Abstract—This paper\textsuperscript{1,2} describes a pilot project at the NASA Goddard Space Flight Center to adopt and deploy a learning process modeled after the After Action Review process used by the military. A process was established, early lessons observed, and an approach to roll-out developed.

This paper introduces a concept for formalizing learning from NASA projects that is modeled on the Army After Action Review (AAR) process. While the AAR was developed to learn primarily from training exercises, it has 25 years of experience-base, theoretical foundations and practical tools that make it a valuable methodology for NASA to learn from. NASA has not paid as much attention to learning lessons from successes being instead overly focused on learning only from mistakes. Without a process for learning from every activity regardless of ultimate outcome, the Agency risks missing out on the bulk of the learning from project work and potentially not really knowing the reasons behind the spectacular successes in addition to the root causes behind the failures.

To distinguish the process at NASA from AAR it was given the descriptive name of “Pausing for Learning” or PFL. The idea is to create a learning event at the end of selected critical events in the life of a project. End of project or even end of mission reflections are good but are too infrequent for an organization like NASA to learn in a timely manner. Also much intermediate learning is lost between concept and launch.

PFLs are integrated into the project life cycle at key points as natural parts of the process. Being facilitated and assembled by outsiders, the key project team members are only required to do a small amount of additional effort. This means that PFLs have the potential to deliver a very high value for a small investment in time and money. In addition to addressing learning needs of NASA, they are an attractive activity that projects have been willing to adopt.

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1. \textbf{THE LEARNING ORGANIZATION}

A learning organization knows how to process knowledge, appreciates the value of shared collective knowledge and grows stronger and more knowledgeable with each activity performed.\textsuperscript{[1]} In order to meet the challenges, take advantage of the opportunities and to best utilize our available resources, NASA needs to make a strong commitment to becoming the best learning organization it can be.\textsuperscript{[2]}

“The United States will develop the innovative technologies, knowledge and infrastructures both to explore and support decisions about the destinations for human exploration.”


Knowledge is central to our new vision. Functioning more like a learning organization that takes advantage of the knowledge we have will be central to our success. We are no longer in a race with other nations. We are in a race with our own human capacities to learn, share and apply what we
can conceive, build and validate.[3] As the CAIB pointed out, NASA has as many managerial limiting factors as it does technological constraints. Alan MacCormack of the Harvard Business School recently pointed out that NASA failed to learn from the Faster Better Cheaper (FBC) era because it conducted post-mortems only on failed projects.[4] This implies that NASA did not always know what worked and what didn’t across its entire portfolio of projects.

2. THE CHALLENGE TO CHANGE AT NASA

The Need for a Plan to Manage Knowledge and Build a Learning Organization at NASA has been highlighted in a number of official documents. Much of the post-Columbia discussion of change has been about the need to change the culture at NASA. The Agency is in the middle of a culture change initiative aimed at unlearning some old behaviors and adopting new ones. Legacy systems may not be reliable enough in today’s environment. Faster, Better, Cheaper, competition for commercial space flight and shifting Federal budget priorities have all changed the environment in which NASA operates. Consider these statements from the CAIB and other Reports about NASA [bold added throughout]:

Based on NASA’s history of ignoring external recommendations, or making improvements that atrophy with time, the Board has no confidence that the Space Shuttle can be safely operated for more than a few years based solely on renewed post-accident vigilance.


Although NASA’s efforts so far are commendable, the Agency must go further. In the current environment, effective management and sharing of knowledge is more critical than ever. The experience of prior managers is not uniformly well documented and made available for the benefit of newer or less experienced program and project managers to effectively utilize in their situations.


The CAIB Report also specifically calls out to NASA the fact that the organization is “not functioning as a learning organization.” Goddard needs to function as fully as possible as a learning organization. Future NASA projects should never accept risk or experience failure because the organization did not apply its best own knowledge.

