Preserving Nuclear Grade Knowledge

by Bob Lange, Learning Technologies & Services
DOE/NNSA - Kirtland Operations
Managed by Honeywell FM&T

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When people think of the government they think of the President, or Congress, or the Internal Revenue Service (IRS), but there are thousands of people in government-related jobs doing things most don't really notice everyday. You can find them everywhere, from the space science folks at NASA, to the Federal Bureau of Investigations (FBI) watching out for the bad guys. There are Rangers, and Social Workers, Nurses and Agricultural Managers. They are people working to keep the many facets of the USA rolling. One very diverse bunch is The Department of Energy (DOE) , a group who is expanding the ways we make and save energy to power our cars, homes, and businesses. Tucked away under the DOE is the National Nuclear Security Administration, the NNSA is an agency that maintains the safety, security, and reliability of the U.S. nuclear weapons stockpile. It works to reduce global danger from weapons of mass destruction. It provides the U.S. Navy with safe nuclear propulsion, and it responds to nuclear and radiological emergencies in the United States and abroad, and it supports efforts in science and technology*. (* DOE/NNSA/KCP website info)

NNSA's Kansas City Plant (KCP), which is managed by Honeywell Federal Manufacturing & Technology, runs Kirtland Operations (KO) in Albuquerque, New Mexico, neighbor to Sandia National Laboratories (SNL). Kirtland Operations has always been a helper organization to SNL, and other national facilities. SNL is the country's brain trust for design and development of everything from nanotechnology to the next generation of energy production methods, and weapon systems. KO and the KCP provide the NNSA with their manufacturing needs for maintaining the nation's nuclear stockpile.

When that's your product, you better do it right, the first time, all the time. The desired result is that if the "device" were a car, it would be so reliable that you could leave it in the arctic for 20 years, bake it in the desert for 20 years, and when you turn the key it starts perfectly the first time. That level of performance requires an exceptional workforce. Usually, you will find enough letters after an engineers' name, to make soup. One such engineer recently retired after more than 44 years! He's not even the longest tenured person we've come across.

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That means, when someone retires, often after 30-plus years of service, they have accumulated a lot of tacit knowledge, gained from years of experience at the job, and the new guy has to pick up that job with perfection. Realistically, it takes approximately eight years for new engineers to come to parity with older, experienced engineers at this level of science.

Since you can't simply suck the brains out of an old engineer, and pass on the subtle touches, and knowing actions learned over the years and put them in a jar, there is a need for a process of effective capture, storage, and retrieval. The Knowledge Preservation Program (KPP) managed by Honeywell FM&T is designed to reduce that time, saving big labor and wasted material bucks.

That process was developed by the people at KO, Learning Technologies and Services (LTS) group in Albuquerque, New Mexico. School was never like this before. From training support for DOE/NNSA Federal Agents at training simulations across the country, complete with exploding simunitions, and laser equipped automatic weapons, to classroom training, on-location training, and process documentation, KO's LTS is a major multimedia production and documentation hub. By using advanced degree educators and experienced media professionals to capture and process many different types of work experience and technology, it has earned a place as an educational "skunk works," who knew?

Back in the day, way back, say about 1988 a group of video and film folks then employed by EG&G then AlliedSignal, now Honeywell FM&T, began to use the latest (then) technology. 10" Laser discs, were the media to create interactive "shoot, or don't shoot" scenarios for law enforcement to train on. Back then, it was really cool and very realistic. Now you can put the same media on just about anything. Those first days of interactivity in video, led to CD-based, and then larger desktop-based learning products using freestanding media and database stored media. That early group exists today at KO's LTS, facility in New Mexico. It's the state with the hot air balloons, and green chili. Maybe you know our Governor? He ran for President. Mmm, maybe not.

