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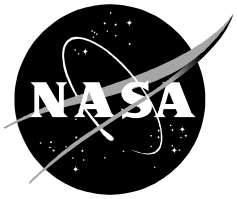

Ensuring Knowledge Continuity during Employee Transitions

NASA Knowledge Capture and Transfer Working Group Report

APPEL Knowledge Services
NASA Headquarters, Washington, DC

December 2021

NASA STI Program Report Series

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Executive Summary

Background

Knowledge management is the organizational practice of continuously capturing, distributing, and effectively utilizing knowledge. At NASA, knowledge management activities are conducted on a federated basis by Centers and Mission Directorates. The NASA Chief Knowledge Officer (CKO) reports to the Office of the Chief Engineer and is responsible for policy and integration of knowledge services across programs and projects in the Centers and Mission Directorates.

NASA's Knowledge Capture and Transfer Working Group was established in support of NASA Policy Directive 7120.6a, which requires the agency to mitigate the knowledge impacts of workforce demographic trends and close anticipated knowledge gaps to benefit future knowledge users. The Working Group was chartered by the agency's CKO and led by representatives from multiple Centers and Mission Directorates from January to September 2021. This report describes the findings and recommendations of the Working Group.

Challenge

NASA maintains a vital knowledge base. Engineers, project managers, scientists, mission support personnel, and people from other disciplines come together to perform extraordinary work every day. They share their knowledge in technical reports and publications, presentations, interviews, lectures, and numerous other forums. However, these formal knowledge-sharing environments do not completely capture or reflect the breadth or depth of the knowledge necessary to achieve NASA's mission success, as this knowledge resides in the agency's workforce, teams, and missions.

The challenge of knowledge capture and transfer is especially pressing. **The anticipated change in the workforce demographics due to attrition through retirement of the most experienced personnel — many of whom cannot easily be replaced — presents a serious knowledge retention challenge for NASA.** In addition, external factors make it difficult for leaders and managers to prioritize the resources needed to ensure that knowledge is retained during project and personnel transitions. It can also be difficult to anticipate which knowledge is most critical to capture and transfer in NASA's complex environment.

NASA leaders and teams have identified challenges with connecting employees to knowledge when they join a team and retaining the critical knowledge held by experienced personnel in advance of retirement or other transitions. Knowledge loss and insufficient expertise generate great long-term costs. Employee transitions can cause stress and loss of productivity for teams, and they can present risks to projects and impact the likelihood of mission success.

Approach, Recommendations, and Next Steps

The Knowledge Capture and Transfer Working Group sought to understand current practices across all Centers for gathering critical knowledge from experts ("knowledge capture") and making it available to others within the workforce for application to new challenges ("knowledge transfer"). **This report explains current knowledge retention challenges, discusses the Working Group's activities and findings, and introduces tools and**

processes to support technical teams and projects through retirements and other transitions.

Three overarching recommendations were developed by the Working Group:

1. **Standardize processes, templates, and guidance to support knowledge capture** for personnel and project transitions.
2. **Develop templates and guidance to support knowledge transfer** and connection processes.
3. **Promote and support knowledge capture and transfer practices and tools** so that they can be applied effectively throughout the agency.

The group's next steps are to communicate the knowledge capture and transfer strategy based on these recommendations, shift NASA's knowledge services approach to adopting and sharing resources with our communities in support of these goals, and develop an implementation plan to advance the specific recommendations of this group in the months that follow this report. This report serves as an account of how the Working Group accomplished its tasks. As a result of this work, NASA and its workforce will be better equipped to capture and transfer knowledge through transitions, support adherence to the Knowledge Policy for Programs and Projects, and thereby help NASA's technical workforce to achieve mission success.

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Background

NASA Policy Directive 7120.6A, Knowledge Policy for Programs and Projects, requires the agency to focus efforts on mitigating the impacts of attrition, workforce demographic trends, and program/project closeouts on knowledge loss and to close anticipated knowledge gaps for the benefit of future knowledge users. The NASA Knowledge Community provides this focus. The NASA Knowledge Community is made up of Chief Knowledge Officer (CKO) teams from each NASA Center and Mission Directorate, as well as points of contact from relevant NASA organizations, including the Office of the Chief Information Officer (OCIO), the Office of Safety and Mission Assurance (OSMA), and the NASA Engineering and Safety Center (NESC). The Chief Knowledge Officer and Director of NASA's Academy of Program/Project and Engineering Leadership Knowledge Services (APPEL KS) convenes the NASA Knowledge Community, which meets at least quarterly to benchmark progress and gather performance updates for knowledge sharing activities. ***In December 2020, many participants noted challenges with upcoming retirements and other workforce transitions, and some identified these as potential risks for missions and programs.***

APPEL KS chartered a NASA Knowledge Capture and Transfer Working Group in January of 2021 to address and mitigate these challenges. Senior representatives from the APPEL KS team led the group with participants from six Centers and three Mission Directorates. The group's goals were to:

- Review and analyze current agency techniques for knowledge capture and transfer for project transferees, retirees, and people leaving NASA.
- Prompt and encourage best practices for knowledge capture and transfer across the agency.
- Advance the "State of the Discipline" for knowledge capture and transfer.

Four teams were created to achieve the above goals: 1) Current State Team, 2) Culture Team, 3) Knowledge Processes Team, and 4) Onboarding and Connecting Team. Each team developed initial goals and modified their focus over time. Through a survey, interviews, and observations of the current workforce, the Working Group gathered and analyzed information on the current state of knowledge capture and transfer at NASA. Based on their results, they prioritized shared tasks, with some completed in this iteration and others to be pursued in the future. By researching best practices from internal and external organizations and studies, capturing workforce recommendations for improvement, and analyzing the current state of knowledge capture and transfer, the Working Group identified solutions to:

- **Encourage a culture in which knowledge is routinely captured** throughout the lifecycle of an employee, not just at retirement or departure.
- **Support knowledge transfer to onboarding employees'** in a more efficient way.
- **Connect newer and more experienced practitioners** for knowledge transfer.
- **Encourage employees to seek out knowledge** from other agency talent.
- **Simplify the process** of capturing and transferring knowledge.
- **Document and formalize** knowledge transfer processes.

Each team brought its research, survey analysis, and pathfinder projects together in August of 2021 to develop a set of shared findings and recommendations. Figure 1 includes a breakdown of the timeline for the Working Group.

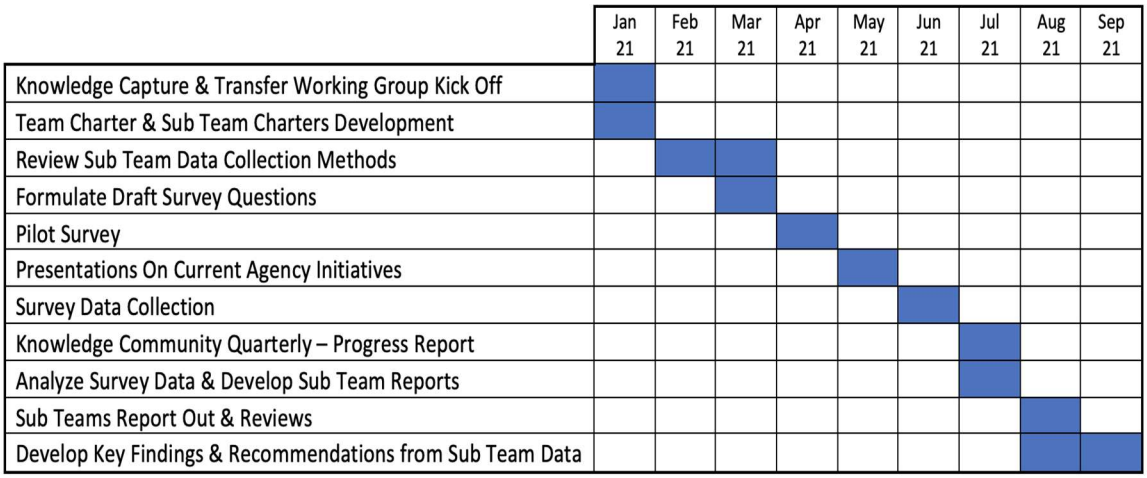


Figure 1: Working Group Timeline

A Brief Note on Scope

This study addresses knowledge capture and transfer activities within NASA. While the Working Group observed external practices and discussed those findings, not all the recommendations will be applicable in other organizations or other environments.

In addition, some sections of this report reference onboarding and offboarding processes. These processes often incorporate significant human capital, information technology, and other administrative elements. This study's scope is limited to the knowledge capture and transfer elements in onboarding and offboarding processes that support knowledge continuity through employee transitions.

Current State

Goals

The Current State Team informed the rest of the Working Group and Knowledge Management (KM) community of current approaches to knowledge capture and transfer and their efficacy to inform future recommendations. Their initial goals were to:

1) Collect a list of tools, techniques, and resources NASA uses to facilitate onboarding and retiree knowledge transfer.
2) Analyze the list for pros, cons, and user satisfaction.

Findings – Survey

Approximately 250 surveys were sent to program and project management and systems engineering leaders, knowledge officers, and training points of contact (POCs) throughout NASA. The team received 84 responses, a 37% response rate. The survey included multiple-choice and open-ended questions to assess the current state of knowledge capture and awareness of offboarding processes that support knowledge or technical skill capture and transfer for those leaving the individual's organization.

The Current State team analyzed reported satisfaction with formal and informal processes and reviewed responses to open-ended questions to gather insights on those processes in use throughout different organizations.

Out of 82 responses to the question, "What are your organization's off-boarding processes (both formal and informal) that focus on knowledge or technical skill capture and transfer for departures?", **60% of the respondents indicated they were unsure of or could not identify processes that focused on knowledge or technical skill capture or transfer**. 11% of respondents identified formal or required off-boarding processes, and 29% identified informal processes, often self-managed or based on conversations among colleagues or teams.

Figure 2 highlights some of the processes that were mentioned in the survey by those individuals who were aware of offboarding processes.

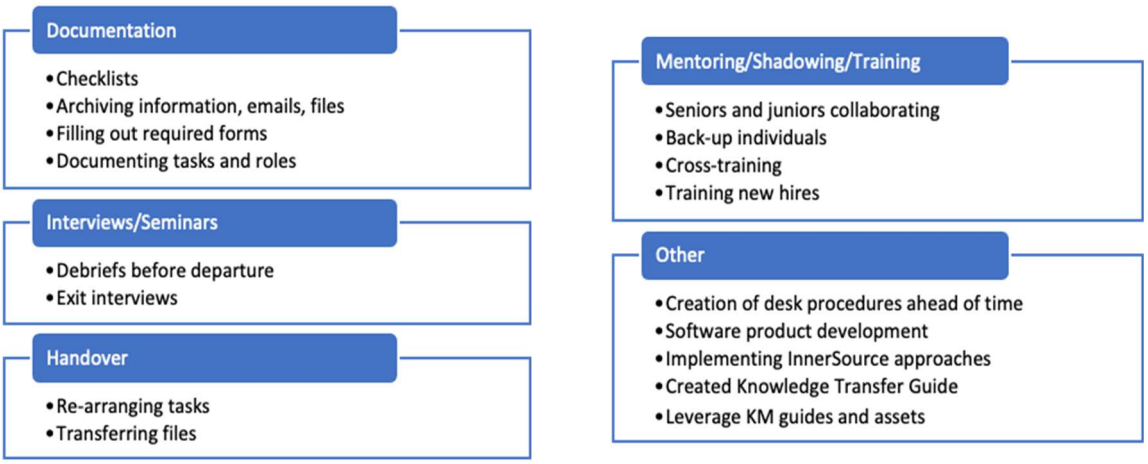


Figure 2: Survey Results of Knowledge Capture Processes

In addition, survey participants were asked about their satisfaction with the current offboarding process.

- Only 14% of respondents were satisfied with the current offboarding processes that support knowledge or technical skill capture and transfer in their organizations
- Nearly half of the respondents were unsatisfied with the current offboarding processes.

The reasons stated included a lack of leadership initiative, a lack of documented processes, a need for more proactive hiring mandates (earlier hiring prior to employee departure, multiples for overlap), limitations on money and time, and the need for a process or a better process. Specific recommendations on these areas are referenced in the Culture section below.

Figure 3: Survey Results of Satisfaction with Current Offboarding Process

Participants were also asked if they were aware of what their organization does to ensure that it is not losing critical knowledge when someone departs.

- Nearly 34% were either unaware or did not implement any additional initiatives.
- Almost two-thirds of respondents noted a variety of types of knowledge sharing activities and offboarding processes they knew in their organization, as illustrated in Figure 4.

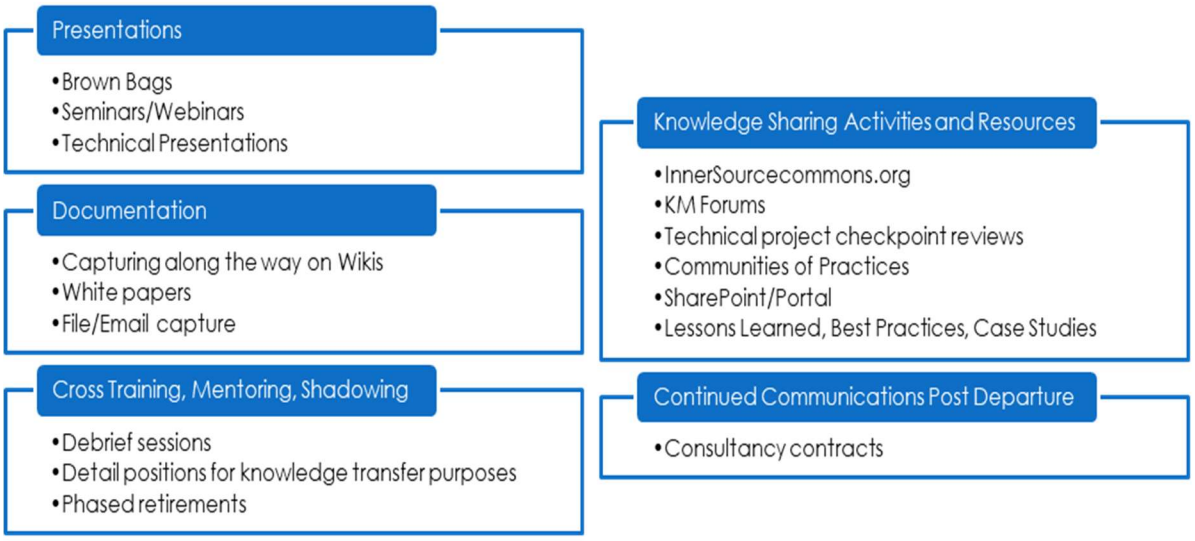


Figure 4: Survey Results of Awareness of Types of Knowledge Sharing Activities

Finally, respondents identified recommendations to resolve the gaps they observed, including phased retirements, allowing longer overlaps, and more support for documentation and process implementation. Figure 5 includes some of the recommendations that were mentioned for improving the offboarding process.

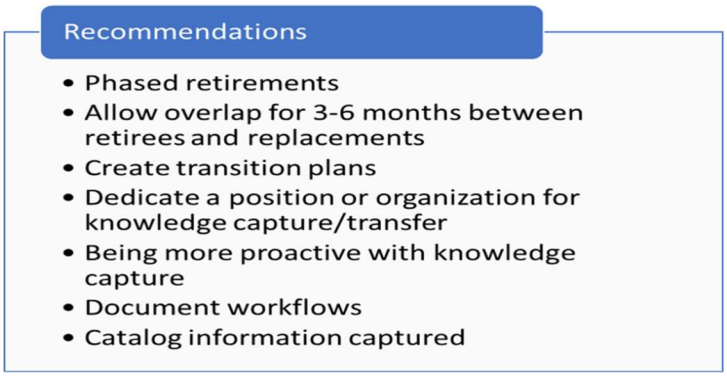


Figure 5: Survey Results for Offboarding Improvement Recommendations

Way Forward

Based on the data gathered, the Current State Team suggested that the Working Group and KM Community:

- Conduct follow-up interviews and focus groups on addressing data gaps and gain a deeper understanding of survey data.
- Communicate lack of awareness to leadership to strengthen the commitment to making time and resources available to act on these findings.
- Develop a standard template or guidance document to provide tips and steps to facilitate the recommended tools and techniques.
- Encourage individuals to self-educate on the tools and techniques of knowledge capture and transfer to support these suggested activities.

Culture

Goals

The Culture Team identified cultural strategies and approaches that can better enable the capture and transfer of knowledge. Their initial goals were to:

1) Establish a baseline of information that supports the business case for knowledge capture and transfer.
2) Identify NASA's cultural accelerators and decelerators to knowledge capture and transfer.
3) Recommend ways to capitalize on accelerators and fill gaps, such as:
   a) Value and impact: Strategic application of the value story, including "quick wins" demonstrating the impact.
   b) Organizational support structures: Practical motivators (carrots and sticks).
   c) Process support structures: Effective KM education, communication, systems, etc.

The team reviewed external practices, internal survey results and discussions with personnel, and assessed the cultural fit for different approaches within NASA work practices to develop recommendations in support of knowledge capture and transfer with culture in mind.

Culture is shared beliefs, values, and customs. We may have the right knowledge management tools and policies, yet still have a gap against our expectations if culture is at odds with Knowledge Management goals.

Findings – External Practices

NASA is not alone in dealing with the challenges described in this report. NASA knowledge management practitioners identified ways to enhance knowledge services through:

- Benchmarking with other agencies, academia, and private industry.
- Reviewing reports and published research on knowledge management practices.
- Participating in organizations such as the Federal Knowledge Management Community and other knowledge management consortiums.
- Joining workshops and events to hear more from other practitioners.

The Culture Team highlighted the work of Stan Garfield, an expert on KM topics, in developing their analysis. Garfield posits that effective knowledge capture and transfer requires a culture that supports it. He has stated that three key organizational values are needed for this to happen, as seen in Figure 6.

Knowledge-Sharing Culture

- Knowledge reuse is valued over reinvention.
- Sharing knowledge helps you advance in your career.
- In the process of innovating, failure is encouraged – as long as the lessons learned are shared so that similar failures are prevented.

Figure 6: Stan Garfield, "Building a Knowledge-Sharing Culture"[1]

The Culture Team noted that if these three elements are true, there may be inherent challenges in waiting to capture knowledge at offboarding, because an expert will have little incentive to make the effort to share at that point in his or her career. To mitigate this, the team reinforced the need to make a greater effort to gather knowledge throughout a career. This will allow the knowledge to benefit others earlier, does not create an additional step before departure, and encourages the actively employed expert to share because it impacts his or her career success.

The Culture Team also reviewed leading KM practices from external organizations recognized for knowledge management expertise, one of which is the American Productivity & Quality Center (APQC). Two trends emerged from industry thought leaders and external resources. The first trend highlighted the importance of standardization within an organization. Standardization reinforces consistency and allows for improved knowledge sharing across teams. The second is a trend towards microlearning — presenting information in "short, focused bursts"[2]. An example of microlearning at NASA would be recording a 5- to 10-minute video clip of a subject matter expert solving a problem, instead of providing an hour-long video interview. Additional practices are listed in Figure 7.

