

Mark Craig Career Lessons and Anecdotes

A 50+ year career archive is best made of value to its users by sharing lessons. It is best brought to life by sharing anecdotes for human interest and backstory, some of which themselves resulted in lessons.

LESSONS:

- Relationships, behavior, values, and respect matter deeply;
- Diversity of skills and points of view are critical to success;
- Strive to **empathize**, not just to understand;
- Differentiate between "**means**" and "**ends**" ... destinations, vehicles, and technologies are "means;"
- Understand the **context** of whatever you do – you'll do it better, and you'll grow:
 - ✓ Above and below, to the left and right;
 - ✓ Elements, processes, markets, policy, ...;
 - ✓ Especially in areas beyond your comfort zone;
 - ✓ Especially in areas ignored by "conventional wisdom;"
- Value your instinct, and develop it;
- Understand your motivation for word and deed ...
 - ✓ To make yourself feel better in the moment, OR
 - ✓ To produce a positive result
 - ✓ The two are usually mutually exclusive;
- "Failure" isn't failure if you learn from it;
- Opportunity is often found at the boundary between "stovepipes;"
- Don't trust what are often called "lessons learned" - make sure that they were.

ANECDOTES:

- A. Working with the Soviets on the Apollo-Soyuz Test Project (ASTP)
- B. Four Unwanted and Painful Changes in Career Path
- C. The Sun Goes Around the Earth ... Really?
- D. Power Tools ... Brand, Story, Myth, and Narrative
- E. Working with "Hidden Figures" Ladies
- F. Relationship with Neil Armstrong
- G. Edward Teller, "Star Wars," and the Space Exploration Initiative
- H. Being Detained at Apollo 11's Launch Pad the Afternoon Before Launch
- I. Peenemunde .. Back in the Day When Junior Engineers did "Real Work"
- J. Impressing Teen-age Daughters: Bill Nye Takes a Selfie ... With Me!
- K. Craig Family Connection with the Space Shuttle

A. Working with the Soviets on the Apollo-Soyuz Test Project (ASTP) - I was a member of ASTP Working Group (WG) #3 which was responsible for docking hardware and procedures. It was co-chaired by Bob White of NASA JSC and Vladimir Syromyatnikov of the Soviet State Research Institute of Machine Building. I performed docking simulations to determine velocity/angle capture boundaries and did preliminary translations of Soviet technical documents into English.

The first Working Group meeting that I attended was somewhat tense as it seemed to me that each side had reservations about working together and did not trust the capability or motivations of the other side. Over time, however, the people on each side came to like those on the other side and to respect their technical capability based on hours of detailed conversations where knowledge and experiences were shared. I came to realize that in many ways the Soviets were like Americans, especially in their sense of humor. I came to both like and respect the Soviet engineers and developed a good relationship with several.

One of the engineers with whom I had a good relationship confided in me that he was very thankful that the U.S. government had “created” the retail establishments around NASA just to impress the Soviets. He had reached this conclusion after having gone to our local grocery store and seen the variety and amount of food. Both the variety and amount were “невообразимый” (unimaginable) in Moscow as he told me, even for the very privileged space engineers. The Soviet’s favorite store in which to go shopping near NASA was Sears where they bought blue jeans and spark plugs in bulk for use and/or resale at home.

The distinction between the Soviet and American shopping experience was highlighted in an observation made by a NASA colleague who had gone to the prestigious GUM department store in Moscow. In the men’s shoe department he was impressed by the large number of shoes. Impressed until he saw that they were all the same style, same color, and same size. He surmised that the People’s Shoe Factory of Novosibirsk (or wherever it was) couldn’t change anything in the product and still meet its production quota, so it didn’t.

LESSON: A common passion can overcome cultural and political differences and stimulate personal relationships, as the passion for space exploration did for the ASTP team and has continued to do for the International Space Station team. The deep and profound relationship that ASTP produced between Astronaut Tom Stafford and Cosmonaut Alexei Leonov is a wonderful example. Almost 30 years after their joint mission, at age 73, Tom and his wife Linda adopted two Russian orphans, boys ages 9 and 12, at the request of Alexei. That’s a relationship!

