



How to Get Your Knowledge Known

Michael Bell, Ph.D.

Chief Knowledge Officer, Kennedy Space Center



Knowledge Sharing Methods and Platforms

- APPEL KS Curriculum
- Spotlight on Lessons Learned
- Critical Knowledge videos
- Small Steps, Giant Leaps podcast
- INSIGHT monthly publication
- Quick Webinars



Questions & Webinar Feedback Quick Webinars

Meta-analysis:
 Aggregating findings from many different studies to create one big, more accurate, and more comprehensive study.
 Single studies may suffer from small sample sizes, measurement error, and selection bias.

- Combined findings from 59 studies
- Peer-reviewed
- Written in English
- Published between 1990 to 2021 in Public Administration Journals

NASA NASA_APPEL NASAappel APPEL KNOWLEDGE SERVICES

BB +60



Critical Knowledge Sharing Tour

ISS EVA 23 Mishap Lessons Learned

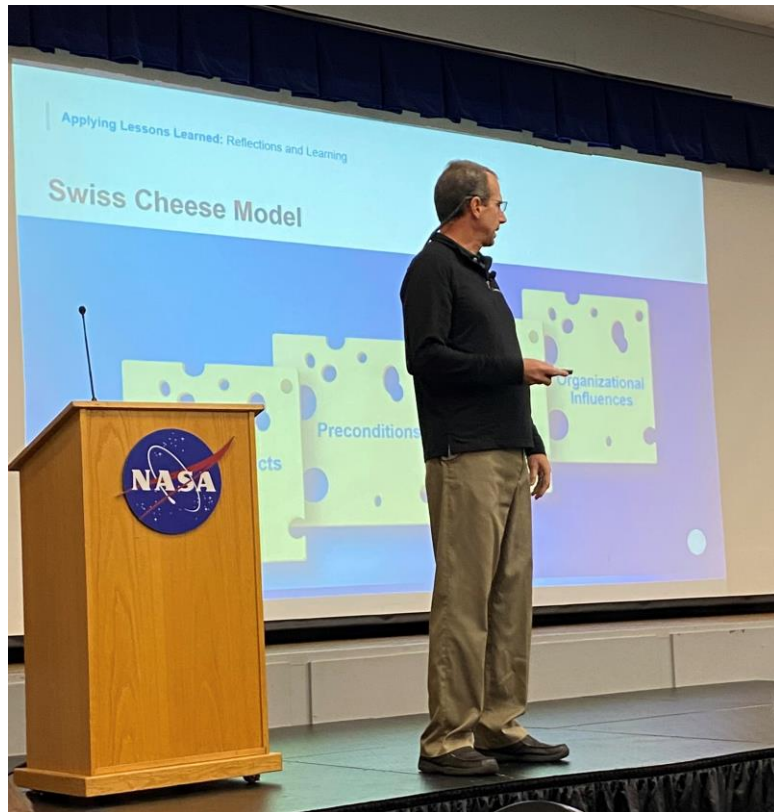


Chris Hansen, Chairman – Mishap Investigation Board



Knowledge Sharing Workshops

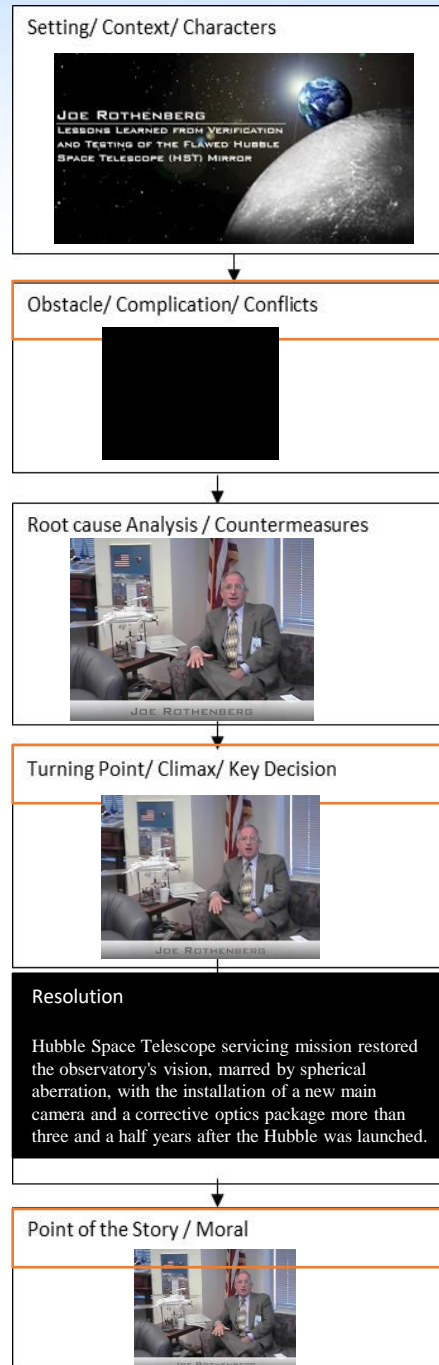
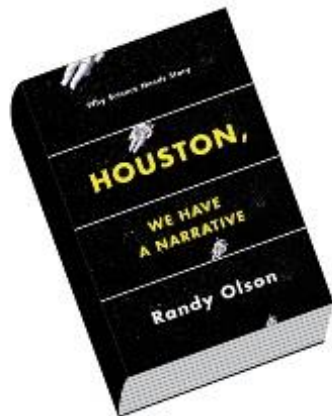
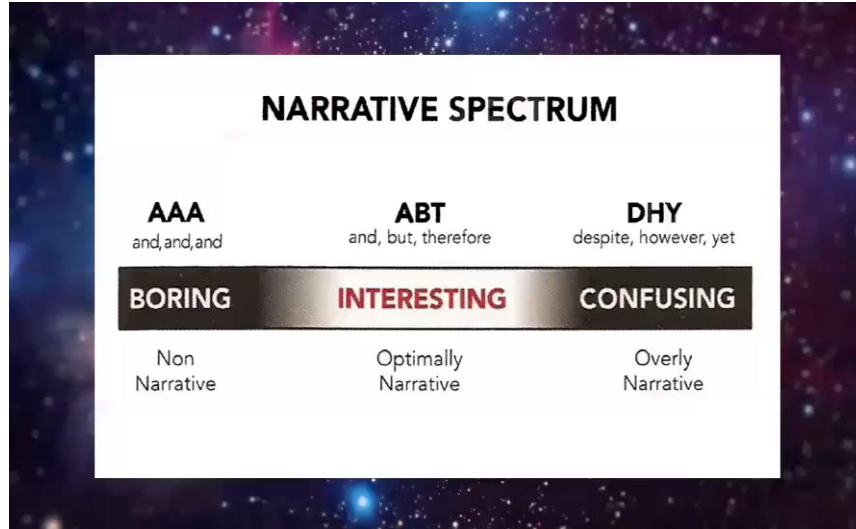
Columbia Lessons Learned