Figure 7: Knowledge Management Good Practices

Beyond these trends, the Working Group noted that knowledge capture and transfer activities tend to entail close partnerships with other functions, such as human resources and

[1] Stan Garfield. "Building a Knowledge-Sharing Culture." *SlideShare*, http://www.slideshare.net/SGarfield/building-a-knowledgesharing-culture .

[2] APQC. (2020, July 23). What is Microlearning? APQC. https://www.apqc.org/resource-library/resourcelisting/what-microlearning .

information technology. By collaborating with these groups, processes can be more efficiently developed, and the incoming and outgoing workforce can navigate these processes more efficiently. For example, many external organizations have implemented mentoring and connection systems to help new employees learn from experienced personnel in the process of joining an organization. Adding this one step in the overall onboarding process makes it more seamless for the new team member, who might otherwise be overwhelmed with the administrative requirements of onboarding and not pursue a mentoring or similar connection.

The promise of new and emerging technologies to support knowledge capture and transfer has engaged knowledge management practitioners since the discipline was established over four decades ago. Many digital technologies are already in place at NASA and other organizations to support knowledge capture and transfer. Technology cannot solve knowledge capture and transfer problems on its own. However, knowledge management practitioners can work with information technology experts to construct and deliver systems that support personnel in making better use of knowledge. Many leading external organizations apply a combination of digital tools and knowledge management processes to deliver knowledge capture and transfer services to their teams.

NASA will continue to engage external organizations and associations to learn, share insights, and collaborate to improve knowledge capture and transfer outcomes.

Findings – Survey

The Culture Team included eleven questions in the Knowledge Capture and Transfer survey as referenced above. These questions focused on the awareness and importance of knowledge capture and transfer practices for respondents. Collected findings helped the Culture Team to prioritize where to focus its recommendations.

Business Case

The survey data validated that capturing the knowledge of offboarding employees is a significant priority. **It was clear that most employees supported the business case for knowledge capture and transfer**. The Culture Team used this data to shift their focus to the implementation of knowledge capture and transfer activities versus that of awareness.

Processes and Methods

Survey participants were asked how satisfied they were with knowledge transfer and capture methods within their respective organizations. In analyzing survey responses, it became clear that if respondents know and are able to use knowledge capture and transfer tools and methods, satisfaction levels increase. That is, if respondents felt comfortable using available tools and methods, they were more likely to indicate satisfaction with those tools and methods. This suggested to the team that the results to this question pair (Figure 8) indicate a need for a **strategy promoting and publicizing a relatively simple, standardized knowledge capture process** that supports offboarding, so that **the technical workforce can become comfortable in using repeatable methods**.

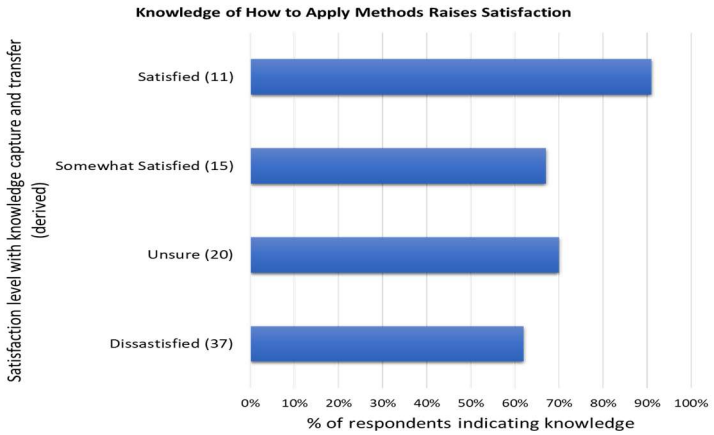


Figure 8: Survey Results of Knowledge of How to Apply Methods to Raise Satisfaction

In developing and analyzing the other culture-related survey questions, the team integrated industry research and viewed the results through the lens of the ADKAR Change Management Model. The model presents five sequential steps to foster change.

Figure 9: ADKAR Model[3]

The Culture Team matched key survey questions to the ADKAR model, then ranked them based on their precedence for each step. Ability and knowledge came in with the highest ratings. Respondents most often cited obstacles related to resourcing—time, money, and expertise—as impediments to effective knowledge capture and transfer. Based on this assessment, **the Culture Team noted the value of establishing common tools and processes that are adaptable to different knowledge capture and transfer circumstances**. By integrating these methods within the course of regular work (e.g., working out loud mentoring for knowledge transfer, job books that highlight meetings or decision-making approaches rather than duties, etc.), resources, capabilities, and desire might be more effectively balanced.

[3] Prosci. "The Prosci ADKAR® Model." *Prosci*, http://www.prosci.com/methodology/adkar

Way Forward

The Culture Team highlighted the Ability dimension in ADKAR's change management model as an opportunity for improvement. They observed:

> **"The opportunity for improvement in this area is to ensure that there are clearly stated and enforced expectations for knowledge capture and transfer roles and responsibilities, deliverables, and resourcing built into plans for missions and projects and in functional areas."**

The Culture Team strongly recommended that effective knowledge capture and transfer be recognized and supported as an integral part of mission success and a required component of successful individual and team performance. This represents a significant change in the current approach for many knowledge services across NASA. The Working Group supported the Culture Team's recommendation.

There will always be impediments to effective knowledge capture and transfer in any organization. Some of these impediments may stem from messaging. The Culture Team developed recommendations for reframing assumptions or concerns to a mindset that supports a knowledge sharing culture (see Figure 10). This messaging can help support changes in perception, in attitudes, and, ultimately, in implementation throughout NASA organizations.

Belief, Value, or Custom	Reframing
The mission comes first. Knowledge capture and transfer is a **lower priority** than technical work needed to complete the mission (unless something goes wrong – then it is high priority).	Mission success depends on building upon what we already know, making knowledge capture and transfer not a competitor of the technical work, but an integral part of it, learning from both success and failure.
There is not allocated **time and money** for knowledge capture and transfer.	Since knowledge capture and transfer are integral to mission success, time and money for knowledge capture and transfer should be built into the project plan.
We do not have a **visible plan** for knowledge capture and transfer. No one has clear **responsibility** for knowledge capture and transfer. There are not **effective methods** for knowledge capture and transfer.	We need to increase visibility and understanding of – plus capabilities and incentives to execute – methods, plans, and responsibilities for effective knowledge capture and transfer.
Real time **technical mentoring** is the best method of knowledge transfer.	Technical mentoring is *one* effective method of knowledge transfer. There are others that can be effective, including asynchronous methods.
There is no **overlap** between the offboarding employee and their replacement to enable knowledge transfer. Knowledge capture and transfer happens at **endings** (careers, projects). There is not enough **transition time** before someone offboards to enable knowledge capture and transfer.	Knowledge capture and transfer is continuous and should be an expectation of the job, and a requirement for career success. At endings, we should capture recent knowledge gaps.
We can rely on **retirees** to consult with and provide institutional knowledge.	Retirees are a valuable yet unguaranteed resource. We need to determine how best to engage them as a compliment to ongoing knowledge sharing efforts'

Figure 10: Areas to Reframe Beliefs, Values, and Customs to Enhance Knowledge-Sharing Culture

Knowledge Processes

Goals

The initial goals of the Knowledge Processes Team were to:

1) Formalize knowledge capture processes.
2) Facilitate smooth transfer and retention of institutional knowledge.

The team investigated existing processes and leading practices uncovered by the survey to develop templates and checklists that could be used by project managers and supervisors experiencing or anticipating knowledge loss, whether it be due to retirement, project transfers, or attrition.

Knowledge capture processes formalize the intent of knowledge collection. Knowledge transfer strategies ensure the knowledge that is captured is actively shared and utilized. Process documentation will provide a repeatable framework for lessons learned and knowledge sharing.

Findings – Current Agency Practices

The current processes and practices described in this section illuminated leading knowledge transfer practices that were taking place in parallel with the Working Group and were highlighted as best practices that other Centers could adopt. Each profile below outlines the organizational practice and provides selected insights into how the practice was or is conducted.

The Langley LEGACY Fellowship

The Langley Research Center (LaRC) KM team included Bart Singer, the Lessons Learned Committee Chair, and LaRC interns Samiksha Gaherwar, Erica Morrison, and Mariah Johnson. They developed an approach to build interest in attracting senior practitioners to contribute their stories and lessons while also building interest and participation in hearing those stories by earlier career practitioners. They called it “Langley LEGACY Fellowship.”

The LEGACY Fellowship is an initiative to recognize esteemed NASA LaRC retirees/pre-retirees for their valuable contributions towards NASA missions and infuse into the current workforce at least some of what made the selected Fellow so valuable.

The fellowship was developed based on focus groups and interviews with civil servants and contractor engineers with twenty or more years of experience and familiarity with knowledge capture efforts. The focus groups concluded that simply recording interviews with departing personnel was insufficient for substantial knowledge transfer. Significant retiree knowledge

transfer is needed to supplement recorded interviews with a more engaging program, preferably with some level of interactivity.

The first Langley LEGACY Fellowship Forum was held for two hours on July 29. It spotlighted John Rogers (former NASA engineer and project manager). The Forum allowed for on-site and virtual participation (reportedly 176 virtual participants). Participants viewed a video interview about John's career and approach to challenges, as well as a compilation of video clips with individuals talking about what they have learned working with John. The forum included a project manager panel discussion, including John and other LaRC project managers, focusing on lessons for aspiring and current PMs.

The first LEGACY Fellowship forum went phenomenally well, with participation far exceeding the 50 or so individuals that were originally thought to be sufficient to declare success. The current Langley team is working on institutionalizing the program, establishing a process for future nomination and selection, completing formal marketing and graphics work, and exploring forum options for the camera-shy.

In reply to a request for feedback on the LEGACY Fellowship event, Langley Research Center Director Clayton Turner responded, "... I enjoyed the opportunity to participate, and I am excited for the program overall as it will make us a better Langley…."

Video Capture and Curation for Retirees

Video capture and curation presents an opportunity for technical workforce personnel nearing retirement to be interviewed and provide important insights for colleagues. Video capture practices can range from one or a few long-form interviews to short snapshots of a specific practice or specific leadership advice. Using video capture reduces the amount of editing and review necessary for the interviewee, and it helps to ensure that the information collected is exactly what was said. One challenge is setting aside sufficient time for the video interview to occur. In addition, video capture is highly dependent on good interview practices and methods. If the right question is not asked, some interviewees will not be able to share their most critical knowledge.

Several knowledge community members from different Centers and Mission Directorates have engaged in video capture for retiring employees. To support broader awareness, the APPEL KS Knowledge Perspectives series designed and hosted two sessions on Capturing Legacy in 2021[4]. The first session provided tips and tricks for capturing and storing video, and it

[4] https://appel.nasa.gov/knowledge-perspectives/

featured advice from a former science media producer at Goddard Space Flight Center on how to prepare, structure, and engage throughout an interview, as well as advice from the NASA Engineering Network's Digital Knowledge specialist on best practices to organize and store videos for later use. The second session focused on how to draw out a compelling story during a video interview, and featured expert interviewers from the APPEL KS team as well as the Johnson Space Center's Knowledge Management Office Case Study Chief. The NASA Chief Knowledge Officer will continue to host sessions like these to raise awareness on specific tools and methods for knowledge capture and transfer and to promote best practice examples, such as a video case study activity led by Marshall Space Flight Center in fall 2021, to the knowledge community and partners.

NASA Safety Center Knowledge Capture and Sharing for Retiring Safety & Mission Assurance Employees Pilot Program

The National Safety Center (NSC) embarked on a project led by Mike Lipka and executed by a team that included intern Cesar Aaron Gonzalez to develop a systematic approach to capture and share knowledge of retiring Safety and Mission Assurance (SMA) employees. The project focused on facing the challenge of retaining valuable knowledge as increasing numbers of experienced, retirement-eligible SMA employees depart with their knowledge and wisdom.

The NSC team conducted assessments and interviews to better understand the current state of knowledge capture and sharing services at each Center and SMA office. Participants of the assessments and interviews included SMA directors and staff, Chief Knowledge Officers throughout NASA, NSC's Knowledge Analytics team members, and other practitioners at the agency. In the end, the finding was that there was no systematic approach to capture and share knowledge of retiring SMA employees. The project team compiled a list of recommendations and next steps to realize the full potential of a knowledge capture and sharing program during the offboarding and onboarding process. Recommendations during offboarding included those in Figure 11.

Figure 11: SMA Offboarding Recommendations

A proactive approach to embed lessons learned in the onboarding experience would be to train new employees about lessons that support the SMA organization. NSC has signed on as the new owner of the SMA lessons learned process and will collect lessons to make them widely available to all employees in SMA. Further, they will host a knowledge-sharing event focusing on lessons gathered every six months.

The project team mapped a high-level process, from knowledge discovery and capture to infusion to existing learning offerings for this program, to support these efforts. This process, depicted in Figure 12, was developed to help Centers lead more effective knowledge capture and sharing activities with their experienced SMA employees.

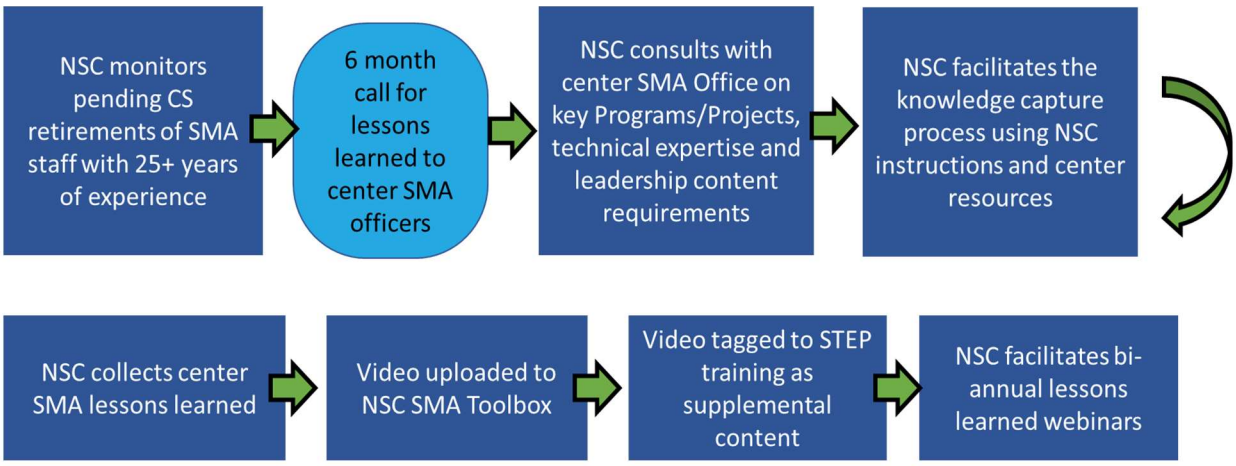


Figure 12: SMA Lessons Learned Capture and Reuse Process

Science Mission Directorate Process Documentation

As depicted in Figure 13, the Science Mission Directorate developed a process of steps that project leads and managers can take for knowledge capture when a departure is imminent (within a month). During a series of meetings, tasks and related responsibilities, procedures and resources, lessons learned, contacts and tips are documented. This information is then provided to the successor. Depending on the amount of lead-time before departure, successive meetings can lead to deeper questions and answers. These transitional meetings can be interviews and/or videos.

Process Option #1 – Quick Transitions

1) Identify the individual who is departing
2) Identify the individual(s) who will take on the departing individual's roles and responsibilities
3) Conduct an initial knowledge capture answering:
   a) What are your primary tasks? For each task:
      i. What are the basic responsibilities for this task?
      ii. What policies, procedures, and resources are available?
      iii. Where are all your documents relating to this task? *(Ensure the successor has access)*
      iv. Any best practices, lessons learned, tips, or tricks to share?
   b) What regular meetings do you attend?
   c) Who are your points of contact outside of your organization that you work with regularly?
   d) What additional tips and resources would you like to share?
4) Send the answers to the initial knowledge capture to the successor(s) and schedule follow-up transition meeting
5) Conduct follow-up knowledge captures as necessary between the departing individual and the successor(s) *(These meetings are intended to encourage deeper question and answers)*

Figure 13: Process for Knowledge Capture Steps for Imminent Departure (Within a Month)

SMD also developed a second transition process that can be used when there is a longer lead-time before an individual is leaving a project or NASA. The approach includes added actions designed to deepen learning, such as shadowing and practicing a task or process with the departing employee observing and providing feedback (Figure 14). The process is

especially valuable when paired with videos of the departing individual doing the task or process.

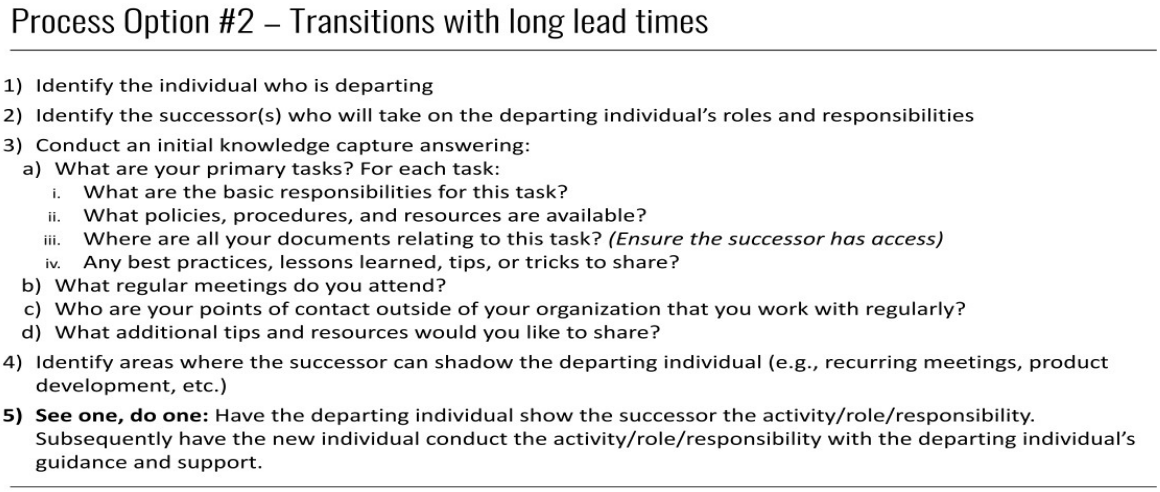


Figure 14: Process for Knowledge Capture Steps for Longer Lead-Time Before Departure

Coupled with traditional onboarding and offboarding checklists, SMD applies these processes to ease transitions and support more effective knowledge capture and transfer for their workforce at NASA Headquarters.

Way Forward

The leading practices described in this section and the complementary information collected in the survey highlight the importance of providing repeatable, easy-to-use processes and practices to the NASA technical workforce to support better knowledge transfer among NASA personnel. The Knowledge Process team recommended that next steps include:

1) Developing templates and checklists based on these best practices.
2) Continually engaging with the knowledge community, NASA employees, and interns to explore and test new and innovative methods of knowledge capture and transfer.

