 Vision for Space Exploration
- + FY 2005 Budget Request
- + 2003 Strategic Plan
- + Freedom of Information Act
- + The President's Management Agenda
- + FY 2003 Agency Performance and Accountability Report
- + NASA Privacy Statement, Disclaimer, and Accessibility Certification
- + Freedom to Manage

Curator: Manson Yew
NASA Official: Gregory Robinson
+ CONTACT LLIS

<http://llis.nasa.gov/>

NASA ENGINEERING NETWORK

HOME OCE LESSONS LEARNED

LESSONS LEARNED

- About
- Center Representatives
- Forums
- Latest Published Lessons
- Multimedia
- Policies and Processes
- Public NASA LL System
- Share (Create) a Lesson

CENTER LESSON LEARNED SITES

- Glenn Research Center
- Goddard Space Flight Center
- Jet Propulsion Laboratory
- Johnson Space Center
- Kennedy Space Center

LESSONS LEARNED

Lessons Learned

LESSONS LEARNED

- About
- Center Representatives
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- Multimedia
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- Public NASA LL System
- Share (Create) a Lesson

CENTER LL SITES

- GRC
- GSFC
- JPL
- JSC
- KSC

LATEST PUBLISHED LESSONS

Lessons Learned from the Administration of the Joint Base Operations Support Contract (J-BOSC) at KSC
Published on 2011-01-06 by Joyce Riquelme for KSC
The Joint Base Operations Support Contract (J-BOSC) combined support functions between NASA operation at the Kennedy Space Center and the Cape Canaveral Air Force Station. Lessons Learned involved with contract management bridging the two Agencies were identified for the Administration Office, A.

Hidden Command Points in Software
Published on 2011-01-06 by Tammy Kennedy for KSC
Some Space Shuttle application software displays were not properly tested to make certain that there were no non-visible command points. If a user unknowingly selected one of these non-visible command points, the software would begin behaving in unexpected ways. Automated tools should be used to en

Thermostat Testing on Insulated Fluid Lines
Published on 2011-01-06 by John F. Vandusen for KSC
There are many insulated fluid lines in the propulsion systems of the Shuttle orbiter. One such propulsion system is the Orbiter Auxiliary Power Units system, which contains many insulated fluid lines with embedded active components. These insulated fluid lines contain thermostats and heaters for

Selection and use of Software Metrics for Software Development Projects
Published on 2011-01-06 by Harold (Hal) Turner for KSC
Metrics or measurements can provide managers with the increased visibility into a software project's status needed to facilitate an efficient and successful project. But these metrics must be properly selected and used. Metrics must be tailored and applicable to the unique characteristics of a

APU Manifold Vacuum Backfill
Published on 2011-01-06 by Daniel Shorten for KSC
Implementing Auxiliary Power Unit (APU) manifold vacuum backfill eliminated the need to enter the Space Shuttle aft fuselage using Self-Contained Atmospheric Protective Ensemble (SCAPE) suits to perform a high-point bleed.

WELCOME

Welcome to NASA Lessons Learned, where safety and engineering excellence are the first priority of mission success.

NASA Lessons Learned is a great way to leverage your knowledge sharing and expertise.

Leader: Michael Bell, NASA Lessons Learned Program Manager [Bio]

+ Public NASA Lessons Learned System (llis.nasa.gov)

SEARCH FORMAL LESSONS LEARNED

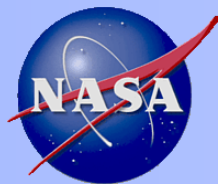
Enter Search Terms:

Select NASA Center:

- ☒ All Centers
- ☐ ARC
- ☐ GSFC
- ☐ KSC
- ☐ SSC
- ☐ HQ
- ☐ OFRC
- ☐ JPL
- ☐ LaRC
- ☐ WFF
- ☐ GRC
- ☐ JSC
- ☐ MSFC
- ☐ WSTF

<http://nen.nasa.gov/portal/site/llis/LL>

Internal LL Page (2nd Q 2010) = 3,491
Internal LL Page (3rd Q 2010) = 3,319



A lesson learned is knowledge or understanding gained by experience---either a successful mission, project or failure.



SHARE EXISTING LESSON

Lesson Details

Use "Share Existing Lesson" feature to share lessons formatted in existing report, analysis, presentation, or video during the course of conducting NASA business. These lessons may not necessarily delineate recommendations. ITAR or controlled information is not appropriate for this feature. "Share Existing Lesson" is moderated.

Submission Instructions

Please complete the requested information below. The required fields are marked by *. Once you have submitted the lesson, a notification e-mail will be delivered to you.

*Submitted By:

First Name:

Michael

Last Name:

Bell

Submitter's Phone Number:

(XXX-XXX-XXXX)

Submitter's Email Address: michael.a.bell@nasa.gov

*Point of Contact:

First Name:

Last Name:

Phone Number:

(XXX-XXX-XXXX)

Email Address:

***Title:** The title should accurately reflect and summarize the subject of the lesson learned. A unique title is preferred but not mandatory.

***Abstract:** The abstract should be a short concise summary of the lesson, preferably no more than a short paragraph or two in length.

*Supporting Documentation:

(Click "Browse" to find on your local system the file you wish to upload.

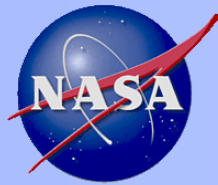
The size of the file should be **less than 100 MB**. The file name should not contain spaces or any of \, |, ^, :, ", %, /, >, <, ?, * characters.)

*Organization:

☒ NASA

Center:

Select NASA Field Center



NEN CoPs - Enabling Collaboration & Lessons Learned

New NEN > Mechanical Systems - Windows Internet Explorer

http://nen.nasa.gov/portal/site/llis/community/MS/

File Edit View Favorites Tools Help

New NEN > Mechanical Systems

Office of the Chief Engineer

- 2nd Annual Engineering Leadership Workshop
- Organization Charts
- Lessons Learned (LL)
- Tech Authorities/Requirements
- Communities by Technical Discipline
 - Aerosciences
 - Autonomous Rendezvous & Docking
 - Avionics
 - Electrical Power
 - Environmental Test & Verification
 - Guidance, Navigation, and Control
 - Life Support/Active Thermal
 - Loads and Dynamics
 - Mechanical Systems**
 - Ask an Expert
 - Conferences
 - Contacts
 - Lessons Learned
 - Library
 - Links
 - Reading Room
 - Standards
 - Nondestructive Evaluation
 - Passive Thermal Control and Protection
 - Propulsion

Mechanical Systems

Rolling Element Bearing Course in August

05-Jul-2010 **Rolling Element Bearing Course in August**

Case Western Reserve University is offering a short course called Rolling-Element Bearing Technology August 10-12, 2010. The purpose of the course is to "provide engineers in product design and manufacturing with the latest technical advances and a better appreciation for the design, appreciation, life, and use of rolling-element bearings."

+ Learn more

submitted by **Joe Pellicciotti** at Goddard Space Flight Center

- Michael Dube wins Space Flight Awareness Award**
- Tedric A. Harris: February 1932 - April 2010**
- Student Project Wins First Place Building Piezo Actuated Strut**
- NASA Papers at the Aerospace Mechanisms Symposium**

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Community Links

- Ask an Expert**
Ask and find questions from Mechanical System experts
- Library**
Mechanical Systems Library
- Conferences**
Upcoming and Past Events for Mechanical Systems
- Links**
Mechanical Systems External Links to bearing systems, deployment systems and more
- Contact List**
Search and Locate Experts from around NASA
- Reading Room**
Find out what other MS members are reading. You can also suggest and recommend any material you find helpful.
- Lessons Learned**
Official and informal lessons for Mechanical Systems
- Standards**
NASA and Industry Standards: AIAA S-114, NASA STD 5017 and more

Welcome (Mechanical Systems)

Welcome to the Mechanical Systems Community of Practice (CoP), the portal to promote collaboration, learning, and knowledge sharing among mechanism engineers. This site connects users to experts in the field and provides access to relevant lessons learned, standards, and other information.