Storytelling

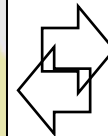
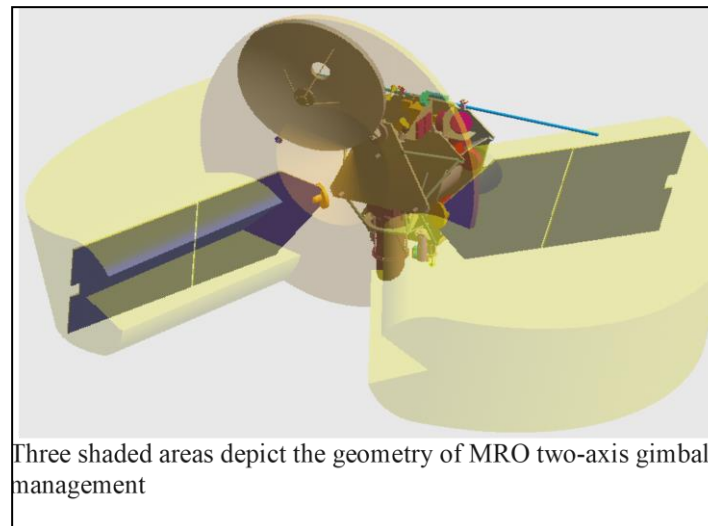
- And, But, Therefore





Project to Project Knowledge Transfer

- Mars Reconnaissance Orbiter (MRO) solar array articulation Keep-Out Zone Anomaly violation occurred, resulting in actual appendage contact with a thermal blanket
- The Juno team met with them and investigated similarities for the Juno solar array articulation. (Jupiter arrival in 2016)

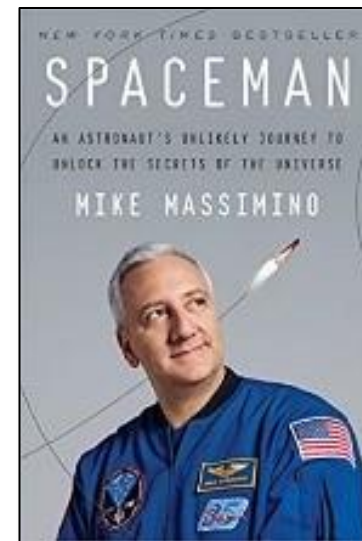
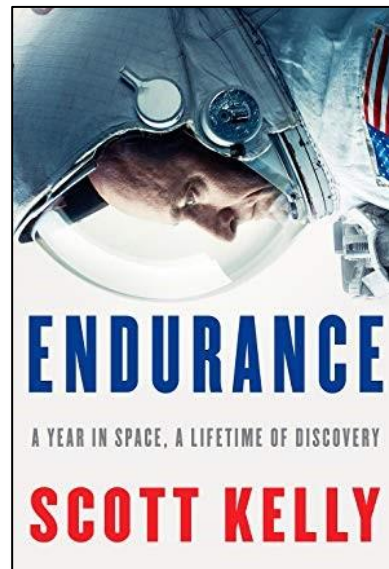
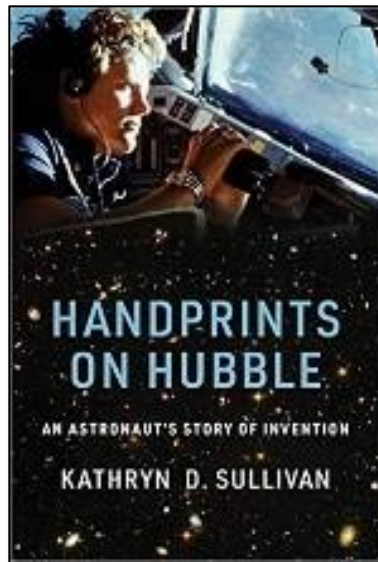


