A Personal View
(Celebrating 50 Years)

Summer 2014

Director's Comments

By Christopher N. Dunn, P.E., D.WRE

As you can see from this, the 50th Anniversary edition of the Hydrologic Engineering Center (HEC) Newsletter, we have taken a different tact with regards to the type of topics we included in the newsletter. Typically, our newsletters are filled with articles about new features available in our software or maybe something unique about a project we are working on. Instead, for this newsletter, we wanted to offer a more personal touch by highlighting some of the people within HEC and behind the software and the support. While HEC is typically known for our software, it is really the people that make HEC a special place to work. We could feature more articles about some of the cutting edge work we are doing such as introducing two-dimensional capabilities in HEC-RAS (I truly believe adding this capability in HEC-RAS (River Analysis System) will revolutionize how hydraulic modeling will be performed by the USACE and the profession). Instead, we decided to focus on the people who make HEC tick.

For fifty years, HEC has had nearly the same mission: perform research, conduct training, and provide technical assistance in the application of hydrologic engineering methods. Yes, we perform software development as

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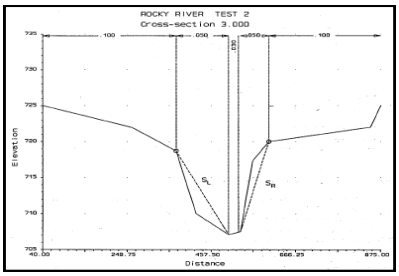
Bill Eichert & HEC Software

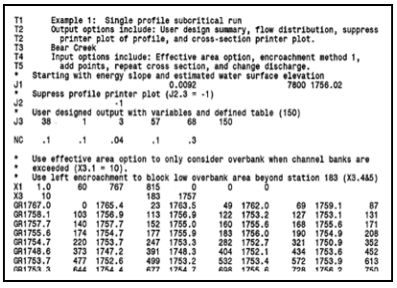
Darryl Davis, P.E., D.WRE

Bill Eichert, HEC's second Director, was an early addition to the HEC staff, coming from the USACE Tulsa District. While in Tulsa, Bill began development of a river hydraulics software package (then entitled "Backwater Any Cross Section") and the move to HEC was a natural progression of his interest in developing hydrologic engineering computer software. His fledgling river hydraulics program soon became HEC-2 (Water Surface Profiles), which at its peak use was world-wide, perhaps the most widely known and used civil engineering software program. Bill would continue to work on HEC-2 and develop another landmark hydrologic engineering software package (HEC-5, Simulation of Flood Control and Conservation Systems) even after he became the HEC Director in 1972. Bill led HEC from the era of punched cards, through remote computing via terminals, to the personal computer era. Bill would likely highlight, among others, the following achievements for his time at HEC and his tenure as Director.

HEC-2: With his own personal efforts, and with the help of many under his direction, this software package became a world-wide standard for steady flow river hydraulics computations; it was the first HEC program adapted to the personal computer. When the National Flood Insurance Program (NFIP) began its mapping efforts in earnest, HEC-2 became the workhorse for the program. Bill conceived of the idea of 'encroachments' as a way of quantifying the 'floodway' concept for the NFIP and programmed the capability into the program. The



current widely known and extensively used successor to HEC-2, HEC-RAS, stands on the back of the pioneering work led by Bill in developing HEC-2. By the way, HEC-2 is still used in many parts of the world.



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T1    Example 1:  Single profile subcritical run
T2    Output options include: User design summary, flow distribution, suppress
T2      printer plot of profile, and cross-section printer plot.
T3    Bear Creek
T4    Input options include: Effective area option, encroachment method 1,
T5      add points, repeat cross section, and change discharge.
*   Starting with energy slope and estimated water surface elevation
J1                    0.0092                    7800 1756.02
*   Supress profile printer plot (J2.3 = -1)
J2                    -1
*   User designed output with variables and defined table (150)
J3    38      1       3       57      68      150

NC    .1      .1      .04     .1      .3

*   Use effective area option to only consider overbank when channel banks are
*   exceeded (X3.1 = 10).
*   Use left encroachment to block low overbank area beyond station 183 (X3.4&5)
X1  1.0     60      767     815     0       0       0
X3  10                      183     1757
GR1767.0        0  1765.4      23  1763.5      49  1762.0      69  1759.1      87
GR1758.1      103  1756.9      113 1756.9      122 1753.2      127 1753.1      131
GR1757.7      140  1757.7      152 1755.0      160 1755.8      168 1755.6      171
GR1755.6      174  1754.7      177 1755.9      183 1756.0      190 1754.9      208
GR1754.7      220  1753.7      247 1753.3      282 1752.7      321 1750.9      352
GR1748.6      373  1747.2      391 1748.3      404 1752.1      434 1753.6      452
GR1753.7      477  1752.6      499 1753.2      532 1753.4      572 1753.9      613
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HEC-5: USACE did not have a reservoir model for performing flood control evaluations so Bill

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In This Issue:

Director's Comments (continued)

well but that has been through a natural outgrowth of our mission to bring new technology into the hands of the practitioner. And yes our mission grew to include water resources planning as well but to say it simply, our job has always been to create cutting edge tools and techniques and put them into the hands of the practicing engineers and planners throughout USACE and the profession. We are supposed to bridge the gap between state-of-the-art technology being created within academia, HEC, and other research organizations and make it available as state-of-the-practice tools and techniques for field use. As history demonstrates, the people from HEC have been very successful in meeting this mission.

As we prepare for our 50th anniversary in late June, we have been interviewing a number of current and former HEC employees. Excerpts from most of these interviews will be included in the 50th Anniversary Book that we are preparing to commemorate the fifty years of HEC's activities and impact on the profession. The 50th Anniversary Book, which will be available later this year, electronically and a few hard copies will be printed as well, will include some material from the 25th Anniversary Book "Hydrologic Engineering Center – A Quarter Century, 1964 – 1989", but will also provide some of the human touch that made and makes HEC such a wonderful place to work. When it is completed, we will post it on our website as well as send out a notice through our normal mailing channels.

We considered writing a newsletter that highlighted the evolution of hydrologic modeling through the decades but decided that our 45th Anniversary Newsletter did a good job of that already. Sure the articles included in that newsletter could be updated to cover the activities of the last five years but that information will not be lost as we will include that information in the 50th Anniversary Book. I hope that is not too confusing. So like I said earlier, the focus of this Newsletter is to let you know a little about the people from HEC. We asked them to tell something special about their time at HEC; a mentor, a project or an experience they have had that made a lasting impression on them and demonstrated why HEC was special to them.