This site was compiled by the Mechanical Systems Technical Discipline Team (TDT), which retains expertise to solve a wide variety of problems across the agency. These include Bearing Systems and Tribology (including lubrication science); Gear and Transmission Systems; Deployment Systems for antennae, solar arrays, instruments and other mission specific hardware (including pyrotechnic systems for deployments); Spacecraft and Instrument Mechanisms including motors, actuators, scan mechanisms, and instrument level deployables; Kinematic and Structure Analyses for Mechanical Systems; EVA Mechanisms; Cryogenic Mechanisms; Test capabilities for the span of NASA Mission Mechanical Systems

We welcome your input, so if you have ideas for how to improve this CoP please fill out the suggestion form on this page.

+ [Read Biography](#)

Technical Fellow: Joseph Pellicciotti

Facilitator: Daria Topousis

Have a Suggestion for the Mechanical Systems Community?

Let us know what you think! Click on the button below to make a suggestion.

Suggestion refers to...

☐ Make this anonymous



Collecting lessons learned - Facilitated Pause and Learn Session

Lessons Learned Workshop Agenda December 19, 2008 HQ 3358

Objective: Share knowledge and lessons learned with open and honest dialog while not villanizing anyone.

Products: Knowledge transfer among team members, potential entry into the Lessons Learned Information System www.llis.nasa.gov

Duration	Activity	Who	Outcome
10 Min	Kick-Off - Lessons Learned Process and background	Michael Bell	Shared Understanding
50 min	Areas of Excellence <ul style="list-style-type: none"> What Worked? How can we learn from this situation? 	All	Discussion
50 min	Opportunities <ul style="list-style-type: none"> What didn't work? How can we learn from this situation? 	All	Discussion
10 Min	Summarize	Michael Bell	Action Items

Pre-work/ Read Ahead

Review of Project Products / Outputs

Facilitator Role:

- ✓ Help to stay focused on the task within the allotted time
- ✓ Ask probing questions
- ✓ Scribe/ Capture relevant lessons learned data

Resources:

- KSC Lessons learned process - KDP-KSC-P-2393
- Think Tank Online Brainstorming System <http://kscapp002.ksc.nasa.gov:8080/thinktank/server/logout.jsp>



NASA Lessons Learned Submission Form

Contact Information

Submitted By: First Name: _____ Last Name: _____
 Submitter's Phone Number: _____ (XXX.XXX.XXXX)
 Submitter's E-mail Address: lessons@support.nasa.gov

Privacy Preference:
 The lessons learned collected through this process will be included in reports and documents that may be available to the public. Please indicate your privacy preference:
☐ I request that my name be withheld from the final publication of this Lesson Learned.
☐ I request that my name be withheld from public display, but it will be retained with the submitted record for verification and audit trail purposes.
☐ I authorize NASA to display my name with this Lesson Learned submission in public documents.

Point of Contact (if different from submitter):
 First Name: _____ Last Name: _____
 Phone Number: _____ (XXX.XXX.XXXX)
 E-mail Address: _____

Lesson Information

Lesson Date: * (Date the lesson was written)

Year of Occurrence: (Year the lesson occurred or was noticed) _____

Organization: *
☐ NASA ☐ Other: _____
 For non NASA organizations please provide the Organization name: _____

* Required field

Five Questions

A PaL session can explore many issues, but the team should try to focus on these five questions:

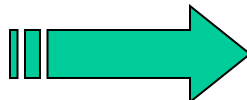
What did we intend to do?

- What worked well, and why?
- What didn't work well --why?
- What did we learn from this?
- What should we change?



Creating a lesson

Significant Events
that change Policy,
Standards or
Procedures



Lessons Learned from KSC's
CLCS project

November 13, 2002

(Existing documents such as PowerPoint presentations,
white papers and technical reports)

SHARE EXISTING LESSON

Lesson Details

Use "Share Existing Lesson" feature to share lessons formatted in existing report, analysis, presentation, or video during the course of conducting NASA business. These lessons may not necessarily delineate recommendations. ITAR or controlled information is not appropriate for this feature. "Share Existing Lesson" is moderated.

Submission Instructions

Please complete the requested information below. The required fields are marked by *. Once you have submitted the lesson, a notification e-mail will be delivered to you.

*Submitted By:

First Name: Last Name:

Submitter's Phone Number: (XXX-XXX-XXXX)

Submitter's Email Address: michael.a.bell@nasa.gov

*Point of Contact:

First Name: Last Name:

Phone Number: (XXX-XXX-XXXX)

Email Address:

*Title: The title should accurately reflect and summarize the subject of the lesson learned. A unique title is preferred but not mandatory.

*Abstract: The abstract should be a short concise summary of the lesson, preferably no more than a short paragraph or two in length.

*Supporting Documentation:

(Click "Browse" to find on your local system the file you wish to upload. The size of the file should be **less than 100 MB**. The file name should not contain spaces or any of \, |, ^, :, ", %, /, >, <, ?, * characters.)

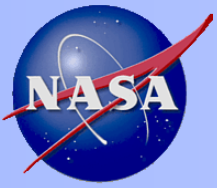
*Organization:

NASA --- Center:

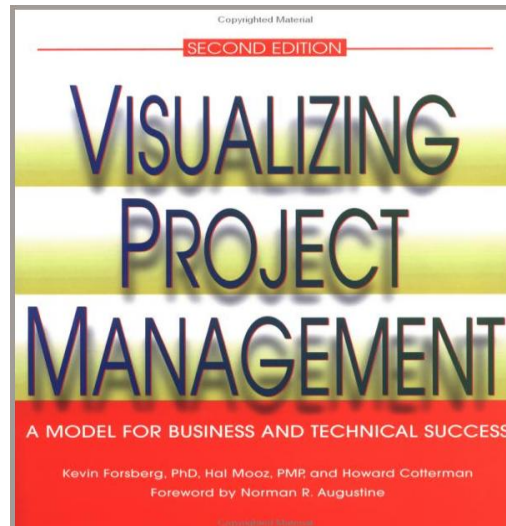


IPAO





“Of all project management concepts, lessons learned from prior failures and successes is most neglected” (p 5)



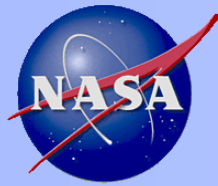
LLIS Search -> Which Lessons Might Impact

Quick disconnect for different systems should be designed differently in order to prevent cross-connections

Lessons Learned Information System Summary	
Project Name: Space Craft Element High Pressure Gas Servicing	Organization: NE-F2
Project Description:	Date: 7/25/2008