Juno Spacecraft



Book Discussions

- Handprints on Hubble: An Astronaut's Story of Invention by Kathryn D. Sullivan
- Endurance: A Year in Space, A Lifetime of Discovery by Scott Kelly
- Spaceman: An Astronaut's Unlikely Journey to Unlock the Secrets of the Universe by Mike Massimino





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Tools » Ask an Expert

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Planetary Data System (PDS)

ASK AN EXPERT

Submit a question and receive a response from a vetted subject-matter expert in an engineering discipline or sub-discipline. Questions and answers are archived for future access.

Each Community of Practice has its own Ask an Expert component. To browse existing answered questions or ask a new question related to a specific discipline, click the desired community below.

Communities

- Avionics
- Electrical Power
- Flight Mechanics
- Guidance, Navigation, and Control
- Mechanical Systems
- Propulsion
- Software Engineering
- Systems Engineering

Ask an Expert

Search for questions: Search

All Categories

Latest Questions

Hi I am a summer intern at JPL in Pasadena, CA I will be conducting mechanical tests on lunar simulators in the coming weeks and was curious if there is any available data on simulant density as a function of the level of compaction I am currently struggling with a lack of data on simulators and their mechanical behavior during various tests. Any information about the testing of lunar simulators, or density, or compaction data would be greatly appreciated and extremely helpful. Thanks. -Christopher J. Lee
Asked 10/23/16 by Christopher J. Lee
Category: General 3 RESPONSES

Can you provide a compressive value for F51 (Shear Ultimate Stress) for 4340 steel, and how this came to that value please?
Asked 10/12/16 by Stuart Williams
Category: General 2 RESPONSES

Have engineering questions?
ASK A QUESTION

Categories

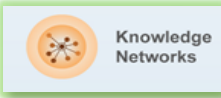
- Latest Questions
- Archived Questions
- Bearing Systems & Tribology (including Lubrication Systems) (0)
- Cryogenic Systems (0)
- Deployment Systems (0)
- EVA Mechanisms (0)
- Gear & Transmission Systems (0)
- General (0)
- Materials & Structure Analysis for Mechanical Systems (0)
- Spacecraft and Instrument Mechanisms (0)
- Test capabilities for the span of NASA Mission Mechanical Systems (0)

Experts

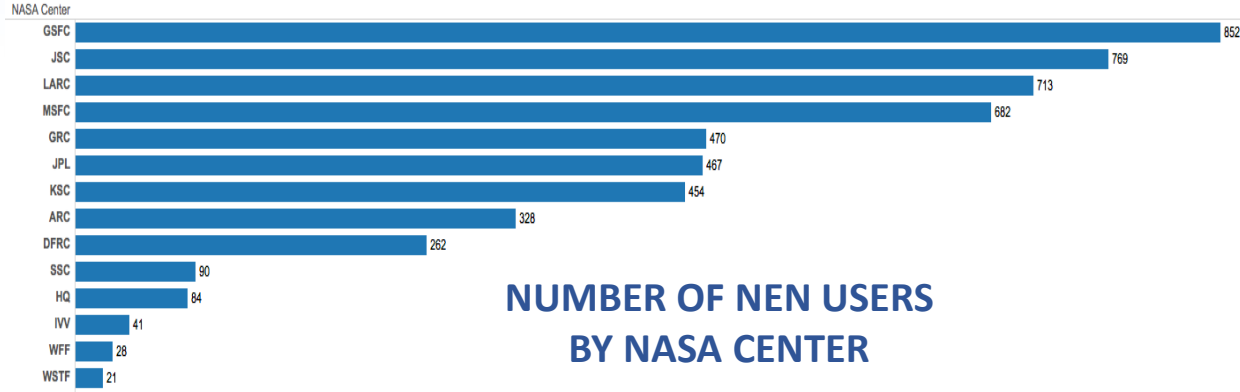
No experts have been designated for this category.

Help

- Comment or Question?
- FAQ



Communities of Practice NASA Engineering Network



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BY NASA CENTER**

A group of people who “share a concern, a set of problems or a passion about a topic, and who *deepen their knowledge* and expertise in this area by interacting on an ongoing basis.”



