Loyola Marymount University

System Case Study and Seminar Memos

Eve Huang
September 7, 2016

Contents

MEMO 1
California High-Speed Rail System

FROM: Yingfen Huang
DATE: Feb 19, 2016
SUBJECT: Memo on Scott Jarvis' Seminar

On February 18, 2016 in the SELP Seminar, Dr. Scott Jarvis presented a lecture titled "California High-Speed Rail". Scott Jarvis is the Assistant Chief Manager of the California High-Speed Rail Authority. He has spent 26 years at the California Department of Transportation (Caltrans) and worked in construction and project management, transportation engineering, and contract administration. He was responsible for overseeing and executing the statewide construction program, consisting of approximately 650 projects valued at over $12 billion.

First, Scott Jarvis introduced the California High-Speed Rail Plan and its benefits. Second he displayed the capital and lifecycle costs of 2014 business plans, as well as its initial operation section. Third, Jarvis explained the project delivery model and provided more details on the program management, risk management, design considerations, design criteria, and program planning. Lastly, Jarvis closed with an appeal asking individuals to pledge support and educate others on this project.

According to Jarvis, California is the 8th largest economy in the world. Due to rapid population growth in CA, the demand for transportation is getting intensifying. High-Speed Rail in California is more than a transportation program. It will connect all Californian population centers and release the pressure of airport and roadway congestion. Furthermore, the High-Speed Rail will improve air quality, preserve agricultural land, reduce greenhouse gases, and modernize the transit system statewide. This project has connected investments from Northern to Southern California, such as the Altamonte Commuter Express (ACE), Sacramento RT, LA Metro, Metro-link, San Diego MTS, etc. The initial operating section starts from the Central Valley, which

serves as the “backbone” of a system that will tie major regions of California together. The project will end in the San Fernando Valley, a total of 300 miles. The first construction segment, Merced to Fresno, is underway. Construction also creates a large amount of jobs, boosting the economy of CA. Jarvis indicated that the High-Speed Rail is a big and complex project which involves a wide range of stakeholders. Thus, it is important to identify and track project risks, such as engineer risks, environmental risks, construction risks, funding and financing risks, and schedule risks. Another important aspect is design criteria. The speed of the High-Speed Rail should be as fast as 250 mph, which should take 2 hours and 40 minutes from San Francisco to LA. Other factors that should be taken into consideration are curve radius, gradients, passage comfort, and seismic, etc. At the end, Jarvis illustrated the start plans in Central Valley and discussed the next steps of this project. He hoped that people would pledge support and educate others on the High-Speed Rail project.

As a system engineer, I found this topic very exciting. I have lived in LA for several years and had suffered from traffic congestion. I am looking forward to using more public transport systems and getting out of the car. This presentation provided deeper backgrounds and details on the High-Speed Rail. It is such an exciting project that I will definitely support it.
Jarvis’s presentation was fluent and logical. The slides were well arranged. I personally liked this presentation very much.

MEMO 2
GPS System

FROM: Yingfen Huang
DATE: Jan 28, 2016
SUBJECT: Memo on Donald Edwards' Seminar

On January 29, 2016 in the SELP Seminar, Donald Edwards presented a lecture titled, "GPS - A discussion on… Programmatics, Engineering, Strategies and Challenges." Donald Edwards, who attended the graduate school of University of Southern California Executive Development Program and holds a MBA degree from Pepperdine University, has over eighteen years of work experience in program management and program execution.

Donald Edwards first introduced the GPS(Global Positioning System), describing his perspectives and observations on it. Second, he introduced the background of the GPS system and displayed details on GPS segments, GPS functions, user equipment, and how GPS works. Third, he indicated the primary threats to a GPS system, and explained the GPS standards and certifications. In the end, he discussed the past and current challenges of the GPS system. Donald Edwards declared his perspectives and observations on GPS system, which focused on user equipment, systems engineering and program management. Edwards stated that GPS started at Navy Himation System in 1963 and then settled down in 1994. According to Edwards, GPS is a global time distribution network, a hybrid of communications, as well as, radar and a global system of reference beacons, providing position, velocity and time information to users. It is composed of three parts: space segment, user segment, and ground control segment. The space segment, which currently has 31 operational satellites at medium earth orbit, broadcasts three frequencies - L1, L2 and L5 GPS signal. The control segment monitors, flies, and updates data on satellites. The user segment, also called user equipment, includes handheld receivers, ground