Title	LLIS Information		Search Term(s)	Summary of Event	Relevant Recommendations
Gravity Probe-B Nitrogen Contamination Mishap Investigation Final Report	Number	1041	ghe	Gaseous nitrogen (GN2) was inadvertently used instead of gaseous helium (GHe) to service the Gravity Probe-B guard tank vent line. Since the tank temperature was much lower than the freezing point of nitrogen, significant blockage of the vent line with frozen nitrogen occurred.	Different gases should be separated from one another and easily identifiable
	Date	10/15/2001	gn2		Gases should be traceable and accountable to prevent unintended changes
	Organization	MSFC			
	Submitter(s)	Robert B. Goss			
LH2 Quick Disconnects	Number	0111	gn2	Quick disconnects for the Space Shuttle main engine drying/purge lines are identical to those for the main propulsion system LH2 prepressurization system.	Quick disconnects for different systems should be designed differently in order to prevent cross-connection
	Date	8/27/1992			
	Organization	KSC			
	Submitter(s)	David Pennington			
Breakout Boxes	Number	0075	gn2	Three breakout boxes were knocked off the orbiter aft compartment entrance platform, damaging flight hardware.	Protective hold locations should be provided for hand portable equipment
	Date	5/2/1992			Hand portable equipment should be equipped with eyelets for tethering
	Organization	KSC			
	Submitter(s)	David Pennington			
GOX Vent Arm Air Receivers Bleed Manifold Venting Operations	Number	0138	gax	A leak from an underground GN2 line resulted in an explosion. The leak occurred when high pressure gas was applied to a pipe that was thinner than expected due to galvanic corrosion.	Vents should be equipped with mufflers to reduce noise levels below OSHA thresholds, if necessary
	Date	9/25/1992			
	Organization	KSC			
	Submitter(s)	Lisa L. Musgrave			
High Pressure Incident	Number	0587		A leak from an underground GN2 line resulted in an explosion. The leak occurred when high pressure gas was applied to a pipe that was thinner than expected due to galvanic corrosion.	Pressure systems should be trained on high pressure gas work with the system they are operating
	Date	5/13/1998			Tests for tight hardware processing equipment should be
	Organization	KSC			
	Submitter(s)	Lisa Grace Kestel			
Pressure Systems, Galvanic Corrosion, Rupture, Explosion	Number	0315		A leak from an underground GN2 line resulted in an explosion. The leak occurred when high pressure gas was applied to a pipe that was thinner than expected due to galvanic corrosion.	Systems should be properly treated to limit corrosion
	Date	10/20/1993			Proof pressure testing should be used to recertify pressure systems
	Organization	MSFC			
	Submitter(s)	Margo White			

Lessons learned are important to future programs, projects, and processes because they show insights from previous projects



NEN Search Across Multiple Repositories (45)

- **ASK-MAGAZINE (ASK-MAGAZINE)**
 - **Best Practices (NASA Best Practices for Design and Test)**
 - **BMPCOE (Best Manufacturing Practices Center of Excellence)**
 - **Clementine Mission (Clementine Mission Lessons Learned)**
 - **Earth Observing (Earth Observing - Earth Observing-1 Baseline Lessons Learned)**
 - **ESH-DOE (Society of Effective Lessons Learned Sharing hosted by the Department of Energy's Environment, Safety and Health)**
 - **GSFC-RULES (GSFC Open Learning System Rules)**
 - **INSIDENASA (InsideNASA)**
 - **ISS-PRACA (Problem Reporting and Corrective Action System)**
 - **KLABS (NASA Office of Logic Design Digital Engineering Lessons Learned)**
 - ***LLIS (Lessons Learned Information System)***
- NEN (NASA Engineering Network)
NEPP (NASA Engineering Parts and Packaging)
NESC (NASA Engineering and Safety Center)
NIX (NASA Image Exchange)
NODIS (NASA Online Directives Information Systems)
NX (NX)
OCE (Office Of The Chief Engineer)
OSP (Orbital Space Plane Lessons Learned)
POLARIS (Program/Project Online Library And Resource Information System) SOFTWARE (Software Process Asset Library)
SSP-PRACA (Space Shuttle Program - Problem Reporting and Corrective Action System)
STI (Scientific and Technical Information)
SYSTEM-ENG (System Engineering Collection)
TECHDOC (Techdoc contains technical documentation)

The screenshot shows the NASA Engineering Network (NEN) website's advanced search page. The header includes the NASA logo and navigation links like 'HOME', 'OCE', 'LESSONS LEARNED', 'COMMUNITIES', and 'TOOLS & RESOURCES'. The 'ADVANCED SEARCH' section features a 'Collection' dropdown menu that is open, displaying a list of repositories including ASK-MAGAZINE, BEST_PRACTICES, BMPCOE, CLEMENTINE_MISSION, DAU-BEST_PRACTICES, EARTH_OBSERVATORY, FPPD, GSFCRULES, INSIDENASA, ISS-PRACA, KEENEY-TECH-STDs, KLABS, LLIS (highlighted), MARS-MISSION, MARSHALL-TECH-STDs, NASA-REPORTS, NASA-TECH-STDs, NEEIS, NEN, NEPP, NESC, NESC-ACADEMY, NIX, NODIS, NX, OCE, OSP, PM-CHALLENGE, and SHUTTLE-MIR. Other search options include 'Author', 'Date: Between', and 'Search' buttons. The footer contains contact information for Manson Yew, NASA Official Gregory Robinson, and the NEN version (v3.0).

*List
supporting
document,
such as
reports,
procedures
or
standards
or NPRs*

Lessons Learned Entry: 3197 Proof-Load Testing of Ground Support Equipment (GSE) Platforms, Slings, and Handling Fixtures Versus Rated Load Testing

Lesson Info:

- **Lesson Number:** 3197
- **Lesson Date:** 2010-05-26
- **Submitting Organization:** KSC
- **Submitted by:** Annette Pitt
- **POC Name:** Alan Baldwin
- **POC Email:** alan.j.baldwin@usa-spaceops.com
- **POC Phone:** 321-861-7034

Abstract:

For many years Ground Support Equipment (GSE) was periodically proof loaded based on NSTS 08171, Operations and Maintenance Requirements and Specifications Documents (OMRSDs) File VI requirements. This caused premature wear of components, decreased safety, and increased time to perform maintenance. Reliability Centered Maintenance (RCM) methodology was used to determine optimum maintenance tactics for GSE and flight assets.

Description of Driving Event:

During Orbiter Processing Facility (OPF) open bay periods the Orbiter Maneuvering System (OMS) pod handling fixture was proof loaded to 20,000 lbs. This required extensive setup, working at heights, working with suspended loads, and the setup of safety clears for two days. The 20,000-lb weights were raised to the handling fixture and then transferred from the crane hook to the handling fixture. The load was then translated full travel path both east and west. Any type of a failure at this point would have caused extensive damage.

Lesson(s) Learned:

Annual proof load testing could be replaced with nondestructive evaluation (NDE) inspection of the critical welds. Proof load of GSE can be replaced with visual/NDE inspections and rated load tests. KNPR 8715.3 provides a section for the nonload test of slings and lifting fixtures. In the case of the OMS pod handling fixture, it is 200% of rated load. In most other cases, it is 150%.

Recommendation(s):

Perform a review of test history, maintenance performed, operation history, and design safety to determine the optimum maintenance requirements.