The Board concludes that NASA’s current organization does not provide effective checks and balances, does not have an independent safety program, and has not demonstrated the characteristics of a learning organization. (p 12)

Columbia Accident Investigation Board (CAIB) Report Aug. 2003

NASA must become a learning organization that by nature learns, evolves, creates and applies knowledge effectively and efficiently. PFLs are a way to help get to the new organizational structure, culture and processes that will enable Goddard to continue to fulfill our unique mission for the American Public, NASA, and the scientific world who have placed their trust in NASA to explore the frontier of space.

3. LESSONS FROM THE ARMY AAR PROCESS

An AAR is “...a professional discussion of an event, focused on performance standards, that enables soldiers to discover for themselves what happened, why it happened, and how to sustain strengths and improve on weaknesses” [italics added]


The Army learned from years of experience with AAR that much of the value in the AAR exercise comes from several key design parameters. [6] First, the focus of the AAR is specific to 1) What happened (events), 2) Why did it happen (cause), 3) How can we improve (action). Second, the AAR is a participant discussion. AAR’s replaced traditional top down lecture critiques. What was valuable about AAR’s was the voice of the team members themselves offering up their views and ideas. Third, the AAR is close to the action in time, space and personnel. Fourth, the AAR does not function as a career review. It is a non-attribution team review of what happened. The team
members participate because they feel free to speak.

Finally, the AAR is part of the overall process whether it be a training exercise, a simulation or a field operation. The action is not complete until the AAR has been conducted. The AAR is a fundamental part of the process built into the project. The AAR method replaced sterile lecture type critiques delivered by judges often some time after the end of the events. The participants were not energized and sometimes defensive about these reviews. While many teams and groups at NASA meet and discuss events after they happen, NASA has no formal process to systematically guide the meaningful collection of learnings in the way the AAR process functions.

4. THE PAUSE FOR LEARNING PROCESS

The PFL can be described as a 3-step process outlined below. Key is having knowledgeable facilitators that are familiar with the topic, the people and process.

Step 1
- Identify when PFLs will occur
- Determine who will attend PFLs
- Select Moderators, Rapporteurs
- Select potential PFL sites
- Review the PFL plan

Step 2
- Review what was supposed to happen
- Establish what happened (esp. dissenting points of view)
- Determine what was right or wrong with what happened
- Determine how the task should be done differently next time

Step 3
- Review objectives, tasks, and common procedures
- Identify key events
- Rapporteurs collect ALL observations
- Organize observations (identify key discussion or teaching points)

5. ROLES & RESPONSIBILITIES

One of the key designs of the PFL is minimal intrusion into project work time. To maintain this, the roles of the participants and the supporting staff who conducts the PFL are clearly laid out here. The facilitator does not need to be an outsider. NASA should consider the PFL facilitator a role to aspire to in project management.

**PFL Project Attendees**

Show up to the event

You may be asked to bring notes or supporting documentation,
Listen to moderator summaries
Be responsive and open to different ideas
You will be asked to re-state portions of an activity
Do not take this as a lecture or critique
- Relate what happened from your own POV
- Explore alternative courses of action
- Handle discovery of errors positively

Leaders should discuss the events with their people in private
Follow-up on needed actions

**PFL Supporting Staff**

Gather attendees: some projects already hold debrief or talk down sessions
Moderator reviews events
- Summarize key events
Encourage participation
- Have junior leaders re-state portions of their part of an activity
Do not lecture or critique
- Ask why certain actions were taken
- Ask how they reacted to situations
- Ask when actions were initiated
- Exchange “war stories”
- Relate events to subsequent result
- Explore alternative courses of action
- Handle discovery of errors positively

Summarize

**Follow-up on needed actions**

After the PFL session is held, the information collected is organized into a visual digital interface for representation over the web. The material is kept in its raw form at the unit level but the PFL contents are easily searchable by the team members for use in learning, extracting important lessons to share up the line and for future planning sessions. From work done with the U.S. Navy, Figure 1 shows a notional picture of what the graphical user interface (GUI) might look like for a collection of PFLs. Development of the software support tool of the PFL process comes after building the learning process since the learning process determines the requirements for the software tool. Reversing this sequence hurts credibility with project teams.