LTS developed a Six Sigma Process Map-based program, that integrates video, stills, audio, 3D animation, and documents, into an HTML-based interface drawing from a vast database of items. It sounds simple, but the integration of the end product with the team that is going to use it is the

key. The KPP was developed in the mid-late 1990's. DOE formally recognized the need to fully implement it in 1998 (DOE-IG 428).

Ted Leamons, manager for the group that produces the program, put it this way. "As aging baby boomers retire from our workforce the loss of knowledge assets is of great concern. Our Knowledge Preservation Program was conceived with the idea of retaining some of this critical knowledge, in selected key areas. Recognizing that something needed to be done, we launched our program with the idea of getting what we could, in selected areas deemed vulnerable, before it walked out the door." Ted added, "The true value of the knowledge gathered is a lot like life insurance, in that its value is not always recognizable at the time of paying the premium year after year but is very important to have it in place." The program has been continuously refined over the years it's been in operation.

The NNSA's KPP not only hopes to keep the tacit knowledge that walks out at retirement safe at home, and operational, but also shorten the time it takes for new engineers and technicians to come up to speed. With over 100 critical processes preserved so far, well, so good! The program is being used by engineers and technicians coming into the nation's security asset facilities.

Bob Qualls, who started with the group over 35 years ago working in film, helped develop the methods used to shoot for "KPP". By having the lead video shooter and editor on the Pre-Production scouting and content gathering phase, right after process mapping, the final product has fewer errors and the shooting is synchronous. Everyone is on the same page. This allows production levels to rise as the amount of wasted motion is reduced, the team knows where they are going, what they are after, and can estimate with authority what it will take. Also using better glass, lighting properly and putting investments only in gear where the result will generate value to the learner. That helps the managers bid the jobs tighter too. Costs have fallen in recent years. It's not like writing and shooting a standard script though.

Diane Miller, Project Lead for many of the productions collects the content, works with the process owners to create the key document that drives the production "I've gotten everything from

a complete set of pristine Six Sigma process maps to a list of items on a cocktail napkin. The process maps are the framework from which the other elements of the program hang. They provide structure and context to otherwise seemingly disjointed information. The way we present information is in context to the process, and this makes our program more efficient than traditional search, engine-based knowledge management efforts".

Its starts with a meeting over content, including work flow, to decide what is critical, and what's not. It's more detailed than a standard script, by the time it gets to the shooting phase, we call it a matrix. The matrix is the master document for the project, indicating what the process is, and sub-sets of that main process, the steps by steps, the overviews, the filenames for the future edited clips, the shot list and how it all fits in the final program.

Once the matrix is in order, the shoot can be scheduled. Sometimes it's broken into interviews with the subject matter experts at the studio, and the location shooting at plants and laboratories, or the whole thing can be done at once. It is content driven; the goal is to find the nuggets of undocumented technique that have slowly worked into the process over years of working. Catching and working those through the process is like finding gemstones in the dirt. Not unlike panning for gold. As you document the process, you discover the tiny bits of gold that may make the process 90% successful rather than 40%.

When the big production day comes, it's an early start. Engineers like to start early, and leave early. Call times can be as early as 5:30 a.m. Often, your location is a half-mile hump with gear, it's a system starter, that's for sure. Sometimes you'll go through layers of security, which is an instant time killer.

It will often be one of three Double Shot Venti mornings. The crew most times consists of two cameramen, one assistant and one project leader. Everyone works cables and gear when the time to move comes. Where this group goes, big crews are not allowed, so everyone plays a role or two. In the rare case more help is needed, the crew can expand using contract, and affiliated colleagues.