embedded receivers, aviation receivers, munitions receivers and space receivers. There are three key points of a GPS work process. The first key point is to measure the distance between the user and the satellite with clever radio techniques. The second point is to pinpoint the users' position by measuring their range to three satellites. The third point is to find a position and to compensate for user clock inaccuracies through a fourth satellite. Furthermore, Edwards indicated two primary threats to the GPS system - jamming and spoofing. Jamming, which is typically "noise-like", is either intentional or unintentional interference which prevents the use of the GPS signal. Spoofing, a false signal generated by an adversary, will display a false position. Additionally, Edwards presented the integration of GPS into weapon systems. Moreover, he explained the SPS, PPS performance standards, and security certification, compatibility certification, as well as MSO-C145, DO-178 and DO-254 certification. In the end, Edwards gave a detailed discussion about the challenges of the system which keep the program going.

As a system engineer, I found this topic extremely interesting. GPS systems are seen and used everywhere and are closely linked to our daily life. The presentation displayed deeper backgrounds and details on GPS system, which let me have a better understanding of the GPS system.

Edwards' presentation was fluent and logical. The slides were well arranged. I personally liked this presentation very much.

MEMO 3
Lean Culture and Leadership Awareness

FROM: Yingfen Huang
DATE: Feb 8, 2016
SUBJECT: Memo on Dr. Sam Obara' Seminar

On February 4, 2016 in the SELP Seminar, Sam Obara presented a lecture titled, "Lean Culture and Leadership Awareness". Sam Obara is a faculty member of the Lean Institute and an instructor of Global Strategy Management for the California Community College system. With 30 years of lean engineering experience, he has taught lean to a multitude of consulting firms, educational organizations such as Harvard and Stanford, and even in humanitarian missions though Asia and Africa.

Sam Obara first introduced the background of the lean system and its relations to Toyota Production System (TPS). Then, he explained "seven wastes" and the importance of understanding the purpose of tools. He also shared Toyota's goal for lean, which is the reduction of waste. Furthermore, he identified four rules that characterize the "Toyota DNA". In the end, Obara discussed the four capabilities of a lean leader, and indicated that the fundamental element of sustaining the progress of lean thinking is lean leaders.

According to Obara, the main part of lean is not copying the tools, but understanding the purpose of tools, using the tools where the ideal cannot be achieved, and exposing problems systematically. Obara illustrated that the goal of lean is to eliminate waste, and the key point to achieve this is to understand the waste. Toyota defined seven types of waste: transport, inventory, motion, waiting, overproduction, over processing, correction or defects. Obara expounded "the four rules" -standards, connections, pathways, and improvements. These rules are characterized "Toyota DNA", and aimed to make the work simple enough to understand and manage. Standards mean all work should be highly specified as to content, sequence, timing and

outcome. Connections mean every customer-supplier must be direct, and have no equivocation while sending requests and receiving responses. The pathway for every product and service must be simple and direct. Any improvements must be made in accordance with the scientific method, under the guidance of a teacher, and at the lowest possible level in the organization.
Additionally, Obara stated that lean leaders must understand the purpose of tools, and are able to use the correct tools in the correct way. Some leaders failed because of using unnecessary tools or copying tools but not understanding the purpose. It is necessary leaders must actualize small, but incremental gains. To allow lean happens, leaders must have four capabilities. First, they should design work so that problems are apparent. Second, they should swarm problems when problems occurred. Third, they should take responsibility for developing their workers,. Forth, thy should share learning laterally. Finally, Obara emphasized the important role of the leaders, and clarified that stronger people will make a stronger company.

As a system engineer, I found this topic very interesting. I heard of the lean system before, but thought it was only used by healthy systems. Obara's presented a deeper background and details on lean, which made me realize that lean can be widely implemented in all kinds of systems, such as schools, hospitals, military and many others.
Obara's presentation was fluent, lively, and interesting. The slides were well made, and included large amounts of images, which made the slides fun to read and easy to understand.