B. Four Unwanted and Painful Changes in Career Path:

1. **In 1972, being terminated when Apollo was cancelled.** Having been a co-op student, I was hired full time by NASA upon my graduation in January, 1971 ... the last person hired during the Apollo program in Houston. When Apollo was cancelled NASA’s downsizing procedure was “last hired, first fired” so I received a Reduction-in-Force (RIF) letter in May, 1972 with a separation date in June. Seven days before that date I got a

letter revoking my RIF because I'd taken Russian at Purdue and the Apollo-Soyuz Test Project (ASTP) had just been approved. Whew .. skin of my teeth, but still scary as a young husband and engineer. As a result I was transferred to another division to work on ASTP and left the Shuttle work behind which I was enjoying very much. This experience motivated my career-long commitment to developing policy and strategy to sustain NASA human space exploration so that, unlike Apollo, reaching a destination does not result in program termination.

2. **In 1987, not becoming Manager of Space Station Program System Engineering & Integration** ... despite having been concurrently its Acting Manager and Assistant Manager in the Program Office in Houston. Responding to the Challenger disaster, NASA decided to move Space Station program management from Houston to an office park in Reston, Virginia ... a move which seemed to me doomed to failure because the program office then had no resident NASA field center as anchor. I and many others decided not to go. This event derailed my career path as well as put in doubt the fate of NASA's next flagship human exploration program.
3. **In 1991, not being named NASA's Assistant Administrator, Space Exploration** ... despite being Acting Assistant Administrator and having led since 1987 technical and programmatic studies supporting the White House Space Exploration Initiative (SEI) decision. Given the precarious situation of the "Star Wars" community at that time, and ostensibly justified by the National Space Council's desire to "cast the net widely" for ideas, I concluded that the White House had wanted someone from the "Star Wars" community to be the NASA Assistant Administrator.
4. **In 2002, not being named Director of the Stennis Space Center** ... despite having been concurrently Acting Director and Deputy Director for 13 months, and having been Deputy Director for 7 years. With the new NASA Administrator being a former Secretary of the Navy and seeing other senior management appointments going to retired naval officers to cement his influence, I concluded that the Administrator had wanted the local Naval Oceanographic Office Admiral as Center Director and was willing to wait for him to be available.

LESSON: Each of these events was traumatic and resulted in a dramatic change in career direction that, in hindsight, worked out well in ways that I never would have imagined. Even when difficult things happen, keep moving forward with a positive attitude, doing your best, and don't harm any relationships with people in the process.

It also helps to appreciate and enjoy your life as always being a work in progress. My grandfather was a prominent attorney in St. Louis. On receiving a very prestigious award when he was 86, a reporter asked him when he decided to be an attorney. His answer ... "What makes you think I've decided yet?" And he meant it.

C. The Sun Goes Around the Earth ... Really? - As NASA's lead on the Space Exploration Initiative (SEI), it became obvious that a challenge equal in both difficulty and importance to the technical was that of engaging the public to create sustained support. In the belief that you best engage people by meeting them where they actually are, we chartered in 1989 what today would be called a scientific literacy survey of the U.S. voting age public. The results were shocking, even though we'd prepared ourselves for their reception by understanding that they told us where people were, not where we wished they were. Answers to a three part question I'll never forget ... "Does the Earth go around the Sun? Does the Sun go around the Earth? or I don't know." Results were about 1/3 each. So ... 2/3 of the voting age adults in America didn't know that the Earth goes around the Sun. Does this matter in and of itself? No, but what else don't they know that does matter like, for example, the number of branches of government and their functions and relationship.

LESSON: Be careful in what you assume that people know, and don't know. Always, always value awareness and curiosity in yourself and in others, and insist that America's public education system develop and promote them.

D. Power Tools ... Brand, Story, Myth, and Narrative - In 2003 I was on an Agency-level team charged with transforming NASA's approach to external communication. To support our effort we convened a panel of experts on branding. Having gotten to know him through a mutual friend, I invited Professor Neal Burns who was Director of the Center for Brand Research at the University of Texas. Neal is a legend in the branding community because he led the profoundly successful re-branding of Harley Davidson in the 1980's. In his work on the panel Neal made such an impression on Agency leadership that he was asked to come to NASA Headquarters for 6 months to be an in-house advisor. Which he did. Long story short, he went back to UT after 3 months because NASA leadership wasn't taking his advice, they thought that they knew better. In 2009, tired of echo chamber space conferences with the same speakers, I led the creation of a TED-inspired conference in Houston for the American Astronautical Society (AAS) that we called *Imagine '09: Ideas at Work*. Our objective was to explore profound and relevant insights from non-traditional sources and domains. That objective was met in unexpected and very profound and entertaining ways, especially by three speakers:

- ✓ Bob Rogers is the founder and CEO of BRC Imagination Arts which creates brand experiences for Fortune 500 companies, museums, and attractions that include The Abraham Lincoln Presidential Library, Coca-Cola, Heineken, NASA, Disney, and Grand Ole Opry. He's twice been an Academy Award nominee and was a Board member of the Motion Picture Academy of Arts and Sciences. Bob spoke on *Public Engagement*. To effectively engage the public, let marketing lead, use story, keep it simple, stretch it out, get the right products. <https://www.youtube.com/watch?v=m6ey0z8ULeU>
- ✓ Betty Sue Flowers was Editor with Bill Moyers of Joseph Campbell's book and PBS series *The Power of Myth*, editor of global scenarios for the World Business Council, co-author

and editor of Shell Oil's Future Scenarios, and Director of the LBJ Presidential Library. Betty Sue spoke on *The Economic Myth*. Defining myth as a story that creates meaningful reality, Betty Sue explored what she sees as our current predominant cultural myth, the Economic Myth. Its ideal is growth and it communicates through images and numbers. She then compared it with earlier but still active Hero, Religious, and Democratic/Scientific Myths. By example she made it clear that, to be effective, both your myth and that of your audience must be understood and taken into account.

<https://www.youtube.com/watch?v=NbWMSlewggw>

- ✓ Joe Rohde is Executive Designer and VP/Creative of Walt Disney Imagineering and lead creator of Disney's Animal Kingdom. Joe spoke on *Narrative and Organization*. Narrative is a best practice organizing principle that integrates shaping, engagement, and messaging to enable enterprise coherence and efficacy. He gave insights and examples from the creation of Animal Kingdom to explain the use of narrative not only to shape Animal Kingdom but also to shape the organization telling the story of Animal Kingdom.

<https://www.youtube.com/watch?v=SaYFPhGhgil>

LESSON: Never believe that your community has all the answers, or that it even understands all the questions. The world is full of amazing people doing amazing things in many different domains that will be relevant to yours. It's actually fun to seek them out, and promotes your growth.

E. Working with "Hidden Figures" Ladies - The Johnson Space Center Engineering and Development Directorate division in which I worked in the 1970's had two women on its staff who were classified as "math aids." In the day before electronic calculators, PC's, and PowerPoint they supported engineers by performing repetitive calculations on Friden mechanical calculators and by manually producing graphs and charts on drafting boards. These two women had started with NASA's predecessor the National Advisory Committee for Aeronautics (NACA) at Langley Aeronautical Laboratory in Virginia and were original members of the Space Task Group (STG) there. They had moved to Houston with the STG when the Manned Spacecraft Center was created. Given their history, I'm sure that at Langley they were members of the group later immortalized by the movie "Hidden Figures." Neither had been to college as I recall but each loved math, and were very good at it. They got their start in WWII by expanding from 3 to 5 significant digits the trig and log tables that we all used before calculators ... amazing diligence and competence. I don't remember being told this explicitly but I knew, as did all the engineers, that one never, ever went back to these women with an "oops, I made a mistake on the input data I gave you so you'll have to redo your last month's work." They were very nice Southern women in demeanor, but boy, could they be tough!

LESSON: Think before you act! I first realized the importance of this lesson as acting got so much easier with the advent of technology. And, as a result, up front thinking got rarer. This lesson served me well my entire career whether as engineer, program manager, Assistant

Administrator, or Center Director. And also in my personal life. Think before you speak. Think before you commit time or resource, and especially before you ask others to do so. Thank you Katherine and Anne.