Onboarding and Connecting

Goals

The Onboarding and Connecting Team focused on understanding how to connect what knowledge is collected via offboarding (departure) with what knowledge is needed for onboarding (entry). If knowledge is effectively captured in during offboarding, it should be processed and made available for others. Unfortunately, the introduction of that knowledge is not as simple as a quick download of everything a prior incumbent knew. In addition, formal onboarding processes are typically managed by administrative offices in alignment with laws and regulations in the hiring/transfer process. Knowledge related to a new role, however, is maintained within people, teams, and organizations. By highlighting the onboarding period as a critical time for new personnel, this team sought opportunities to make the best use of the transition period and find other opportunities for new personnel to connect with organizational knowledge. The team's initial goals were to:

1) Scope out a Peer-to-Peer activity designed to connect early career professionals (3 years or fewer) with senior leaders to discuss their onboarding and early career experiences (This activity was designed and piloted at Glenn Research Center (GRC) in 2016).
2) Understand existing Human Resources onboarding practices that could complement or reinforce knowledge transfer processes.
3) Determine what role(s) Human Resources could play in knowledge management related to onboarding approaches.
4) List other activities that would enhance the knowledge management aptitude of new employees.

Building knowledge connections between people who are departing teams and people who are joining teams requires attention to knowledge processes and effective partnerships.

Findings – Research

Many current opportunities for knowledge transfer occur in the administration of human resources activities, rather than in knowledge management or knowledge services activities. For new employees, human resources personnel are typically the primary interface as they join the agency, and human resources and professional development activities are often a default foundation for introductory knowledge transfer. This team's members met with and interviewed human resources leads across the agency to learn what kinds of activities were taking place to orient and onboard new employees. Of particular interest was how the onboarding activities connect new people to different sources of organizational and agency knowledge. The team observed an effort to unify onboarding processes at the agency level, but that effort is still in progress. Full-time teleworking appears to have helped unify practices.

One practice that has been used at several Centers, although not consistently across the agency, is the passport for new hires — a booklet with key agency and Center information and open-ended questions for a new employee to address at different points during their first year.

At one Center, it was reported that accomplished activities were to be signed off when completed, and the human resources office was informed when an individual had completed their passport. At that Center, the new employee passport program was discontinued when its champion moved on. An updated revision of the New Employee Passport was posted to SharePoint in October 2021, shortly prior to publication of this report. The new version of the Passport is accessible internally from the NASA Shared Services Center public document repository.

Way Forward

The Onboarding and Connecting Team suggested working towards:

1) Integrating specific opportunities for knowledge transfer into onboarding processes.
2) Highlighting the importance of sponsorship programs and formal mentoring during the onboarding process.
3) Supporting a New Employee Passport for new hires based on the knowledge capture and transfer processes outlined above.

Key Findings and Recommendations

The final reports for each team were developed and shared in a collaboration space for asynchronous review by other Working Group members. Each team also briefed the Working Group leadership on their findings. After a thorough review by all members, the group reconvened to discuss the findings. From the online brainstorming of this group, reports were consolidated and synergized into key findings and top overall recommendations.

Key Findings

The table below lists the key findings contributed by team members during the sessions:

	Key Findings
Current State	▪ Concerns cited with current practices include **a lack of documentation** and limitations on money and time.
	▪ Despite strongly believing in the need for knowledge capture and transfer, **only 14% of those surveyed were satisfied** with how the offboarding process is currently done.
	▪ Respondents with 30-34 years of experience were the most dissatisfied with the current process of knowledge capture and transfer.
	▪ NASA has many great methods and tools, but **people do not know how to approach the larger planning process of using those methods** and tools to capture and transfer knowledge in a systematic, targeted way.
	▪ As many as a third of respondents recognized knowledge capture and transfer **as shared accountability for all members of the organization** and the offboarding employee's supervisor or manager.
Culture	▪ In interview conversations, the **experience varies dramatically —** there might be some value in providing opportunities to connect across Centers if Center onboarding capabilities are limited.
	▪ **83 of 84 respondents agreed or strongly agreed with the value of knowledge across all dimensions surveyed**.
	▪ Cultural trends by Center or other demographics were not evident.
	▪ The overwhelming majority of concerns cited by respondents centered on their ability to conduct effective knowledge capture or transfer processes, making improvement in this area the top priority. For all respondents**, lack of resources** was identified as the number one obstacle, except for the dissatisfied group, which prioritized lack of ownership.
Knowledge Processes	▪ Specifying a process for knowledge capture and transfer or improving an existing process was the top recommendation for survey participants.
	▪ The team's findings and survey reports indicated the importance of developing **standardized templates or guidance** and providing employees with examples of knowledge transfer and capture activities during different stages of their career.
	▪ Early retirement knowledge capture could also be enhanced by developing processes, templates, and guidance to share with supervisors, project managers, and retirees.

Onboarding and Connecting	▪ Processes are retroactive after identifying the individual who is departing. It is important to have a **proactive, ongoing process** where knowledge capture begins much earlier regardless of an employee's employment status.
	▪ Effective knowledge capture event agenda includes the knowledge capture interview itself and additional ways of **engaging a broad audience.**
	▪ In addition to direct engagement with a departing employee, it is helpful for those conducting knowledge capture to talk with others who have worked with the employee to find out **what they are most worried about losing when their colleague leaves.** These unique contributions can be helpful in pulling out the tacit parts of how they operate.
	▪ Onboarding Passports can provide relevant recommendations based on the time period in the employee's career, because**many early-career respondents were not aware** of the knowledge capture process.
	▪ Two trends emerge from industry thought leaders and external resources: 1) **standardization** and 2) **micro-learning** (Ex. Record a 5 to 10-minute video clip of an SME solving a problem versus an hour-long video interview).

Recommendations

Recommendation 1
Standardize processes, templates, and guidance to support knowledge capture for personnel and project transitions.

Recommendation 1 mitigates the current gap in the use of standard processes and templates for knowledge capture for departures, whether due to retirements, attrition, project close-outs or other needs. The Culture Team noted that one enabler to more successful organizational knowledge management is a clear, specific process for people to follow. While there are excellent practices in some places, other areas prove difficult for teams who need to retain the critical knowledge of an individual who is departing or for organizations that need to preserve project knowledge when groups are transitioning. Elements to support this recommendation include:

- Develop a standardized template or guidance that can be adapted for different circumstances and contexts.
- Provide employees with examples of knowledge transfer and capture activities during different stages of their careers.
- Provide guidance for the use of interactive forums to support retiree knowledge transfer.
- Standardize and make available across the agency best practices and lessons learned that were uncovered through this study.

Recommendation 2
Develop templates and guidance to support knowledge transfer and connection processes.

Recommendation 2 mitigates the considerable variability processes to transfer knowledge to personnel who are new to the agency's technical workforce or new to existing teams. This variability creates substantial additional effort across the agency. There are excellent practices in some places, yet people may struggle to navigate the knowledge transfer process in other areas. The Working Group's research shows that experiences vary a great deal. Elements to support this recommendation include:

- Standardize and make available across the agency best practices and lessons learned that were uncovered through this process to include:
    - Onboarding Passport.
    - LEGACY Fellowship.
    - Buddy Assignments.
    - Mentoring and Shadowing.
    - Books documenting responsibilities, roles, policies and procedures, documents, websites, key points of contact, milestones, and other duties for replacement personnel.
    - A standardized template or guidance that can be adapted for different circumstances and contexts.

Recommendation 3
Promote and support knowledge capture and transfer practices and tools so that they can be applied effectively throughout the agency.

Recommendation 3 mitigates challenges in applying good knowledge capture and transfer processes based on inconsistent messaging, practices, and tools. The Culture Team recommended that methods for knowledge capture and transfer be developed, promoted, and publicized across projects and programs to close the gap. They also recommended researching and identifying the best tools, systems, and other resources available at the agency. In addition, if culture change principles are incorporated into these communications, NASA will more effectively reframe the definition of mission success. Elements to support this recommendation include:

- Promote methods for knowledge capture and transfer and publicize them.
- Partner with the Office of the Chief Information Officer to identify high quality discovery, best-known tools, connected systems, and open access policy.
- Apply reframing language to knowledge capture and transfer practices.

Conclusions and Next Steps

Through this process, the Working Group and partners learned that there was a cultural awareness and desire to engage in knowledge capture and transfer themes but limited resources, capabilities, and time to implement knowledge capture and transfer practices throughout NASA. Recognizing these limitations is an important shift in our understanding of knowledge services at NASA. While many participants in the Working Group previously focused on highlighting and communicating the value of NASA's critical knowledge, the report's recommendations highlight the need to support knowledge capture and transfer activities more actively for teams and individuals.

The group's next steps are to communicate this strategy, shift the knowledge services approach to adopting and sharing resources with NASA communities, and develop an implementation plan to advance the specific recommendations of this group. As a result of this work, NASA and its workforce will be better equipped to capture and transfer knowledge through transitions and ensure mission success.

Appendix A: Knowledge Capture and Transfer Survey Results

Directions Given to Participants

The NASA Knowledge Capture and Transfer Working Group is conducting a survey about practices for closing the knowledge gap created by retirements, project transfers and attrition. This survey is being distributed to the technical and knowledge management workforce to gain an understanding of the barriers and contributors to an organizational culture that supports knowledge capture and transfer, and to learn what is happening to facilitate this in projects and programs.

The survey should take only 10 minutes. Responses are required for all starred questions. The survey will close June 24 at 6 pm Pacific Time.

Please note: For purposes of this survey, here are definitions of two terms:

"Organization" is defined as the team or project with which you primarily work, including leadership, contractors or support personnel, and other matrixed team members.

"Departure/s" is defined as the activity associated with members of your organization leaving positions due to retirement, project transfer or attrition.

Thank you for your support!

Survey Questions

Question 1: Is an anticipated increase in departures and the related knowledge loss a concern to your organization? (0 = No Concern 3 = Medium Concern 5 = Extreme Concern)

Average Response: 3.2

Question 2: How urgent is the issue of pending departures to your organization? (0 = Not Urgent, 3 = Medium Urgency 5 = Extremely Urgent)

Average Response: 2.6

Question 3: Do you have one or more specific concerns when a member of your organization departs? Please be specific in the comment box.

The table below indicates the themes that emerged and example responses:

Themes	Example Responses
Time Constraints	● Typically, there's a very short window to transition knowledge and information (2 weeks or less) if the **departure is sudden**.
Loss of Knowledge (Technical, Social, Contextual)	● Loss of detailed, **contextual knowledge** of processes and projects. ● **Technical subject matter experts are of the most concern**. ● Loss of **technical history** of heritage flight hardware still in use. ● What **informal personal connection web** does this person have related to key topics?

	• …We may have processes and procedures to guide us through our work, but **the specific experience is hard to capture in a policy memo.** • The obvious...the loss of experience increases the risk of sub-optimal designs and decision-making, leading to **potential mishaps**, **inefficiency** and worse.
Knowledge Capture, Accessibility, and Transfer Management	• The knowledge is not being documented, or if it is, it is not in an orderly, formal way, and people do not know where to find it. • The lack of effective documentation … means that new organization members experience more **startup inefficiency** than necessary. • Transition plans in a **virtual environment**.
Staffing/Funding	• **Staffing/funding levels** generally do not support proactive measures to recruit, hire, and train replacements with adequate time to transfer knowledge from departing staff members...
Replacement and Succession Training	• Difficult to replace personnel with same or better level expertise... • Transition periods that allow comprehensive knowledge transfer tend to be very short or non-existent...
Workload	• **Workload added** to other employees.
No concern, Not Sure, or Hard to Predict	• We are typically **cross-trained**, and we usually get **sufficient notice** of departures that there is time to transfer knowledge and fill gaps. • Not sure. I guess the concern is **we don't know what we don't know**…

Question 4: What are some potential impacts of departures to your organization? Select those that apply. Feel free to add additional comments in the "Other" box.

ANSWER CHOICES	RESPONSES	
Loss in productivity	51.19%	43
Lack of consistency in practice	65.48%	55
Reduced ability to adapt to change	15.48%	13
Loss of historical and contextual knowledge	95.24%	80
Total Respondents: 84		

The table below indicates the themes that emerged and example responses:

Themes	Example Responses
Loss of Productivity and Efficiency	• As people leave, more work is put on the remaining people, who typically have less experience. The **loss in productivity** is due to less experience and knowledge transfer. It is taking longer to do the same thing. • As for productivity, my historical observation is that it takes a new person **six months to 1 year** to learn the ropes and achieve maximum productivity in a new position.

Loss of Contextual Knowledge	• The loss of historical and contextual knowledge is particularly concerning in the case of unique NASA facilities where a **deep understanding of their theory of operation, design assumptions, and operating characteristics** may not be well documented. • **Historical and contextual knowledge** is so critical in decisions, actions and delivery of products, services, and other mechanisms that support the overall mission success. • **Loss of the rationale** behind decisions.
Safety, Failure, or Mistakes	• **Repeating past mistakes—**Spending time rehashing previously resolved issues.
Loss of Experience and/or Capability	• **We cannot put in a paper-based process to transfer knowledge.** What we are losing is decades of experience when senior engineers retire. That experience can NOT be written down and referred to as a "cookbook" for doing our jobs.
Opportunities for Change	• People leaving also creates an **opportunity for change** and allows for **new ideas**. There are always those unique and critical people that really leave a gap, but in general, it seems like movement is a good thing.

Question 5: Has your organization identified critical relevant knowledge that may be lost because of departures? If so, has a plan been developed to retain this knowledge? Please check all that apply.

ANSWER CHOICES	RESPONSES	
Yes, knowledge has been identified, but no plan exists to capture it.	15.48%	13
Yes, knowledge has been identified, and there is a plan to capture it.	21.43%	18
No, this is not a priority.	13.10%	11
No, no one owns this task.	27.38%	23
No, there are insufficient resources to do this.	29.76%	25
Other (please specify)	33.33%	28
Total Respondents: 84		

The table below indicates themes that emerged from “other” responses, as well as some example responses:

Themes	Example Responses
Some Knowledge Identified Without Fully Implemented Plans	• Some knowledge has been identified, and there are some plans, but it is **inconsistent** across different functional areas. • The need to identify critical relevant knowledge is acknowledged. Our first step is to **identify key roles and the associated relevant knowledge**. No real action has been taken yet.
Knowledge Identified Capture Efforts	• A **code repository** is being established for improved model sharing. • Yes, some information has been identified, and there is a plan to capture it.

Insufficient Resources or Lack of Emphasis	● A general **plan of mentorship** has been put into place, but there are **insufficient resources/time to document** the detailed knowledge/lessons learned as well as we would like. ● If this is a priority, **no emphasis has been communicated**.
Task Ownership	● No, nobody owns the task, and the problem is **not being proactively addressed.** ● It is an **individual/SME area dependent** on identifying replacements and/or capturing historical knowledge.
Not Sure	● No, it is **difficult to specify** the critical knowledge to be captured and the **mechanism to capture** it. ● Not sure - this isn't communicated well.

Question 6: Please identify your level of agreement with the following statements.

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE	TOTAL	WEIGHTED AVERAGE
There is long-term value in capturing and reusing knowledge.	2.38% 2	4.76% 4	26.19% 22	66.67% 56	84	3.57
Knowledge capture and reuse should be a routine part of work.	1.19% 1	0.00% 0	33.33% 28	65.48% 55	84	3.63
Knowledge transfer should be prioritized across NASA's multi-generational workforce.	3.57% 3	1.19% 1	29.76% 25	65.48% 55	84	3.57

Question 7: In your organization, who is responsible for knowledge capture and transfer for departures?

ANSWER CHOICES	RESPONSES	
Departing person's supervisor	86.90%	73
Departing person's project manager	27.38%	23
Center or Mission Directorate Chief Knowledge Officer	16.67%	14
Total Respondents: 84		

The table below indicates the themes that emerged and example responses:

Themes	Example Responses
Departing Person	● The **departing employee** to document and pass on pertinent data to another team member.

Everyone	● **Everyone,** through code comments and documentation that would allow for future fixes/understanding. ● **All employees** are responsible for transferring knowledge.
Supervisor	● I believe it is usually the **departing person's supervisor**. In my opinion, though, it is **everyone's** responsibility to transfer and capture knowledge.
No One	● None. You don't just soak up the knowledge before someone walks out the door. When departure is planned, knowledge capture is typically done by **mentoring/pairing** the departee with their future replacement.
Depends or Varies	● It depends on the knowledge being captured. ● **No consistent one person**.

Question 8: Which knowledge capture and transfer methods are implemented within your organization?

ANSWER CHOICES	RESPONSES	
Document collection	72.62%	61
Lessons learned	64.29%	54
After action reviews	28.57%	24
Case studies	22.62%	19
White papers	30.95%	26
Knowledge maps	11.90%	10
Wikis or knowledge portals	32.14%	27
Courses by NASA experts	40.48%	34
Informal information sharing spaces	53.57%	45
Communities of interest	17.86%	15
Communities of practice	45.24%	38
Total Respondents: 84		

The table below indicates the themes that emerged and example responses:

Theme	Example Responses
Other Methods	● **Brown bag sessions** (lunch n' learn). ● Center-sponsored **colloquia**. ● One-on-one **mentoring/partnering**. Pairing junior engineers with senior engineers (e.g., making them a deputy to a more knowledgeable engineer to bridge the gap when promotions or departures happen).
None	● None of these are formally required, coordinated, or funded. It's all **ad hoc**.

Question 9: How effective is your organization at capturing and transferring knowledge throughout a person's career? (0 = Not Effective, 3 = Somewhat Effective, 5 = Extremely Effective)

Average Response: 2.0

Questions 10: What are your organization's offboarding processes (both formal and informal) that focus on knowledge or technical skill capture and transfer for departures? (Please identify key processes, not specific details).

The table below indicates the themes that emerged and example responses:

Themes	Example Responses
Documentation, Records Collection and Wikis	● Document current tasks, points of contact, and next steps. Document annual tasks. Document roles. ● In my organization, we try to make sure knowledge is captured in our **wikis** and other documentation and that at least one other person on the team is **cross-trained** to take over that person's activities. For onboarding, we have a **checklist in a wiki** of what the new person will need to get up to speed on. ● Some practices that I'm aware of: holding **regular knowledge transfer seminars** during phased retirement, collecting pertinent data and transferring ownership to another team member…
Electronic Files and Records Transfer	● Exit interviews, **transfer of technology** to employee's supervisor for 60 days after departure so they have access to the employee's files. ● No formal process. Informal include **capturing e-mails and archiving documents** and also **handing off tasks** to colleagues. ● **Records retention** requirements are the only formal. ● **Transfer of files**, use of shared folders, out brief/transfer of major projects/responsibilities.
Replacement Training and Handovers	● If we know about it, they can usually **walk us through where everything is** ahead of time, and it's smoother. ● Person to person through **overlap of responsibilities** prior to a planned departure like retirement. ● … **Mentoring**. **Training** with combining experienced and junior contributors. ● Some individuals use a **shadow** (have the new hire join them in daily activities); some do **phased retirement** where mentoring is more involved.
Meetings and Briefings	● **Discussions** between departing employee and the replacement or interim individual. **Presentation of knowledge** by departing employee in a series of briefings. ● A series of **exit meetings** between the departing person and the office (or new leader of the office).
Interviews	● **Interviews, Oral Histories**. ● **Exit interview** with agreed upon “to do” list prior to departure.
Offboarding	● To the best of my knowledge, there is an offboarding process, but it **only addresses completing or delegating current tasks without an emphasis on knowledge capture**. ● **Person leaving explains to boss** or person coming on what's going on.
Other	● Attempts to **assign back up** to individuals so that if/when they leave, there will be some knowledge to work from. ● Created a **Knowledge Transfer Guide** that identifies best practices like: transition planning; capturing knowledge along the way (not just when offboarding is imminent) through KM forums, knowledge assets, etc.; leveraging **systemic KM assets** (like our quality management system,

	knowledge guidebooks, our KM plan, our **lessons learned procedure/database**); leveraging **out-processing procedures**, **mentor/protégé relationships**, formal training; administering **exit interviews/surveys** to capture knowledge and deliver feedback.
Not Standard	● Ad-hoc. ● Nothing standard.
None or Unknown	● Unknown. ● Nothing official. The other part of this answer is—**who sees it**, **who has access to it**, and who even knows that something will be or has been documented or collected? ● No official process to my knowledge. Responsibility resides with the best interest of the branch head and/or project.

