



U.S. Spacesuit Knowledge Capture – Expanding Our Future



ICES-2023-16

GROUND COMMAND
COLOR TELEVISION
ASSEMBLY (GCTA)

LUNAR COMMUNICATIONS
RELAY UNIT (LCRU)



Overview

- U.S. Spacesuit Knowledge Capture (SKC) & Strategic Communications Program
- Evolution
- Successes & Challenges
- Special Projects
- Knowledge Capture & Sharing Mechanisms
- Impact of Capturing Knowledge
- Conclusion
- Acknowledgements





SKC & Strategic Communications Program

A unique, educational program for NASA's technical personnel & partners & the public



Images by NASA

Team Members:

- Cinda Chullen, Manager
- Vadenka Oliva, Administrator
- Gordon Andrews, Producer
- Diana Rodgers, Multimedia Coordinator
- Jessica Krenzel, Multimedia Editor
- Multimedia Developer Intern

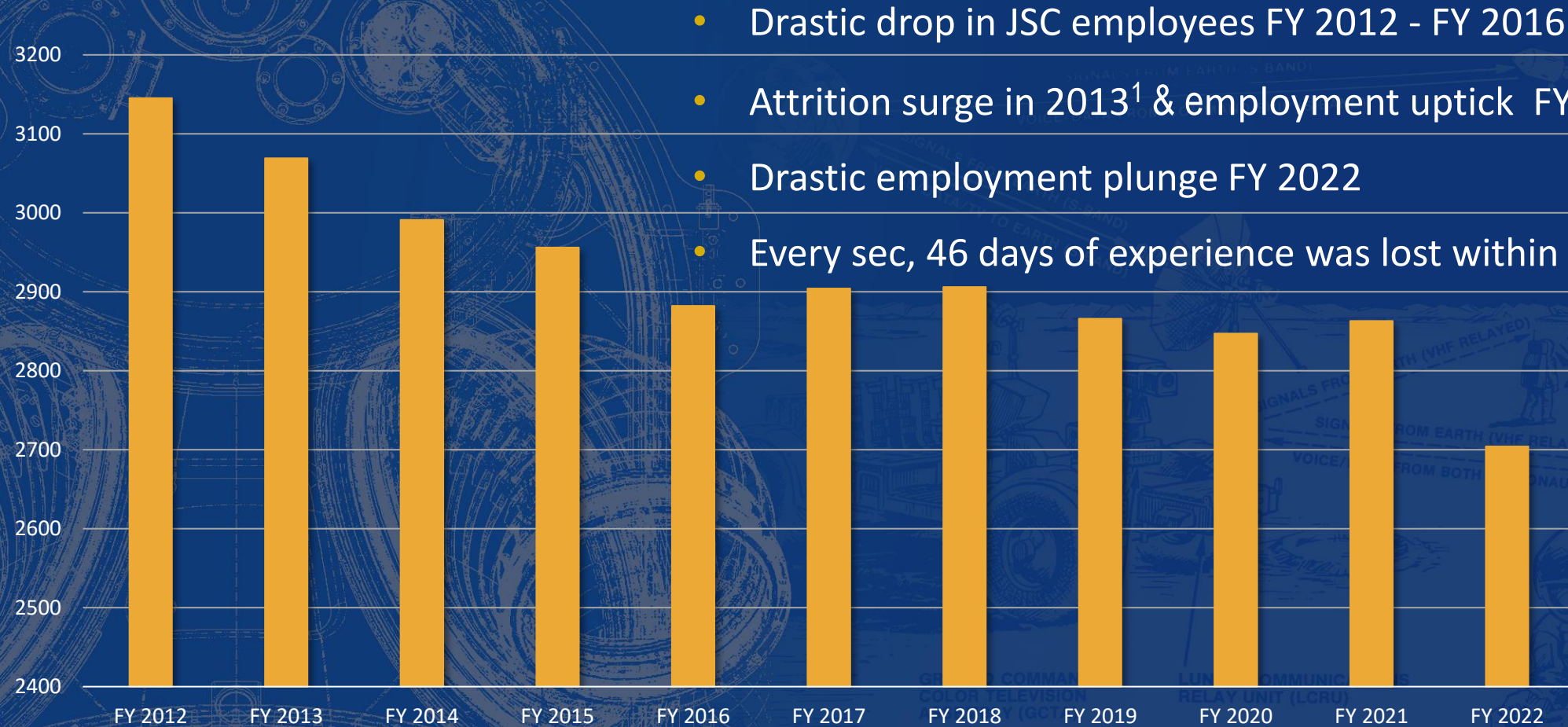


Evolution

- Infancy – 2007:
 - Formed to fill knowledge gaps
 - Existed with manager only, without funding
- Formative years – 2014:
 - Began to focus on components within Advanced Extravehicular Mobility Unit (AEMU) (later known as Exploration Extravehicular Mobility Unit (xEMU))
- Later years – 2019:
 - Began to capture & preserve xEMU buildup at Johnson Space Center (JSC)
- Recent year – 2022:
 - Began to support Extravehicular Activity and Human Surface Mobility Program (EHP)
 - Emphasized external communication with continued focus on knowledge capture & preserving lessons learned from subject-matter experts (SMEs)



Evolution (cont'd)



- Drastic drop in JSC employees FY 2012 - FY 2016
- Attrition surge in 2013¹ & employment uptick FY 2017
- Drastic employment plunge FY 2022
- Every sec, 46 days of experience was lost within fed govt²

Number of JSC federal employees FY 2012 – FY 2022 (excludes contractors)³



Successes

SKC Products

Categories of Products	Number of Products
Publicly available	96*
Preparing to submit into the DAA	24‡
Restricted access	8*
Sensitive	6‡
In DAA process	3*
xEMU modules	61‡‡
Spacesuit Spotlights	15**
Total number of products	213

*107 products have been submitted into Document Availability Authorization (DAA) system

‡30 products have not been submitted into DAA system

‡‡61 xEMU modules not distributed (not planned for public or agency release)

**15 Spacesuit Spotlights not distributed (planned for NASA internal use only)

Note: The NASA Engineering and Safety Center (NESC) Academy is processing 12 events that have been DAA-approved but are not yet accessible on the NESC Academy website.



Challenges

- Export control – arduous process to scrutinize & sanitize products