<https://nen.nasa.gov/web/nen>



Aerosciences Contact: Dave Schuster	Additive Manufacturing
Autonomous Rendezvous and Docking Contacts: Neil Dennehy	Avionics Contact: Oscar Gonzalez
Entry, Descent and Landing Contact: Michael Wright	Electrical Power Contact: Chris Iannello
Environmental Test & Verification Contact: Ed Strong	Fault Management Contact: Lorraine Fesq
Flight Mechanics Contact: Dan Murri	Guidance, Navigation and Control Contact: Neil Dennehy
Human Factors Contact: Cynthia Null	Life Support/Active Thermal Contact: Hank Rotter
Loads and Dynamics Contact: Curtis Larsen	Materials Contact: Bob Piascik
Mechanical Systems Contact: Michael Dube	Models and Simulations Contact: Martin Steele
Nondestructive Evaluation Contact: William Prosser	Passive Thermal Control and Protection Contact: Steve Rickman
Polymer Matrix Composites Contact: David Lowry	Propulsion Contact: Tom Brown
Small Spacecraft Contact: Sue Aleman	Software Engineering Contact: Michael Aguilar
Space Asset Protection Contact: Steve Kapurch	Space Environments and Radiation Contact: Chris St. Cyr
Structures Contact: Ivatury Raju	Systems Engineering Contact: Jon Holladay



Expert Finder

The screenshot shows the NASA Innovation Portal's Expert Finder interface. The search term is "non destructive evaluation". The results are displayed in a network view centered on "COMPOSITE MATERIALS".

Search Results Summary:

- Search Term: non destructive evaluation
- Category: COMPOSITE MATERIALS (17)
- Found: 6 experts

Found Experts:

- Jess M. Waller
- Daniel J. Wentzel
- Juan M. Fernandez
- Mallory M. Murphy Johnston
- Ralph D. Buehrle
- Brian K. Stewart

Category Breakdown:

Category	Count
COMPOSITE MATERIALS	17
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS	1
STRUCTURAL MECHANICS	21
ELECTRONICS AND ELECTRICAL ENGINEERING	10
METALS AND METALLIC MATERIALS	2



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What does NASA's Digital Transformation mean to you?
Calibration User Based Management System (Asset, Configuration, Lifecycle, Data Sharing, & more)
0

Clay, Samuel J. (SSC-SACOM)[SYNCOM SPACE ...]
01/27/2023 04:30 PM · Idea #7755

Background: I started working at SSC in 2007 as a full time Calibration Manager for E1, E2, & E3 test stands. To clarify, as Calibration Manager I was the 'go between' for the end users and the actual Calibration Laboratory (End User ↔ Cal Manager ↔ Cal Lab). Coming from the Navy and ...
Read more

What does NASA's Digital Transformation mean to you?
DT as a Culture Shift
1

Rainbolt, Kevin D. (GRC-NB00)
01/27/2023 03:20 PM · Idea #7754

The phrase "Digital Transformation" is a bit nebulous and tough to define in a single sentence or diagram. It may mean different things to different people or organizations. Nevertheless, the spirit of DT can make radical enhancements to how people do their jobs, and how work gets done.

For ...
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applications culture digital tools transformation workforce

All Ideas
ACTIVE +
AWARDED +
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Lessons Learned Centers & Organizations
Lessons learned databases at NASA centers and organizations.
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Lessons learned are;

- knowledge or understanding gained by experience either successful mission or project failure.
- important to future programs because they show insights from previous projects

Lessons Learned Entry: 1534

Lesson Info:

- Lesson Number: 1534
- Lesson Date: 2005-04-29
- Submitting Organization: DFRC
- Submitted by: Trong Bui

Subject:

Excessive Slack in the Retention Line of the Main Rocket Recovery Parachute

Abstract:

The Dryden Aerospire Rocket Test Director's Discretionary Fund (DDF) project conducted flight research of an aerospire rocket nozzle design using high power amateur rockets. The standard nozzles in these rockets were replaced by the aerospire nozzles and the rockets are then flown with aerospire nozzles only. Two aerospire rockets were flown successfully to altitudes of over 26,000 ft and speeds of over Mach 1.5. The flight data acquired during the flight tests were stored onboard and retrieved after the rockets were recovered. The rockets were recovered using a dual-stage parachute system. The smaller drogue chute comes out at rocket apogee to stabilize the rocket. The main chute deploys at approximately 2500 ft above ground level to slow the rocket descend for a soft impact on landing. During the first rocket launch, the main chute deployed inadvertently when the drogue chute activated, and the rocket descended on the main chute from apogee. During the second rocket launch, the main chute bag got outside of the rocket airframe and was entangled with the main chute retention line, preventing main chute deployment and causing the rocket to descend under drogue chute only. Both of these problems were caused by excessive slack in the main parachute retaining line.

Description of Driving Event:

The main chute bag is retained inside the rocket by the main parachute retention line and the main chute's electronically controlled release device. The drogue chute pulls on the main chute pack when the drogue chute is deployed. The excessive length of the main chute retention line causes the main chute to be pulled out of the rocket airframe when the drogue chute is deployed at apogee during the first rocket launch. During the second rocket launch, the main chute retention line was shortened in an attempt to solve this problem. However, it still contained enough slack to cause the main chute bag to exit the rocket airframe and become entangled with the retention line, preventing deployment of the main chute.