Documents Related to Lesson:

1. KNPR 8715.3, KSC Safety Practices Procedural Requirements
2. NSTS 08171, Operations and Maintenance Requirements and Specifications Documents (OMRSDs)

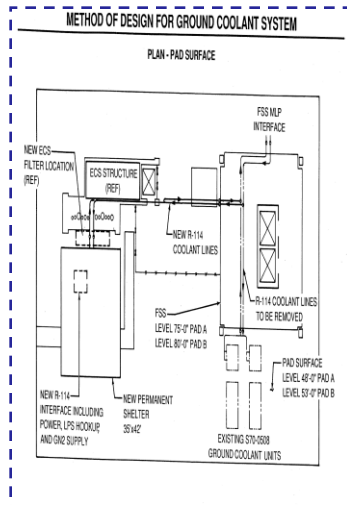
Mission Directorate(s):

- Space Operations

Additional Key Phrase(s):

- 1.Ground processing and manifesting
- 1.Early requirements and standards definition
- 1.Long term sustainability and maintenance planning
- 1.Engineering design and project processes and standards
- 1.Configuration control and data management
- 1.Maintenance
- 1.Planning of requirements verification processes

Supporting technical reference documentation can be attached / included in the lessons learned entry



REVISIONS DESCRIPTION										REVISIONS DESCRIPTION									
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B										B									
C										C									
D										D									
E										E									
F										F									
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TABLE 4.3-4
SHEET 2 of 19
ENVIRONMENTAL CONTROL AND
LIFE SUPPORT SYSTEM
INTERFACE CONTROL DOCUMENT
42845
100-2-10000
REV 1
PAGE 300

Lessons Learned Entry 2736 Ground Cooling Reliability and Operating Stability Design Enhancement

Lesson Info:

- **Lesson Number:** 2736
- **Lesson Date:** 2010-04-22
- **Submitting Organization:** KSC
- **Submitted by:** Annette Pitt
- **POC Name:** Matthew Craycraft
- **POC Email:** matthew.c.craycraft@nasa.gov
- **POC Phone:** 321-861-3876

Abstract:

The Space Shuttle Orbiter rejects heat from onboard electrical equipment, crew members, and other sources to an independent ground refrigerant loop through an onboard heat exchanger. Ground-provided umbilicals that separate from the spacecraft at launch provide primary loop single-phase coolant to the onboard heat exchanger from the circulation unit located at the base of the launch pad. The collected heat is in turn rejected from this primary coolant loop to a secondary two-phase refrigerant system. This method of heat rejection proved to be unreliable and difficult to control for the ground cooling system operator because the spacecraft heat loads varied. A much more stable, reliable system was put in place when a third intermediate loop was implemented into the ground cooling system with a heating element that allowed the refrigerant loop to operate at a constant set point.

Description of Driving Event:

The ground cooling unit was experiencing regular failures, and was consuming many engineering hours identifying and resolving problems. Also, constant vigilance was required because it was difficult for the operator to control to the desired cooling set points.

Lesson(s) Learned:

To reject varying spacecraft heat loads prior to launch, circulate a primary loop single-phase refrigerant through the spacecraft-to-ground heat exchanger while maintaining a constant heat load via a heater on a secondary ground loop to a tertiary two-phase refrigeration loop because that makes a more stable and reliable system for ground-cooling equipment than the previously used variable-load system.

The heaters eliminate mechanical load control devices such as hot gas bypass, cylinder unloaders, and desuperheat, and allow the refrigeration loop to operate at one known set point, providing the ability to quickly identify and correct problems.

Recommendation(s):

For ground cooling equipment at the launch pad used to reject varying spacecraft heat loads prior to launch, circulate a primary loop single-phase refrigerant through the spacecraft-to-ground heat exchanger while maintaining a constant heat load via a heater on a secondary ground loop that rejects heat to a tertiary two-phase refrigeration loop operating at a single set point.

Evidence of Recurrence Control Effectiveness:

Not Applicable

Documents Related to Lesson:

- [Click here to download Ground Coolant Design Presentation 1990](#)
- [Click here to download Ground Coolant System Presentation 1991](#)
- [Click here to download Ground Coolant Presentation 1993](#)
- [Click here to download Ground Coolant System Reliability Improvement Study](#)

Mission Directorate(s):

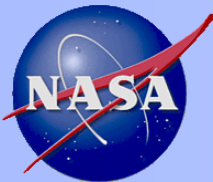
- Space Operations
- Exploration Systems

Additional Key Phrase(s):

- 1.Launch support systems
- 1.Orbiting Vehicles
- 1.Launch Systems

Additional Info:

- **Project:** Space Shuttle Orbiter



Enabling Collaboration

From: "Whittlesey, Albert C" <albert.c.whittlesey@jpl.nasa.gov>
Date: Fri, 3 Oct 2008 08:27:58 -0700
To: "Oberhettinger, David J" <david.j.oberhettinger@jpl.nasa.gov>
Subject: Re: Subscription Notification: New Documents Available on the NASA Engineering Network

David,

Thanks for sending the item.

The Lesson Learned system, as I have complained about in the past, has taken all useful information out of it and the words printed in the LL have no value to me whatsoever. It has as much value to me as saying that the sun rises in the East. I believe even managers would find the words in there to be obvious and adding no value to their knowledge base.

However, it does have the name and telephone number contact of the cognizant individual.

I called Dale Force at GRC and it was then that I got a very nice and useful story. I'm happy.

Thanks again.

Albert
x4-3497

----- Forwarded Message

From: <nen-subscriptions@etouch.net>
Date: Sat, 27 Sep 2008 17:35:48 -0700
To: "Oberhettinger, David J" <david.j.oberhettinger@jpl.nasa.gov>
Subject: Subscription Notification: New Documents Available on the NASA Engineering Network

<<http://www.nasa.gov>>

New Document Notification

The NASA Engineering Network has added the following document(s) which match your subscription. If you would like to change your subscription, please visit:
<http://insidenasa.nasa.gov/portal/site/llis> and log-in with your user account.

Category: NASA Centers/Glenn Research Center

Document: External filter needed to achieve low EMI from TWTA (Lessons Learned
Entry: 1864) <http://nen.nasa.gov/llis_content/imported_content/lesson_1864.html>

For help, please contact nen-admin@etouch.net

ADVANCED SEARCH

Advanced Options

Author contains and

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Enter search term: Search

- By Collection
 - LLIS
- File Formats
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- Mission Directorates
 - Exploration Systems
- NASA Centers
 - Jet Propulsion Laboratory
 - Kennedy Space Center
 - NASA Headquarters
- Period
 - 2007

Search

Results 1 - 4 of about 4 for constellation integration panel. Search took 0.06 seconds.

- Establishing a Constellation Systems Integration Panel to Arbitrate Technical Concerns - [Exl Related Standards](#) 2011-03-30
 Description: The Level 2 Constellation Systems Integration Panel (CxSIP) was established to resolve technical concerns that crossed the boundaries of individual projects within the Constellation Program.
 Creator: Jenni Palmer
 NASA Organization: KSC
 Collection: LLIS - Lessons Learned Information System
- [PDF] CONSTELLATION LAUNCH CONTROL SYSTEM OPERATIONS ASSESSMENT TRADE ... 2010-12-09
 Description: ... GSE system will have Panel View field PLC ... Fewer Test Team Integration Opportunities - Reduced ... Constellation Launch Control System Operations Assessment Trade ...
 Collection: LLIS - Lessons Learned Information System
- Capture of Apollo Lunar Module Reliability Lessons Learned: Reliability Engineering - 22k Related Standards 2007-10-23
 Description: A July 2007 workshop attended by the former Grumman Corporation's Apollo Lunar Module Reliability and Maintainability (R&M) Team and Constellation Program personnel traced the success of the Apollo Lunar Module (LM) to reliability features that were looked into an early stage of LM design. Th
 Creator: David Oermettinger
 NASA Organization: JPL
 Collection: LLIS - Lessons Learned Information System
- Capture of Apollo Lunar Module Reliability Lessons Learned: Program/Engineering Management - 20k Related Standards 2007-09-25
 Description: A July 2007 workshop attended by Constellation Program personnel traced the success of the Apollo Lunar Module designers to the NASA and contractor culture, Grumman's flat organization structure, an ability to hire the "best and brightest" engineers, placement of the Reliability function
 Creator: David Oermettinger
 NASA Organization: HQ
 Collection: LLIS - Lessons Learned Information System

