



JPL Knowledge Management

NEWSLETTER



Issue 1 - Spring 2014

Office of the Chief Knowledge Officer

Why Does JPL Need KM?

By David Oberhettinger

The JPL knowledge management (KM) program seeks to make better use of what JPL knows—to help capture, retain, and share the wealth of technical knowledge that is accumulated by the institution, by our projects, and by individuals over the course of our pioneering space-flight projects. JPL is not unique in facing a serious knowledge retention challenge with the attrition of our most experienced personnel. (NASA has three times as many employees over age 50 as under 35; twenty years ago the numbers were equal.) However, replacing this intellectual capital is particularly challenging for JPL because nowhere outside JPL and its contractors does there exist an equivalent hub of expertise in deep space system development and operation. Further, sharing JPL knowledge among projects is key to our success with future projects.

The JPL KM program responds to a NASA KM initiative. In November 2013 the Agency issued [NPD 7120.6](#), “Knowledge Policy on Programs and Projects,” which calls for each NASA center and mission directorate to appoint a Chief Knowledge Officer (CKO) and implement a KM program.

JPL is planning a four-step knowledge management strategy to *make better use of what JPL knows*:

- Determine what JPL technical knowledge is most critical to retain and share.
- Identify the gaps in retention/transfer of this critical knowledge.
- Implement measures to close the gaps.
- Establish a continuous improvement process for KM.

The JPL Office of the Chief Knowledge Officer (OCKO) is supporting the following institutional KM initiatives:

- [JPL KM Strategic Planning](#)
- Assessing the KM practices of leading companies
- Conducting JPL key knowledge/ knowledge gap interviews
- Case study training
- Video capture (JPL Tube) of high value knowledge
- Pause & Learn (PaL) sessions for project managers and for project system engineers (PSEs)
- NASA EDL Repository ([EDL-R](#))
- Maintenance of a formal JPL Lessons Learned Committee
- Coordination with NASA and NASA Center KM efforts.

The “JPLer” as a Knowledge Champion

By Minh Le

We generally recognize that the knowledge accumulated over a JPL project (or over a career) has lasting value to the institution, even after a project or task has concluded. JPL maintains libraries and sponsors other tools and activities aimed at capturing and sharing project, line organization, and personal knowledge for reuse. However, the success of these knowledge initiatives rests largely on the individual employee. There are a variety of daily actions that the individual JPLer can take to help support the Lab’s continued success.

- **Knowledge champion.** Promote knowledge husbandry and reuse by serving as an advocate in your line organization and project(s).
- **Knowledge broker.** Alert your co-workers to knowledge needs, and link them to information resources beyond those you now share.
- **Knowledge steward.** Take the initiative to archive (i.e., not just on your hard drive) knowledge that may be valuable to JPL at a later date.
- **KM innovator.** Suggest new JPL initiatives or improvements to KM-related services and tools.
- **KM facilitator.** Facilitate knowledge capture and sharing venues, such as noontime seminars and lessons learned exchange, and assure the information is retained for later use.

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KM Benefits the Mars Program

By Rob Manning, Mars Program Engineering Manager

For decades, JPL missions have relied on the evolutionary re-use of designs, systems, concepts, hardware, software and patterns developed by people that came before. The Mariner series of spacecraft were directly built off the Ranger series, each successively improved and expanded before the Mariner series culminated in the Viking orbiter and Voyager spacecraft in the 1970’s. Later missions like Mars Pathfinder directly capitalized on the designs and hardware developed for the Cassini spacecraft (in fact many of Cassini’s components and assemblies flew on Pathfinder before they flew on Cassini). Of course the incredible and manic 3-year development of the MER rovers would not have been possible had they not been based on the detailed design, architecture and concepts developed for Mars Pathfinder and Sojourner rover.

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There is no way that JPL could have successfully embarked on the fantastic voyage that is MSL, without the rich and deeply authentic experiences, knowledge and products that have accumulated since JPL embarked in the race to explore the universe beyond our Earth in 1958. The patterns, nomenclature, concepts, designs, standards and products that have been layered on mission by mission since then have formed the bedrock behind the successes of JPL (and our partners) recent triumphs.

As new mission and instrument concepts and new architectures and technologies are invented, these new systems will add ever more exciting (and perhaps unimaginable) layers of complexity upon our tall stack of knowledge. Our focus will of course be on developing and testing these new layers, but to maintain the integrity of these new layers, we cannot lose sight of the many layers that lie below.