F. Relationship with Neil Armstrong - In 1968 I was a Purdue co-op student at NASA's Manned Spacecraft Center (MSC) performing a study of entry trajectories for missions to the planet Venus based on the recently acquired Mariner V and Venera-4 atmospheric data. Purdue's co-op coordinator Prof. Cargnino knew Neil and kept urging me to just stop by. So .. late one morning I walked by Neil's office in Bldg. 4; he was at his desk reading. I screwed up my courage, knocked, walked in, and introduced myself. He got up from his desk and extended his hand in greeting. Said he'd been expecting me, invited me to have a seat, and proceeded to ask me all about what I was working on. He was genuinely interested. About 30 minutes into our conversation Gene Cernan came into Neil's office, somewhat excitedly, and offered Neil congratulations; for what neither said. Neil introduced me to Gene as a fellow Boilermaker, proceeded to tell Gene about my Venus studies, and invited Gene to join us which he did. The next day it was announced that Neil would command Apollo 11. Now I knew why Gene had come by. Neil's selection had just been announced to the astronaut office. What kind of person dedicates 30 minutes to a student on such a day? Simple, a genuinely nice man.

Neil and I kept in touch infrequently after that, but more so when I led NASA's Lunar/Mars Space Exploration Initiative (SEI) efforts and later as I continued to work for a NASA human spaceflight policy that enables enterprise sustainability ... sustainability after any destination is reached. My last conversation with Neil was in November, 2011 as we were discussing the NASA 2010 Authorization Act. True to form, and unlike so many NASA alums, Neil wasn't pushing his own plan for NASA but rather said he would support any plan that the country had debated and determined to be best.

When asked about Neil my answer is simple. If we all had been given the opportunity to select the first person to set foot off Earth, I'm very confident that we would have chosen Neil Armstrong.

G. Edward Teller, "Star Wars," and the Space Exploration Initiative - President George H. W. Bush's announcement of the Space Exploration Initiative (SEI) in July, 1989 on the 20th anniversary of Apollo 11's lunar landing came at a momentous time with profound implications. Having supported the White House since 1988 in its planning for the SEI announcement, I was heavily involved in both the government's and NASA's response to it until 1991.

SEI played out against a backdrop of tectonic shifts in global politics and the U.S. government response to them. The Berlin Wall came down in the Fall of 1989. In 1991 the Soviet Union formally dissolved, thereby ending the Cold War. All of this, of course, had a significant impact on U.S. government plans and priorities. One of the main areas impacted was the U.S. Strategic Defense Initiative (SDI), so-called "Star Wars." The combination of the end of the Cold War and technical challenges had caused SDI's budget to be repeatedly cut and it to be significantly refocused. Given this environment, it's not surprising that the SDI organization and one of its

principle stakeholders, the Lawrence Livermore National Laboratory (LLNL), were extremely interested in the possibilities of SEI.

A very strange aspect to me of National Space Council staff SEI meetings in the White House was the presence of Dr. Edward Teller ... “father of the hydrogen bomb,” LLNL senior executive, and a leading advocate of SDI. He would wander in and out of meetings and say very little. With the threats to SDI’s existence, I wondered if he was collecting information to develop a strategy to protect SDI by imbedding its staff and technology in NASA’s civilian SEI.

Given the lengths to which he’d gone several years earlier to sell SDI as documented in Pulitzer Prize winning journalist William J. Broad’s book Teller's War: The Top-Secret Story Behind the Star Wars Deception, I certainly experienced and came to conclude that this effort to protect SDI also included, if not deception, a fair amount of hyperbole and unsupported claims.

H. Being Detained at Apollo 11’s Launch Pad the Afternoon Before Launch - In the summer of 1969 I was a co-op student at the Manned Spacecraft Center (MSC) in Houston. My best friend from high school and I decided to go to Florida to see the Apollo 11 launch which was scheduled for the morning of July 16. We flew into Tampa the morning of July 15 and drove across the state to the Kennedy Space Center (KSC). As we approached KSC we could see the Saturn V launch vehicle in the distance amazing. My plan was to enter KSC using my NASA badge and see how close we could get, thinking that we would not be able to get very close at all. Well ... that didn’t work. At MSC at that time a car and its occupants could enter the Center if any occupant had a NASA badge. Not so at KSC, each person needed a badge. So, with my friend John’s kind permission, I left him at the KSC gate and told him that I’d get as far as I could but that no doubt I’d be back soon to pick him up.