MEMO 4
NPONESS Lesson Evaluation

FROM: Yingfen Huang
DATE: April 12, 2016
SUBJECT: Memo on Colonel Charles Begeman's Seminar

On April 7th, 2016 in the SELP Seminar, Colonel Begeman presented a lecture titled "NPOESS Lesson Evaluation." Begeman holds a BS in Electrical Engineering from South Dakota State University and a MS in System Engineering (SE) from the Air Force Institute of Technology. Begeman currently servers as the Evolved, Expendable Launch Vehicle program Chief Engineer at the Space and Missile Systems Center, Los Angeles AFB, CA.

During the first part of his presentation, Begeman explained basic knowledge of SE, SE processes, requirements, configuration management, and related methods and concerns. In the second part, Begeman introduced the background and history of The National Polar-orbiting Operational Environmental Satellite System (NPOESS). By analyzing the NPOESS divergence, Begeman illustrated five factors that contributed to the failure of NPOESS: decision making and leadership, cost estimation and budgeting, VIIRS technology and engineering, foundational program elements, and intellectual capital. At the end, Begeman summarized the reasons of NOPESS failure and stated his findings and recommendations from this lesson.

Historically, the National Oceanographic and Atmospheric Administration (NOAA) and Department of Defense (DoD) operated separate civil and military polar-orbiting weather satellite systems. To save costs and meet both NOAA and DoD requirements, the Clinton Administration pursued a "converged" polar-orbiting system that became NPOESS. NPOESS was a joint DoD/DoC/NASA endeavor that attempted to integrate the capabilities and infrastructure of the DoC Polar-Orbiting Environmental Satellite Program (POES), the DoD

Defense Meteorological Satellite Program (DMSP), and NASA's long-term continuous climate record collection (CCRC). It was intended to serve as a single, integrated satellite system satisfying both civil and national security requirements for space-based, remotely sensed environmental data, with the aim of significantly improving weather forecasting and climate prediction. Unfortunately, the program changed to a dramatic divergence and ended up in failure. According to Begeman, five main findings and observations are contributed to the failure of PONESS program. The first is the decision marking and leadership. As a multi-agency program, NPOESS co-evolved with its dynamic context creating a challenging program leadership environment - no clear, consistent lines of authority, roles and responsibility. The program manager's authority to utilize the requirements trade space during program execution was constrained and eventually eliminated. The second is cost estimation and budgeting. The cost estimation, including cost risk and contract prices, were under estimated. The budget cut made the program to be severely under-funded. The third is VIIRS technology and engineering. NPOESS failed to establish effective management of the supplier system that help to the increase of efficiency and avoid risk in the purchasing. The fourth is foundational program elements. Alliances between agencies with divergent mission priorities and cultures were ill-fated. The fifth is intellectual capital. Individual skills were not consistently well aligned with organizational needs. NPOESS had an insufficient number of talented and experienced staff appropriate to the complexity and scope of the acquisition plagued the program. In conclusion, divergent forces originated both within the NPOESS program and from its context as follows: senior support, mission priorities, alternatives, requirements, unity of leadership, funding, constituent support, and IPO cohesion. At the end, Begeman listed some recommendations from this case: ensure realistic and independent cost estimation, be a smart buyer, pursue naturally

aligned interagency partnerships with shared mission priorities and requirements, do not mix the DoD and NASA acquisition models, ensure programs are staffed in key positions, ensure leaders and program managers enforce a strict, disciplined, and have persistent focus on the highest priority capabilities from the start.

This presentation provided tremendous details and great case studies about SE process in NPOESS program. It opened my mind and made me realize how dysfunctional a big complex system can be. Improper management and methods could lead to a loss control of the system and fatally failure. I learned a lot from this case study.

Begeman's presentation was interesting and fun. He is knowledgeable and has strong leadership management skills. The slides provided plenty of valuable information about NPOESS case. I like this presentation very much

MEMO 5
Obama Health Care System

FROM: Yingfen Huang
DATE: Jan 28, 2016
SUBJECT: Memo on Steve Tarzynski's Seminar

On February 12, 2016 in the SELP 692 Seminar, Steve Tarzynski presented a lecture titled, "Obamacare 1.0 and 2.0, A Closer Look at PPACA and Future Reform Efforts." Tarzynski, who holds a MD degree from Rush Medical College in 1973, has 20 years of experience from the clinical faculty teaching Pediatrics at UCLA School of Medicine. He was also the former Chief of Service of Pediatrics for KP West LA, and has been an activist for health care reform for over 43 years.