So I suppose I should start by providing my own HEC experience. I have many experiences that I could relate such as when I was walking around Washington D.C. after dinner with the former Director, Darryl Davis, and how he told me how special a place HEC was and how special the people were. I knew Darryl wasn't one to heap unwarranted praise on an institution or an individual so that admittance was huge for me and left a lasting impression. However, that is not the story I want to highlight for this newsletter. Instead, I want to talk about the interesting work relationships we have here at HEC. It may seem odd and perhaps uncomfortable even to the outsider but for some reason it seems to work here. First, let me preface my remarks by saying that I did not start my career at HEC. Rather, I came from the Federal Highway Administration so as I entered HEC in mid-career I had a certain idea as to how I thought collaboration worked. Then I went to my first internal Corps Water Management System (CWMS) development meeting at HEC and I was quite surprised about the lively and at times heated but open and uncensored debate that occurred. The CWMS software suite includes pieces of software from each of the three divisions from the Center so ideas came from a "round table" and not just from one POC. While it is important to note, the success of CMWS is predicated on the ability of many people within the Center working toward one common goal and at times sacrificing their individual software commitments for the need of CMWS, it isn't always easy to convince a number of highly intelligent, educated and motivated Type A personalities to put their personal feelings behind for the pursuit of a common goal. But, somehow it happens. That is the type of people we have at HEC. They can put their personal, professional goals aside for the common good. They may not always be happy about it but they understand the need and they act professionally in their charge. After all, collaboration is a must if we are to be successful in meeting our mission of bringing tools to the profession that they will actually use.

There must have been ten to twelve people in the room that day and they debated on the future of the software, the requirements, features, priorities, funding allocation, usability, data, software distribution and everything in between. While rank was respected, everyone with an opinion was heard but at the same time, any idea could be challenged along the way. It was the intensity or perhaps the passion that struck me. The level of technical discussion was very high. Since I

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Director: Christopher N. Dunn, P.E., D.WRE

Water Resource Systems Chief: Lea Adams, P.E, D.WRE

Director's Comments (continued)

was new to the process and the Center, I did not weigh in but I thought, surely, this meeting was an anomaly and other development meetings would be less tumultuous. However, I found the CWMS development meeting to be the norm rather than the exception. Almost all development meetings start with an agenda and a Lead but at times, the meetings can turn into more of a brain storming session as unique ideas are introduced and then hotly debated as to their relevance and their ability to be included in the software system. To an outsider, they might see this process as completely chaotic and somewhat uncomfortable as friends and coworkers review and dissect ideas without too much concern as to who introduced the idea. Ultimately, everyone has the same goal in mind and that is to build software for the profession that is useful and intuitive to use. However, how we get there often treads on feelings. Yet as the software becomes better, hard feelings seem to heal. Interesting? In fact, typically, right after one of these hotly debated meetings, many of the participants go out to lunch or on break and talk about family, sports, politics or current events as if the meeting they were just in had never happened. How do people make that emotional switch? If I knew that I wouldn't be a Civil Engineer. It just works.

So why does HEC work like this? From what I have been told, this is nothing new and HEC has worked this way for years. Obviously, much of HEC's success has to be attributed to the former leadership. The Directors set the vision, listened to the staff, at times made some very uncomfortable decisions and then cajoled, motivated, praised and used other forms of "encouragement" to move the Center in a certain direction. Sometimes these strategies and visions were not popular but there are many examples of where a new direction for the Center paid huge dividends. One clear example was the implementation of "NexGen" which was a coordinated process to modernize HEC's software suite. In retrospect, I'm not sure there are too many people who would say the NexGen decision was bad one. After all, that process brought us tools such as HEC-RAS and HEC-HMS. Another example was when all the engineers at HEC were told they were going to use HEC-DSS (the Data Storage System) to read and write data from their software. I wasn't here then but I'm sure there were many debates. "Why do I have to use DSS? I can build my own data system." Or "Why are we building our own data storage system when some other agency, university or private enterprise already has a data storage system that meets most of our needs". Can't you just hear it? I have to say, somehow they succeeded at not only creating HEC-DSS but also getting everyone at HEC to accept it and use it with their software. I'm sure Leadership had something to do with that decision. The creation of DSS has to be one of the greatest success stories within HEC's history. DSS has been and continues to be the foundational database for all software at HEC. It allows us to build integrating tools like CWMS and HEC-WAT (Watershed Analysis Tool). It has been so successful that other agencies have adopted it as well.

Perhaps, it is the many success stories we have had in the past like the development of HEC-DSS that shapes us; where those at HEC accepted the decision to build and use a product that met the needs of all but understood there would have to be some sacrifice to each party. Perhaps, these highly driven, highly educated people who are quite confident in their own knowledge and skills see that, at times, it is to HEC's and their advantage to put those qualities aside and to work unselfishly and collaboratively to build a product that is greater than any tool they could have built on their own. Perhaps, it is the Leadership that is directing the process. Maybe, it is all of these things combined. I don't know, but it works. Our fifty year history certainly suggests that is the case.

Chris Dunn, P.E., D.WRE
Director

Bill Eichert & HEC Software (continued)

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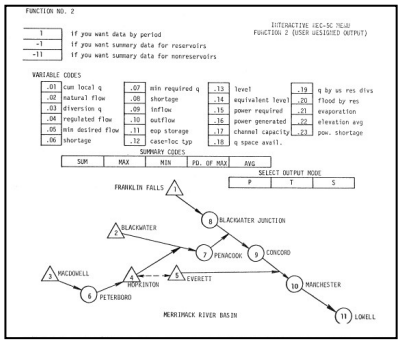
undertook to extend the basic monthly time-step simulation program (HEC-3, Reservoir System Analysis for Conservation) to include system-wide flood control

operations. The outcome was HEC-5. The program was extended to include hydropower, water quality, and other conservation simulation capabilities. HEC-5 became the central core software when HEC, under Bill's leadership, ventured into the realm of real-time water control management. An expressive HEC staff member once declared (and still does!) that HEC-5 is "the free world's most powerful reservoir simulation program!". As with HEC-2, the successor to HEC-5, HEC-ResSim (Reservoir System Simulation), stands on the back of the pioneering work by Bill in developing HEC-5. And again



by the way, HEC-5 remains in use in many parts of the world.