Seeing the Saturn V in the distance I drove toward it. Much to my surprise with my NASA badge I was cleared through every gate until I was at the entrance to Pad A with the Saturn standing tall on it. I parked in a lot where VIP busses were streaming by with tourists leaning out the windows taking pictures. So I took out my camera and did the same, until I got a tap on the shoulder from a security guard asking me who I was and what was I doing. Turns out that having a camera AND a NASA badge was not allowed without permission, which I didn’t have. He escorted me to the Pad A guard station and told me to wait there until he could figure out what to do with me. After more than an hour and many unproductive calls to what I’m sure were swamped managers he told to leave and to never come back. Tough duty - stuck for over an hour staring up at Apollo 11’s Saturn V launch vehicle!

I thought of this 12 years later when on the early Space Shuttle flights I led the ice/debris inspection team on the pad after the vehicle was fueled just before launch. "I'M BACK, and this time with a much better camera AND a telescope."



John and I saw the magnificent Apollo 11 launch from about 10 miles away across the Banana River at the Air Force gate to KSC, the gate off the Bee Line Expressway where John had spent so much time the afternoon before ... and where we were continually menaced that morning by helicopters spraying for mosquitos.

I. Peenemunde .. Back in the Day When Junior Engineers Did "Real Work"

During the Space Shuttle's development, as Integration Manager of its Solid Rocket Booster (SRB) Separation System, I worked extensively with engineers at NASA's Marshall Space Flight Center (MSFC) in Huntsville, AL which had responsibility for developing the SRB. In the 1970's there were still MSFC engineers on staff who had worked for Werner Van Braun at the German Peenemunde launch site during WWII. I knew several of them and one, in particular, was a real character and became a friend. He said he'd been the "youngest engineer at Peenemunde." Knowing that I'd been a co-op student and that I was a young engineer in my 20's at the time, he always made a point of telling me stories about what it was like to have been a young engineer at Peenemunde, back in the day when junior engineers did "real work."

One of his stories has stuck with me. When there was a problem with a rocket engine's igniter at Peenemunde the standard approach, so he said, was to set a broom on fire and stick it up the nozzle, and then run like a bat out of Hades ... run as only a young engineer could. That's how young engineers contributed back in that day. I'm sure that my eyes got as big as saucers on hearing this story. The imagery! This was offset by his despair at not being eligible for government veterans' benefits. Wrong army I kept telling him, to no avail.

J. Impressing Teen-age Daughters: Bill Nye Takes a Selfie ... with Me! - At the 2016 Rotary National Awards for Space Achievement (RNASA) ceremony Bill Nye the Science Guy received the Space Communicator Award and I received a Stellar Award. Bill, CEO of The Planetary Society, knew of me through two of my longtime colleagues Bruce Murray and Lou Freidman

who were founders of the Planetary Society with Carl Sagan. Bill introduced himself and wanted to take a selfie.



Katie and Claire, then 18 and 16, had grown up meeting astronauts and space dignitaries. I'd even given the *Wiggles* a VIP tour of the Johnson Space Center in 2004. But Bill Nye! Their immediate texted response was "Dad, BILL NYE REMEMBERED YOU!!!!!!!!!" after which they texted it to all their friends whom I'm sure were equally shocked.

K. Craig Family Connection with the Space Shuttle - My parents Carol and Wally Craig experienced the first Space Shuttle launch STS-1 in 1981 while I was in Mission Control's Mission Evaluation Room (MER) in Houston. Thirty years later our daughter Claire experienced the final launch STS-135 with me in 2011. My daughter Katie and wife Christy experienced in 1998 the launch on STS-88 of Unity, the first U.S. element of the International Space Station. Having worked on the Shuttle as a co-op in 1969 and in many capacities until my retirement 46 years later, the Space Shuttle spanned much of my career and was an emotional anchor. By its regular launches over 30 years and variety of work done the Space Shuttle in many ways paved humankind's "psychological highway into space."



My family's support has in many ways made my contributions to NASA possible so sharing these experiences with them was an important way for me to say thank you. The experience of a Shuttle launch is unique and beyond description ... brighter and louder than you can bear, your clothes vibrating against your skin. And beyond the experience, sharing the history. They have witnessed humankind's first steps in the development of space. My prayer is that in all this our daughters will see that through values, hard work, and perseverance they can change the world for the better in whatever they chose to do. Do the right thing Ladies!