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Like Bob Berry and Dustin McEntarfer in KCP, two very highly qualified, long-time video professionals that are familiar with the client and process. They help elevate the product production value without carry the cost full time. The Subject Matter Expert (SME) interviews can take place at the location, or in a studio setting. The KPP crew uses Lowell Rifa soft lights with egg crates to control spill and get that soft but to the point look and Lowell pro lights to catch the holes around machinery. The camera gear is a Sony D-55 camera head with a Fujinon 20x with extender. Sometimes the subject is too big for a scope camera but just right to use the extender, standing by is a Canon wide angle. Most everything fits on a large Magliner cart with the parade consisting of a 8' jib with robo-head, a Sony D-55/PVV-1, the O'Conner 35L tripod/head assembly with pedestal on dolly wheels, a Sony PD 170 & microscope camera, monitors, and the cart full of the usual accomplices, y'know, sparkling water and a bowl of M&Ms with no red ones. Well, maybe not. See, you can't actually bring food items into most of the locations so no M&Ms. It's a lot of work for a small crew, but it's like any traveling shoot group, eventually you get down to the essentials to do the job. After nearly a decade of working on these projects, the production teams are very efficient, and fun to be with too.

Imagine seeing high precision technicians grinding out gears the size of one quarter of an ice cream sprinkle, or high-energy lasers and pulsed power systems applied to hybrid microcircuit production, Then, there are the hydro-form presses the size of a building, and chemical processes that are like something off the Discovery Channel on steroids. There are some serious hazards in some areas, but the NNSA and Honeywell have worked to eliminate, mitigate and control them to the point where it is a safer work environment than most people have. Honeywell has manufactured some of the NNSA's most intricate and technically demanding products at the KCP. It's some very interesting non-broadcast subject matter. It makes for an exhausting few days of shooting, then weeks of editing on one of three Avid Media Composer systems. The result can be from a few dozen, to over 100 clips that range from a minute to five minutes, for each program, which are compressed and fed to the database to interact with the other elements of the program. Larry Heard, Senior Instructional Specialist, works to keep the database straight and uploads the compressed files. "The database functions as a knowledge management system, for rapid retrieval

of the media. We also create CD, and DVD presentations of the completed program". Of course, access is tightly controlled by an intense IT department.

America has an amazing workforce of incredible minds that are unsung heroes of our national security. They are scientists and technologists who are now approaching retirement, with incredible skill sets. These Americans don't make a fortune, don't get fame, never will, but they do get the ability to save and pass on their hard fought experiences to the next generation coming into the national security business. The DOE should be commended not just for trying to help us all get another mile from a gallon of gas, and turn wind into power, but for also saving a huge brain trust from walking out the door and leaving America's ability to defend itself less capable. The NNSA and Honeywell FM&T through this particular KPP effort are capturing that rare tacit knowledge right now, as fast as possible, for future generations to use it, rather than lose it. Working as a creative in this industry, is not for those who seek the limelight, or big bucks, but the personal satisfaction and feeling of contributing to the nations assets is great.

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PICTURES:

Videographer Bob Qualls (right) meditates on shooting one of the countries top chemical engineers, Don Graczyk (center) at Argonne National Laboratory.

Videographer Dustin McEntarfer of the Kansas City Plant moves Bob Qualls and camera into position at a facility in Texas.

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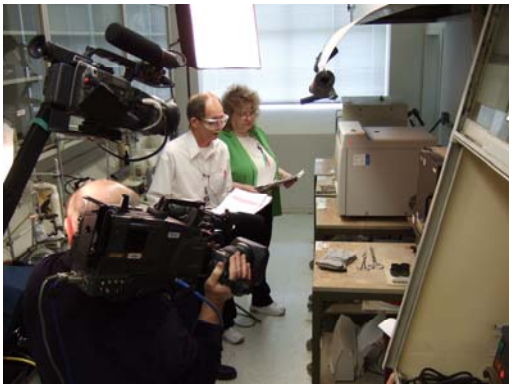

Don Graczyk does his process; Diane Miller keeps her eye on the accuracy of the capture.

Bob Qualls, Don Graczyk and Alice Essling, shoot chemical process.

Bob Lange and Bob Qualls ready to ship crates of gear back home after shoot.

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Bob Lange on Avid Media Composer at Air Park Facility, New Mexico.