Question 11: Are you satisfied with your organization's current offboarding processes for knowledge capture and transfer? Why or why not? What would you do differently if anything?

The table below indicates the themes that emerged and example responses:

Themes	Example Responses
Time Constraints	● No. In general, **insufficient time is afforded for knowledge transfer** during the offboarding process. ● I would like **more time built into our daily activities** to capture knowledge and to revise it more frequently. It's a valuable exercise that we don't all have time for.
Budget and Staffing	● No. I would like to implement a formal process, but I **require resources** in the form of staff to conduct this type of program. ● I would **dedicate someone to it** and make it that person's job and not the job of the manager or PM.
Defined Process or Policy	● It's okay, would prefer some sort of **template** to help. ● No. We need a **formal, enterprise-wide process**. ● No, because I believe there's a recognized gap, but no particular effort to close it. To make a difference, **management will have to adopt a policy** and **make it a priority**.
Workload	● Usually, we are **too oversubscribed** to make this a priority even though not doing so hurts us ● It's never satisfactory. With our **workloads**, it is difficult to imagine the bandwidth to do much better.
Formal Offboarding and Transitions	● No, I'd like **overlap** between departing and incoming person, but limitations on the ability to do that. ● If I did something different, it would be to **allow 3 to 6 months of full-time overlap** to allow for significant OJT. The real-time, longer duration transfer of knowledge captures a larger percentage of knowledge than just passing documents or video.
Document Management and Software Solutions	● **Knowledge capture should be integrated with knowledge generation, not an afterthought**. **Deploying tools and services that encourage collaboration, information access, and indicators of quality** can help integrate these practices into everyday tasks… ● **Dedicate an organization-specific form** for passing of knowledge (i.e., how are the important players, what is the status of the program/project, who is your team, what are the current issues, etc.).

	● More can be done to **catalog the information captured** (i.e., using data management tools to extract info from videos), then disseminate the information—informal work transitions.
Ongoing Effort	● Retirements are easier to handle because typically, there is planning time and/or the retiree can still be contacted. **People switching jobs are exactly the opposite...** Knowledge capture needs to be a group activity and periodic. ● No, there should be knowledge capture **throughout the career**, not after someone has given notice.
Leadership and Prioritization	● **Not much emphasis** is placed on it! ● **Lack of expectation** for knowledge transfer until it's too late.

Question 12: Beyond offboarding, what else does your organization do, if anything, to ensure that it's not losing critical knowledge when someone departs?

The table below indicates the themes that emerged and example responses:

Themes	**Example Responses**
Mentoring and Shadowing	● Some **mentoring** is fostered in the organization to assist in the career growth of younger staff members. ● **Mentoring**— formal and informal.
Documentation and File Sharing	● Document weekly status. **Document actions**. ● Through the use of formal and informal knowledge sharing activities, use of **portals, WIKIS**. ● Capturing lessons learned, debrief sessions, **storing common documents/knowledge sharing through SharePoint/Teams website.** ● **White papers** and **making time to capture lessons learned** helps. Lessons learned are difficult to capture for long-term "teaching," but continued efforts to do so are valuable.
Training and Cross-training	● **Train the incoming individual** as well as leave **user manuals** for the next person. ● Providing **cross-training alternates for key roles**.
Lessons Learned	● Maintains a **lessons learned** and a catalog of methods data bases. **Conducts technical presentations**. These aren't dependent on departures but rather are ongoing processes. ● **Lessons Learned** are captured and required to be reviewed and vetted for new designs.
Presentations and Sharing Events	● **Lunch and learn.** ● **Interviews** for case studies and **oral histories** lessons learned collection. ● **Ongoing After-Action Reviews**, Forums. ● **Communities of practices** but varies levels of engagement, effort, and execution.
Continual Capture	● Try to **collect critical knowledge in-process** rather than at the end.
Contracts and Phased Retirements	● **Consultancy contracts.** ● Some use of **phased retirement**, where practical.
Nothing or Unknown	● Unknown.

Question 13: Do you have any specific resources, templates, or standard operating procedures for knowledge capture and transfer that we can share with the NASA Knowledge Community? If so, please identify the type and share your name and e-mail address here. Check all that apply.[5]

Question 14: If you can, please recommend one or two other people at NASA who could share helpful insights about innovative knowledge capture and transfer processes within programs and projects so we can follow up to learn more. Please type name/s and e-mail address/es in the comment box.[6]

Question 15: How many years of work experience do you have?

ANSWER CHOICES	RESPONSES	
Under 5	7.14%	6
5 - 9	11.90%	10
10 - 14	10.71%	9
15 - 19	11.90%	10
20 - 24	13.10%	11
25 - 29	13.10%	11
30 - 34	17.86%	15
35 - 39	11.90%	10
40+	2.38%	2
TOTAL		84

Question 16: What is your technical workforce category? (Choose one)

[5] Participants' responses were captured and distributed internally.
[6] Participants' responses were captured and distributed internally.

ANSWER CHOICES	RESPONSES	
Discipline engineer	16.67%	14
Program/project manager	19.05%	16
Systems engineer	19.05%	16
Project support	13.10%	11
Safety and mission assurance personnel	8.33%	7
Procurement/acquisition workforce	1.19%	1
Science personnel	1.19%	1
Other: Please specify:	21.43%	18
TOTAL		84

Question 17: What is your assigned work location?

ANSWER CHOICES	RESPONSES	
Ames Research Center	19.05%	16
Armstrong Flight Research Center	5.95%	5
Glenn Research Center	16.67%	14
Goddard Institute for Space Studies	1.19%	1
Goddard Space Flight Center	3.57%	3
NASA Headquarters	9.52%	8
IV&V Facility	2.38%	2
Jet Propulsion Laboratory	10.71%	9
Johnson Space Center	7.14%	6
Kennedy Space Center	11.90%	10
Langley Research Center	4.76%	4
Marshall Space Flight Center	4.76%	4
Michoud Assembly Facility	0.00%	0
Plum Brook Station	0.00%	0
Stennis Space Center	2.38%	2
Wallops Flight Facility	0.00%	0
White Sands Test Facility	0.00%	0
TOTAL		84

Appendix B: Current State

Current State Team Charter

Current State NASA Practices Subteam Charter

Team Members
•Ben Bruneau, APPEL KS & Stephanie Booth, STMD
Key Milestones
•Solicit the organizations targeted for data collection. •Receive requested information from targeted organizations. •Analyze and summarize the information received.
Additional Notes
Searching for NASA knowledge transfer initiatives and information on how they are performed so they might be utilized by other NASA organizations. Examples: NASA mentoring programs, knowledge-based video and audio repositories (interview, webinars, podcasts, etc.), knowledge rich article repositories, courses led by experts conveying knowledge, rotational work detail programs.

Team Goals
•Goal 1: Collect a list of current tools, techniques, and other resources NASA uses to facilitate onboarding and retiree knowledge transfer, including pros and cons/satisfaction of each. •Goal 2: Analyze the aforementioned list.
Justification
To inform the rest of the working group and KM community of current approaches and their efficacy to inform future recommendations.
Scope
In Scope: Knowledge capture and transfer activities by all NASA Mission Directorates, Centers, and a subset of large offices, programs and projects.
Out of Scope: External knowledge transfer initiatives, including from private sector and other government agencies. HR. Succession planning

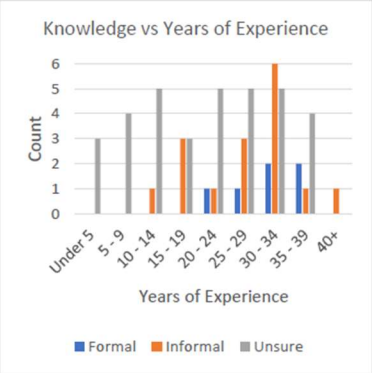
Current State Team Report

Knowledge Capture and Transfer Survey

Open-Ended Questions Results
Q2, Q9, Q10, Q11, Q12, Q13

Knowledge of Formal or Informal Processes

- **60% of** respondents were **unsure or unaware** of any organizational off-boarding processes.
- Only **11%** of respondents **were aware** of any **formal** off-boarding processes.



Types of Off-Boarding Processes by Count

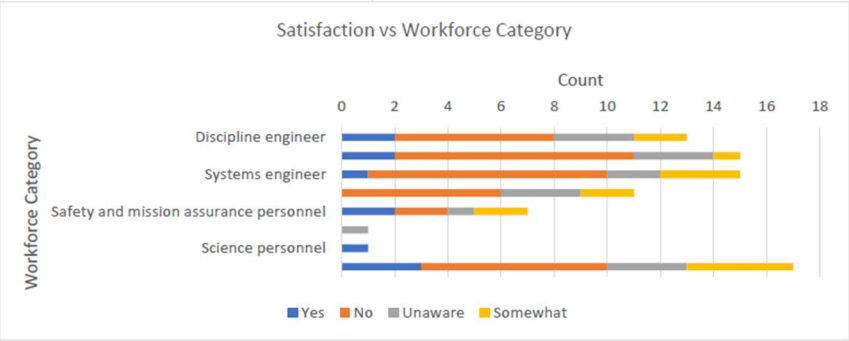
Documentation
Interviews, Informal Discussions, and Seminars
Re-arranging Tasks
Mentoring, Shadowing, and Training

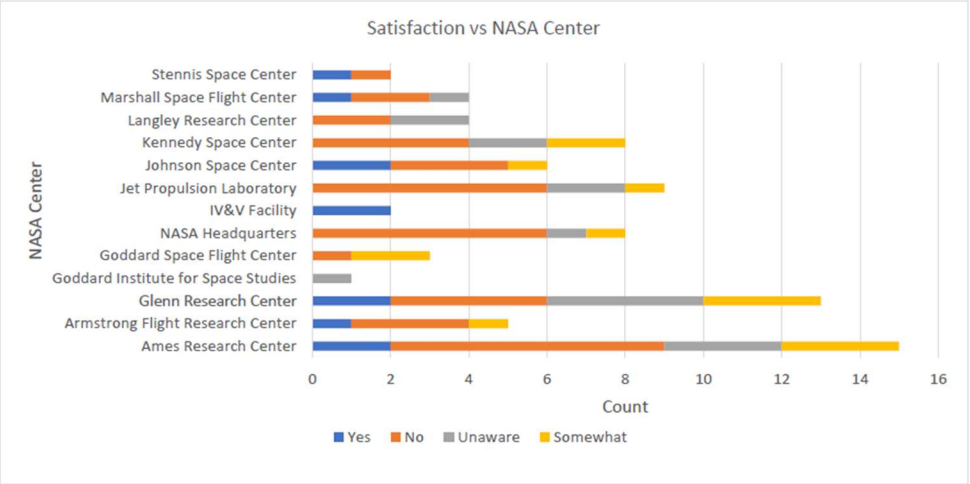
- The **entirety of respondents** who have **awareness of formal** off-boarding processes have **20+ years of experience**.
- The **majority** of those who responded with "**Documentation**" have **30+ years of experience.**
- "Re-Arranging Tasks" was pertinent to specific workforce categories: Discipline Engineer, Program/project Manager, Systems Engineer, and Project Support.

Level of Satisfaction with the Current Processes

Of the respondents who answered this question:

- Only **14%** of respondents were satisfied with the current off-boarding processes
- Nearly **half** of the respondents were unsatisfied with the current off-boarding processes
- Respondents with **30-34 years** of experience have the most **dissatisfaction**
- Most respondents with **under 5 years** experience were **unaware** of off-boarding processes. The same number of respondents with **35-39 years** of experience were **also unaware**





- No one with the role of Project Support was satisfied
- majority of Systems Engineers and Program/Project were dissatisfied

Reasons for Dissatisfaction and Recommendations

Top Reasons: No proper documentation and limitations on money and time.
Top Recommendations (by count):

1. Need for a process or a better process
2. Need for a Hiring Mandate and/or train multiples at a time
3. Leadership to take initiative on creating and building better processes

- The respondents who stated "No Proper documentation process" as a reason for dissatisfaction were in the higher range of work experience (25+) and a mix of Program/project manager, system engineers, and project support
- The respondents who stated a "Need for a process or better process" were spread across the work experience, but majority of those had higher years of experience.

Additional Knowledge Management Initiatives

Presentations: Brown Bags, Seminars, Technical Presentations
Documentation: Wikis, White Papers, File/Email Capture
Lessons Learned, Best Practices, and Case Studies
Cross Training, Mentoring, and Shadowing: Debrief sessions, Phased Retirements
Knowledge Sharing Activities and Resources: InnerSource, KM Forums, Checkpoint reviews, communities of practice
Continued Communication Post Departure

Data Caveats:

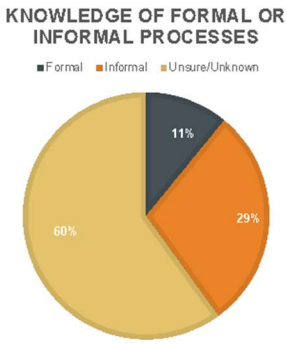
- Q2 and Q9 were intended to go up to 50, however the answer allowed a scale up to 100. Therefore, the results may not reflect accurately.
- Safety and Mission Assurance Personnel, Procurement/acquisition workforce, science personnel, and other had a combined count of 9 respondents.
- Most of the survey respondents were from ARC and GRC (14+).
- On the other hand, there were no respondents from MAF, PBS, WFF, and WSTF.

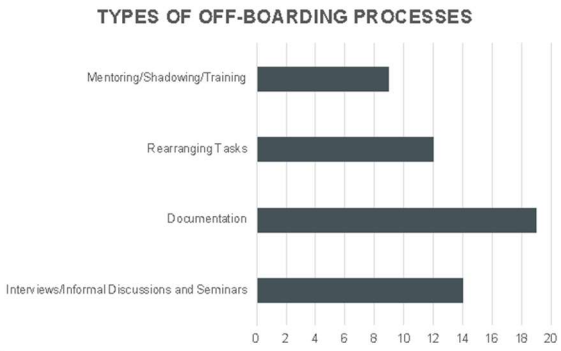
Current State Team Open-Ended Question Analysis

KNOWLEDGE CAPTURE AND TRANSFER SURVEY

OPEN-ENDED QUESTIONS RESULTS

Q10: WHAT ARE YOUR ORGANIZATION'S OFF-BOARDING PROCESSES (BOTH FORMAL AND INFORMAL) THAT FOCUS ON KNOWLEDGE OR TECHNICAL SKILL CAPTURE AND TRANSFER FOR DEPARTURES

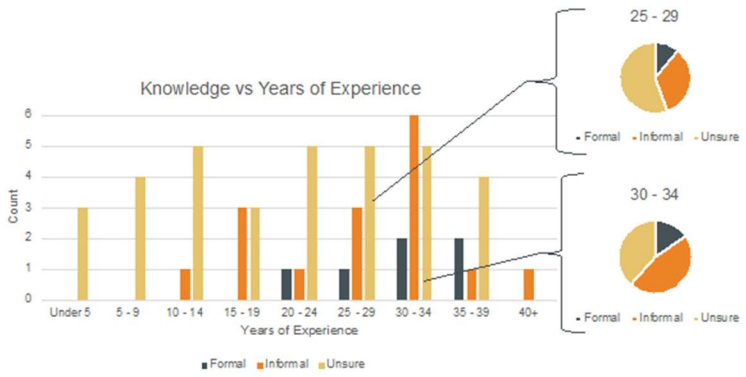




Of the respondents who answered this question:

- **60%** of respondents were unsure or unaware of any organizational off-boarding processes.
- Only **11%** of respondents had knowledge of any formal processes.

KNOWLEDGE OF FORMAL OR INFORMAL PROCESSES CHARTS



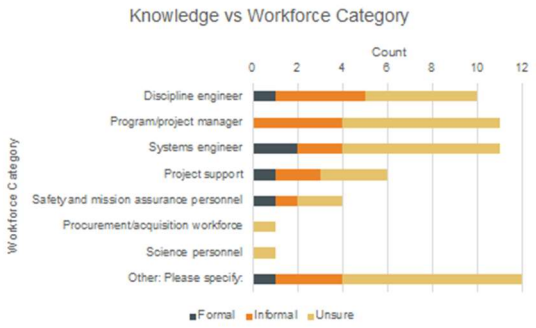
	Averages	
	Urgency (Q2)	Effectiveness (Q10)
Formal	67	37
Informal	55.25	28.43
Unsure	53.41	35.29

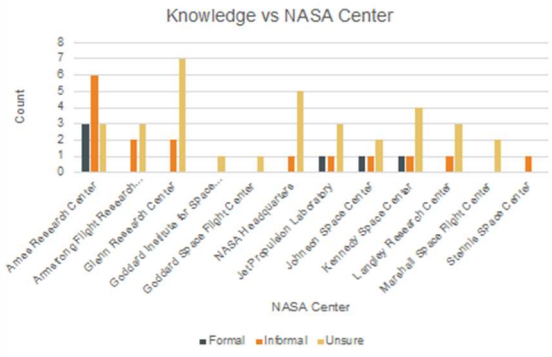
Key Take-Aways

- The graph to the left shows that **entirety** of respondents who have knowledge of **formal processes** have **20+ years of experience**.
- There were higher levels of urgency within those respondents who answered to having knowledge of formal processes* (20+ years of experience).
- However, regardless of knowledge of formal or informal processes, the average regarding the effectiveness of organizations capture and transferring knowledge is low*

* Q2 and Q9 were intended to go up to 50, however the answer allowed a scale up to 100. Therefore, the results may not reflect accurately.

KNOWLEDGE OF FORMAL OR INFORMAL PROCESSES CHARTS





Data Caveats:
- Most of the survey respondents were from ARC and GRC (14+).
- Other high centers included JSC, JPL, and HQ(8+).
- On the other hand, there were no respondents from MAF, PBS, WFF, and WSTF.
- This may explain the disparity in overall counts within workforce category and work locations.