- Securing video & photography services – rarely funded
- Navigating through coronavirus disease 2019 (COVID-19):
 - Adhered to added safety protocol to shoot video & photography
 - Used new teleconferencing tool – allowed employees to spatially distance while collaborating



Special Projects

- xEMU – Documented xEMU buildup
- Spacesuit Spotlights – Capture & honor spacesuit SMEs
- Historical Documents – Scan historical documents donated by SMEs
- Exploring the Moon Conference (publicly accessible):
 - Focus on spacesuits, Lunar Terrain Vehicle (LTV), pressurized rovers, & Artemis geology tools



Special Projects (cont'd)

- Cataloged 623 glass projector slides:
 - Images featuring Apollo EMU Human-in-the-Loop (HITL) Thermal Vacuum (TVAC) Chamber Testing
- Curation of Historical Spacesuit Hardware:
 - Identify & archive Crew and Thermal Systems Division (CTSD) surplus hardware
- Consolidated Library:
 - Create & maintain a visual resource library for internal customers & public

Special Projects (cont'd)

- xEMU Technical Community of Practice (CoP):
 - Collaborated with xEMU CoP to train & share knowledge
 - Use videography & photography to chronicle testing & integration of components



Image by NASA

Fully Integrated xEMU

Special Projects (cont'd)

■ Spacesuit Spotlights

- 10- to 30-minute interviews capturing insights of & honoring spacesuit contributors



William (Bill) Lynch
Systems Engineer



Kristine Davis
xEMU Pressure Garment Subsystem
Hardware Manager

Images by NASA

Knowledge Capture & Sharing Mechanisms



- Collaborators – NASA Agency, NASA JSC, & external
- Classroom – Real-time lectures, interviews, & workshops
- Vignettes – Share lessons primarily through storytelling
- Videoconferencing – Online capturing & sharing lessons learned
- Virtual Tours – JSC government facilities for interested industry
- Technical CoP – Interactive in-depth knowledge sharing
- Existing Library – Archived over 200 recorded events



Impact of Capturing Knowledge

- Asset to Agency:
 - NASA's Day of Remembrance – share valuable lessons learned
 - JSC's Health & Safety Day – host annual learning event
 - Curriculum – provide educational content for new & early career employees
 - Historical artifact inventory – curate historical spacesuit hardware
 - Disseminate – provide effective approach to share knowledge
- Recognition & Feedback:
 - Positive results from audience-completed surveys
 - Example of feedback – CTSD's senior manager recognizes a lessons-learned event as the most valuable 90-minute meeting attended