Lesson(s) Learned:

Excessive slack in the main chute retention line can cause inadvertent main chute deployment or main chute bag entanglement.

Recommendation(s):

Eliminate the need for a main chute retention line. Use a strap that secures the main bag to the electronically controlled main chute release device.

Evidence of Recurrence Control Effectiveness:



Exploration Flight Test 1 (EFT-1) Nominal End-of-Mission Recovery Operations

Lesson #: 14801

ABSTRACT

During the time leading up to the EFT-1 recovery in December 2014, the Ground Systems Development and Operations (GSDO) Program developed nominal end-of-mission recovery procedures and hardware used to recover the Orion Crew Module (CM) into a U.S. Navy well deck ship. After the recovery operation was complete, hardware suitable for the at-sea well deck environment, and 3) need to review methods of integrating trained personnel to accomplish the mission. After EFT-1 was accomplished, GSDO led a Cross Program Integration Team sponsored ad-hoc trade study to apply these lessons and develop an improved nominal end-of-mission recovery concept of operations to meet the Exploration Systems Development (ESD) requirement number R-6.

DRIVING EVENT

During the EFT-1 recovery operation, several events delayed the recovery operation. These include: 1) time required to reconfigure support equipment to prevent equipment failure; 2) time required to accomplish underwater heatshield imagery; and 3) time required to pass tending lines from the recovery ship to small boats. In addition, there was a pre-determined procedural delay to measure thermal soak back (the amount of thermal energy absorbed by the CM). As a result, the time from splashdown to CM secured in the well deck exceeded seven hours.



LESSON(S) LEARNED

- Need to simplify the CM recovery operation. Numerous lessons learned specified that the operation was too complex, required excessive communications, was hampered by competing shipboard operations and requires two separate movements to place the CM into the designated recovery cradle.
- Need to review methods of integrating trained personnel to accomplish the mission. The Recovery Team noted that personnel who were provided mission orientation were pulled away to do other unrelated tasks and replaced with personnel who did not receive familiarization, several ground operations personnel did not participate in pre-mission test activities and were thus unfamiliar with the planned flow of operations, and personnel tasked to accomplish heatshield imagery were unfamiliar with the camera equipment.

RECOMMENDATION(S)

1. Accomplish the Landing and Recovery trade study to evaluate alternate nominal end-of-mission concepts of operation.
2. Publish lessons learned from the development tests and EFT-1 in a single document and make that document easily accessible for quick reference.
3. Apply lessons learned to future training/orientation programs, operations procedures development and support equipment development events.

RELATED POLICIES, STANDARDS, HANDBOOKS, PROCEDURES, OR OTHER

DOCUMENTSOP1 4003; Ground Systems Development and Operations Program Offline Processing and Infrastructure Integrated Processing Team Results of Orion Crew Module Underway Recovery Development Tests 1-4 and Exploration Flight Test-1



Tech Standards

<https://standards.nasa.gov/nasa-technical-standards>

standards.nasa.gov/standard/NASA/NASA-HDBK-4001

Office of the NASA Chief Engineer
NASA Technical Standards System

Home Program Overview OCE Website NTSS Description Program Resources Glossary of Standards Acronyms FAQs

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- NASA Technical Standards
- Endorsed Standards
 - Endorsed Standards List
- Inactive or Cancelled Standards
- Center Standards
- NASA Directives (NODIS)
- Whole Building Design Guide
- CCSDS Standards
- ES&C Standards

Electrical Grounding Architecture for Unmanned Spacecraft

Options for Standards Update Notification System (SUNS)

Send SUNS Updates: Yes

SUNS Notification Type: Correction

Lessons Learned

To associate Lessons Learned to a specific standard, find the related lesson in LLIS. These lessons have been vetted and approved via the lessons learned process. Then, click "Create a new "Lessons Learned" record for this Standard" and complete the information.

If you have a lesson learned that is not in LLIS, click "Proceed to the NASA Engineering Network to create a new "Lesson Learned" about this Standard" to be vetted and approved in that process. Then, associate the lesson by clicking "Create a new "Lessons Learned" record for this Standard."

Standard Document Number	Document on LLIS	Lesson Learned Title	Relevance to Standard	Date Created
NASA-HDBK-4001	LLIS-0379	Violation of Magellan Electrical and Grounding Specification	This lesson provides an example of where violations of electrical interfacing and grounding requirements can have serious consequences and should not be undertaken lightly or without a formal project waiver. The lesson would be relevant to sections 3.3, 4, and 4.2.7 of the Handbook.	2022-07-07
NASA-HDBK-4001	LLIS-0658	Electrical Grounding Practices for	This is a reliability practice lesson learned pertaining to electrical grounding practices for aerospace hardware. It closely parallels the Handbook in details of electrical	2022-07-07





How to get your knowledge known “E-mail blasts”



KSC Daily News
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Monday, August 28, 2023

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Announcements

New Lessons Available in the NASA Engineering Network
The following new lessons learned entries were added the NASA Engineering Network.