WHAT ARE YOUR ORGANIZATION'S OFF-BOARDING PROCESSES (BOTH FORMAL AND INFORMAL) THAT FOCUS ON KNOWLEDGE OR TECHNICAL SKILL CAPTURE AND TRANSFER FOR DEPARTURES

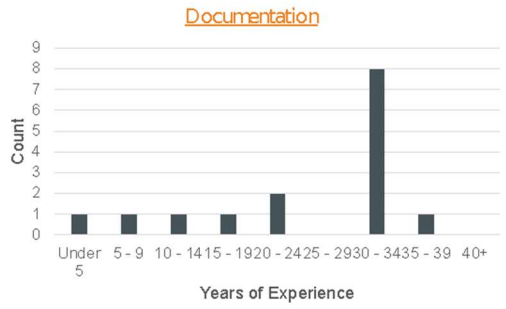
Top Processes:

1. Documentation
   - Checklists
   - Archiving Information, Emails, and Files
   - Filling out required forms
   - Document tasks and roles
2. Interviews / Seminars
   - Debriefs before depart
   - Exit Interviews
3. Re-arranging Tasks
   - Transferring Files
4. Mentoring / Shadowing / Training
   - Seniors and juniors collaborating
   - Back-up individuals
   - Cross-training
   - Training new hires

Additional Processes/Information:

- Creation of Desk Procedures ahead of time
- Software product development
- Implementing InnerSource approaches
- Community Storage
- Created a Knowledge Transfer Guide
- Leveraging Knowledge Management guides and assets

TYPES OF OFF-BOARDING PROCEDURE – NOTABLE COMPARISONS



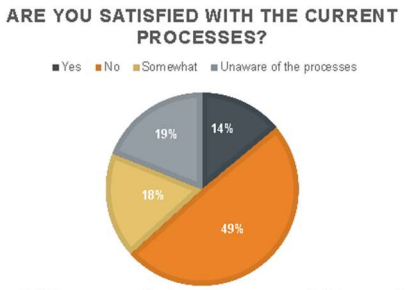
Key Takeaways:

- The majority of who responded with "Documentation" have 30+ year of experience.
- "Re-Arranging Tasks" was pertinent to specific workforce categories: Discipline Engineer, Program/project Manager, Systems Engineer, and Project Support.

Data Caveats:

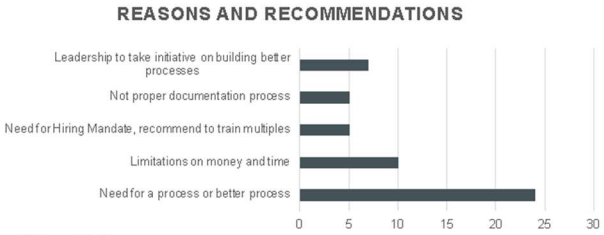
- Safety and Mission Assurance Personnel, Procurement/acquisition workforce, science personnel, and other had a combined count of 9 respondents.

Q11: ARE YOU SATISFIED WITH YOUR ORGANIZATION'S CURRENT OFF-BOARDING PROCESSES FOR KNOWLEDGE CAPTURE AND TRANSFER? WHY OR WHY NOT? WHAT WOULD YOU DO DIFFERENTLY, IF ANYTHING?



Of the respondents who answered this question:

- Only **14%** of respondents were satisfied with the current off-boarding processes
- Nearly **half** of the respondents were unsatisfied with the current off-boarding processes



Other Challenges:

- To enough people to fill positions

Specific Recommendations:

- Phased Retirements
- Being more proactive with knowledge capture
- Dedicate an organization specific form for knowledge transfer
- Document workflows
- Allow overlap for 3-6 months between retirees and replacements
- Create a dedicated position for knowledge capture/transfer
- Catalog information captured
- Create transition plans

SATISFACTION WITH ORGANIZATION'S CURRENT OFF-BOARDING PROCESSES FOR KNOWLEDGE CAPTURE AND TRANSFER

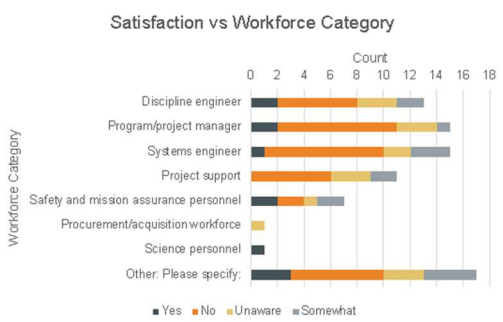
	Averages	
	Urgency (Q2)	**Effectiveness (Q10)**
Yes	31.36	45.81
No	56.82	33.07
Somewhat	53.27	43.71
Unaware	52.375	43.68

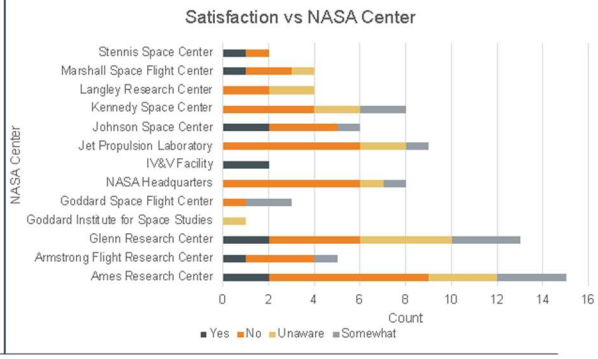
Key Take-Aways

- The graph to the left shows that respondents with **30-34 years** of experience have the most **dissatisfaction**
- Most respondents with **under 5 years** experience were **unaware** of off-boarding processes. The same number of respondents with **35-39 years** of experience were **also unaware**.
- Those who were **satisfied** had **lower urgency** regarding the issue of pending departures

* Q2 and Q9 were intended to go up to 50, however the answer allowed a scale up to 100. Therefore, the results may not reflect accurately.

SATISFACTION WITH ORGANIZATION'S CURRENT OFF-BOARDING PROCESSES FOR KNOWLEDGE CAPTURE AND TRANSFER





Key Takeaways:

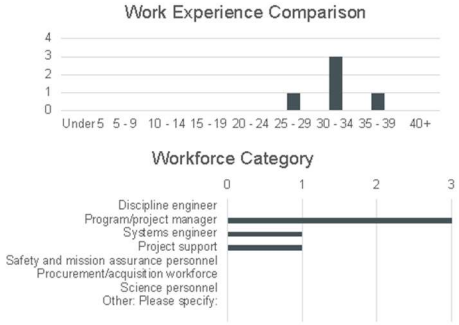
- No one with the role of Project Support was satisfied
- Overall, most respondents were not satisfied with current off-boarding procedures. Notably, majority of Systems Engineers and Program/Project were dissatisfied
- Not a single respondent in JPL, HQ, KSC, LRC, and GSFC were satisfied with current off-boarding processes
- All (2) respondents in IV&V were satisfied

Data Caveats:

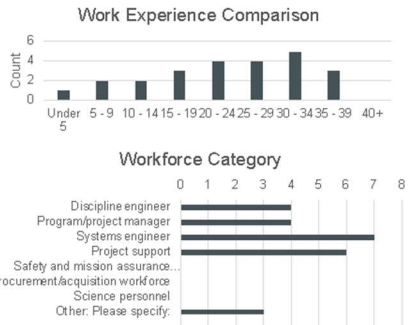
- Most of the survey respondents were from ARC and GRC (14+).
- Other high centers included JSC, JPL, and HQ (8+).
- On the other hand, there were no respondents from MAF, PBS, WFF, and WSTF.
- Safety and Mission Assurance Personnel, Procurement/acquisition workforce, science personnel, and other had a combined count of 9 respondents.
- This may explain the disparity in overall counts within workforce category and work locations.

REASONS AND RECOMMENDATIONS – NOTABLE COMPARISONS

No Proper Documentation Process



Need for a Process or Better Process



Key Takeaways:

- The respondents who stated "No Proper documentation process" as a reason for dissatisfaction were in the higher range of work experience (25+) and a mix of Program/project manager, system engineers, and project support
- The respondents who stated a "Need for a process or better process" were spread across the work experience, still heavier on the higher side.

Data Caveats:

- Safety and Mission Assurance Personnel, Procurement/acquisition workforce, science personnel, and other had a combined count of 9 respondents.

BEYOND OFF-BOARDING, WHAT ELSE DOES YOUR ORGANIZATION DO, IF ANYTHING, TO ENSURE THAT IT'S NOT LOSING CRITICAL KNOWLEDGE WHEN SOMEONE DEPARTS?

Nearly **34%** responded that they were either unaware or did not implement any additional initiatives

Some of the responses are re-stated from informal processes responses (i.e., Documentation, Mentoring, etc)

DO YOU HAVE ANY SPECIFIC RESOURCES, TEMPLATES, OR STANDARD OPERATING PROCEDURES FOR KNOWLEDGE CAPTURE AND TRANSFER THAT WE CAN SHARE WITH THE NASA KNOWLEDGE COMMUNITY? IF SO, PLEASE IDENTIFY THE TYPE AND SHARE YOUR NAME AND EMAIL ADDRESS HERE. CHECK ALL THAT APPLY.

Only 9 responses

All checked "Knowledge Capture and Transfer for Departures"

RECOMMENDATIONS FOR NEXT STEPS

Conduct Follow-Up Interviews

- Conduct interviews with suggested leads (~10) from Q14
- **Benefit**: Can gather more detailed information about interesting activities or other processes regarding knowledge capture/retention from retirees and/or job transfers

Communicate Lack of Awareness

- Communicate the lack of awareness about formal knowledge capture and transfer processes to leadership, and possibly the community as a whole
- **Benefit:** Educate leadership about current circumstances; start working toward a smoother transition process for future retirees

Develop a standardized template or guidance

- Create a standardized process template for all centers and groups to utilize
- Create a standardized knowledge capture primer or guidance to highlight best practices
- **Benefit:** Provide employees with examples of knowledge transfer and capture activities during different stages of their career. Activities include mentorship programs, job rotations, standardized retiree knowledge capture checklist documentation, brown bags, webinars, communities of practice, etc.

Self-Educate on Knowledge Capture and Transfer

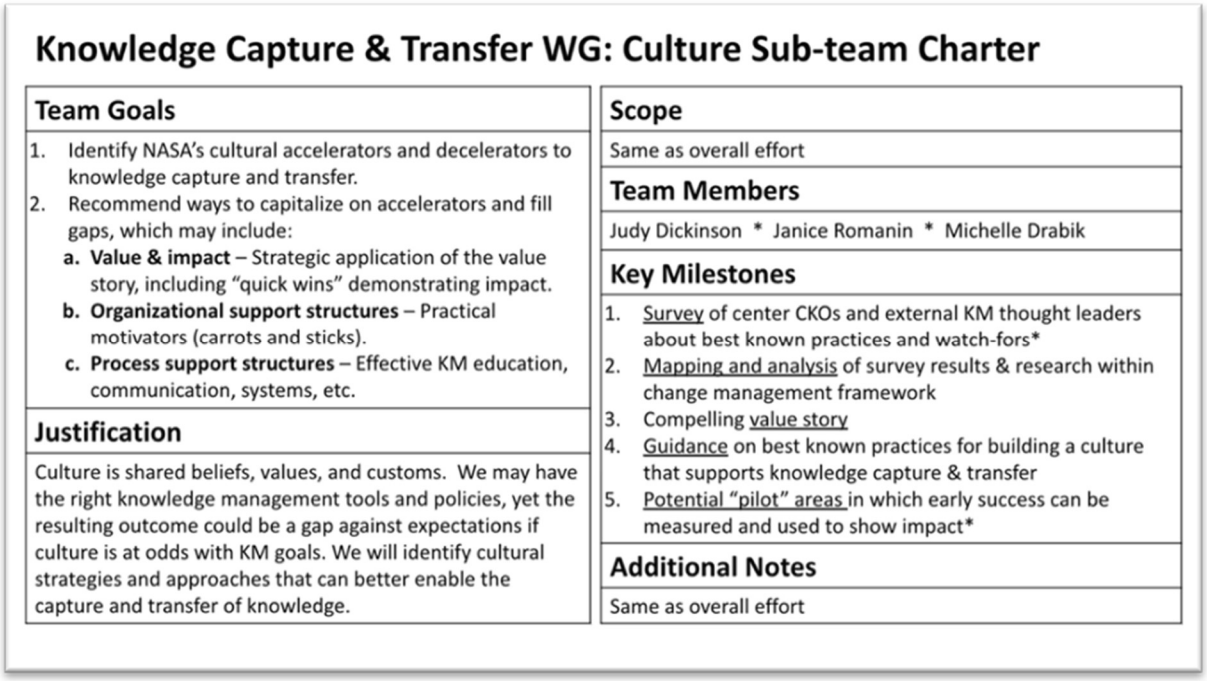
- Read additional material, such as case studies or research papers, on knowledge capture and transfer activities and processes
- **Benefit:** Possibly create or brainstorm additional ideas to improve NASA's current processes and activities

Address Data Gaps

- Address the data gaps in the survey (low # of respondents at centers or in workforce category, etc.). Possible solutions can include sending out additional surveys or conducting interviews targeting that audience
- **Benefit:** Allows for a more thorough and inclusive representation of data and trends

Appendix C: Culture

Culture Team Charter



Knowledge Capture & Transfer WG: Culture Sub-team Charter

Team Goals

1. Identify NASA's cultural accelerators and decelerators to knowledge capture and transfer.
2. Recommend ways to capitalize on accelerators and fill gaps, which may include:
   a. **Value & impact** – Strategic application of the value story, including "quick wins" demonstrating impact.
   b. **Organizational support structures** – Practical motivators (carrots and sticks).
   c. **Process support structures** – Effective KM education, communication, systems, etc.

Justification

Culture is shared beliefs, values, and customs. We may have the right knowledge management tools and policies, yet the resulting outcome could be a gap against expectations if culture is at odds with KM goals. We will identify cultural strategies and approaches that can better enable the capture and transfer of knowledge.

Scope

Same as overall effort

Team Members

Judy Dickinson * Janice Romanin * Michelle Drabik

Key Milestones

1. Survey of center CKOs and external KM thought leaders about best known practices and watch-fors*
2. Mapping and analysis of survey results & research within change management framework
3. Compelling value story
4. Guidance on best known practices for building a culture that supports knowledge capture & transfer
5. Potential "pilot" areas in which early success can be measured and used to show impact*

Additional Notes

Same as overall effort

NASA Knowledge Capture and Transfer Working Group: Culture Sub-Team Report

September 15, 2021

Janice Romanin

Judith Dickinson

Michelle Drabik

Contents

Overview

What is "Culture" in Organizations?

Though there are many different definitions of organizational culture, most definitions are variations of the following:

> ***An organization's culture is a set of shared assumptions around values, beliefs, and customs that guide behavior of its members.***

It is also possible for a variety of subcultures to exist within a large organization, fostered by different local management styles. A local subculture can exist in harmony, parallel, or in conflict with a larger organizational culture or other local subcultures.

The Cambridge English Dictionary defines the component terms of the above definition as follows:

> ***Assumptions*** – Things accepted as true, without question or proof.
>
> ***Values*** – Principles that help one decide what is right and wrong, and how to act in various situations. We assign value by judging the importance or worth of something to us.
>
> ***Beliefs*** – Feelings of being certain that something exists or is true.
>
> ***Customs*** – Ways of behaving that have been established for a long time.

Though these definitions show that culture in organizations only—at best—thinly based on evidence and largely based on feelings and traditions derived from organizational anecdotes and mythology, culture is extremely powerful and persistent in determining workplace behavior and action. As management guru Peter Drucker famously said, "Culture eats strategy for breakfast."

Why Culture is Important to Knowledge Capture and Transfer

If, by definition, the behavior of an organization's members is guided by organizational culture, it follows that their knowledge-sharing (including knowledge capture and transfer) behavior is likewise guided by organizational culture.

KM expert and author Stan Garfield states that a culture that supports knowledge sharing has 3 key elements:

1. Knowledge reuse is valued over reinvention.
2. Sharing knowledge helps you advance in your career.
3. In the process of innovating, failure is encouraged – as long as the lessons learned are shared so that similar failures are prevented.

Effective knowledge capture and transfer is dependent on a culture that supports it.

If these 3 elements are true, there can be inherent problems in capturing and transferring knowledge at offboarding, particularly because an expert has little incentive to make the effort to share at the point of offboarding. Their may be some reason to hope that one's expertise may be re-used to leave a positive legacy, but their career trajectory will no longer be a factor within the organization and discussing

failure/lessons will is not likely to be their preferred last impression. Therefore, though there is an urgency to capture and transfer knowledge before key experts leave an organization, every effort should be made to capture and transfer knowledge throughout an expert's career with the organization, so that the knowledge can be re-used at earliest availability and captured when it is most fresh, it does not become an undue burden compressed into the window prior to a departure, and the actively employed expert still has practical motivation for doing it because it impacts their career success.

Culture Sub-Team

Charter

Knowledge Capture & Transfer WG: Culture Sub-Team Charter

Team Goals	Scope
1. Identify NASA's cultural accelerators and decelerators to knowledge capture and transfer. 2. Recommend ways to capitalize on accelerators and fill gaps, which may include: a. **Value & impact** – Strategic application of the value story, including "quick wins" demonstrating impact. b. **Organizational support structures** – Practical motivators (carrots and sticks). c. **Process support structures** – Effective KM education, communication, systems, etc.	Same as overall effort
Justification	**Team Members**
Culture is shared beliefs, values, and customs. We may have the right knowledge management tools and policies, yet the resulting outcome could be a gap against expectations if culture is at odds with KM goals. We will identify cultural strategies and approaches that can better enable the capture and transfer of knowledge.	Judy Dickinson * Janice Romanin * Michelle Drabik
	Key Milestones
	1. Survey of center CKOs and external KM thought leaders about best known practices and watch-fors 2. Mapping and analysis of survey results & research within change management framework 3. Guidance on best known practices for building a culture that supports knowledge capture & transfer 4. Compelling value story (if needed, depends on survey) 5. Potential "pilot" areas in which early success can be measured and used to show impact (optional)
	Additional Notes
	Same as overall effort

4/7/2021, Rev.2

Figure 1. Knowledge Capture and Transfer Working Group – Culture Sub-Team Charter.

Approach

The Culture Sub-Team decided to review the works of Knowledge Management thought leaders to understand the characteristics of cultures that support effective knowledge capture and transfer, and compare that to data collected about NASA's culture by surveying NASA Center Chief Knowledge Officers (CKOs). When the Working Group decided to conduct a unified survey, the survey population was expanded beyond Center CKOs and incorporated more questions, providing the Culture Sub-Team with additional respondents and data. (Note that data collection was opportunistic, with surveys sent to a set of respondents of each Center's choosing and with a varying response rate from each Center. For this reason, cultural trends by Center or other demographics were not evident.)

The Sub-Team analyzed the survey data against a well-known and widely accepted change management model, ADKAR, explained in the next section of this report, to identify areas of opportunity for NASA.

To develop guidance, the team matched best known methods and considerations from both data collected in the survey and from the review of KM thought leader publications to the identified areas of opportunity.

Change Management

The ADKAR Change Management Model

Nearly 20 years ago, Jeff Hiatt developed the ADKAR change management model popularized by the change management consultancy Prosci. The model presents 5 sequential steps to foster change:

1. **Awareness** – Understanding the need
2. **Desire** – Wanting to make it happen
3. **Knowledge** – Understanding what must be done
4. **Ability** – Having the capability to execute
5. **Reinforcement** – Providing ongoing support

Assuming that improving knowledge capture and transfer would require a change from the current state, the sub-team decided to look for opportunity trends by categorizing each concern described by respondents by the step of the ADKAR model relating to that concern. The following criteria were used:

1. **Awareness** – Respondent noted that the organization lacks basic directives or plans for capturing and transferring knowledge and/or fails to recognize its value.
2. **Desire** – Respondent noted a tendency for individuals to repetitively choose to put other tasks first and/or not capture or transfer their own knowledge.
3. **Knowledge** – Respondent expressed a lack of clarity or confidence about how to identify, scope, and execute knowledge capture and transfer tasks.
4. **Ability** – Respondent named specific obstacles relating to infrastructure, technology, resourcing, and processes that chronically disrupt effective knowledge capture and transfer.
5. **Reinforcement** – Respondent specified a lack of leadership support or noted disincentives for knowledge capture and transfer.