Software distribution: An important legacy of Bill Eichert was his steadfast commitment to the belief that HEC software should be in the public domain for access and use by all. This commitment became challenging when copyright laws were interpreted as encouraging Federal (or any other) software development individual to copyright the software for their own purposes. As security concerns grew, and potential for marketing Federal software as an income source arose, the challenge became even more difficult. Today's widespread availability of HEC software owes much of its achievement to Bill's commitment.

The Mustang & HEC Family

Penni Baker

June 2014, fifty years ago the Hydrologic Engineering Center (HEC) was created along with the Mustang. Both are industry standards and still going strong.

Forty years ago (September 1974), I started work at HEC. I was three months out of high school, had been a Teacher's Assistant for a Business Teacher who encouraged me to take a test to get on a list for Federal jobs. Fortunately, I made the list and received two other job offers right away. The offer from HEC was the third one and in those days if you turned down number three you were removed from the list.

I didn't drive (no Mustang) and my interview was in August, so my father drove me to Davis and my brother tagged along. After climbing the stairs to my interview, I was greeted by John Dralle who gave me an overview of HEC, and then I was interviewed by John Peters. While the interview was going on, other HEC staff entertained my Dad and brother. My brother was allowed to play on a computer terminal, funny thing he became a Network Administrator for a major medical facility in Sacramento designing networks. HEC hired me and my first day of work was 3 September 1974, I was part-time and was hired to finish (typing) the IHD (International Hydrologic Decade) volumes (twelve). I worked for the Training and Methods Branch. Soon I was assisting in the mailing out of publications, training course materials, and HEC software. In those days, we mailed software on computer cards, one piece of software could be eight boxes of computer cards. After three years of

The Dream Machine

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The Mustang & HEC Family (continued)

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doing this and finishing the IHD volumes, I was hired permanently.

I almost didn't stay, about a month after I was hired one of the programmers got into an argument with the computer operator. She was about 8 ½ months pregnant at the time and he made her cry. I was very shy for the first six months of work and I thought what kind of a horrible place I had gone to work for. That turned out to be a bump in the road. People like John Peters, Ken Brooks, Art Pabst, and John Dralle treated each other with respect and were very helpful to me. My first mentor was John Peters, he was able to tell me I was doing a good job, but at the same time provided me with constructive criticism that helped me immensely in my work ethic without making me feel like a failure.

When I first started working, the HEC family did a lot of things outside of work together. Most of the Center went to lunch on Fridays; bowling leagues were organized; tennis tournaments were organized; company picnics; camping trips; hiking adventures; excursions to South Lake Tahoe; and, more. This enhanced the family feel and at the time the staff size was small, about twenty-five people. Over the years this has changed, just like the downtown core of Davis has changed. Now the HEC family gets together at picnics and holiday parties.

I have worked under three of the four HEC Directors; I have had about a dozen Division Chiefs for direct supervisors; and, I have gone from Clerk Typist, to Computer Operator, to Computer Programmer, and now to IT (Information Technology) Specialist in forty years. From typing manuals; mailing software; assisting in HEC training classes; managing an in-house mini-computer; keypunching during workshops; and, assisting the Administrative Officer with the accounting software. To writing and testing software code; developing graphical user interfaces (GUI) for HEC-FDA (Flood Damage Reduction Analysis) and HEC-PBA (Project Benefit Analysis); being involved with the initial deployment and testing (four USACE sites) of the Corps Water Management System (CWMS); responsible for HEC-FIA (Flood Impact Analysis); writing and reviewing user documentation; providing training; administration of HEC's servers (Exchange, website, UNIX); provide assistance to HEC individual user workstations (loading software, using software, fixing hardware issues); maintaining the HEC website; manage HEC Newsletter; overseer of the development of the HEC-WAT (Watershed Analysis Tool) software, including the FRA (Flood Risk Analysis) compute option; writing papers for professional journals, and presenting the information at conferences, meetings, and training sessions; creating Performance Work Statements (PWS) and managing the funds associated with the work; and, being part of the PDT for the Columbia River Treaty (CRT) 2014/2024 Review. All of this and much more are the opportunities that have been provided to me. The second mentor in my career here at HEC is Christopher Dunn. Chris was my Division Chief for about five years in the Water Resource Systems Division. During that time there was a great deal of staff turnover in the Division, with a great deal of work to be done. Up to that point, I wasn't thrilled about speaking in public. I like to write (Chris has helped me immensely with my writing skills), but speaking in public, I tried to avoid that ordeal. Well, Mr. Dunn thought I needed a shove out of my "comfort zone" and being the boss he shoved. At first, it was pretty rocky, but soon I got the hang of it, and I think I do a pretty decent job giving presentations. Without Chris's patience, calmness, and his caring, I would not have the skills or the confidence that I have to meet the challenges of being part of a PDT team like the CRT. So once again, late in my career I was afforded guidance that enhanced my work ethic and my character.

So in forty years has it all been wonderful? Is it every wonderful all the time in a family - nope. I am not what you would call a pliable person. When I feel the need to stick up for myself I do. I have worked in an environment of mainly men and engineers and at times being a non-engineer and not as highly educated as most, I have been left with injured feelings. One of my lowest points at HEC was when a job became available that I wanted, but was not even considered by management for the job. John Dralle told me you really don't want that job, you will be much more successful staying on your present path and he was right. But moments like that have been far and few between. Why haven't I left? Well one thing, I don't like change (big change) but HEC gave me the ability to be able to make small changes, that allowed me to stay at HEC. I was eighteen years old when I started on this path and when you are surrounded my people who work the same way you do and are afforded the opportunities that I have been given (I would not have gotten anywhere else) one does not leave. I once was the youngest person at HEC, now I am one of the "old-timers" and will probably get in that nice blue Mustang and drive off one of these days. Will I return to the HEC family, probably not (I've never made it to a high school reunion yet), but I will never forget my HEC family.

International Training

Jon Fenske, P.E.

My twenty years of working at HEC have been rewarding, adventurous, and full of learning experiences. Being the lone groundwater specialist on the staff has afforded me the opportunity to create and develop research and project work across the United States - from south Florida to

Fairbanks, Alaska. I have also travelled overseas and encountered cultures I would not have had the chance to experience. I am far from the most-travelled employee at HEC, but the experiences I have had in Korea, the Netherlands, Kenya, and Ethiopia have broadened my view of the world, and strengthened my belief in the basic goodness of people in all countries. Below is a photo from Nairobi, Kenya where Jeff Harris (retired HEC employee) and I presented a course in hydrologic concepts and models to a great group of enthusiastic students.

