Breakfast with Theodore von Karman & Laurance Rockefeller

By Dr. Allen E. Fuhs
Distinguished Professor (Emeritus)
With Input by Dr. John Erdos

In the span of one week during a hot 1954 September in Pasadena, I transitioned from lieutenant junior grade United States Navy Reserve to graduate student at Caltech. I traded military brown shoes with a mirror-like shine on the toes for hush puppies. My appointment at Caltech had two parts. First, I was to earn a Master's Degree in Mechanical Engineering and, second, to serve as a Teaching Assistant for eight hours per week. As a Teaching Assistant, I graded papers and monitored laboratory sessions.

Fortunately my last year-and-half of "sea duty" was on the staff of the Commander of Amphibious Forces Pacific Fleet, a vice admiral. This vice admiral, who was the Navy's first astronaut, sent his Flagship and one of his rear admirals to South Korea. Being part of the vice admiral's Staff, I also stayed on the beach in Coronado. This was a 0800 to 1700 (8 to 5 for you non-military types) job with duty also on Saturday morning. My wife and I had an apartment in Coronado. Once a week in the evening, I commuted to San Diego via the ferry boat from Coronado. My wife, Emily, and I enrolled in night classes at the San Diego Community College. Emily, who had an MBA, was working at Convair. She enrolled in an advanced accounting course. I enrolled in an advanced mathematics course in preparation for Caltech. An engineer from Convair Aviation taught my mathematics course.

College Days

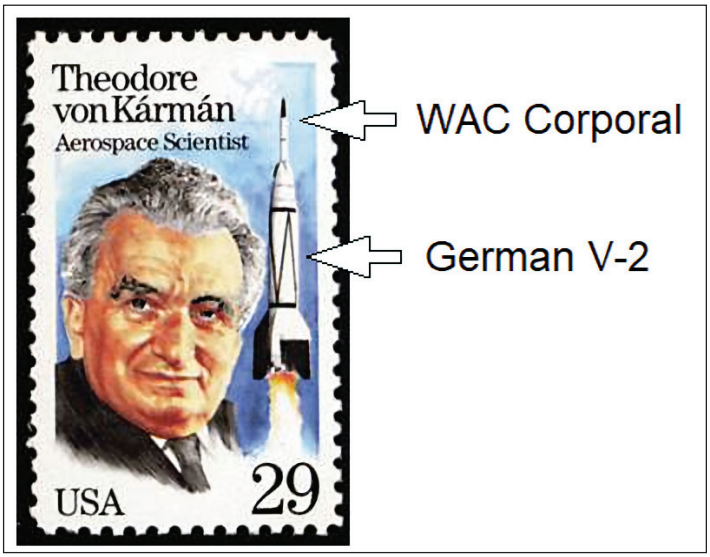
At Caltech, the days merged into weeks, the weeks into months, and the months into college quarters. After three quarters, only nine months, I marched down the aisle and across the stage to graduate. My diploma stated that I was a Master of all of the Sciences in Mechanical Engineering. My second year at Caltech was different. I was awarded a Guggenheim Scholarship. Harry Guggenheim, who was a pilot, and his father established research centers at several Universities including Caltech. The research centers also funded students. By accepting the Guggenheim Scholarship, I became committed to a career in jet propulsion and rockets.

In 1926, the founder of the Guggenheim Caltech Aeronautical Laboratories, GALCIT, was Professor von Karman, an internationally known engineer and mathematician. In 1992, the United States Postal Service issued a stamp to honor his career.

Professor von Karman was a very talented engineer. Had he, however, been a physicist he undoubtedly would have received a Nobel Prize.

In the Spring of 1957, a note was posted on the bulletin board at Caltech indicating Professor von Karman, who had retired from the faculty, was requesting help from graduate students. We all were excited by the prospect of working with the famous and talented von Karman. He accepted six volunteer students and I was fortunate to have been one of these. Every Wednesday afternoon we rendezvoused at his modest house on Marengo Street in Pasadena. He opened his liquor cabinet and offered a choice of drink to each student (I always had a soft drink). After a half hour of conversation, each student in turn was invited into von Karman's study. The results of the student's work were discussed, and new assignments were made for the next week. Remember these were the days when calculations were made with a slide rule. Computers or electronic calculators did not exist.

During that summer, I was required to do my two weeks active duty for the USN Reserve. I did not know how von Karman would respond to the news. He wished me well for the two weeks



The infancy of hypersonics. United States Postal Service commemorative stamp issued 1 September 1992.

von Karman team at wing tip of Ercoupe aircraft on August 12, 1941. From left to right, Clark B. Milliken (son of Robert Milliken, President of Caltech and Nobel Prize in Physics), Martin Summerfield, von Karmen, Frank Malina, and Homer Boushey, pilot of first JATO. March Air Force Base. (Photo from NASA Jet Propulsion Laboratory)

of service. Von Karman had had considerable interaction with the military. In WWI he had served in the Hungarian Air Force as an officer. He was a founder and first chairman of the USAF Scientific Advisory Board.