ADKAR Focus Areas for Knowledge Capture and Transfer

The sub-team's analysis highlights that our greatest areas of opportunity are in the elements of Ability and Knowledge. Respondents with all levels of concern (i.e., high, medium, and low) about knowledge capture and transfer all noted opportunities related to Ability, especially respondents with higher levels of concern. Respondents with low levels of concern only noted opportunities related to Ability. Respondents with medium levels of concern noted a significant number of opportunities related to Ability but noted slightly more linked to Knowledge. Only a few responses linked to Desire and Awareness, and none at all were linked to Reinforcement. (See Figure 2.)

No clear trends related to individual Centers or demographics were observed.

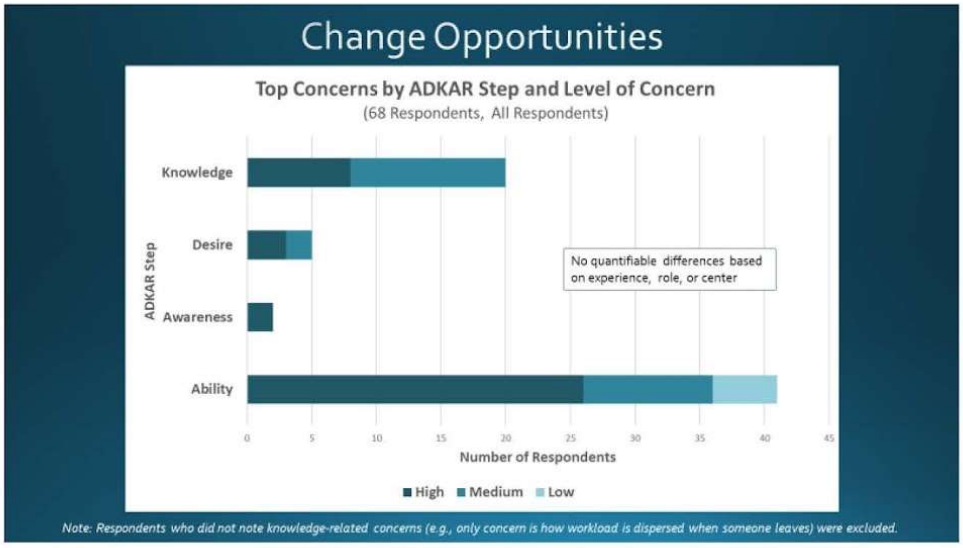


Figure 2. Change Opportunities Mapped to ADKAR Model.

#1 Concern – Ability. Highlights include:

- Not enough notice is received before an employee exits
- The hiring process does not permit enough transition time or overlap
- Content storage and discovery architecture and practices hinder discoverability
- There is insufficient funding for knowledge capture and transfer
- There is insufficient staffing for knowledge capture and transfer
- Competition for talent limits the pool of qualified candidates to receive the knowledge

#2 Concern – Knowledge. Highlights include:

- How to capture proper amount, detail, & context; did we get it all?
- How to identify & address single points of failure
- How to break down silos
- How to better communicate
- Where to find knowledge
- How to capture for future usability
- How to transfer the "Spidey sense" to a successor
- How to capture knowledge relevant to a role instead of just each individual's knowledge

#3 Concern – Desire. Highlights include:

- Technical tasks are the always the priority, leaving no time for knowledge capture and transfer
- People don't or won't record knowledge, even if they have time
- People don't or won't mentor successors

#4 Concern – Awareness. Highlights include:

- No planning is available
- Poor/no basic instructions are available
- Uncertainty about the value of knowledge

Awareness – Understanding the Need

The value of knowledge capture and transfer has been quantified in the literature. For example, Panopto's 2018 Workplace Knowledge and Productivity Report found that:

- The average large US business loses $47 million in productivity each year as a direct result of inefficient knowledge sharing.
- 42% of organizational knowledge is unique to the individual, acquired specifically for their role, and not shared by coworkers. When the employee leaves, coworkers cannot cover 42% of that job.
- 60% of employees report that it is difficult, very difficult, or nearly impossible to obtain information from their colleagues needed to do their job.
- Employees spend 5.3 hours per week waiting for information. These delays impact project schedules — 66% will last up to a week, and 12% a month or more.
- 85% of employees agree that preserving and sharing unique knowledge in the workplace is critical to increasing productivity.
- 81% of employees state that knowledge gained from hands-on experience is the hardest to replace once it's lost.

The sub-team originally thought it would need to craft a strong value story for why knowledge capture and transfer is important, drawing from both NASA anecdotes and external research. However, survey data suggests that the need for knowledge capture and transfer is already understood and accepted:

83 out of 84 respondents agreed or strongly agreed with the value of knowledge across all dimensions surveyed.

Therefore, the culture sub-team did not pursue crafting a value story, as this does not appear to be a priority developmental need for NASA's knowledge-sharing culture.

However, despite strongly believing in the need for knowledge capture and transfer, only 13% of those surveyed were satisfied with the status quo in how it is currently done. This makes it clear that there is room for improvement in other areas. (See Figure 3.)

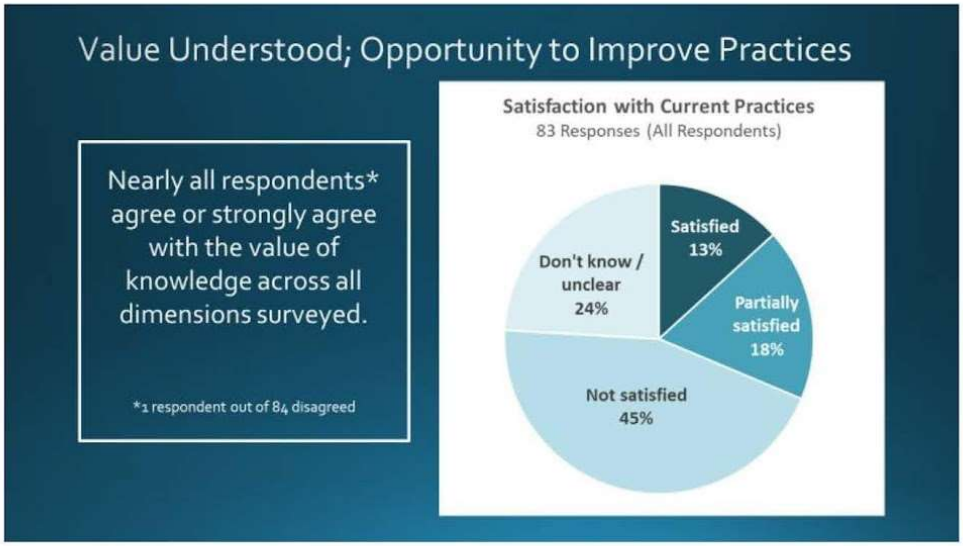


Figure 3. Perceived Value and Satisfaction with Current Knowledge Capture and Transfer Practices.

Levels of concern and perceived urgency to capture and transfer knowledge of offboarding employees are notable, especially concerns about losing deep, tacit knowledge; having sufficient documentation; and be able to find and use captured knowledge in the future. (See Figure 4.)

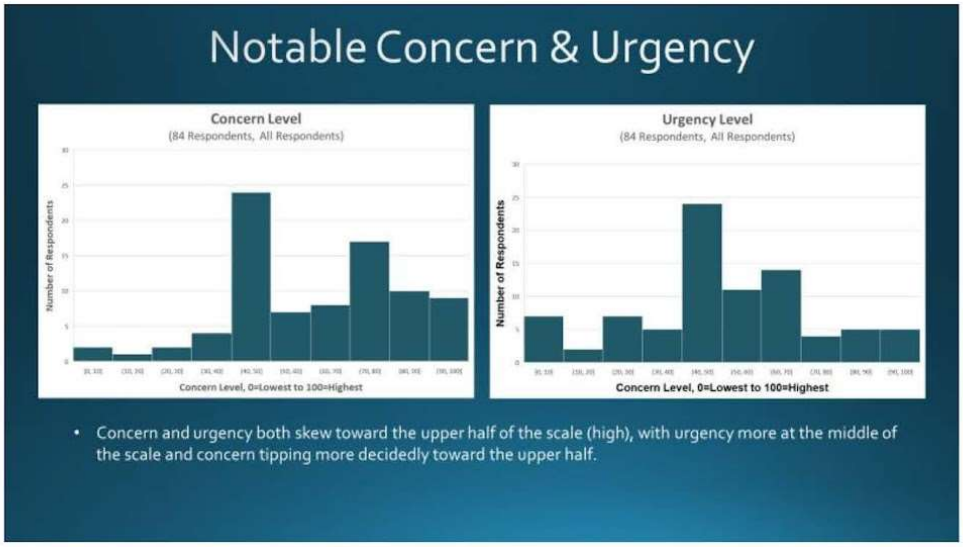


Figure 4. Knowledge Capture and Transfer Concern and Urgency Levels.

When each respondent's rating of concern was paired with their rating for urgency, it followed that those with higher levels of concern also thought urgency was more significant, those with middling levels of concern also perceived a middling level of urgency, and those with a lower level of concern also assigned lower urgency, either expressing that resources were too limited to increase the existing priority of knowledge capture, or that knowledge capture and transfer was already adequately handled. (See Figure 5.)

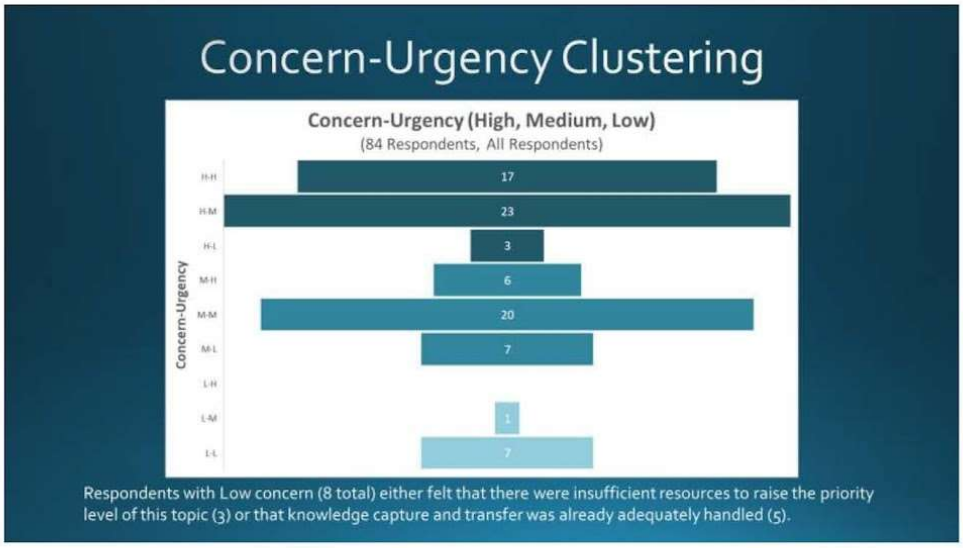


Figure 5. Clustered Knowledge Capture and Transfer Concern and Urgency Levels.

Awareness of plans for capturing and transferring knowledge seems to have only a weak correlation to statements by respondents signifying their overall satisfaction level with knowledge capture and transfer methods. Those that are satisfied or somewhat satisfied are slightly more aware of plans than those that are dissatisfied. The group that was unsure about plans was least satisfied.

"AWARENESS" OPPORTUNITY:

IMPROVE VISIBILITY OF KNOWLEDGE CAPTURE AND TRANSFER PLANS.

However, only one third to just over half of respondents in any group are aware of knowledge capture and transfer plans. So, though respondents themselves strongly are aware of the need for effective knowledge and transfer, they may have less confidence in the organization's priority for this need because plans are inadequately visible. (See Figure 6.)

This suggests an opportunity to develop, clarify, and promote understanding of knowledge capture and transfer plans.

Figure 6. Respondent Awareness of Knowledge Plans.

Desire – Wanting to Make It Happen

Though all respondents assigned highest responsibility for driving knowledge capture and transfer to an offboarding employee's supervisor or manager, up to a third of respondents recognized knowledge capture and transfer as a shared accountability for all members of the organization. A small set of those dissatisfied or unsure about knowledge capture and transfer methods assigned responsibility to the Chief Knowledge Officer (CKO).

"DESIRE" OPPORTUNITY:

MAKE EFFECTIVE KNOWLEDGE CAPTURE AND TRANSFER EVERYONE'S JOB.

This presents an opportunity to boost desire for shared responsibility for knowledge retention.

	Satisfied (11)	Somewhat Satisfied (15)	Unsure (20)	Dissatisfied (37)
Supervisor or Manager	100%	100%	95%	89%
CKO			5%	11%
Shared	27%	33%	20%	19%

Figure 7. Who Do Respondents Identify as Responsible for Knowledge Capture and Transfer?

Knowledge – Understanding What Must Be Done

Those most satisfied with knowledge capture and transfer methods at offboarding have the most familiarity with current methods for doing it. All others, including those who are dissatisfied, unsure, or somewhat satisfied lag behind in their awareness of methods by a noticeable margin.

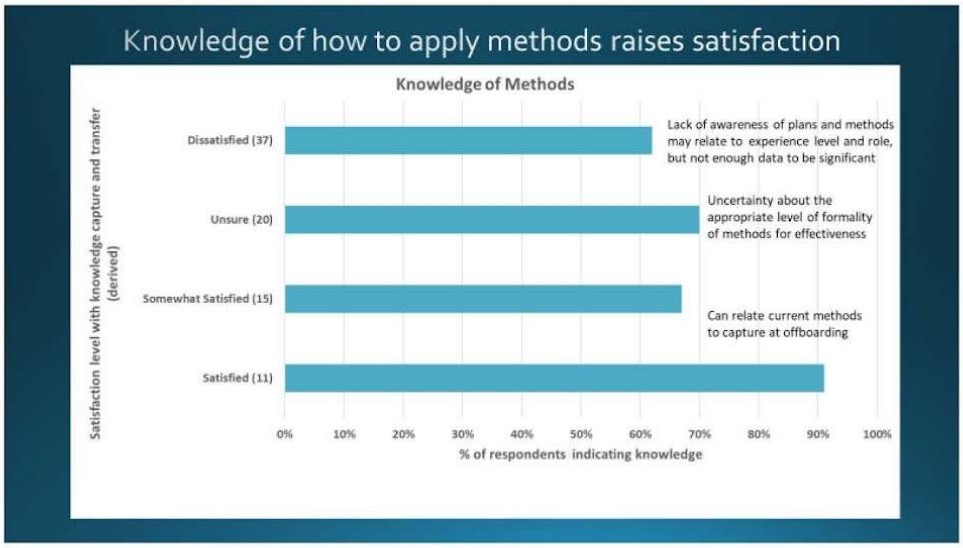


Figure 8. Knowledge of Knowledge Capture and Transfer Methods

Respondents indicated awareness of knowledge retention methods, but the data suggests that a limited understanding of options for capturing and transferring knowledge and/or how to most effectively apply such methods may contribute to dissatisfaction. About two-thirds of respondents could name at least one method (See Figure 9.), and of those, about half could name more than one method. (See Figure 10.) Of freely named knowledge retention methods, respondents definitively named documentation most often. (See Figure 11.)

"KNOWLEDGE" OPPORTUNITY:

IMPROVE RECALL AND SKILL IN EFFECTIVE APPLICATION OF VARIETY OF KNOWLEDGE CAPTURE AND TRANSFER METHODS.

This presents an opportunity to boost confidence in knowledge capture and transfer capability by expanding the toolkit of best-known methods and/or improving recall and skill in application of these methods.

Because the "knowledge" change element was the second highest area of concern for respondents, this should be a key focus area in recommending improvements.

Figure 9. Respondents Who Could Freely Name an Active Knowledge Retention Practice.

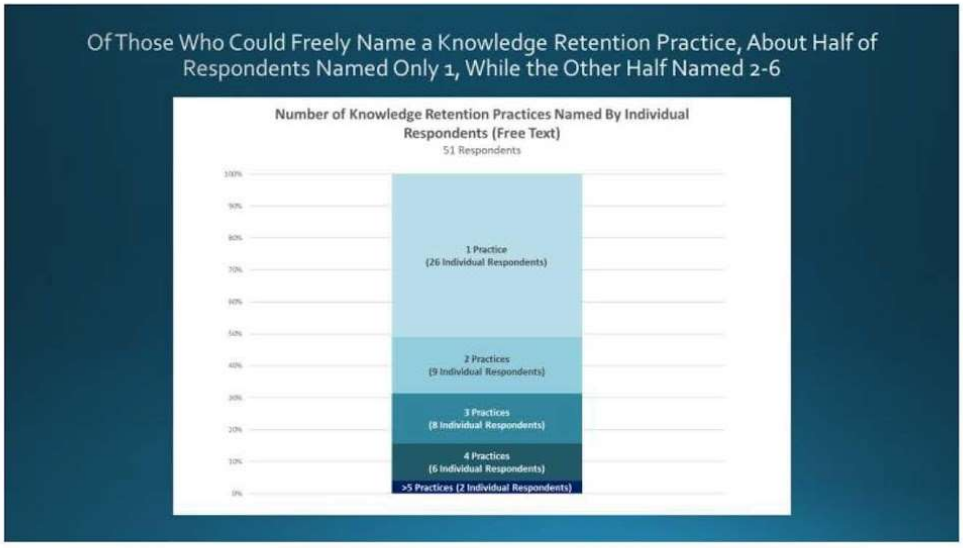


Figure 10. Numbers of Active Knowledge Retention Practices Named by Respondents.

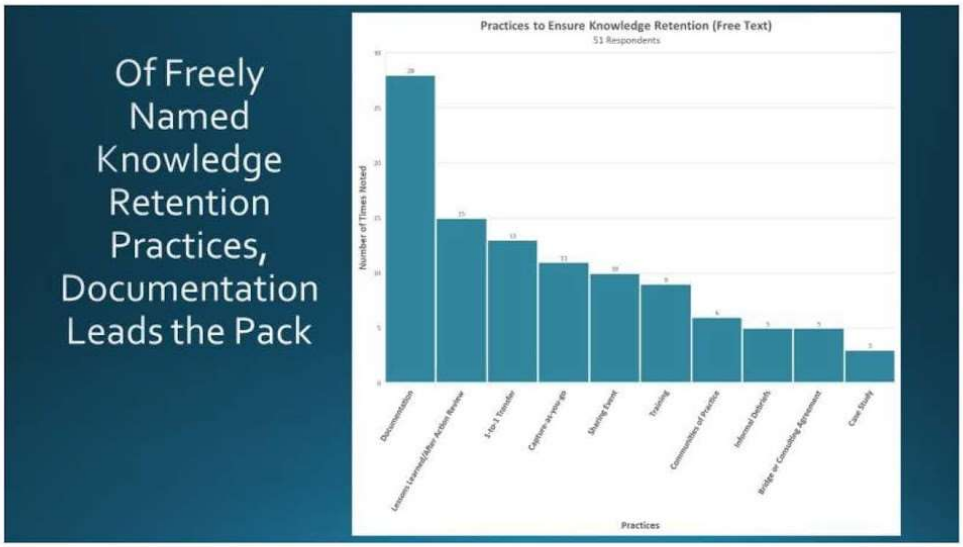


Figure 11, Knowledge Retention Practices Freely Named by Respondents.