Tarzynski introduced the current health care system in the United States and pointed out its flaws through four aspects: cost, access, quality, and equity. Tarzynski then discussed three heath care solutions: free markets, PPACA(the Patient Protection and Affordable Care Act), and the single payer system. Afterward, he explained the benefits and the deficiencies of PPACA, which is also known as Obamacare. At the end of the presentation, Tarzynski emphasized the single payer health plan would benefit patients and doctors, as well as employers and America.

According to Tarzynski, the current health system of U.S., called the multiple payer system, is costly, inefficient, and has poor accessibility, quality and equity. For example, in 2007 more than $2.2 trillion (16.5% of GDP) was spent on health insurance. This has become a huge burden on families and individuals. Plus, the current employment-based insurance has shifted an increasing cost to workers, which has resulted in 62% of business bankruptcies. High cost, however, has poor accessibility and quality: millions of people are either uninsured or not covered for

important and costly medical services. More people are suffering financial risks from high medical expenses. Additionally, at least one fourth of total US health care spending goes towards administration costs, which is inefficient and a waste of resources. Doctors and hospitals are spending more time trying to get reimbursed for providing health care services rather than with patients. To improve the U.S. health system, Obama proposed PPACA, which guaranteed that all Americans have a right to health coverage. This benefited 25 million people, but still the PPACA did not solve all of the fundamental problems. Insurance companies still play the central roles, coverage is still tied to employment, and administration is even more complex and costly. To pursue a better solution, Tarzynski proposed single payer system, which is composed of public-private mixed and non-profit medical groups. Everyone would be covered under one plan and no longer linked to employment. This plan would pay easier and cost less time, thus decreasing administrative costs for doctors. This system is beneficial for patients, too. It is full care, for all, for less, free choice, and forever. It is also cost-saving for employers. The saved money can be used to improve the work environment and the welfare of employees, which could increase a company's competitiveness in the global economy. Furthermore, it will release the pressure for the whole nation, reinforce the social stability, and make the U.S. economy stronger.

As a system engineer, I found this topic very interesting. Health care is one of the fundamental rights to elevate a citizen's wellness, which is closely related to a nation's development. Tarzynski critically analyzed the health system in U.S., which was thought-provoking and also raised my interests on the American health care reform.

Tarzynski’s presentation was expressive and impressive. The slides provided large mount of details and data to support the arguments. I personally liked this presentation very much.

MEMO 6
Satellite Programs

FROM: Yingfen Huang
TO: Dr. B. W. Oppenheim, LMU
DATE: Jan 27, 2016
SUBJECT: Memo on Dr. Gordon Leon's Seminar

On January 21, 2016 in the SELP Seminar, Dr. Gordon Leon presented a lecture titled "Satellite Program - Rambling of a Retried Program Manager or Would you like to be a rocket scientist and build really cool stuff ?" Dr. Leon has thirty years of technology management experience at Boeing Satellite System and is currently a consultant for Alpine USA, Enterprise Architect and Bal Seal Engineering.

Dr. Leon introduced the satellite system, describing its tough environment in space and indicating the complexity and challenge to build spacecraft. He listed some satellite failures and accidents in satellite history. He also raised a question about how to build quality spacecraft and mentioned that the key factors for building a quality spacecraft are program phase, program execution and program organization. At the end of his presentation, Dr. Leon stated his summary about the qualities of a rocket scientist.