Dynamic Link to NASA Standards

Advanced Options

Author contains and

Author contains and

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Collection

Date: Between and

Enter search term: Search

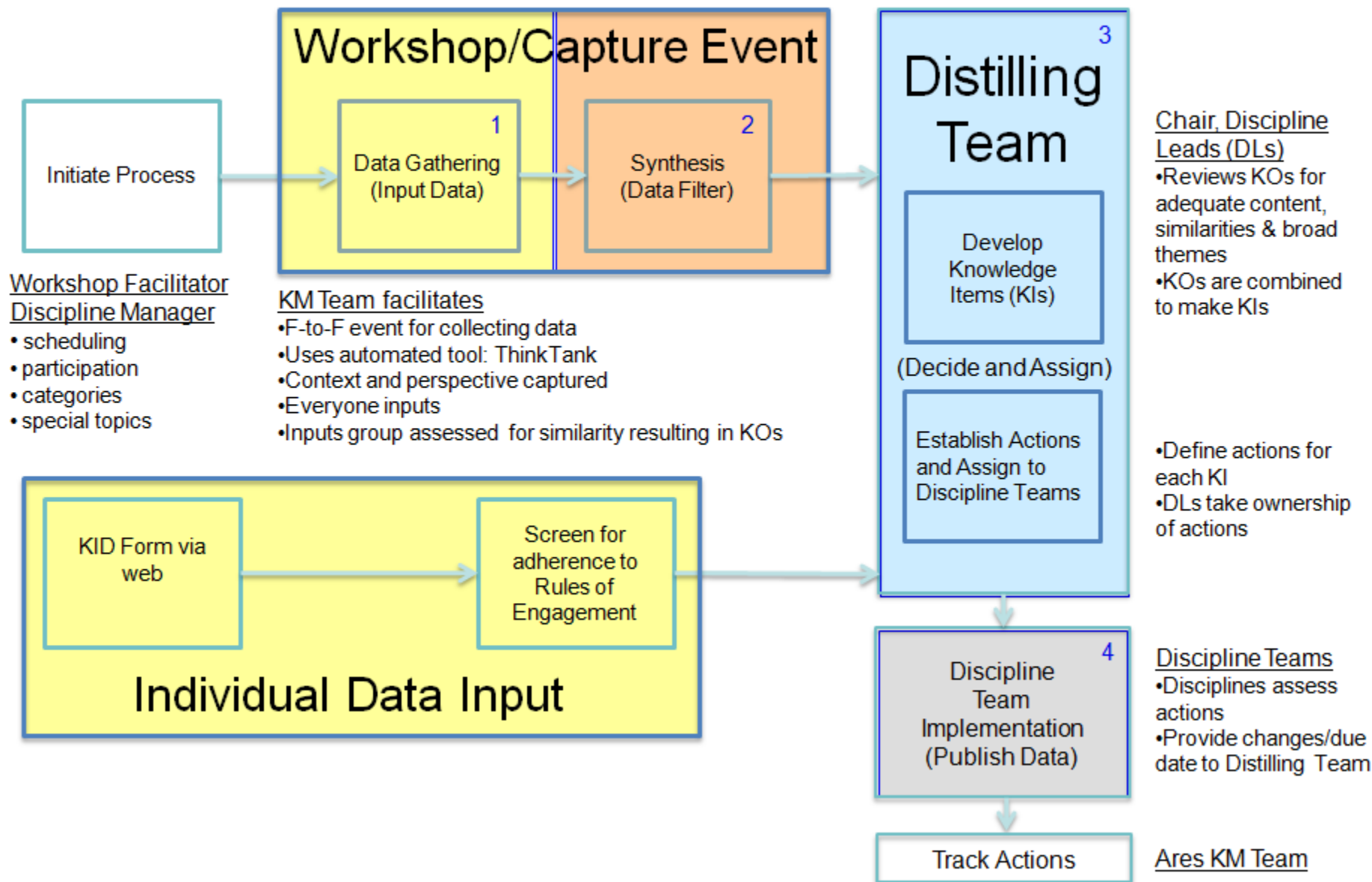
Search

Results 1 - 10 of about 22 for constellations OR Constellation program OR lessons learned OR systems integration OR extravehicular activity. Search took 0.22 seconds.

- [PDF] May 6, 2008 Safety and Assurance Requirements Division TO ... 2008-07-11
 Description: ... Safety and Mission Assurance Documents for Constellation Program ... the NASA Safety Program: Center Directors ... Ensure that safety lessons learned are disseminated ...
- [MS EXCEL] Traceability of SMARTS Requirements from Document: various for ... 2008-06-25
 Description: ... Document: various for Project: Constellation (CxP) ... outcome-based standards in program/project technical ... the following: review lessons learned associated with ...
- [PDF] 080506_CxP_SMA_Requirements_NN_NonOSMA.xls Page 1 of 72 as of May ... 2008-06-25
 Description: ... Document: various for Project: Constellation (CxP) Filter ... based standards in program/project technical ... the following: review lessons learned associated with ...
- [MS EXCEL] 080506_CxP_SMA_Requirements_Y 2008-06-25
 Description: ... from Document: various for Project: Constellation (CxP) ... Legacy systems and projects already in development should ... tasks for this project/program/facility shall ...
- [PDF] 080530_CxP_70059.xls Page 1 of 186 as of May 6, 2008 2008-06-25
 Description: ... Traceability of Constellation (CxP) Document: CxP 70059 to ... risk acceptance, and appropriate lessons learned at all ... for the Center's facility safety program) ...
- [PDF] 080506_CxP_SMA_Requirements_YY_SMAOnly.xls Page 1 of 104 as of May ... 2008-06-25
 Description: ... from Document: various for Project: Constellation (CxP) Filter ... Legacy systems and projects already in development ... of the software safety program, and their ...
- [MS EXCEL] Traceability of Constellation (CxP) Document: CxP 70059 to SMARTS ... 2008-06-25
 Description: Traceability of Constellation (CxP) Document: CxP 70059 ... the responsible organization (s)/program(s)/project ... Implement the CAP, and generate the lessons learned. ...
- [MS EXCEL] Traceability of Constellation (CxP) Document: CxP to SMARTS ... 2008-06-25
 Description: Traceability of Constellation (CxP) Document: CxP to ... Requirements: NASA General Safety Program Roles and ... Information and Information systems, where compromise ...
- [PDF] 080506_CxP_Non70059.xls Page 1 of 7 as of May 6, 2008 2008-06-25
 Description: ... Traceability of Constellation (CxP) Document: CxP to ... Requirements: NASA General Safety Program Roles and ... Information and Information systems, where compromise ...
- [PDF] OPEN 2008-04-29
 Description: ... the temporal scope of knowledge-based systems. ... 6 Problem Recurrence Control and Lessons Learned 3.3.7 ... In CxP 70068, "Constellation Program Problem Reporting ...
 Subject: NASA-HDBK-6739.18
 Collection: NASA-TECH-STDs