Despite the advent of the internet and its incredible search capabilities, for the past decades we still rely on the memories of our teammates to remind ourselves about how and why those layers work. Over the span of a handful years, this approach works very well. But over longer time spans this approach breaks down.

We can try to document what we have done but in the rush to get the hardware to launch, we place insufficient priority on retaining and documenting knowledge for the next projects.

We can attempt to circumvent this by simply copying the work done by others. This can work well when the application of similar to the original design intent, examples include MPL->Phoenix, MSL->Mars 2020, GRACE->Grace follow on, OCO->OCO-2, etc. These approaches are most successful when the original developers are still available for support and consultation.

But we could do better. Time and time again we discover that core knowledge and capabilities become permanently lost or nearly forgotten. Only with great expense can these be re-invented and restored. For example, it took years of effort to re-invent the mono-prop throttled engine technology used on Viking in the 1970's so that MSL could control its landing velocity. Today, with the advent of GPS, we are witnessing the end of the commercial use of radar as terrain proximity sensors. Without GPS at Mars we find ourselves struggling to keep high precision Doppler radar capability alive so that future landers to Mars can land safely.

The vast layers of experience and knowledge that we gain during the development and operations of project/mission have huge residual value to JPL and NASA. If we could do a better job of capturing intellectual capital for reuse and feed-forward, our costs and risks for the next mission can be greatly reduced while we also push the boundaries of robotic exploration.

NASA Sponsors JPL KM Sessions



*Top: Dr. Edward J. Hoffman
and Dr. Edward W. Rodgers*

During the week of February 17, Dr. Edward J. Hoffman (NASA CKO) and Dr. Edward W. Rogers (NASA-Goddard CKO) visited JPL to support the JPL knowledge management program. Dr. Hoffman conducted Masters With Masters interviews, in which master practitioners explain their craft. Interviews with Janis Chodas, Richard Cook, James Erickson, and David Lehman — all experienced flight project managers — were broadcast on JPL TV. Expect the full videos to appear on the [Masters with Masters YouTube site](#) in the near future.

Dr. Rogers is the recognized NASA expert on institutional learning utilizing case studies, a methodology pioneered by the Harvard Business School. NASA-Goddard has developed over 50 case studies to enhance learning at workshops, retreats, and conferences. JPL is interested in the potential for case study presentations to make mission knowledge attractive and engaging by involving people in the decision making process. Dr. Rogers trained 5X management on the [case study methodology](#), and he conducted four case study sessions at different venues including the monthly JPL project managers' meeting.

Video Capture of Decision-making and JPL Know-How

"Now why did we decide back then to set the value of that software alarm to 'Off' prior to launch?"

Video capture of important technical interchange meetings and noontime seminars has previously required use of professional camera operators, and it has been impractical to hunt for a key 90-second snippet among hundreds of hours of recorded video. But today you can:

1. Record a meeting or class using your personal cellphone or camera.
2. Upload the video to [JPL Tube](#), which generates an indexed and searchable transcript that can take a user directly to the video snippet of interest.
3. Choose to limit the individuals who will have access to the JPL Tube video.

Here are a few considerations:

- Some attendees or managers may be sensitive to the recording of decisional meetings.
- Depending on the conference room and the camera that is used, a portable clip-on floodlight may help to illuminate the speaker's face; and an external microphone may improve the accuracy of the JPL Tube transcript.
- Each file upload to JPL Tube is limited to 4GB, so you may need to use a lower resolution camera setting or split large files into multiple uploads.
- Obtaining clearance of the video for public release is not mandatory: JPL Tube is accessible only to U.S. Persons within the JPL firewall.

The “JPLer” as a Knowledge Champion

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- **KM leader.** Section and division managers recognize knowledge capture and retention as a priority, reflected in employee performance reviews.
- **KM collaborator.** Network with knowledge champions in other organizations and technical disciplines, and recruit new knowledge champions.

JPL is a world-class innovator, but our success is based on a solid foundation of knowledge about what works and what has been found to be less effective. Often, knowledge that we have failed to retain has had to be generated once again. And retaining this knowledge is especially important given instances where we re-fly previous spacecraft and mission designs. Each of us has the power to actively husband knowledge that might be key to JPL’s continued success, and the JPL KM program is here to help you.

JPL Knowledge Management Newsletter

Jet Propulsion Laboratory

The JPL Knowledge Management Newsletter is intended to promote the capture, retention, and sharing of JPL intellectual capital. Please alert us to any ongoing knowledge activities:

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