According to Dr. Leon, spacecraft is complicated and challenging to design and build due to space's tough environment, its millions of interfaces, high launch loads, high cost, and etc. Building a successful satellite requires getting all the details right. Even a small error could cause fatal failure of the whole program and a massive lose of money. For example, tin whiskers on power relays could result in a loss of a mission, and the solar array power degradation caused over $600 million to be lost. There are three important factors to build quality spacecraft. The first factor is program phases. The program phases start with a proposal, which is a conceptual

level designed to ensure the customer requirements can be met. The second phase is program start up. This means to transit the conceptual design into real hardware design, and this phase focuses on creating the overall program plan. The third phase is design, which includes a standard platform design, configuration design and structural design. The fourth phase is units and subsystem, which involves units manufacturing, units installation and subsystem assembly. The fifth phase includes device and system tests, such as environment tests, EMC/EMI tests, and etc. The sixth step is outer-space environment simulation. This require shipping the device to a launch site and testing the spacecraft operating functions in a flight model. The last phase is to launch the spacecraft at the launch site, where it is visible to the company, the customer and the overall space community. The second important factor for building a quality satellite system is program execution. A good satellite program must have a clear baseline, requirements, organization and roles-and-responsibilities. The third important factor is management of the program. Most of the satellite program management is matrix organizations, and a good leadership should have vision, drive, credibility and optimism.

As a system engineer, I found this topic extremely interesting. Last month, I went to the Kennedy Space Center, which raised my interests on the topic of spacecraft. The lecture displayed a full process and deeper details on the satellite program, which helped me gain a better understanding of spacecraft.

Dr. Leon's presentation was fluent and logical. The slides were well arranged, and I personally like this presentation very much. However, I expect more technical management lectures in the future.

MEMO 7
SE in GPS System

FROM: Yingfen Huang
DATE: April 14, 2016
SUBJECT: Memo on Col. James Horejsi's Seminar

On April 14, 2016 in the SELP Seminar, Col. James Horejsi had a conversation with students about System Engineering (SE) in the Global Positioning System (GPS). Horejsi holds a BS degree in Electronic Engineering (EE) from LMU and a MS in EE from the Air Force Institute of Technology. He was the Former Chief Engineer and Director of Engineering and Architectures at SMC. Currently, Horejsi serves as Chief Engineer of GPS.

During the first part of his presentation, Horejsi introduced the background and history of GPS, some basic concepts of GPS, and the development of GPS. He illustrated details about GPS system missions, features, design, and GPS program execution phases. In the second part, Horejsi answered students' questions on GPS and discussed general SE processes, SE principles, six thinking, Model Based System Engineering (MBSE), and related methods and measurements tools in the GPS system.

According to Horejsi, the GPS is a satellite-based radio navigation system. It provides suitably equipped users with the capability to precisely determine three-dimensional position, velocity, and time information on a global basis. It originally was developed to provide the U.S. and the DoD with worldwide navigation, position, and timing capabilities to support military operations; in 1983, it was officially made available to civilians. GPS consists of three major segments: the space vehicle, the user equipment, and the control station. The space vehicle segment consists of a system of 24 space-based satellites. Each satellite is capable of continuously transmitting L1and L2 signals for navigation and timing, and L3 signal for nuclear detonation data. The user equipment (receiver) receives signals from a minimum of four different satellites to determine a

three-dimensional position. The control segment commands, uploads systems, control data, monitors, and tracks the space vehicle to validate ephemeris data. The Master Control Station is located at Colorado Springs. The question and answer discussion covered the GPS transition from concept through development, production, and operational capability release. Horejsi indicated that the GPS program presented challenges in various areas such as technology, customers, organizations, cost, and schedule for a very complex navigation system. SE played a major role in the success of this program. The challenges of SE in this system include: integrating new technologies, identifying system requirements, incorporating a system of systems approach, interfacing with overmany government and industry agencies, and dealing with the lack of an operational user early in the program formation that required a strong, efficient Systems Engineering process. To handle those challenges, Horejsi mentioned "Six Thinking Hats" which is a simple, effective parallel thinking process that helps systems engineers become more productive, focused, and mindfully involved. He also mentioned MBSE as a method to deal with complex systems like GPS.

As a systems engineer, I found this topic very interesting. GPS is such a complex system that makes SE highly critical in its process. Horejsi described complex details on GPS system, especially the SE principles in GPS. It helps enhance my understanding of as a systems engineer. Horejsi has immense and extensive knowledge of SE and answered students' questions patiently. I personally like the conversation very much. If Horejsi provided some slides, the presentation would have been better.