Ares KM Approach

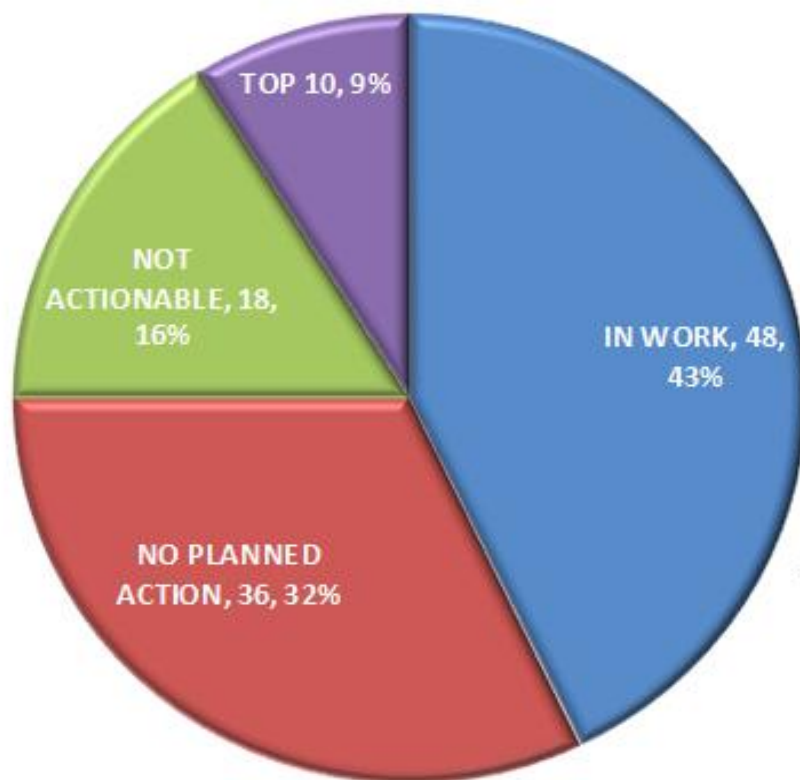




Build 10-1 Lessons Learned - Summary



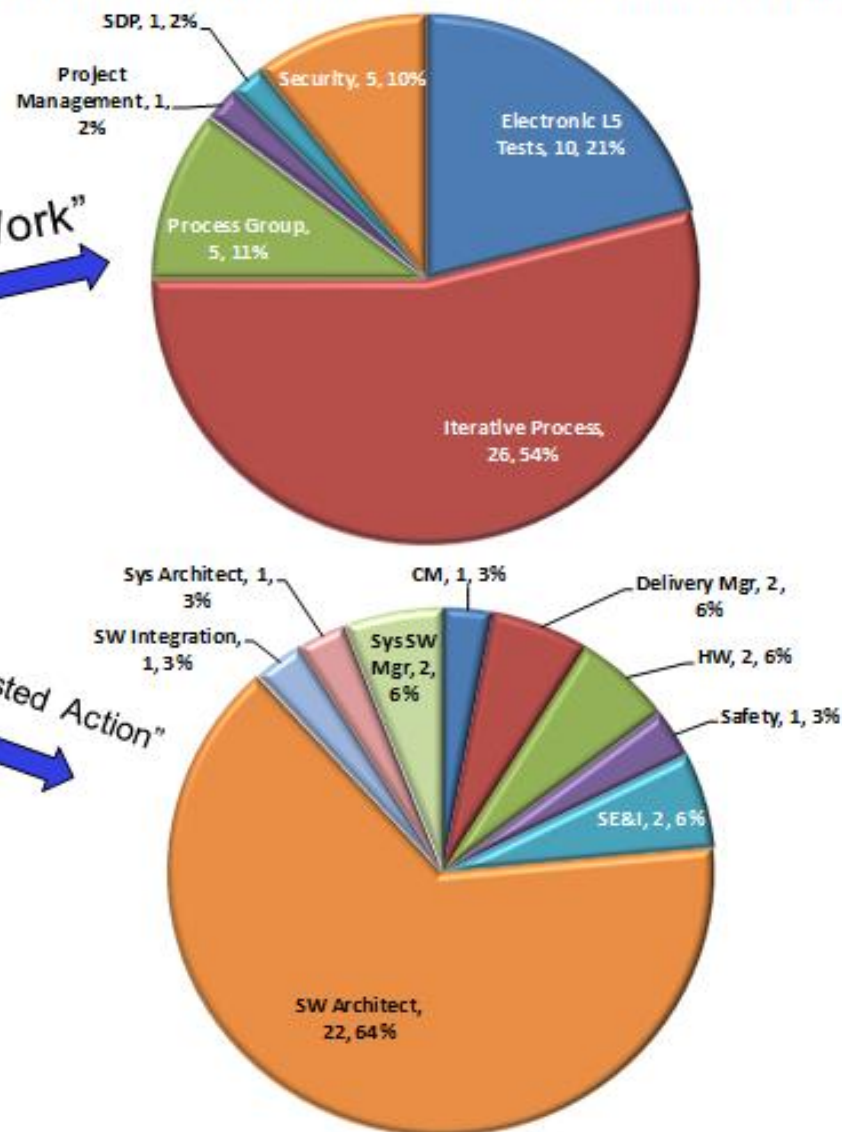
- Total Submitted: 112**



These Lessons Learned appear to be addressed in processes currently In-Work.

"In-Work"

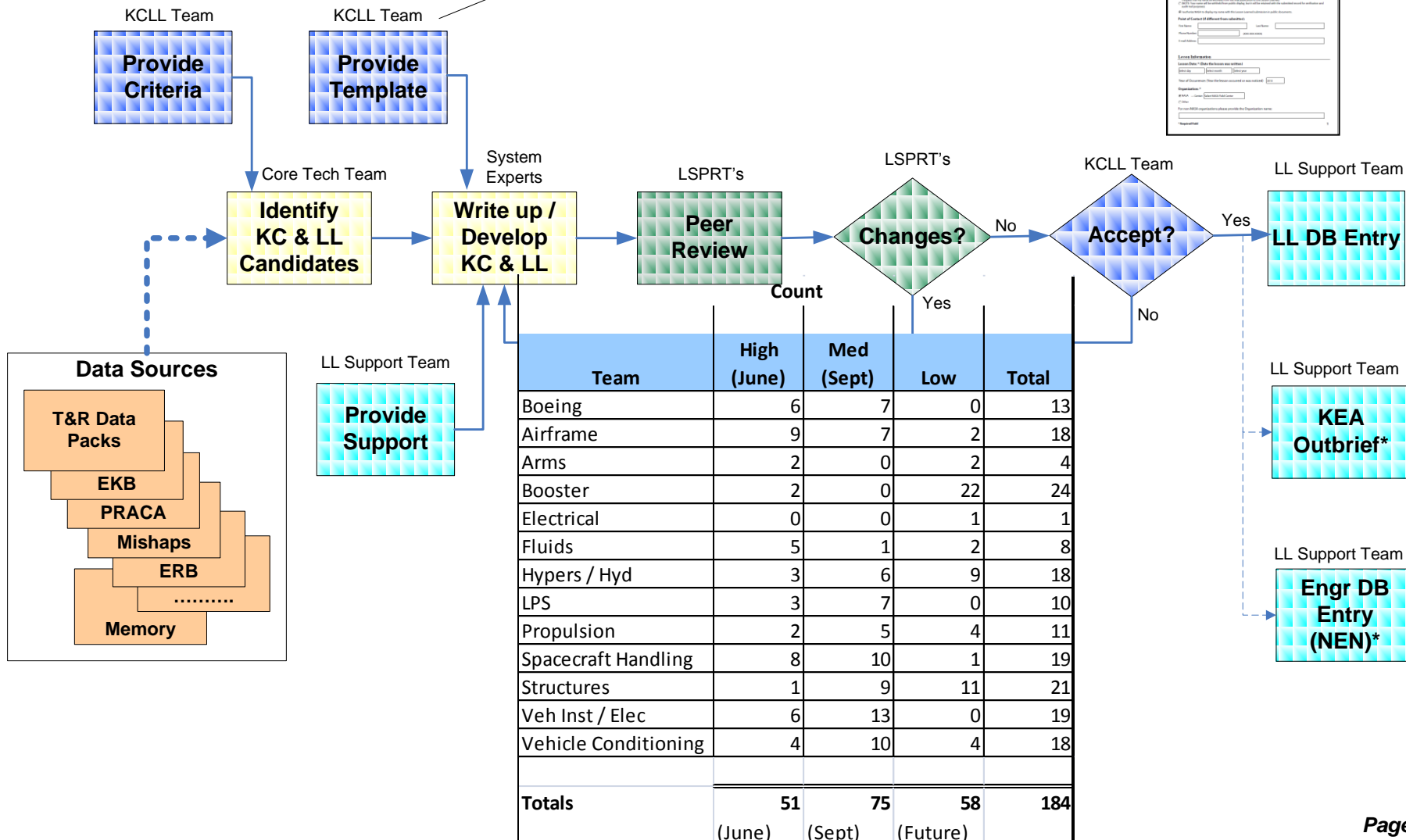
"No Suggested Action"