Ability – Having the Capability to Execute

The overwhelming majority of concerns cited by respondents centered on the "Ability" change element, making improvement in this area the top priority. For all respondents, lack of resources was identified as the number one obstacle, except for the dissatisfied group, which prioritized lack of ownership.

This same dissatisfied group that cites lack of ownership as the top obstacle also assigned lower shared responsibility for knowledge capture and transfer than other groups, and more responsibility to the CKO than the other groups (See figures7 and 12.), reinforcing the "Desire" Opportunity stated earlier to promote the concept that knowledge capture and transfer is a shared responsibility.

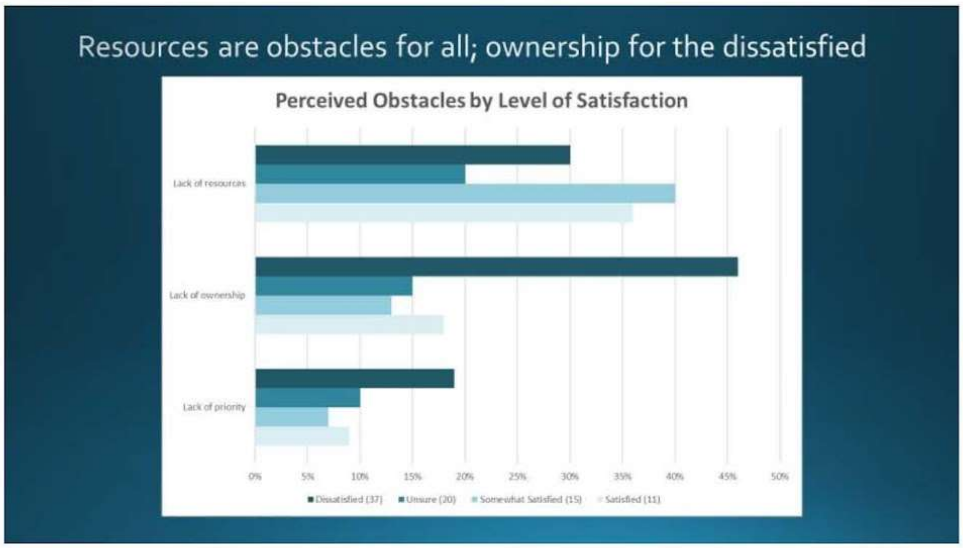


Figure 12. Perceived Obstacles to Knowledge Capture and Transfer.

"ABILITY" OPPORTUNITY

BUILD INTO ALL MISSION, PROJECT, AND FUNCTIONAL PLANS CLEARLY STATED AND ENFORCED EXPECTATIONS FOR KNOWLEDGE CAPTURE AND TRANSFER ROLES AND RESPONSIBILITIES, DELIVERABLES, AND RESOURCING.

The opportunity for improvement in this area is to ensure that there are clearly stated and enforced expectations for knowledge capture and transfer roles and responsibilities, deliverables, and resourcing built in to plans for missions and projects and in functional areas.

Reinforcement – Providing Ongoing Support

Nothing of note was specified in this element by respondents, though a case could be made that ongoing support requires definitive improvements in all of the previously discussed areas.

Considerations for reinforcement by leaders adapted from Stan Garfield's Executive Commitments for enabling success include:

1. Budget and allocate time for knowledge capture and transfer.
2. Lead by example; practice knowledge capture and transfer.
3. Communicate regularly about plans and progress as a standard part of meeting agendas and communications among leaders and with employees.
4. Ensure that concrete goals set for all employees and project teams, and are enforced. They need to actually be assigned, monitored, and achieved.
5. Inspect compliance to knowledge goals with the same fervor as for other key performance indicators. If reviewed along with the usual operating metrics, it will be clear that they are just as important.
6. Reward employees and teams that share, innovate, reuse, learn, and collaborate. Rewarding desired behaviors provides positive reinforcement, offers motivation, and communicates to everyone how such behaviors are valued.

Cultural Trend Analysis

Key Findings

There are a number of recurring themes that reflect our culture for knowledge capture and transfer. One frequently stated belief, as noted in the introduction of this report, is that knowledge capture and transfer is vary valuable. However, after that, frequently cited beliefs, values, and customs all explain why we do not capture and transfer knowledge as effectively as most would like. Some highlights aggregated from survey responses are:

Beliefs

- *Knowledge capture and transfer is very valuable.*
- Technical mentoring is historically our best, proven way to transfer knowledge.
- With more projects and tighter resources, we now have no time for technical mentoring.
- Technical work will always take precedence over knowledge capture and transfer.
- We don't have allocated time for knowledge capture and transfer.
- We don't have a charge number for knowledge capture and transfer activities.
- We don't have good methods for capturing and transferring knowledge.
- We don't have a plan for how to capture and transfer knowledge.
- We don't have an owner that ensures knowledge capture and transfer happens.

Values

- The mission comes first. We'd like to fit in knowledge capture and transfer, but are already overextended.
- When someone is offboarding, they need to work on the project right up until the end, and no one left behind can take a crash course in a short time from the exiting expert.
- Capturing knowledge is only a top priority when something goes wrong.

- Retirees can consult after they leave.
- Retirees are/feel undervalued.

Customs

- We hurry up and capture at the end of a project or career.

Reframing Toward a Mindset that Can Overcome Cultural Obstacles

Recalling Stan Garfield's three key elements of a culture that supports knowledge sharing cited earlier (knowledge reuse>reinvention, sharing knowledge=career advancement, failures→learning), it is clear that we need to reframe how we look at and address these beliefs, values, and customs to enhance our knowledge sharing culture. (See Figure 13.)

Belief, Value, or Custom (grouped & summarized)	Reframing
• The mission comes first. Knowledge capture and transfer is lower **priority** than technical work needed to complete the mission (unless something goes wrong – then it is high priority).	Mission success depends on building upon what we already know, making knowledge capture and transfer not a competitor of the technical work, but an integral part of it, learning from both success and failure.
• There is not allocated **time and money** for knowledge capture and transfer.	Since knowledge capture and transfer are integral to mission success, time and money for knowledge capture and transfer should be built in to the project plan.
• We don't have a **visible plan** for knowledge capture and transfer. • No one has clear **responsibility** for knowledge capture and transfer. • There are not **effective methods** for knowledge capture and transfer.	We need to increase visibility and understanding of—plus capabilities and incentives to execute—methods, plans, and responsibilities for effective knowledge capture and transfer.
• Real time **technical mentoring** is the *best* method of knowledge transfer. • There is no **overlap** between the offboarding employee and their replacement to enable knowledge transfer.	Technical mentoring is *one* effective method of knowledge transfer. There are others that can be effective, including asynchronous methods.
• Knowledge capture and transfer happens at **endings** (careers, projects). • There is not enough **transition time** before someone offboards to enable knowledge capture and transfer.	Knowledge capture and transfer is continuous and should be an expectation of the job, necessary for career success. At endings, we should merely need to check for any small clarifications or gaps to fill.
• We can rely on **retirees** to consult.	Retirees are a rich, but unguaranteed, resource. We need to know how to best engage them.

Figure 13. Reframing Beliefs, Values, and Customs to Support a Knowledge Sharing Culture

By reframing these cultural elements, we can promote the mindset needed to better address knowledge capture and sharing, overcoming beliefs, values, and customs that present obstacles to us now.

Cultural Enablement

Enablement Facets

The Knowledge Sharing Culture best practices tip sheet (NASA Internal Use Only) lists the following cultural enablers grouped into facets of people, process, and technology.

People

People-related enablers focus on manger reinforcement, incentives, and time allocation:

1. Managers regularly inspect, talk about, and directly participate in knowledge sharing and reuse.
2. Desired knowledge behaviors are rewarded regularly, consistently, and visibly.
3. Time is allowed for knowledge tasks.
4. Employee promotions required demonstrated knowledge sharing.

Process

Process-related enablers focus on re-using prior knowledge, submitting new content at project milestones, integrating knowledge and business processes, and standardization.

1. Project teams reuse standard, institutionalized knowledge from previous, similar projects.
2. All project teams submit reusable content to the appropriate repositories at standard milestones.
3. Knowledge processes are integrated with standard business processes that are transparent to users.
4. All reusable content is checked for quality, scrubbed to remove confidential data, and provided in standard formats.

Technology

Technology-related enablers focus on information retrieval ease, speed, and relevance; connectivity and integration; and team collaboration tools.

1. It is easy for any question to be asked or problem posed such that a useful answer is provided rapidly.
2. Useful information is delivered to users when they need it based on the work that they are doing.
3. Information flows are automated between all systems so that no data needs to be re-entered.
4. Users can access the knowledge they need even if they are not connected to the network.
5. All teams collaborate using team spaces.

Priority Accelerators and Decelerators

Survey respondents gave examples of what they felt was needed to address shortcomings of knowledge capture and transfer at off-boarding. The sub-team analyzed these along with previously discussed findings and information from industry experts to construct a list of NASA-specific priority cultural accelerators and decelerators, categorized by cultural enablement facets.

Ability-related Accelerators and Decelerators

Related to the ADKAR element of Ability, respondents noted needs for:

- Increased transition time to enable better knowledge capture and transfer
- Improved recruiting competitiveness
- Defined and committed resourcing to knowledge capture and transfer
- Improved discovery (especially across siloed information)

	Accelerators	Decelerators
PEOPLE	• **Incentives (and penalties)** – Clear knowledge capture and transfer expectations tied to personal and team performance (rewards, advancement)	• **Lack of enforcement** – Poor methods for, adherence to, or consistency of evaluation. People and teams are rewarded if technical goals are met, even if knowledge goals are not
PEOPLE	• **Shared accountability** – Promote the concept that knowledge capture and transfer is everyone's responsibility, supervisors and managers reinforce it, and dedicated KM resources (e.g., CKO) can provide expert help	• **Not my job syndrome** – individual users or teams abandon accountability for capturing and transferring their own knowledge

PROCESS	• **Smooth transitions** –
	  • **Continuous knowledge capture and transfer**, guided by well-defined technical succession and knowledge transfer plans
	  • **Highly efficient recruiting/hiring** processes
	  • **Talent magnet** – Attractive mission, wages, benefits, location, working conditions; outreach to diverse talent; great reviews
	  • **Positive employee experiences**, including retiree appreciation
		• **11th hour knowledge capture and transfer** – Neither fresh nor thorough, hard to free up and focus time from both the learner and expert
		• **Slow to hire/backfill** – Inefficient approval & process steps
		• **Poor value story** – Unattractive mission, wages, benefits, location, working conditions
		• **Disgruntled off-boarders** – give short notice and bad reviews that discourage job seekers

PROCESS	• **Committed organizational investment** –
	  • Write resourcing (budget, time, talent) into plans and proposals
	  • Validation to a quality standard
	  • Expert coaching available
		• **Personal chore** –
		  • Do it on your own time
		  • Just get it done; it doesn't have to be good
		  • Limited coaching or guidance

TECHNOLOGY	• **High quality discovery** – Best-known tools, connected systems, and open access policy.	• **User frustration**
		  • Unclear validity (source - who, where, what?)
		  • Repetitive search failures
		  • Silos

Figure 14. "Ability" Cultural Accelerators and Decelerators.

Knowledge-, Awareness-, and Desire-related Accelerators and Decelerators

Related to the remaining ADKAR elements, respondents noted needs for:

- Building the team to expand knowledge sharing: 1 NASA vs. individualism and project-ism
- A visible plan to address each single point of failure
- Specific plans for maintaining role-based knowledge (vs. capturing on an expert-by-expert basis) – build out technical succession plans with coordinated actions
- Better education on methods of knowledge capture and transfer (including communication)
- Better guidance on how to choose knowledge targets and define scope of capture

	Accelerators	Decelerators

PEOPLE	• **Team spirit** –
	  • 1 NASA vs. individualism and project-ism; breaking down siloes.
	  • Reinforced awareness of mission and role expectations– shared vision & accountability
	  • Rules of engagement built for inclusivity
		• **Internal competition** – Sharing or collaboration beyond the bare minimum dilutes personal worth; overly incentivized individual or team performance

PROCESS	• **Visibility into detailed plans –**
	  • How to address single points of failure
	  • Technical succession by role/capability
	  • Tracking and progress checks
		• **Minimal, disconnected plans** – Fully left to differing local practices and priorities

	• **Established and well promoted methods for knowledge capture and transfer –**
	  • Knowledge transfer (mentoring & shadowing)
	  • Mapping, targeting, scoping, & evaluating knowledge
	  • Effective capture methods and tools
	  • Effective communications training
		• **Users must fend for themselves –**
		  • Users don't know what they don't know
		  • Users find documentation of processes with the wrong level of detail
		  • No "help line"

TECHNOLOGY	• **Leading edge professional development** –
	  • Variety of education and guidance delivery, including virtual, self-paced, or smart-assist
	  • Tracked certification and/or incentives
	  • Linked to performance management system
	  • On demand and flexible
	  • Pro-active matching to needs
		• **Tell, not teach** (e.g., no skill checks)
		• **Do it on your own time**
		• **Wrong level of detail or relevancy**

Figure 15. "Knowledge" Cultural Accelerators and Decelerators.

Reinforcement-related Considerations

None were mentioned, though reinforcement would be enhanced by strong leadership commitment to resourcing, promoting, and demonstrating the above noted accelerators.

Conclusion

NASA's success in capturing and transferring knowledge of off-boarding employees is shaped by its culture. Presently, there are beliefs, values, and customs embedded in our culture that can act as obstacles to effective knowledge capture and transfer. These can be reframed to create a mindset that enables overcoming these obstacles.

To take action to improve the knowledge sharing culture, there are accelerators that should be developed, enhanced, or promoted, and decelerators that should be minimized. Each center is encouraged to assess its own level of maturity for each recommended accelerator and determine its own developmental priorities based on its unique culture.

The highest priorities across all respondents are in the ADKAR change elements of Ability and Knowledge. The most often cited obstacles relate to resourcing – time, money, and expertise—to complete effective knowledge capture and transfer. It is strongly recommended that, to propel effective knowledge capture and transfer, a strong commitment to resourcing knowledge activities as an integral part of mission success and a required component of successful individual and team performance be considered.

Opportunities are summarized below. Refer to the section of this report on Cultural Enablement for additional detail on recommended accelerators for targeted cultural change.

ABILITY: BUILD INTO ALL MISSION, PROJECT, AND FUNCTIONAL PLANS CLEARLY STATED AND ENFORCED EXPECTATIONS FOR KNOWLEDGE CAPTURE AND TRANSFER ROLES AND RESPONSIBILITIES, DELIVERABLES, AND RESOURCING.

KNOWLEDGE: IMPROVE RECALL AND SKILL IN EFFECTIVE APPLICATION OF VARIETY OF KNOWLEDGE CAPTURE AND TRANSFER METHODS.

AWARENESS: IMPROVE VISIBILITY OF KNOWLEDGE CAPTURE AND TRANSFER PLANS.

DESIRE: MAKE EFFECTIVE KNOWLEDGE CAPTURE AND TRANSFER EVERYONE'S JOB.

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Appendix D: Knowledge Processes

Knowledge Processes Team Charter

Knowledge Process Documentation and Transfer Team Charter

Team Goals

Identify how agency organizations
- Formalize knowledge capture processes
- Facilitate smooth transfer and retention of institutional knowledge

Justification

Process documentation to provide a repeatable framework for lessons learned and knowledge sharing. Knowledge capture processes formalize the intent of knowledge collection, and knowledge transfer strategies ensure the content is actively shared and utilized.

Scope

In Scope: Soon to be retirees, employees in phased retirement status, center NASA Alumni groups, on-boarding and off-boarding activities, and program, technical and leadership knowledge transfer.

Out of Scope: Internal transfers or detailees, succession planning efforts.

Team Members

- Samantha Haurie, SMD
- Michael Lipka, NASA Safety Center

Key Milestones

- Identify current NASA knowledge capture and transfer processes and activities for lessons learned
- Draft document of available knowledge capture and transfer techniques, tools and best practices.
- Communication plan for sharing the resources across the agency

Additional Notes

- Deliverable is a PowerPoint

Knowledge Processes Team Report

Process Option #1 – Quick Transitions

1) Identify the individual who is departing

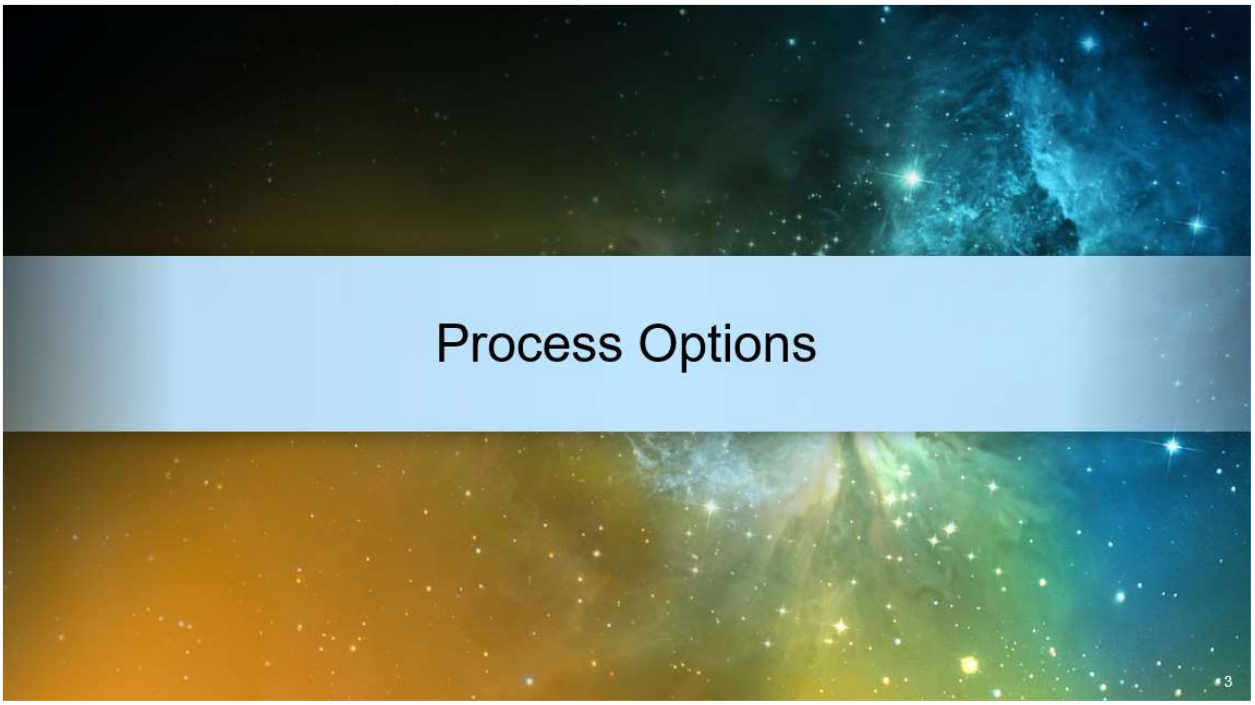
2) Identify the individual(s) who will take on the departing individual's roles and responsibilities

3) Conduct an initial knowledge capture answering:
   a) What are your primary tasks? For each task:
      i. What are the basic responsibilities for this task?
      ii. What policies, procedures, and resources are available?
      iii. Where are all your documents relating to this task? *(Ensure the successor has access)*
      iv. Any best practices, lessons learned, tips, or tricks to share?
   b) What regular meetings do you attend?
   c) Who are your points of contact outside of your organization that you work with regularly?
   d) What additional tips and resources would you like to share?