- [Inadvertent Lift of NORS Tank in the SSPF](#)
- [SharePoint Nintex Licensing](#)

Find more NASA Lessons Learned at: <https://nen.nasa.gov/web/ll>. POC: Michael Bell 867-3312 or michael.a.bell@nasa.gov

From: NASA Engineering Network - Subscription Service <larc-dl-support-nen@mail.nasa.gov>
Sent: Thursday, January 12, 2023 1:00 AM
To: Bell, Michael A. (KSC-NETA0) <michael.a.bell@nasa.gov>
Subject: NEN Subscription Service

LESSONS LEARNED

- [E-1 Triethyl Aluminum-Triethyl Borane \(TEA-TEB\) System Contamination](#)

[Manage Your Subscriptions](#)
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From: NASA Engineering Network - Subscription Service <larc-dl-support-nen@mail.nasa.gov>
Sent: Tuesday, November 22, 2022 1:02 AM
To: Bell, Michael A. (KSC-NETA0) <michael.a.bell@nasa.gov>
Subject: NEN Subscription Service

LESSONS LEARNED

- [NDE Investigation of Crawler Shoes: Process Refinement and Logistics](#)

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LLBot Excel Add-In for searching for lessons learned

File Home Insert Page Layout Formulas Data Review View Help **Lessons Learned Bot** Comments Share

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 Generate Custom Data-set
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 Currently Selected Dataset: lessons_learned
 Enable Additional Filtering
 “+” Add Data To Currently Selected Data-set
 Select Number of Results to Display: 10
 Font Size: 12px
 “-” Remove Currently Selected Data-set

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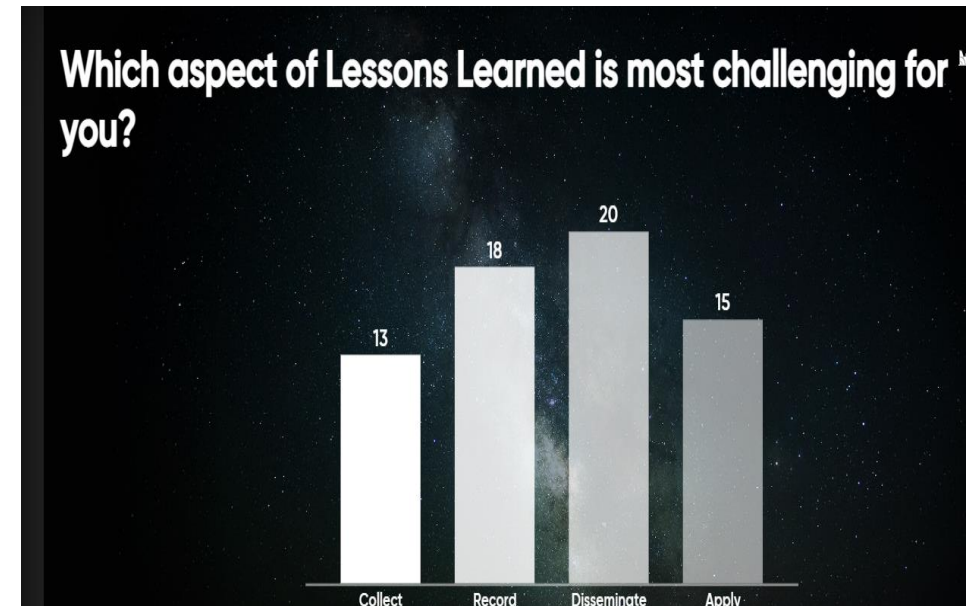
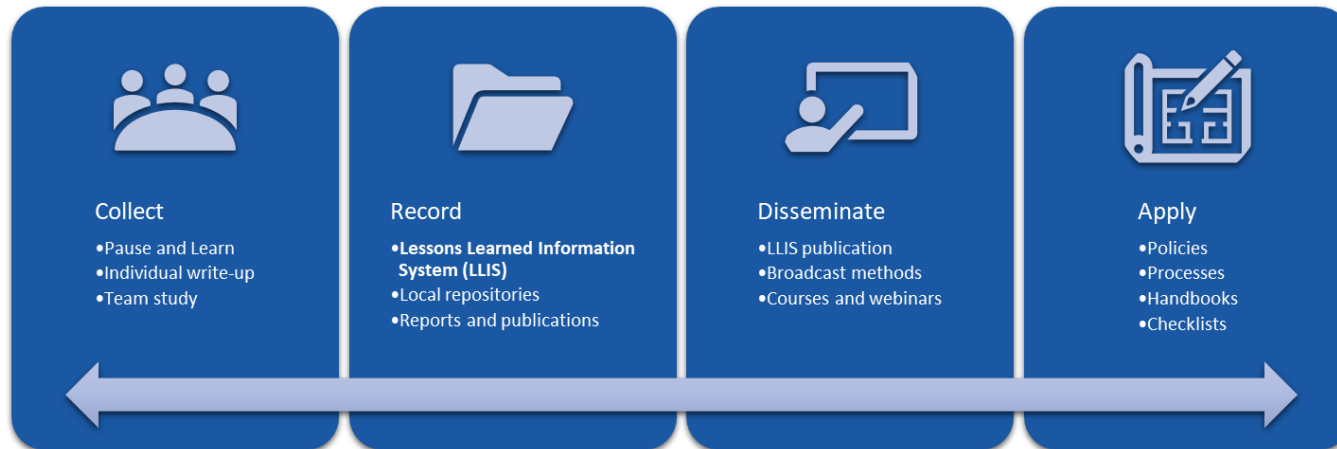
14 X ✓ fx