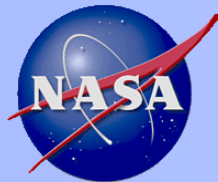




KSC Shuttle Ground Ops Lessons Learned Collection Process

http://usafeng04/kb/EKB_GO/wip_share/KC-LL_Project/Templates & Examples/LessonForm.pdf





A lesson learned entry

- 1) pertains to safety or mission success
- 2) is likely to be relevant to other projects
- 3) does not duplicate an existing lesson learned



Lessons Learned Entry: 1727 Diffusion Confusion: Achieving Process Control Given Complex Networks of Suppliers

Lesson Info:

- **Lesson Number:** 1727
- **Lesson Date:** 0-04-14
- **Submitting Organization:** JPL
- **Submitted by:** Thuykien Nguyen
- **POC Name:** Jon Cowart
- **POC Email:** jon.n.cowart@nasa.gov
- **POC Phone:** 321-861-3042

Abstract:

A video clip lesson learned on the topic of Process Control. The Shuttle External Tank (ET) employs a diffuser to control the uniform dispersal of gases used to maintain positive pressure as the level of liquid oxygen and liquid hydrogen drop after launch. An unacceptable material substitution by a sub-tier vendor was discovered that affected a number of diffusers already installed on ETs, including one on the tank mated to Discovery for the Return-to-Flight mission. Effective process control assures that guidelines are followed and that mission-critical products are created the same way every time. This 4-minute, 48-second video is a product of the Space Shuttle Program and its Process Control Focus Group.

Description of Driving Event:



[Click here](#) to view the lesson learned video.

Lesson(s) Learned:

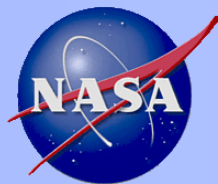
When spaceflight programs employ a complex network of suppliers, an unacceptable material substitution by a sub-tier vendor may not be detected until a component is already installed.

Recommendation(s):

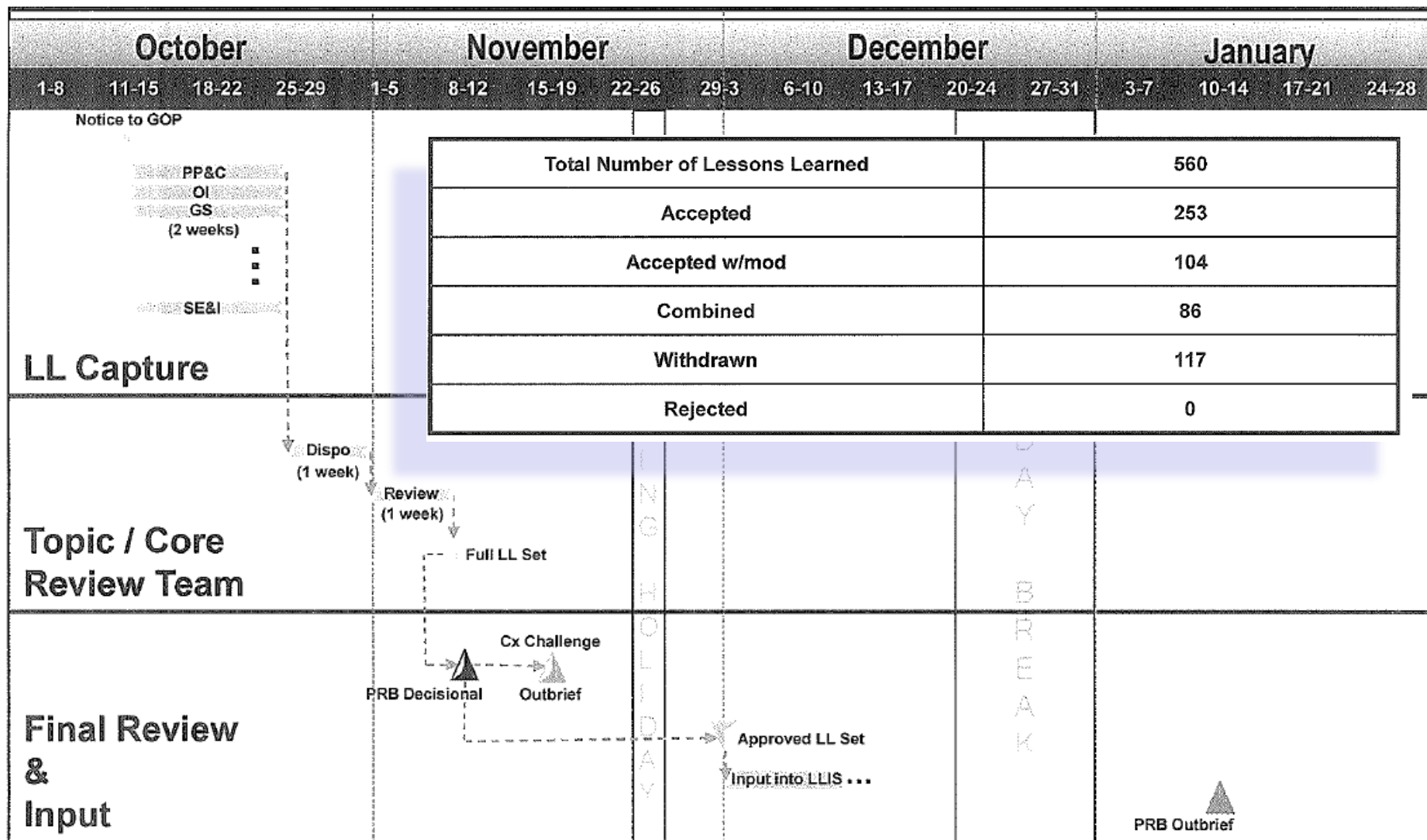
Give special attention to process control and verification for completed assemblies that are acquired through complex supplier relationships that involve multiple tiers and multiple sources at the same tier.

Additional Key Phrase(s):

- Program Management
- Program Management, Acquisition / procurement strategy and planning
- Program Management, Communications between different offices and contractor personnel
- Engineering Design (Phase C/D)
- Engineering Design (Phase C/D), Launch Systems



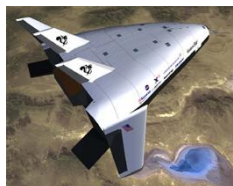
Constellation *GOP* Lessons Capture

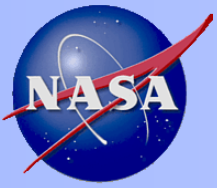




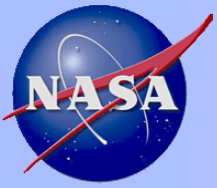
What's Next?

- Now that a significant amount of new entries are in the process of being added from the Space Shuttle Grounds Ops project and Constellation Ground Ops, *data mining* could potentially uncover;
 - ☐ Associations between entries and discover novel /unidentified patterns.
 - ☐ Understand how lessons are clustered together with other associated terms
 - ☐ Analyze trends or themes that have design implications for the new flight projects



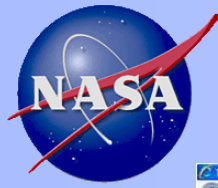


Knowledge sharing is critical to NASA's success. The NASA Lessons Learned Program enables the agency's workforce to find and share knowledge easily and broadly, enabling project teams to learn from one another's on-the-job experiences and recommendations for managing and mitigating project risk.