MEMO 8
Systems Engineering in HealthCare

FROM: Yingfen Huang
DATE: Mar 17, 2016
SUBJECT: Memo on Dr. Steven W. Badelt's Seminar

On March 17, 2016 in the SELP Seminar, Steven Badelt presented a lecture titled "Systems Engineering in Healthcare". Steve Badelt holds a BS in Electrical Engineering from Carnegie Mellon University, a MS in Biomedical Engineering, and a PhD in Neuron engineering from UCLA. He has over 20 years of experience in the design and launch various products and medical devices, including mechanical auto injectors, electromechanical patch injectors, and insulin-pumps. His reputation is not limited to medical devices, but also engineering management and business development.

Steven Badelt first introduced the successful use of System Engineering (SE) in biotech and medical devices. Second, he displayed the medical device criteria and regulations in the world, highlighting the classification and related SE principles in the US market. Third, Badelt explained risk management of medical devices. He emphasized that safety is the top priority in this industry, not technical risk. He displayed various standards and guidance files in medical technology such as IEC and ISO. Lastly, Badelt displayed several SE integration failures in the medical devices, and discussed the use of SE process in the hospital as well as the future of SE in healthcare.

According to Steven Badelt, SE has been applied to many fields such as medical technology, medical devices, and biotech. The results of its application, such as the reduction to cost and schedule, are notable. SE integrates functions, teams and design controls into the product lifecycle and product development, which has achieved significant improvements on medical

devices, such as imaging systems diabetes systems, combination products, etc. Badelt introduced the regulated markets and criteria files of medical devices around the world. He emphatically introduced the criteria file of US - 21CFR820.30, and provided numerous details and SE principles of 21 CFR820.30: design and development planning, design input, validation process, and V model. He also pointed out that patient safety is integral to medical device design during risk management. Badelt discussed another risk management standards - ISO1497, and explained related principles such as harms, hazard, severity, probability, risk evaluation, risk control, and residual risk. By comparing technical risk management in aerospace and through case studying, he illustrated deep information about risk identification approaches, such as checklist and SE modeling. Furthermore, Badelt provided some other system process standards files and related process, such as risk management in ISO 14971, IEC 60601-1:2009, ISO 11608:1, software management in IEC 62304, human resource management in ISO 62366, etc. At the end, Badelt discussed SE processes applied in the hospital. He described defense acquisition management framework, and indicated that defense buys are top-down, and healthcare buys are bottom up. He illustrated several integration failure in medical devices, such as alarm fatigue, electrode incompatibility, product mimicry, and Lure-Lock, and believed that SE will play a greater role in healthcare in future.

This presentation provided tremendous details and great case studies about SE process in medical devices. It opened my mind to realize that SE can be widely used in so many different industries.

Badelt's presentation was interesting and fun. The slides provided plenty of valuable information about SE. Badelt also was very talkative and patient to answer all the questions. I personally liked this presentation very much.

MEMO 9
Systems Engineering in a Lean Aerospace Industry

FROM: Yingfen Huang
DATE: Mar 11, 2016
SUBJECT: Memo on Dr. Dal B. Lee's Seminar

On March 10, 2016 in the SELP 692 Seminar, Dal Lee presented a lecture titled "Systems Engineering in a Lean Aerospace Industry". Dal Lee holds a Bachelor of Science degree in Mechanical Engineering and a Master of Science in Systems Engineering from Loyola Marymount University. He has 27 years of experience at Boeing Satellite Systems in program Systems Engineering and technology development. His reputation is not limited to System Engineering, but also includes mechanical systems, control systems, and manufacturing processes, etc.

Dal Lee first defined Systems Engineering(SE), systems management, systems viewpoint, systems approach, and the SE process. Then, he compared Lean principles and SE enablers with the classical elements that comprise systems engineering. Next, he discussed the cognitive and personality characteristics of a successful systems engineer. At the end, he reviewed the necessary qualities of a qualified systems engineer.

According to Dal Lee, SE is an interdisciplinary approach and means to enable the realization of successful systems. SE management is the execution of the technical conscience of a program through its life cycle. The system viewpoint is looking at a system from the top down. Each element of the system provides a required amount of value to the system, and the value of the whole system must be greater than the sum of its parts. Dal Lee explained five basic objectives in the SE process, such as ensuring the right requirements, baselines, and compatibility. He illustrated Lean principles and Lean SE key enablers, which include value, flow, and pull, etc.