After the course we had the chance to tour the Masia Mara. It rained the night before, so we needed a bit of help from the locals on the way:

Then it was on to Ethiopia where we met another group of great students and experienced the one of the most interesting and ancient cultures on Earth.

Thank you HEC!

For Fifty Years HEC has Led the Way

Diane Cuming

For Fifty Years HEC has led the way,
Making it look like child's play.
When I first came to HEC,
Everyone was busy as a bee.
Working on something called punch cards, putting them into a very large,
Harris Computer. I remember it took up a room entirely,
Humming along mightily.
Running programs like HEC1, 2, and 3,
While I was transferring calls around to people from a phone tree.
Back then the only thing I knew about water, was that it ran downhill,
Which I thought wouldn't take much skill.
The programs have changed with things like RAS 2D,
Although the one thing that hasn't changed is they are still free.
The phone calls still come to be transferred around,
Even though HEC programs are very sound.
The world wants HEC products to assist their engineering needs
We are glad to comply so they can finish their deeds.
Now so many years later I realize I have been taught so much
Everyone helped me without ever giving a fuss.
I have grown and learned so much more
That I still don't want to walk out the door.
I look back on those years, and I realize still
The only thing I know about water is that it runs downhill.

From Tennessee to California

Matthew Fleming, P.E.

I have had many great experiences over the years working at HEC, from working with colleagues on projects, going on trips, and providing technical support. My first experience with HEC occurred in the summer of 2001. I was a graduate student at Tennessee Technological University, in Cookeville, TN. The Nashville District, USACE, was funding part of my graduate school, and one of my tasks for the Nashville District was to become familiar with the new continuous simulation Soil Moisture Accounting (SMA) loss method in HEC-HMS (Hydrologic Modeling System) Version 2.1 and to develop a calibrated model of the Dale Hollow watershed. Part of the work was to also explore the difference in using radar rainfall data or interpolated rain gage data. Many long evenings were spent learning about the SMA loss method and about rainfall-runoff simulations in general. During this project, I was using Beta versions of HEC-HMS Version 2.1; therefore, I was in contact with the HEC-HMS development team asking questions and reporting bugs in the software.

As the project was wrapping up, Arlen Feldman, Chief, Hydrology & Hydraulics Technology Division at the time, asked if I would come to HEC for a week to present my work to the HEC-HMS development team and to talk about my experiences using HEC-HMS. I immediately said yes and was excited about the opportunity of traveling to California, which I had never been to before. I had never really traveled at all, and there were a couple of hurdles I had to jump. I remember one of the bigger issues was that I did not have a credit card and very little cash in the bank (I was a college student at the time). Since this was the first time traveling to California, I tried to make an adventure out of the trip. I planned on flying in on a Saturday and spending all day Sunday exploring. The hard part was choosing what to do on that one day. I looked at traveling to San Francisco for the day, but being from a small town, I ranked that option low on the list. I really wanted to see the Sierra Mountains. My list included Lake Tahoe, Yosemite, and Devil's Postpile National Monument in the Mammoth Lakes area. Today, I would have only chosen one of these options and taken my time exploring, but back then I thought it was realistic to knock out all three of these destinations in one day. The route was mapped and directions were printed.

My first solo flight seemed to be going well until I landed in Sacramento and had my first experience with lost luggage. I got my first rental car and made it to the hotel in Davis late Saturday night. Being new to travel and lost luggage, I was a little stressed about getting my luggage back from the airline. I was constantly in contact with the airline and found out my luggage would be at the airport at 8 a.m. Sunday morning. I decided to swing by the airport and pick up the luggage before heading out on my journey. Unfortunately, this would put me way behind schedule (for some reason, I had planned on leaving at 5 a.m. for the journey). So I decided not to go to all three destinations in one day and removed Lake Tahoe from the agenda (that's right, I removed the easiest destination from the trip).

After picking up the luggage, I started the drive toward the mountains. Since this was before affordable GPS navigation systems, I had to rely on my road atlas. This involved pulling over many times to make sure I was going the correct way. I remember many things about the trip - the narrow, windy roads and amazing vistas. Driving through Yosemite was spectacular. I had never seen such mountains; I remember stopping at Lake Tanaya to take a break and seeing the huge granite mountains in the background. Driving out of Yosemite and down towards Mono lake was an experience, too. The road was steep, the geology was unique, and it was interesting to see the change in vegetation in the rain shadow along the east side of the Sierra. I made it to the office to buy a bus ticket to Reds Meadow Valley and Devil's Postpile, the last shuttle of the day down. Luckily I had an hour to enjoy walking around the valley and looking at the Devil's Postpile Monument. I made it back to the car around dusk and began the long journey back to Davis. Overall, the driving part of the trip took over 11 hours and 550 miles. Since moving to Davis, I have made many trips to the mountains to explore and now try to spend more time walking through the mountains instead of driving through them.

The meetings with the HEC-HMS team that week went well. I showed the team the HEC-HMS model results from the Dale Hollow watershed and talked about my experiences using HEC-HMS and HEC-GeoHMS. I remember how kind everyone was at HEC and that they took time to talk to me and give me advice for finishing the project. While at HEC, someone mentioned that a few jobs would be opening up soon and that I should apply for them. Three jobs did open up later in the year, and, of course, I sent my application. I knew that HEC would be a great place to work and that the natural beauty of the area was amazing. June 2014 will be my twelfth anniversary at HEC, and I am appreciative of the opportunity I had to visit HEC in the summer of 2001 and what that trip has meant for my career.

HEC at 50

Tom Evans, Ph.D., P.E.