*" Some of the best lessons we ever
learn are learned from past
mistakes. The error of the past is
the wisdom and success of the
future. "*

-Dale Turner



Think Tank Session: Electronic After Action Review Brainstorming

ThinkTank - Windows Internet Explorer

http://hscapp002.hsc.nasa.gov:8080/thinktank/web/main.html

File Edit View Favorites Tools Help

ThinkTank

thinktank
by GroupSystems

Session #9: Pause And Learn Session
Activity: What Worked?

Brainstorm Organize Comment Transfer Data Report

Edit Delete Outdent Indent Cut Copy Paste Paste Special

Ideas: Uncategorized Ideas

1. Policies 0 (0)
2. Procedures 0 (0)
3. People 0 (0)
4. Equipment/ Systems/ Technology 0 (0)
5. Measurements 0 (0)
6. Management/ Org Structure 0 (0)
7. Facilities 0 (0)
8. Communication 0 (0)
9. Incentives 0 (0)

Cause-and-Effect Diagram

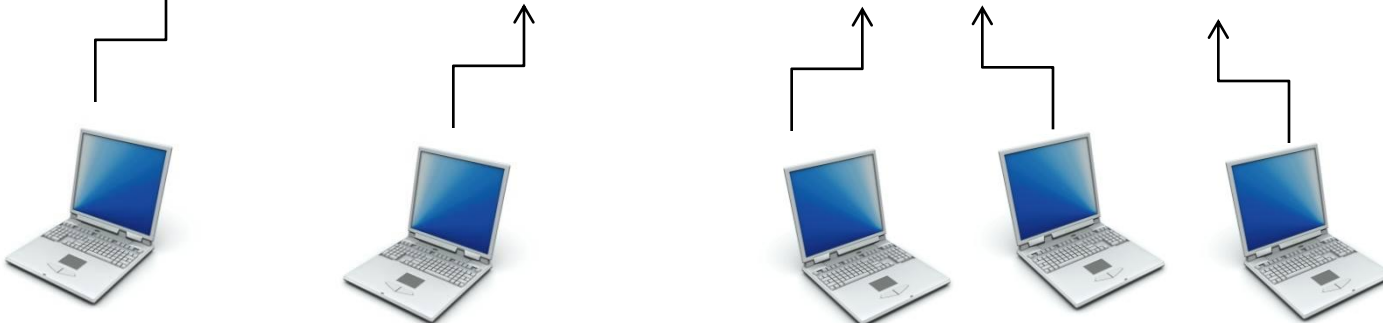
Management Policies Measurements Material Personnel
Communication Org Structure Environment Methods Machinery/ Equipment

Lessons Learned from the Project

(Type here to submit an idea.)

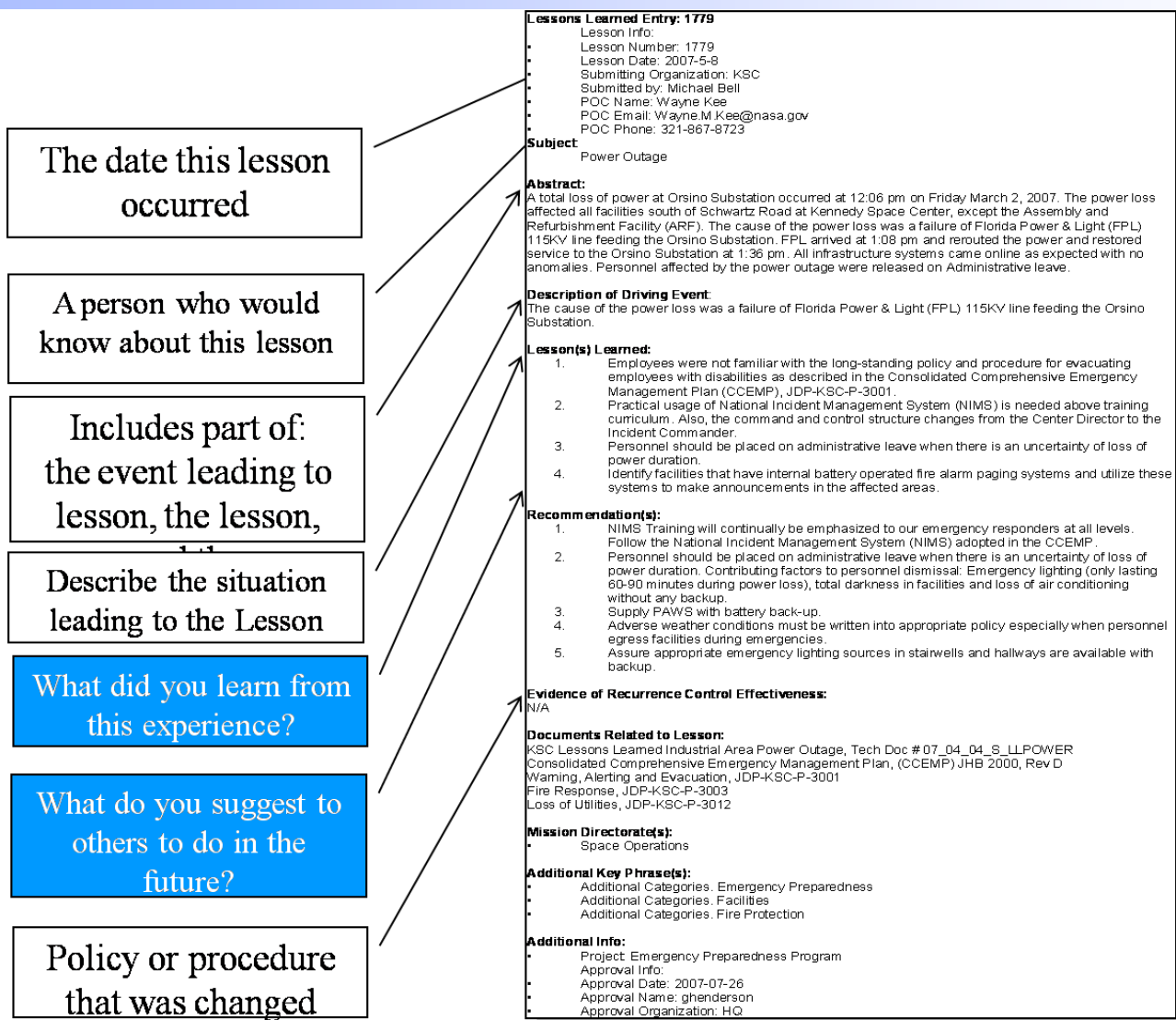
Append Insert Send

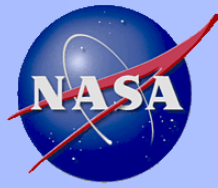
Session Settings
Agenda
Start Participants
Stop Participants
New Edit Delete Go To
Sample Rank Order
What Worked?
Brainstorm ideas for lessons learned with Policies, Procedures, People, Equipment, Technology, Measurements, Management, Facilities, Org Structure, Communication
What Didn't Work
Brainstorm ideas for lessons learned with Policies, Procedures, People, Equipment, Technology, Measurements, Management, Facilities, Org Structure, Communication
What do we suggest others do in the future?
Rank Order Vote
Instructions
Documents
Activity Settings
Roster





Lesson Components





Developing a Lessons Learned

- **A successful experience (brightspots, useful workarounds or solutions) on the project. When, where, what phase, how did they occur?**
- **A problem or challenge on the project (technical glitches, communication gaps, testing overlooked) When, where, what phase, how did they occur?**
- **What would you recommend to others based on this experience? (Best practices, new process steps, templates, new methods)**