4) Send the answers to the initial knowledge capture to the successor(s) and schedule follow-up transition meeting

5) Conduct follow-up knowledge captures as necessary between the departing individual and the successor(s) *(These meetings are intended to encourage deeper question and answers)*

Heliophysics Division 2



Process Option #2 – Transitions with long lead times

1) Identify the individual who is departing

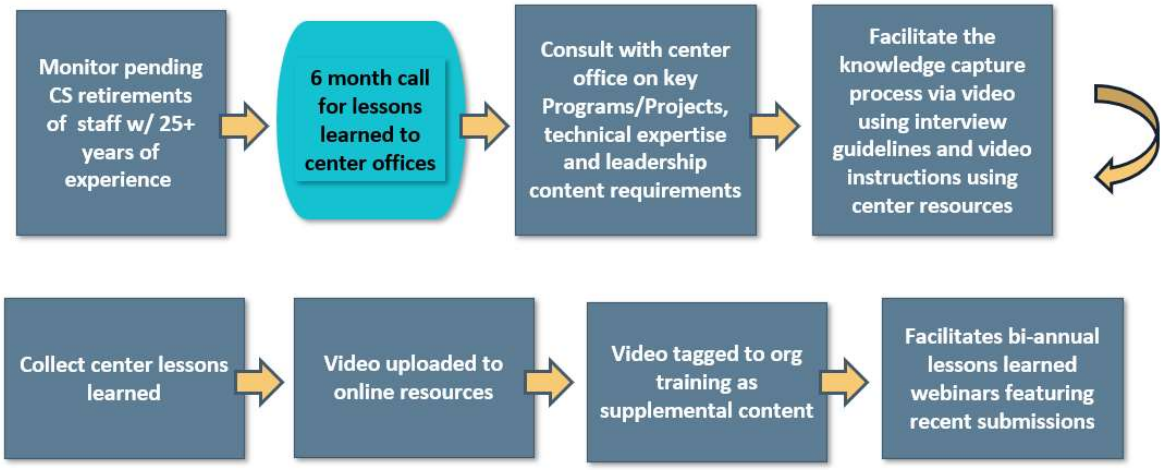
2) Identify the successor(s) who will take on the departing individual's roles and responsibilities

3) Conduct an initial knowledge capture answering:
   a) What are your primary tasks? For each task:
      i. What are the basic responsibilities for this task?
      ii. What policies, procedures, and resources are available?
      iii. Where are all your documents relating to this task? *(Ensure the successor has access)*
      iv. Any best practices, lessons learned, tips, or tricks to share?
   b) What regular meetings do you attend?
   c) Who are your points of contact outside of your organization that you work with regularly?
   d) What additional tips and resources would you like to share?

4) Identify areas where the successor can shadow the departing individual (e.g., recurring meetings, product development, etc.)

5) See one, do one: Have the departing individual show the successor the activity/role/responsibility. Subsequently have the new individual conduct the activity/role/responsibility with the departing individual's guidance and support.

KNOWLEDGE CAPTURE FROM RETIRING EMPLOYEES



Best Practices and Additional Considerations

- Ensure you document any and all knowledge possible
- Remember to ask for lessons learned
- If at all possible, have the departing individual introduce the successor to the team(s) they'll be working with
- Consider asking "What would you have liked to have known when you first took on this role?"
- Document and list any trainings that would be useful for the incoming individual

Appendix E: Onboarding and Connecting

Onboarding and Connecting Team Charter

Onboarding and Connecting Subgroup Charter

Team Goals
• Scoping out a Peer-2-Peer revival (Connects newer employees to senior employees/managers) • Determine what role(s) Human Resources may play in KM related to onboarding approaches (can/will they help us and transfer info. Q-What can KM do for HR?) Survey? • Collect existing onboarding practices (HR) Survey? (Internal NASA Benchmarking with HR? Does HR do the same thing at every Center?) • List other possible activities that would enhance the KM aptitude of new employees
Justification
• Need to figure out how to connect what knowledge is collected via offboarding with what knowledge is needed for onboarding. • HR is arguably where the expertise lies for onboarding • Don't reinvent the wheel
Scope
In Scope: Transferring captured knowledge
Out of SCope: Knowledge Capture (how)

Team Members
• Bart Singer, LARC; Lee Jackson, GRC; Angela Barnes, HQ
Key Milestones
• Outline of Peer-to-Peer approach • Focus group discussions with HR personnel • Documented findings
Additional Notes
Connecting – People who need knowledge to people who have knowledge Onboarding – Formal and informal practices associated with bringing new employees up to speed. Can extend up to 3 years from the start of employment. Some practices could apply when moving to a different group. Using HR as benchmarking SMEs for onboarding Questions from Shirita Nash activity Focus group might be more manageable than broad survey

Appendix F: NASA Safety Center Report

This section includes the report from the NASA Safety Center about their concurrent efforts in knowledge capture and transfer.

NASA Safety Center Knowledge Capture and Sharing for Retiring Safety & Mission Assurance Employees Pilot Program

Cesar A Gonzalez
Health Sciences
NASA Glenn Research Center
Office of Safety and Mission Assurance
2021 Summer Session
September 2, 2021

This final report has been reviewed and approved by Mentor to ensure information is accurate and does **not** contain sensitive or proprietary data.

Signature Michael J. Lipka

Michael Lipka
Glenn Research Center Code NA

September 2, 2021

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NASA Safety Center Knowledge Capture and Sharing for
Retiring Safety & Mission Assurance Employees Pilot Program

Cesar Aaron Gonzalez
DePaul University
NASA Safety Center, Office of Safety and Mission Assurance Internship
Summer 2021
Michael Lipka
NASA Glenn Research Center, Cleveland, OH 44135

Abstract

This internship project focuses on facing the challenge of retaining valuable knowledge as experienced Safety and Mission Assurance (SMA) employees will soon be retiring, leaving with their knowledge and wisdom as they walk out the door. With an increasing population of eligible retirees and little to no systematic approach to capture and share knowledge of retiring SMA employees it is vital to develop a program that does so. It was quickly understood that the majority of SMA employees were seasoned employees with plenty of time working, making their knowledge and experiences much more valuable. As time goes on more experienced SMA employees will retire and be replaced with a new less experienced workforce. This runs the risk of more mistakes being made, more time spent on corrective actions and training, which can lead to an impact on the organization's productivity. With this understanding of the challenge, there is now an objective to create a knowledge capture and sharing process that transfers the experiential knowledge from retiring SMA employees to new SMA employees during the offboarding and onboarding processes.

The use of Lessons Learned is a principal component of an organizational culture committed to continuous improvement. When documented and disseminated properly, Lessons Learned provide an excellent method of sharing ideas for improving work processes, operations, quality, safety, and cost management. They can also help improve management decision making and worker performance through every phase of a project.

Retiring employees are a rich resource of content for lessons learned. The combination of hands-on experience and the long-term perspective of how the work needs to be done or sometimes more importantly, how the work should not be done develops into the wisdom that is invaluable to new employees.

Regarding the NASA Safety Center (NSC), there is concern of losing SMA knowledge and expertise needed to facilitate the continuity of SMA expertise and operations on Programs and Projects. For the foreseeable future, the NSC is challenged to develop a solution for the upcoming retirement wave in order to continue providing high quality products and services to SMA activities across the agency.

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Internship Organization

Established in 2006, the NASA Safety Center (NSC) supports the Safety and Mission Assurance (SMA) requirements of the National Aeronautics and Space Administration's (NASA) full portfolio of programs and projects. Reporting to NASA's Office of Safety and Mission Assurance (OSMA), the NSC focuses on improving the development of personnel, processes, and tools needed to safely and successfully manage risks to achieve NASA's goals. OSMA includes five major organizations (Figure 1), three of which are at NASA Headquarters: The Mission Assurance Standards and Capabilities Division, Mission and Program Assessment Division, and the Institutional Safety Management Division. The NASA Safety Center in Cleveland Ohio; and the NASA Independent Verification and Validation (IV&V) facility in Fairmont, West Virginia.

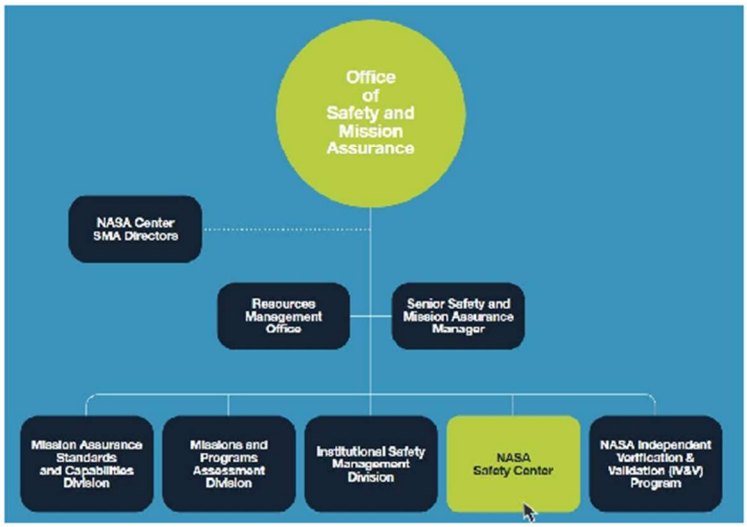

Figure 1: The Office of Safety and Mission Assurance organization chart.

With four main functioning offices within the NSC (Figure 2), the duration of the internship was spent working with the Technical Excellence Office (TEO). Here the TEO group works to continuously improve NASA's SMA workforce to a superior level of discipline proficiency by making effective, structured, measurable training and development opportunities accessible to SMA personnel that will provide support to NASA Programs and Projects to improve safety and success.

Figure 2: The NASA Safety Center organization chart

In all, the NSC and its accompanying offices are a key contributor to OSMA that enables the organization to assure safety and mission success to all NASA activities through the development, implementation, and oversight of agency wide policies and procedures for safety, reliability, maintainability, risk assessments, quality assurance, and software assurance. Functioning as one center of excellence, the NCS strives to NASA's preeminent and sought-after resource for all SMA knowledge expertise, and education.

Main Body

Background

The focus of this project relates to NASA's large population of experienced employees that are eligible for retirement. NASA is known to have a high employee retention as many of their employees have been with the agency for over 10-15 years (Erisman, 2020). With such an experienced workforce NASA has proven that they can provide high quality products and services that advance our understanding of Earth and space. Although having a tenured workforce has its strengths it also comes with its challenges. The challenge being retaining expertise knowledge from their employees as the upcoming retirement wave approaches. This issue is not limited to the NSC, but also pertains to NASA as an organization.

Challenge Statement

As time passes NASA's experienced employees will decide to retire, leaving with their valuable knowledge. It was estimated by knowledge service experts that 41% of NASA's workforce was eligible to retire in the year of 2020 (Forsgren, 2020). Regarding the NSC, there is concern of losing SMA knowledge and skills needed to facilitate the continuity of SMA expertise and

operations on Programs and Projects. For the foreseeable future, the NSC is challenged to develop a solution for the upcoming retirement wave in order to continue providing high quality products and services to SMA activities across the agency.

Scope of Internship Work & Objective

In response to a rapidly retiring workforce, the NSC is exploring the development of a knowledge capture and sharing pilot program that transfers the experiential knowledge from retiring SMA employees to new SMA employees during the offboarding and onboarding processes. The developed pilot program would identify critical SMA knowledge categories, systematically capture retiring employees' experiences during the offboarding process, and infuse the content back into existing NSC learning offerings. This internship focuses on understanding the current state of knowledge capture and sharing services available at the center level for SMA offices, determine a systematic approach to integrate a knowledge pilot into the SMA offboarding and onboarding processes, and recommends next steps that will enable the knowledge capture and sharing pilot program.

Methodology & Deliverables

The methods and activities needed to successfully develop the knowledge capture and sharing plan relied heavily on communicating with NASA's Chief Knowledge Officers, SMA management and staff, along with the NSC's Knowledge Analytics team. In addition, other agency personnel were consulted with throughout the internship. The following methods were used to assess the current state of the situation to develop the pilot program.

- Consult and interview center Chief Knowledge Officers across the agency to identify current tools, processes, and practices for capturing Lessons Learned
- Interview SMA directors and staff at various centers to assess the current state of offboarding and onboarding practices
- Review current SMA employee gains and losses data with NSC Knowledge Analytics Lead
- Apply survey results from Chief Knowledge Officer Agency Working Group survey on Knowledge Capture and Transfer practices during the offboarding and onboarding processes
- Mapped a high-level process from knowledge discovery and capture to infusion to existing learning offerings

Results & Assessments

An assessment was done to better understand the current state of knowledge capture and sharing services at each center and SMA offices. Each center assessment was conducted through a series of interviews with center Chief Knowledge Officers, SMA offices, and the agency Chief Knowledge Officer working group. After analyzing the results, we determined there is no

systematic approach to capture and share knowledge of retiring SMA employees. The following describes the results and assessments found throughout these discussions.

Center Chief Knowledge Officers

The Chief Knowledge Officer is responsible with leading NASA's knowledge management efforts to ensure that the agency's workforce has access to the critical knowledge needed for mission success. Their role within the agency is to develop policies and requirements necessary for integrating knowledge capture across programs, projects, and centers. In addition, they are responsible for establishing, maintaining, and overseeing knowledge sharing standards and capabilities that support the development of NASA's workforce. Through these interviews were able to determine that Lessons Learned are essentially everywhere in a variety of forms across the agency and are not easily shared or accessible to others. Each center functions differently based on their activities, because of this they will create their own center-based Lessons Learned repository and make it accessible to only center-based personnel. Some Lessons Learned can even be found in Directorate, Programs and Project specific repositories as well.

After interviewing the Chief Knowledge Officers, we found:

- Lessons Learned are everywhere in the agency: Lesson Learned Information System (LLIS), APPEL Knowledge Services web page, and NSC Center Lessons Learned web page
- Programs & Projects: Documents from review activities
- Directorate: Collection of Program/Project reviews
- Waiting for retirement is too late to begin knowledge capture program

Center Safety & Mission Assurance Offices

The center SMA Offices are spread throughout the agency and are responsible for their associated SMA personnel and activities. To better understand the office's current state of offboarding and onboarding practices, a series of interviews were done with the SMA administrative staff. There it was found that all SMA employees during the onboarding process are required to complete the NSC's Safety and Mission Assurance Technical Excellence Program (STEP Level 1) training. This training provides technical insight for participants to work in the discipline of SMA with confidence and credibility. It was also found that SMA supervisors are responsible for instructing the new SMA employee on relevant Programs and Projects and can assign further training if needed. Regarding the offboarding process, the SMA Offices communicated that there was little to no process in place for offboarding exiting employees. Explaining that there was no time to organize such a process, and no strategic direction to conduct it.

Chief Knowledge Officer Agency Working Group Survey

In addition to the interview portion of this project, the Chief Knowledge Officer Agency Working Group had been working on a survey that would be distributed agency wide to assess center's current offboarding processes for knowledge capture and transfer. While investigating the existence of a formal offboarding process, it was found that only 11% of organizations have formal offboarding practices with mostly captured knowledge in documents or supervisor training. Another significant finding was that when asked about their satisfaction with the current processes, 67% of the participants where not satisfied and think a better process is needed to capture relevant knowledge (CKO Agency Working Group Survey, 2020).

Discussion & Recommendations

Using the findings from the current assessment, the project team compiled a list of recommendations and next steps to enable the full potential of the knowledge capture and sharing program during the offboarding and onboarding process. The following recommendations were made. Since this process focuses on capturing knowledge through video interviews, the NSC plans to provide this process as a knowledge service, similar to how they approach video webinars.

SMA Offboarding

Here the NSC would monitor the SMA Offices and their staff to identify those who have twenty-five or more years of experience. In a six-month interval, the NSC will have a call for captured lessons and consult with the SMA office about key Programs/Projects, technical expertise, and leadership content they want to systematically capture. Similarly, to how webinars are organized, the NSC will facilitate the planning, execution, and closure of the knowledge capture video interview process using center instructions and resources. Refer to Figure 3 to see where SMA offboarding activities lay within the overall process.

SMA Onboarding

To be more proactive and avoid having Lessons Learned locked in repositories, the project team recommends embedding captured lessons as part of the SMA onboarding experience. This allows SMA Supervisors to train new employees with relevant Lessons Learned to support center focus Programs and Projects. Serving as a center of excellence, the NSC would take initiative and store collected SMA Lessons Learned in OSMA or NSC existing sites to make them available for all SMA personal agency wide. Along with this, the NSC would host a knowledge sharing event in the form of a live webinar that invites SMA personal or anyone interested to review the Lessons Learned capture over the previous six months. Refer to Figure 3 to see where SMA offboarding activities lay within the overall process.

Figure 3: SMA Lessons Learned Capture and Reuse Process

High-Level Process Map

In addition to the recommendations, the project team mapped a high-level process from knowledge discovery and capture to infusion to existing learning offerings for this program. This process (Figure 3) was developed to help centers lead more effective knowledge capture and sharing activities with their experienced SMA employees.

Benefits of adopting this SMA Knowledge Capture and Reuse Approach:

1. Lessons Learned capture for offboarding and use in onboarding offered as a knowledge service for center SMA offices
2. Retirees identified well in advance of retirement
3. Content requirements are center driven based on their Program and Projects and resident technical expertise and leadership experience
4. Content is tagged to appropriate STEP training as supplemental content
5. All center content is available in the SMA Toolbox on demand facilitating the "cross-pollination" of Lessons Learned
6. Engage in active learning via SMA discussion event webinars

Next Steps

Now that the current assessment is complete, and a mapped process is developed, a list of next steps is provided below to further enable the full protentional of this program.

1. Approval of NSC Management
2. Prepare communications messages to inform and elicit center SMA support
3. Develop interview guide for knowledge sharing interviews
4. Support center SMA offices in identifying content requirements and agency, Center and NSC resources
5. Review information architecture for tagging Lessons Learned in STEP and SMA Toolbox

6. Conduct a Pilot with the NASA Safety Center Mishap Investigation Manager and Assessments and Investigations Office Director, Glenn Research Center (GRC) & Johnson Space Center (JSC)
7. Report back to NSC leadership in Q2 FY2022

Conclusion

The project team was able to present to the NSC's management using their supporting evidence, quantitative analysis, and assessments. With this understanding, the developed program is intended to help centers lead more effective knowledge capture and sharing efforts with their experienced SMA employees. Their knowledge is highly sought after, complex, and essential to the productivity of the NSC. If executed, the developed program would bring great benefits not only to the NSC but to the discipline of SMA as a whole.

References

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