Friends with memories longer than mine have told me that when Roy Beard presented HEC-1 to the world in October 1968 (around the time of my ninth birthday and HEC's fourth) there was resistance from a few members of the profession who felt that if you couldn't do a convolution integral by hand, you had no business working as a hydrologic engineer. Making the process "too easy" - as easy as preparing a description of a watershed in a stack of punch cards full of hieroglyphics like

BA .66
BF 10.0 -.25 1.2
PR 400
PW 1
PT 61 62 63
PW .6 .3 .1
LE .6 1.0 1.0 0
US 1.3 .8

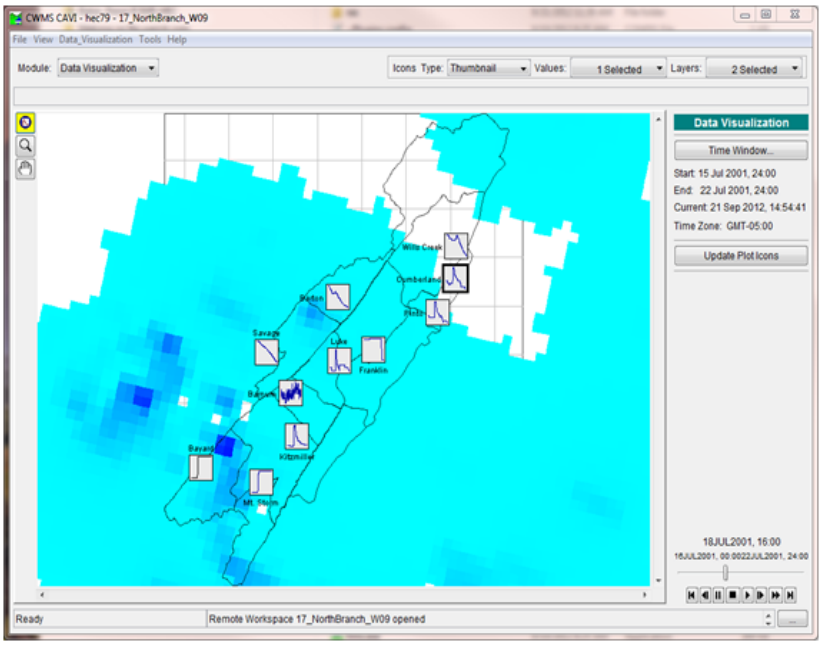
and having access to a computer center where you could have the cards read, and waiting overnight for your job to run, and then interpreting the slightly less cryptic results - was a disservice to the profession.

Needless to say, I've never had much sympathy for this point of view. For the first few years I worked at HEC, I was occasionally irritated by lingering resistance from a diminishing number of users who didn't like programs with graphical user interfaces (GUI), like HEC-RAS or HEC-HMS or the GIS (Geographic Information System) programs I was introducing and promoting. An engineering program that presented pictures to the user stuck in the craws of such folks, no matter how sound the mathematics behind the pictures was.

And the math was sound. That's the point. The most significant change in the programs that HEC provides today over working with paper and slide rules or even the HEC-1(Flood Hydrograph Package) generation of programs isn't that they've got slick user interfaces or that they make hydrology "too easy"; it's that they're much better and much more powerful tools for doing good engineering work. We are doing more detailed analyses of much more complicated hydrologic and hydraulic processes in much less time. We are using bigger, more detailed, and more accurate (most of the time) data sets than anybody could imagine having access to fifty years ago. That means that HEC's computer programs give engineers the opportunity to gain greater understanding and insight into the natural processes we try to regulate and mitigate.

"Understanding" and "insight" are, I think, at the center of two reasons that I feel pride and satisfaction for the work I've done at HEC. The first is that when I can do something (like contributing to a computer program) to reduce a long and tedious task - determining which part of a radar image overlaps a particular watershed, for example - to one that can be done in a few minutes, I'm giving hydrologic engineers the opportunity to think more deeply about the reasons that they are doing that task and what it means, instead of mechanically churning over the minutia of their computations.

My second reason is that by participating in projects, teaching in HEC classes, and corresponding and talking with engineers who use HEC programs, I have had a rare opportunity to learn from a large number of people working at the top level of their field of water engineering. Working where I do, with the people I work with, has given me a staggering number of "aha" moments on topics ranging from geeky computer programming details to the meanings of hydrologic statistics to the practical consequences of public policy. Having had those moments of insight, I know what they feel like, and when someone tells me that a lecture I've given, or some instructions I've written in a manual made them "get" a topic they hadn't quite grasped before, I understand what they are thanking me for. It makes me feel very lucky to have spent nearly twenty years of my working life in a place where I can constantly learn and constantly pass what I've learned on to people who can make good use of it.



A Director's Viewpoint

Darryl Davis, P.E., D.WRE

My span of employment with the Federal government, USACE, and HEC was thirty-seven years of the fifty years HEC has been in business (all in the same building in Davis, CA!). I came to work just before tropical storm Agnes devastated the East Coast (first really large scale application of HEC models in support of recovery); in the early stages of engineering applications with remote, hermetically sealed, major digital computers (e.g. punch cards and overnight turn-around); the enactment of the Federal water resources planning act (project development now a multi-discipline, public process), and the National Flood Insurance Program (the infamous 1% annual chance exceedance flood insurance standard). I was HEC's Director for the last seventeen years of my Federal service, retiring shortly after Hurricane Katrina struck New Orleans (another touchstone in the evolution of what risk really means). My tenure as Director began a few years after personal computers became reasonably wide-spread and ended with the ubiquitous 'Smart Phone'. I would characterize the seventeen years of my stewardship as a period of exceptional staff stability and rapid technological change. On my watch, HEC retained most of the technical staff and was led by essentially the same management team until the last few years when we restocked and I retired.

HEC essentially had no direct budget appropriation and thus functioned pretty much as a small reimbursable consultancy owned by USACE, subject to the fluctuating whims of the Federal budget and policies discouraging internal funds transfers - our life blood. I kept a folder labeled 'HEC Move Efforts' because there were actions about every three to four years to either move us (often to St. Louis or Washington, DC) 'to reduce training travel costs', or fold us into the ERDC Coastal and Hydraulics Lab to 'improve research efficiency and eliminate duplication of effort'. We obviously kept these efforts at bay and managed to maintain financial solvency that kept HEC intact with its personality that made it a special resource to USACE, the nation, and the larger international community of water resources professionals. We also stayed in Davis. We enjoyed a diverse clientele that included USACE offices from headquarters to field offices to research laboratories; also other Federal agencies and a few universities; and direct foreign assistance with many countries around the globe. We had a number of private consultant-HEC partnerships for international work, particularly in the Middle East.

On the product side, we quickly embraced the emerging technology of interactive computing. There followed in rapid order, a new family of hydrologic engineering and planning analysis software, the well known HEC-RAS, HEC-HMS, HEC- ResSim, HEC-FDA (Flood Damage Reduction Analysis), and others. These products continue to be used and improved today. We jumped on and rode the GIS technology wave by partnering with ESRI® (creator of ArcGIS®) and subsequently developing and integrating geo-utilities into many of our software packages. We also set about 'greening up' HEC and the staff by moving into ecosystem analysis (HEC-EFM, Ecosystems Function Model) and making our core hydrologic engineering and planning analysis software better support the work of the environmental community. A notable activity was integrating our major software packages into a real-time data acquisition and decision-support system (CWMS) that functions 24/7 helping manage water control at the seven hundred plus USACE reservoirs. We are especially proud of the fact that we managed to keep our software products in the public domain for the benefit of all, world-wide.