**Key Attributes of GUI for a PFL**

1. Project Timeline
2. Document Tree
3. Project Charts
4. Video Interface
5. Standard Content Tabs (structure)
6. Easy Navigation
7. Interactive Learning
6. THE PFL PILOT AT GODDARD

The Goddard Knowledge Management Office has partnered with Bridgeborn, LLC to design, develop and deploy a PFL process in the projects at Goddard. We started with a pilot for the PFL process within the GOES/POES Program that builds the series of weather satellites for NOAA. In the course of conducting 3 PFL’s to date, Bridgeborn has generated a number of Lessons Learned about the PFL process itself as well as lessons specific to the PFL sessions conducted. Lessons learned about the PLF process fall into 3 categories: lessons for us as PFL developers and implementers; lessons for NASA PFL participants; and, lessons for NASA as a community.

From the perspective of Bridgeborn as contract support to the Goddard Knowledge Management Office, it has been a privilege to be welcomed into the GOES/POES Program. In the course of our interactions with a number of the technical and management teams, we have learned a number of lessons about developing and implementing the PFL process. First, we need to be both listeners and facilitators.

In terms of the PFL participants, we recognize that these are very busy, very smart people. In order for them to fully engage in the process, they had to know first and foremost, that the PFL session would not be a waste of their time. This required us to show them that they as individuals would improve their ability to contribute to their projects, individually and collectively, as well as the quality of their product which enhances the contribution of GSFC to NASA’s mission. It meant that we would have to be minimally intrusive to their daily routine, and make the PFL...
session as efficient and effective as possible. We had to do this while learning enough about what they do to effectively develop and implement the session.

We also learned that NASA as a community is going to have to make some fundamental changes to its culture and systemic processes. First, the notion of “safe space” needed to be articulated and inculcated in management and the technical staff. This would protect and therefore enable the participants to speak their minds without fear of retribution. Second, the PFL is not a top down process but more of a bottom up movement that is of, by, and for the projects and the people who do the work. That means that it cannot be mandated from without, but rather must spawn from within. And third, it will take time for the notion to catch on and be widely adopted. This means that the implementation, tenor, and tone will inevitably be different across programs and projects.

An example of one of the more important lessons learned was that evaluating an RFP is a complex, time consuming process that is simply hard to do. There are few if any short cuts or measures that can truncate the time and effort required to do the job right. This means that the project must allocate enough time upfront having resisted the temptation to under estimate what it really takes to do the job. For engineers primarily focused on designing and building, the RFP process may seem like a diversion. Learning from those who have been through it seems to help with getting the right focus to make it a successful experience for others.

7. SUMMARY OF LESSONS LEARNED

The pilot PFL project at Goddard will enable NASA, other centers and partners to learn how and when to insert the PFL concept into the project management process. The PFL concept is not new. It is based on many years of experience, organizational and behavioral research and practical insertion into project life cycles. NASA has been criticized for not taking learning seriously enough in its organizational systems. Adopting a PFL type of concept will not only build learning into the programs and projects undertaken but also help lead the change the Agency is trying to accomplish towards becoming the best learning organization it can be.

NASA has embarked on a Lessons Learned initiative to extract lessons from across the agency. While it is good to catch up on knowledge that is lying around, extraction methods are not a sustaining design for a learning organization. Learning activities must be useful to the participants and not just future users of the information. This is a critical design flaw copied over and over in corporate and government lessons learned processes. PFLs like AARs are designed to benefit the participant as much as future users. This is what makes the PFL an effective tool for establishing the learning culture that NASA needs now. When coupled with effective lessons learned, technical standards and safety reporting systems, PFLs can play an important role in creating an effective learning culture.

REFERENCES


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