A	B	C	D
			HUMAN FACTORS DESIGN STANDARD HF-STD-001B
			5.2.8.1.5. CLAMPS AND MOUNTING PLATES
	5.2.8.1.5.1	Snug fit.	5.2.8.1.5.1 Snug fit. Clamps and mounting plates shall fit snugly without deforming or crimping the line or cable. [Source: UCRL-15673, 1985]
	5.2.8.1.5.2	Spacing	5.2.8.1.5.2 Spacing. Clamps and mounting plates shall be operable by hand or with common hand tools. [Source: MIL-HDBK-759C, 1995; UCRL-15673, 1985]
	5.2.8.1.5.3	Special clamps	5.2.8.1.5.3 Special clamps. Quick-release clamps (hinged or spring) shall be used if cables are removed frequently. [Source: MIL-HDBK-759C, 1995] Discussion. Hinged preferable for non-overhead mounting, because they support the weight of the line during maintenance, freeing the maintainer's hands for other tasks. Exhibit 5.2.8. these two types of clamps. For overhead mounting, a spring clamp with a hinged, locking latch over the clamp's open side is preferable because it would help prevent [Source: MIL-HDBK-759C, 1995] HF-STD-001B 103 Exhibit 5.2.8.1.5.3 Quick-release clamps, hinged and spring.
	5.2.8.1.5.4	Placement	5.2.8.1.5.4 Placement. Clamps and mounting plates shall be located at both ends of bends where the bending radius is 75 mm (3 in) or less. [Source: UCRL15673, 1985]
	5.2.8.1.5.5	Unsupported cable	5.2.8.1.5.5 Unsupported cable. Lengths of cable or wire longer than 300 mm (12 in) shall be attached to the equipment chassis by means of clamps, unless contained or cable retractors. [Source: MIL-STD-1800A, 1990; MIL-HDBK-759C, 1995]
	5.2.8.1.5.6	Visibility of clamps	5.2.8.1.5.6 Visibility of clamps. All clamps shall be visible when equipment is installed. [Source: MIL-STD-1800A, 1990]
	5.2.8.1.5.7	Mechanically-mou	5.2.8.1.5.7 Mechanically-mounted clamps. If a wire or cable is not routed through a wiring duct or conduit, it shall be attached with mechanically-mounted (not adhes clamps. [Source: MIL-STD-1472G, 2012] Discussion. Mechanically-mounted clamps can ensure the correct routing of electrical cables within and between units of eq can also (a) ensure that cables do not hinder or obstruct equipment maintenance, (b) prevent chafing due to contact with an adjacent surface, and (c) facilitate the m

Lessons Learn...
 Welcome to the Lessons Learned Bot! Please click on Excel cell with text in it to get started.



Lesson Learned Process Activities



Knowledge Tools



Collect

- After Action Review
- Pause and Learn
- Collaboration Tools



Record

- Taxonomy and Metadata
- Capturing Legacy: Drawing Out a Great Story
- Tricks for the Smartphone Videographer



Disseminate

- Lessons Learned Database Inventory
- Quick Webinars
- Storytelling
- Search and Findability
- Podcasts
- Panels, Presentations, Lunch and Learns




Apply


- Mentoring
- Reflective Practice
- Policy Review
- Case Study Discussion




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Space Technology Mission Directorate



John Stealey
Stennis Space Center



Comms Plan with ADKAR and RACI

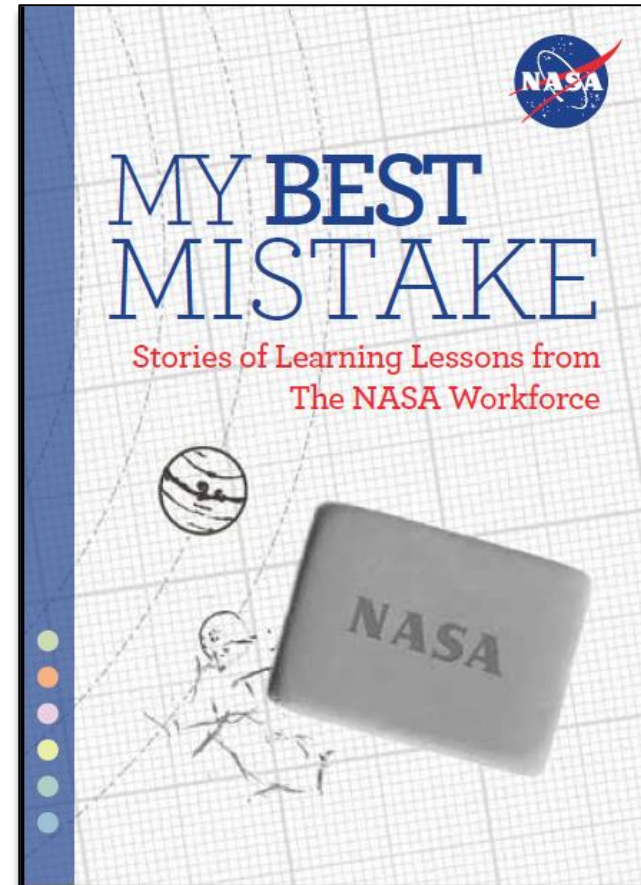
If We Build It... They Will Come.....