We also re-wrote the family of hydrologic engineering and planning analysis guidance manuals, conducted training, held workshops and seminars, and began what turned out to be a rather challenging (and contentious) endeavor to integrate the concepts and technology of risk analysis into hydrologic engineering and planning analysis studies and decision processes. Our foray into the risk analysis world began in the early 1990's, managed to survive for the next twenty years, and then with the advent of the risk-informed dam safety program, took off; risk assessment and risk-informed decision processes are now standard fare in USACE.

The majority of HEC's work was (and is now) in support of U.S. civilian water resources activities, literally hundreds of consultancy and assistance projects during my tenure as Director. In the latter years, we increased our international activities. One notable effort was becoming rather deeply involved in the water resources management of the Tigris and Euphrates systems and the 'marsh restoration efforts' as a component of our support for the Gulf and Iraq wars. We hosted and trained Iraqi staff at HEC, met and worked on site with Iraqi colleagues modeling the systems, and provided guidance for water management studies for water supply, flood management, and marsh restoration.

For those seventeen years as the HEC Director (1989 – 2006), I had the best job in USACE, for which I am very grateful.

A Retrospective of HEC Environmental Projects

John Hickey, Ph.D., P.E.

Our environmental program began with a study that was unintentionally inherited about a reservoir that was ultimately never constructed. The year was 1969. Construction of Marysville Dam on the Yuba River in Northern California had been authorized and there were concerns about its potential thermal effects on salmon spawning, which requires cold water, and rice farming, which requires warmer irrigation water. Through a bit of happenstance related to personnel movement between a young HEC, Sacramento District, and a university, HEC found itself responsible for investigating the influence that the proposed reservoir would have on water temperatures in the Yuba.

This was a new challenge for HEC. Then Director, Leo Beard, widely addressed as Mr. Beard, asked a young engineer named Jerry Willey to research some methods. Braced with a handful of technical papers, the two settled on a promising technique. Mr. Beard coded the algorithm in a day and, over the next few months, Jerry tested and applied it. The result of this effort became known as the Reservoir Temperature Stratification model. It used a regression approach with variables for inflow, outflow, evaporation, precipitation, radiation, and air temperature to simulate water temperature and was the first HEC environmental software tool.

From these beginnings, also came the Water Quality for River-Reservoir Systems (WQRRS) package of software, capable of simulating 18 physical, chemical, and biological parameters for a variety of time steps, and HEC-5Q, which directly extended the water quantity capabilities of the HEC-5 reservoir simulation model to include water temperature, dissolved oxygen, nitrogen, phosphorus, algae, metals, phytoplankton, and many other constituents (see figure).

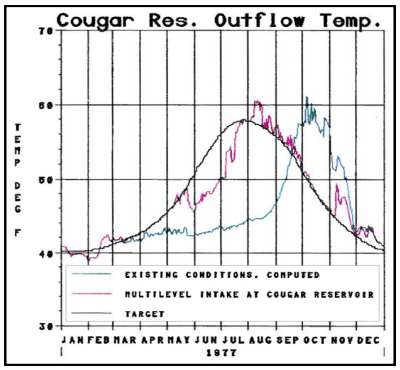


Figure compares performance in meeting seasonal water temperature targets (gray) below Cougar Dam with (pink) and without (blue) a then proposed water temperature control device, South Fork McKenzie River, Oregon. Analysis performed with HEC-5Q in the mid-1990's. Construction of the water temperature control device for Cougar Dam was completed in 2005.

The success of these tools is certainly a tribute to the long and consistent influence of Jerry Willey as well as the professional relationships between HEC and people like Peter Boyer, Earl Eiker, Jerry Orlob, Carl Chen, and Don Smith, who were all instrumental in development of HEC water quality technologies. HEC work in the reservoir water quality arena continues today with HEC-5Q, now used in conjunction with HEC-ResSim, being applied to assess alternative reservoir policies for Mobile District.

Beginning in the 1970's, there was another important environmental influence at HEC. HEC staff were cultivating the capacity to perform hydrologic engineering within the broader context of water resources planning. The environment was included in this context through its association with water, as were many other considerations. Looking back, it is difficult to tell whether this thinking was somehow underpinned by the passage of key federal environmental legislation, bolstered by the rising social and environmental movement of that era, or simply the influence of HEC staff who believed in a planning process that was truly multi-objective and inclusive. Whatever the case may be, it produced training courses that remain popular and contemporary including Water and the Watershed and Hydrologic Engineering for Planners, analyses like the *National Assessment of Reservoirs to Drought* and the *National Hydroelectric Power Inventory*, and notable reports such as *Physical and Economic Feasibility of Nonstructural Flood Plain Management Measures* and *Authorized and Operating Purposes of Corps of Engineers Reservoirs*, which, 22 years after publication, remains the definitive reference on why water is managed at Corps reservoirs – interestingly and in a nice recognition of its value, the latter report was explicitly called out for update in a recent House of Representatives' Conference Report known as the Water Resources Reform and Development Act. Darryl Davis, Mike Burnham, and Bill Johnson were all notable contributors to this philosophy.

In the 1980's and 90's, with new authorities for modifying projects to improve the environment, beneficial use of dredged materials, and aquatic environmental quality, the Corps became increasingly involved with ecosystem restoration. Ecological criteria began to be included in applications of HEC-PRM, an optimization software known as the Prescriptive Reservoir Model, as done for the Missouri, Columbia, and Bill Williams Rivers. In the late 90's and early 2000's, HEC supported a flood risk management and ecosystem restoration planning study for the Sacramento and San Joaquin Rivers that provided an opportunity to consider how ecological analyses might align with existing hydrologic and hydraulic tools. That effort was the genesis of HEC's Ecosystem Functions Model (EFM), a software tool which performs statistical and spatial analyses of ecosystems.