Furthermore, he detailed 30 elements of SE, such as requirements, life cycle costing, interface control, verification and validation, quality assurance and management, and configuration management. He provided the issue briefing package template and discussed typical issues of SE and the three teams of issue management: phase operations, issue, and root cause team. Next, he thoroughly discussed cognitive and personality characteristics of systems engineers. He believes that a qualified systems engineer should know how to define system boundaries and translate customers' needs into requirements. A systems engineer should be able to describe the system in all relevant perspectives, and anticipate implications from proposed modifications. S/he should have the capability to describe system functions and interface, while being able to integrate and combine experts of different disciplines. Besides, a successful systems engineer should be able to perform cost optimization, define inspections and test for verification and validation, and anticipate future modifications to a system.

This presentation provided tremendous details and great ideas about SE. From the presentation, I feel it is such a great challenge to be a systems engineer as a systems engineer not only deals with the system itself, but also related interdisciplinary elements. A systems engineer requires numerous skills from technical aspects to system management and leaderships. It is complicated, but interesting work.

Dal Lee's presentation was interesting and fun. The slides included plenty of valuable information about SE. I will definitely check those slides again during my future work.

MEMO 10
Water System of City of Los Angeles

FROM: Yingfen Huang
DATE: Jan 21, 2016
SUBJECT: Memo on Dr. Joseph Reichenberger's Seminar

On January 14, 2016, Dr. Joseph Reichenberger presented a lecture titled "Our Water Supply - Are we going to run out of water?". Dr. Reichenberger is a Professor of Civil Engineering and Environmental Science at LMU, and he is a member of the board of the Directors in the San Gabriel Valley Municipal Water District.

Dr. Reichenberger introduced the water system of Los Angeles, describing the primary sources of water in CA. Then, he gave more details about the water sources of the city of Los Angeles. Furthermore, he indicated critical issues with these water sources. Next, he provided several possible solutions for those issues to improve the water system of Los Angeles. In the end, Dr. Reichenberger stated his outlook for the future, and his final conclusion is that Los Angeles will run out of cheap water.

According to Dr. Reichenberger, the primary sources of water in CA include surface water, groundwater, recycled water, and desalted water. The city of Los Angeles water sources come from the Metropolitan Water District (52%), Owens Valley (36%), groundwater (11%), and recycled water (1%). In the lecture, Dr. Reichenberger introduced coastal plain groundwater basins and the advantages to use groundwater: low cost, good quality, and requires the least energy. Dr. Reichenberger states that groundwater is well managed under court order (pumping rights), and is well replenished by the natural rainfall and imported water. Thus, the city of Los Angeles will not run out of groundwater. Still, the groundwater faces a challenge - contamination - polluted by industrial waste, which requires costly treatment. The next major water source of Los Angeles is imported water, which involves in the DWR (the State Water

Project), the Metropolitan Water District of So. Cal (Colorado Aqueduct), and the LA Dept. of Water and Power (the Owens Valley Aqueduct). Dr. Reichenberger emphatically introduced the State Water Project, which pumps water from northern to southern CA. Yet, the SWP is weak and has potential failure because of the Delta fact - due to pumping to the aqueduct, the flow in the Delta is reversed (seawater floods to fresh water). The Delta land is below river water level, which could be subject to flooding and levee failure; endangered species and etc. The other imported water sources are affected by climate change, such as drought. The drought is more severe, which causes lake sources to dry. Dr. Reichenberger then provided two possible solutions for the SWP: the Bay-Delta Tunnels and more storage, such as sites reservoir and the Temperance Flat Reservoir, which are expensive and costly. Dr. Reichenberger then mentioned some other solutions which could help save the water, like conservation, recycled water, desalt seawater, etc. In the end, Dr. Reichenberger compared the cost of those solutions and gave a conclusion that water resource projects are costly. The city of Los Angeles will not run out of water, but run out of cheap water.

As a system engineer, I found this topic - water system - extremely interesting. Last semester, I was in the System Engineering course. One of the group final projects was the city of Los Angeles' water system. This presentation displayed deeper backgrounds and details, which let me to learn a lot and have full understanding on water system of Los Angeles.

Dr. Reichenberger 's presentation is fluent and logical. The slides were well arranged. I personally like this presentation very much.