Item #	Organization	Solution	ADKAR	Description/Message Purpose	Communication Method	Target Audience	Completion Target Date	Author	Delivered From	Status	R	A	C	I	Notes
	Enter the organization	Enter the product/solution	What stage of ADKAR is aligned to the communication	Enter the activity - town hall? Virtual? Tool?	Enter the description of the communication	Enter target audience	Enter the date of the communication	Who will write the communication	Who will send the communication	Complete, started not scheduled	Enter the person's name, job title, role, function				Additional Information
1	Knowledge Community	KC&T Report Presentation/Next Steps	A	Email	Review of report and next steps	Center and MD CKO teams	12/9/21	T	T	12/17/21	T CKO	T CKO	KC&T Team	Joe P. Terry S.	
2	History Office DISA	KC&T Report/Recommendations	A	Personal call/email	Peer Review request	History Office POC and DISA CKO	12/9/21	T	T	12/17/21	T CKO	T CKO	SM WOC	KC	
3	OCE Deputies	KC&T Report/Next Steps	A	Virtual Meeting	Review of report and next steps	Terry S. Joe P	1/14/2022	T	T	1/14/2022	T CKO	T CKO	SM WOC	KC	
4	Science and Technical Information Program	KC&T Final Report	A	Email	Request to post in NTRS	Public	1/18/21	SM	T	2/1/22	T CKO	T CKO	TS JP	KC	
5	OCE	KC&T Presentation	A	Virtual Meeting	Announcement and overview of project	OCE Leadership	Regular leadership meeting	SM	T	TBD	SM WOC	T CKO	TS JP	KC	
6	APMC	KC&T Presentation	A	APMC's Virtual Meeting	Announcement and overview of project	PM Counsel	Regular APMC meeting	SM	T	TBD	SM WOC	T CKO	TS JP	KC	
7	OCHCO	KC&T Presentation	A	Personal call	Awareness of project, request to update leads in regular meeting	OCHCO lead	2/14/22	SM	T	TBD	SM WOC	T CKO	TS JP	KC	
8	EMC	KC&T Presentation	A	EMC Virtual Meeting	Announcement and overview of project	EMC	Regular APMC meeting	SM	T	TBD	SM WOC	T CKO	TS JP	KC	



Barriers to Knowledge Sharing

- Fear of Rejection or Criticism
- Lack of Communication Channels
- Time Constraints





Breaking Down the Barriers

- Creating a Culture of Openness
- Tie Knowledge Sharing To Program Objectives
- Recognizing and Rewarding Knowledge Sharing
- Leading by Example
- It's Top Down and Bottoms Up



"We did and extensive lessons learned process that enabled us at every level within the organization and within the hardware production with the contractor level or NASA doing integration and analysis to be able to factor that into the learning as well as future missions."

JANUARY 17, 2024 | [NASA OFFICIALS TESTIFY ON MOON EXPLORATION](#)



Questions?





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Systems Engineering



Lessons Learned



Knowledge Inventory



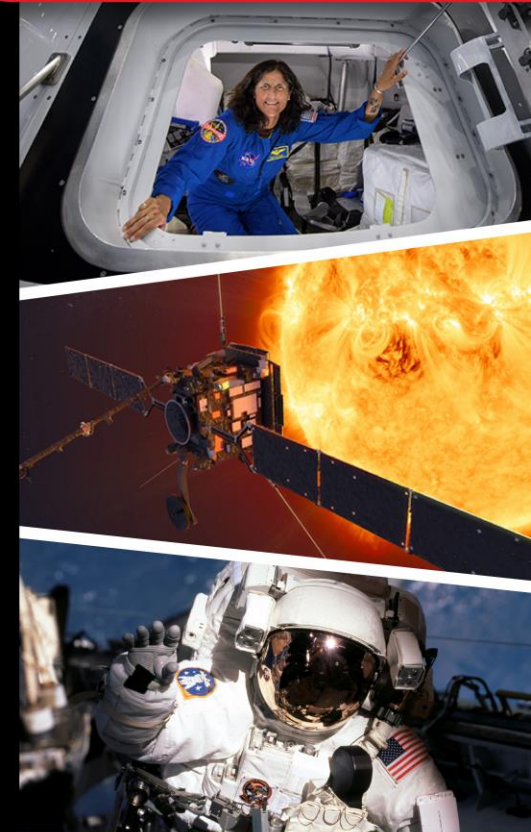
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