Since that time, the HEC suite of ecological software has expanded to five tools that support a gamut of tasks ranging from formulation of river management alternatives to

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A Retrospective of HEC Environmental Projects (continued)

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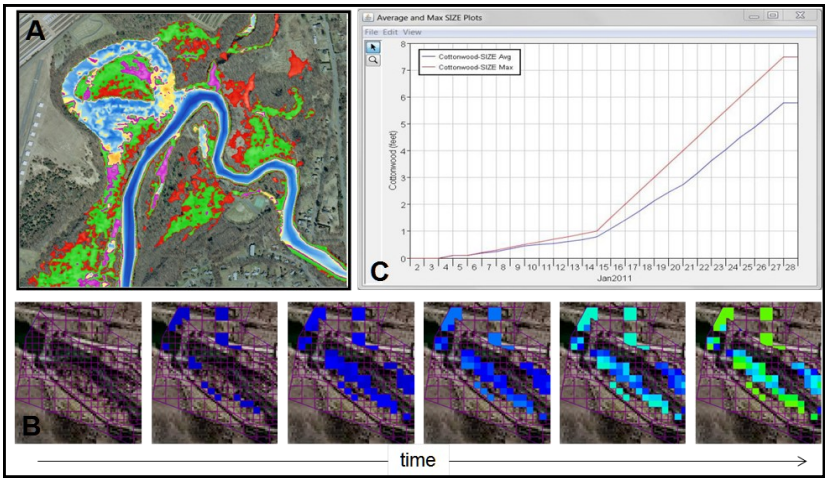

Figure shows a habitat map (A) for the Farmington River, Connecticut, and images from an ecosystem simulation (B) with linked time series (C) for the Truckee River, Nevada.

habitat mapping to ecosystem simulations that are dynamic in time and space (see figure). Environmental capabilities are also being added to our established hydrologic, river hydraulic, and reservoir software packages, including integration of sediment and water quality features in HEC-HMS and HEC-RAS as well as coupling of water quality models, HEC-5Q and CEQUAL-W2, with HEC-ResSim.

Project support in the environmental arena continues with ongoing collaborations between HEC and IWR, ERDC, over ten Corps districts, and other organizations such as U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. Geological Survey, and The Nature Conservancy. HEC's involvement in two of these projects - the Sustainable Rivers Project, an ongoing national partnership between the Corps and the Nature Conservancy to implement environmental flows, and the National Portfolio Assessment, a review of reservoirs from water supply, water management, and sediment management perspectives - has spanned several years and is helping clarify the status of reservoir management and identify strategies on how operations might be made more sustainable.

One aspect of the National Portfolio Assessment was a review of reservoir operating policies. In short, reservoirs have manuals that describe their operations, which are updated occasionally to incorporate new operations. For the Assessment, all editions of manuals were reviewed. Operational changes were identified and categorized per the authorized purposes of the dam. An interesting finding was that environmental purposes are now the most common motivation for operational changes. Changes for environmental purposes began to outnumber those for recreation, infrastructure, hydropower and navigation in the 1990's and then also water supply and flood risk management in the 2000's.

This is a reflection of where we find ourselves today. The water management community we belong to and support is being increasingly challenged to modernize its environmental strategies. Our restoration planning community is under pressure to complete studies in shorter times and with less funding. Hydrologic and hydraulic engineers are becoming ever more involved with analyses to see how the nation's rivers and waters might be managed differently to provide more environmental benefits.

Our software tools and project experiences have positioned HEC to help with these challenges. However, it remains to be seen how this potential will be used to fulfill environmental opportunities. As HEC technologies continue to advance, will features be added that allow our reservoir operators to better manage environmental as well as water resources? Will environmental considerations be factored into the prioritization of projects for infrastructure renewal? Will we be able to help build the capacity needed in engineering and planning to perform rapid technical assessments of restoration alternatives as part of a streamlined planning process?

The simple and somewhat off-point answer to these questions is "yes". The future seems certain to hold more environmental work and HEC will inevitably adapt to support the aspects of it that are relevant to water resources, whether in this incarnation of our projects and software or the next. A deeper matter is how we will engage these opportunities and commit the thought and resources needed to achieve them. Hopefully, we will look back on our next fifty years with a satisfaction that our collective vision empowered us to anticipate and meet environmental opportunities before those challenges became compelled by conflict.

Several HEC alumni and friends contributed to this article. Darryl Davis, former HEC Director, shared his perspectives on the evolution of HEC's environmental capabilities. Jerry Willey conveyed a history of HEC water quality work that could only have been told by him and his 29 years of personal involvement. Darryl Davis, Jay Lund, University of California at Davis, Mike Deas, Watercourse Engineering, and David Ford, David Ford Consulting Engineers, all shared their experiences with - and appreciation for - the work of Bill Johnson, an engineer, teacher, and HEC alum who passed in 2003 and was an insightful planner, strongly committed to holistic solutions.

From a District View

Matt McPherson, P.E., D.WRE

For decades HEC has improved the USACE and the practice of civil engineering. While others lead with grand visions and proclamations of noble goals, HEC prides itself on translating advancements and ideas into practical tools and methods usable by mainstream engineers, and relevant for their real-world water resource projects. These engineering products are all contributed to the public for free.

I learned of this wonderful, unique little piece of the federal government in 1987, when the Detroit District (USACE) hired this wide-eyed neophyte into its Hydraulics and Hydrology Branch. In accordance with eternal universal tradition, the initial duties consisted mostly of jobs spurned by others, such as squinting at topographic contours with planimeters, coloring areas on soil-type maps, and running all manner of errands to people and places normally avoided by those with a choice in the matter.

In particular, each morning I charted reservoir operational data for a senior engineer, who duly consulted the rule curve, scratched out a few calculations in the margins, then penned the Official Engineering Division Recommendation of how to operate the reservoir that day. He entrusted me with the important mission of communicating this sober advice to the gruff old chain-smoking Chief of the Construction and Operations Division. On normal days I stood in respectful awe as the august presence indicated concurrence with a grunt and a plume of smoke. Sometimes he dismissed me by balling up the paper and throwing it at me. On other occasions he gave me his sincere reply to take back to my senior engineer (which I tended to paraphrase). On one significant occasion, the great man rose from his desk with great vigor to ensure clarity of his message by positioning his face inches from mine, and conveying his desired punctuation with heartfelt finger-stabs.