Conclusion

- SKC Program:
 - An important entity as NASA pursues new space endeavors
 - Communicates knowledge of NASA's vital assets (e.g., spacesuits, LTV, & tools)
 - Seeks ways to expand its scope & share pertinent space-related knowledge



Acknowledgements

EHP (funding source)	Michael Mankin & Tim Hall
Space Suit and Crew Survival Systems Branch	Kevin Wells, Jeff Loechel, Liana Rodriggs, & Sarah Walsh
NESC	Morgan Abney
Imagery Online	Maura White
Videographers	Jim Hansen, Matthew McGee, & Clayton Urbanick
NESC Academy Professionals	Daniel Hoffpauir, Alex Walker, & Ricardo Major
Scientific Photographers	Bill Stafford, Josh Valcarcel, Robert Markowitz, Riley McClenaghan, & James Blair
Graphic Designers	Jeannie Corte & Logan Goodson
IT Support	John Springhetti
CoP Coordinator	Sarah Hargrove
Subject Matter Experts	Each presenter



SIGNALS FROM

VOICE/DATA FROM COMMAND SHIP (S-BAND)

SIGNALS FROM EARTH (S-BAND)

VOICE/DATA/TV TO EARTH (S-BAND)

Questions

ICES-2023-16



GROUND COMMAND
COLOR TELEVISION
ASSEMBLY (GCTA)

LUNAR COMMUNICATIONS
RELAY UNIT (LCRU)





Special Projects (cont'd)

- Exploring the Moon Conference
 - Debuts virtually summer of 2023
 - Publicly accessible via web-based & social media platforms
 - Educates, engages, and inspires academia, industry partners, & space enthusiasts about NASA's journey to the Moon
 - Forum = newsroom & podcast with combination of real-time moderators & panelists, multiple 5- to 20-minute pre-produced videos focused on spacesuits, LTV, pressurized rovers, & Artemis geology tools
- Donated Historical Documents
 - Over 2500 documents donated by SMEs:
 - Information from Project Mercury, Apollo, & Gemini; advanced life support system development; & the EVA systems of Space Shuttle & ISS Programs
 - Reports, memorandums, drawings, & configurations



Special Projects (cont'd)

- Apollo EMU Human-in-the-Loop Thermal Vacuum Chamber Testing Images
 - Cataloged 623 glass projector slides featuring Apollo Extravehicular Mobility Unit (EMU) Human-in-the-Loop (HITL) Thermal Vacuum Chamber (TVAC) testing images into JSC's Imagery Online
- Historical Spacesuit Hardware Curation
 - Identify & archive surplus hardware that resides within JSC's Crew and Thermal Systems Division



Knowledge Capture & Sharing Mechanisms

■ Collaborators:

- Flight Operations Directorate (formerly known as Mission Operations Directorate Training Academy)
- JSC History Office
- JSC Engineering Academy
- NASA STI Program
- Smithsonian
- NESC Academy (URL: <https://nescacademy.nasa.gov/catalogs/cfd4cdc970c046358afc1c2e5f72a0554d>)

■ Mechanisms:

- Classroom lectures, interviews, and workshops
- Vignettes
- Videoconferencing
- Virtual tours
- Technical CoP
- Library



Special Projects (cont'd)

US SKC Library

Create, develop, & maintain EHP knowledge in a consolidated electronic library;

Capture & develop internal & external EHP multimedia & communications events & products

Maintain a visual resource library for internal customers & the public



U.S. Spacesuit Knowledge Capture Program Library



Choose an icon to view a list of all available modules for that subsystem.

					
xEMU	xPGS	xPLSS	xINFO	ADDL TOPICS	NESC
Exploration Extravehicular Mobility Unit	Exploration Pressure Garment Subsystem	Exploration Portable Life Support Subsystem	Exploration Informatics Subsystem	Additional Topics	NASA Engineering & Safety Center (SKC)

GROUND COMMANDED
COLOR TELEVISION
ASSEMBLY (GCTA)

LUNAR COMMUNICATIONS
RELAY UNIT (LCRU)