This manner of intercourse troubled me little, as an innocent having recently agreed to work for the Army, and well along toward developing a deep appreciation for the new reality of a full-time pay-check. But then I got my first taste of what HEC could do for my career, as the management afforded me unlimited access to a glistening new miracle of technology: a Tektronix 4100-series terminal and associated color printer. I was thrilled and gratified at the opportunity, which I chose to believe was inspired by my trumpeting of my experience with punching and feeding stacks of cards into the university computer (although the truth later revealed that I was simply the only one in the office with time to experiment). Also during this time, the senior engineer taught me how to perform the relevant reservoir operational calculations, and departed for greener pastures. So after the requisite ink-smudged learning curve, I automated the computations within our nascent HEC-DSS database, generated old and new plots of the important information, and printed them as part of a more comprehensive computer-based report for the daily operational decision.

Many managers in those times lacked personal experience with computers, and tended to value the confident and clearly printed Word from the all-knowing machine more than the dubious scrawl of a flawed human engineer, which was often undermined with ignorant misspellings and indecisive scribble-outs. When first confronted with me as the author of the Official Engineering Division Recommendation, rendered with all the crisp colors and neat lines that the Tektronix could muster, the Chief of Con-Ops grunted and puffed with a degree of interest and deliberation never experienced before. He honored me with series of questions ("You did this? You? Really?"), and eventually heaped unimaginable praise on my work ("Yeah, maybe this is better"). Our subsequent intercourse continued to feature occasional finger-punctuated messages delivered vigorously with close facial proximity, but the reports were never crumpled and thrown.

This experience gave me a very favorable impression about HEC. Later that year the District management saw fit to send me to a ten-day course in Davis, combining HEC-1 and HEC-2. John Peters, David Ford and the rest of the team held me in thrall, and inspired me to

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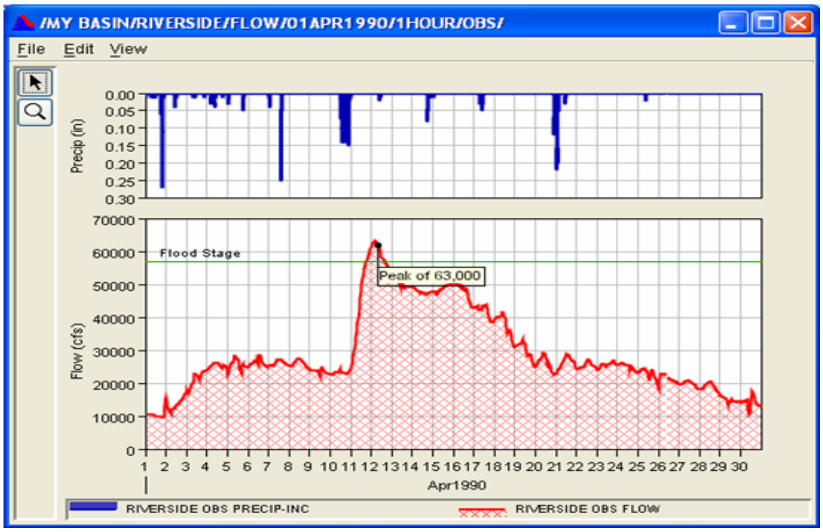

From a District View (continued)

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return for many follow-up training classes and workshops. I remember how lucky I felt to learn lessons in Statistical Hydrology from Harold Kubik, and have Art Pabst help me figure out where to put the '_' in arguments for mixed-language programming with DSS. Of all the wonderful people from HEC, my personal favorite was the illustrious Richard Hayes, who always made you feel good as you learned, and always found a way to help you get your project done when you needed it most.

Like me, people from all over the country descended on 609 Second Street through the year and over the years. Almost every one of them are impressed with HEC, and the various congregations serve an important purpose within USACE to update technical skills and promote consistency by learning through doing. They also really enjoy Davis, and greatly admire the community and downtown. It's always fun when the wandering Enterprise reporters snare one of our students to ask their thoughts on the topic of day, and they love it when we forward the newspaper clipping documenting their brief fame and footnote in Davis history.

No place is perfect, and plenty of flaws come to mind after serving in the belly of this beast for 15 years. But I still remember those initial impressions, and feel good that they still hold true. For me, the enduring virtue of HEC is its focus on helping the engineers in the field get their jobs done, and I still do everything in my power to uphold that tradition.

UCD Student to HEC Employee

Cameron Ackerman, P.E., D.WRE

It was almost twenty years ago, when a fellow UCD student told me about the "greatest place to work". At the time, I wasn't sure what that meant, but I followed up the suggestion with repeated phone calls and emails to this nice man named Arlen. I always received the same response: "we will be having a management meeting soon; I'll get back to you". After a couple dozen harassing emails and phone calls, I was finally asked to stop by and drop off a resume - which turned into a brief conversion. Little did I know at the time, my brief meeting was actually my job interview - and I was going to be HEC's newest intern.

I really had no idea what to expect from HEC - my first impressions were of smart, friendly people that had great interests beyond the obvious water resource related issues I expected would be the focus of HEC. In the following years, I would learn much more about what made HEC special. As I tore through one HEC leader after another - thanks Arlen, Vern, Mike, Chris, Arlen, Gary, Jeff, … Matt - I've learned that the HEC employee is typically defined by their service and dedication to helping colleagues look for new ways to solve problems, more efficient methods for engineering solutions, and in-the -end trying to help make the planet a better (safer) place by managing our most precious natural resource, water.

Over the these years at HEC, I have been dedicated to helping provide information that can be used to protect people from flood waters and educate people about flood prone areas by creating river hydraulic models, inundation maps, and developing flood warning systems. However, the most rewarding work for me has been to share my experiences in modeling and analysis by teaching and exchanging ideas with thousands of engineers throughout the US and overseas. Overseas travel to Germany, Latvia, Hungary, Kazakhstan, Korea, Cambodia, Netherlands, Mongolia and Kenya has provided me with unique life lessons. For instance, while the green salad may look delicious, it may be prudent to pass; it's rude to allow your companion's glass to be empty; you *can* go 48 hours without sleep; brushing your teeth with bottled water is not wasteful, it's essential.

I've explored the historic site where Genghis Khan discovered the golden whip, viewed the Great Rift Valley, and seen the ancient Silk Road. I've had a 42-hour travel day and shared a bottle of vodka with a Russian. I've climbed great heights to reach a sacred Buddhist temple. And from all the experiences, I've learned that life is what you make of it and with whom you share it - and it's far too short to not be fun. I've spent almost half my life working at HEC with great people and making good friendships that will last a lifetime. So to those of you that have made HEC a special place over these last fifty years, I thank you. Hopefully, I'll be able to help make to the next twenty years of HEC a success and have a little bit of fun doing so.

Genghis Khan & the Golden Whip