Three years later in 1958, after graduation from Caltech with a PhD in Mechanical Engineering and a minor in Physics, I accepted a position as an assistant professor at the Technological Institute at the Northwestern University in Evanston Illinois. The first two months in the mid-west were delightful with the red and yellow leaves covering the ground. The first snow brought slush and the need to wear snow boots. The first snow was quickly covered by a layer of Chicago soot. Each fresh snowfall was soon covered by soot. As the dreary winter progressed, our thoughts more and more focused on California.

While I was at Northwestern University, Professor von Karman presented a lecture at the Technological Institute. At the reception, he was surrounded by the President, Provost, Deans, Faculty Chairman, interested faculty, and local Press. I approached von Karman, who after two years recognized me, and asked "Fuhs, are you still drinking Coca Cola?" My reply was "Yes sir." He remembered me from the time I was his human computer.

Emily was teaching at the High School in Skokie which was about 10 miles from Evanston. After driving on snow slick roads, one afternoon she announced we were going back to California. It was not a suggestion but a command. From that day forward we planned for our return to California.

The Spring of 1959, I resigned from Northwestern. We travelled to Los Angeles where I sought a new position. We were guests at the house of friends in the Palos Verdes whom we had met at Caltech. One day was spent at Caltech talking to my former teachers about employment opportunities in Southern California. Over the next several days I interviewed with a few companies.

Much to my surprise I received a call from Professor von Karman stating he wanted to see me the next day in Pasadena. I left Palos Verdes and drove towards Pasadena. It was a hot day. The 1955 Chevrolet V-8 vapor locked on the Pasadena freeway. This was not a new experience. I covered the fuel pump with a wet rag. In 10 to 15 minutes, the fuel pump could pump gasoline. I was 45 minutes late to my appointment.

Arriving at von Karman's house in Pasadena, I was surprised to find Laurance Rockefeller there also for the meeting.

Ercoupe aircraft on a steep ascent with the help of JATO rocket. The pilot was Homer Boushey. (Photo from NASA Jet Propulsion Laboratory)

Background

During the 1930s and early 1940s some of von Karman's graduate students were fervently interested in rockets. They could not conduct rocket tests on campus at Caltech due to safety. They moved the rocket tests to the Arroyo Seco just west of Pasadena. By 1941, their rockets were safe enough to attempt rocket assisted take off and finally pure rocket powered flight of an aircraft. The photo on the previous page shows part of the team Professor von Karman had assembled. The photo above shows the first Jet-Assisted Take Off (JATO).

After the successful demonstrations of JATO, von Karman and his students formed and incorporated a new company called Aerojet. As WWII progressed, the need for the production of large quantities of rockets became apparent. Professor von Karman and his students had neither the experience nor the desire to manage a large rocket production facility. The Aerojet Corp. was completely reorganized and absorbed by General Tire and Rubber with new financiers and managers. The name was changed to Aerojet General. The stockholders of the original Aerojet Corp. were given the choice of surrendering their shares for immediate cash or exchanging their original shares for shares in the new Aerojet General Corporation. Professor von Karman exchanged his shares for cash. He later regretted that decision. Frank Malina (see Figure 2), on the other hand, took shares in the new Aerojet Corporation.

Why was General Tire and Rubber interested in the von Karman's Aerojet Corporation? The answer, which needs to be amplified, is synthetic rubber. In WWII synthetic rubber was important. Here is the recipe for a typical solid propellant rocket: synthetic rubber, powdered aluminum fuel to increase energy density, and ammonium perchlorate as oxidizer. Of course, making a rocket is not as simple as the preceding sentence implies. A poorly designed solid propellant rocket is as dangerous as a stick of dynamite.

Both Martin Summerfield and Frank Malina were caught in Senator Joe McCarthy's hunt for Communists. Apparently, Senator McCarthy never could prove his accusations against Malina and Summerfield. Malina moved to Paris and became a multi-millionaire from his Aerojet stock. Martin Summerfield became a professor at Princeton. (I worked with Martin Summerfield for many years in AIAA Publications.) With Malina's success, Professor Von Karman realized he too could have been wealthy if he had retained his Aerojet stock. Let's now return to Pasadena

Theme building at LAX located in middle of the airport. (Photo from Wiki Commons)

and my meeting.

Breakfast with von Karman

After 60 years the exact details of my meeting with Professor von Karman and Rockefeller cannot be fully remembered. Professor von Karman and Rockefeller told me they wanted to open a new company on the West Coast specializing in Aerospace R&D. I was offered a one-half time faculty position at Caltech as an Assistant Professor. The offer for salary or support for creating the new Aerospace R&D company was zero. I told the two gentlemen that I needed to discuss their offer with my wife. Since they were flying East the next morning, we agreed to meet at LAX the next morning.

In 1959 parking within a few hundred feet of the LAX Theme Building was possible I told Professor von Karman and Rockefeller that I appreciated their vote of confidence in my ability. Earning tenure at any University is a full-time effort. At the moment I did not have any product or R&D idea to develop. Also, my wife had been teaching school for many years. The time had come for me to find and accept a suitable position.

In June of 1959 I was not fully aware of the real world of R&D. In the real world, s*omebody must pay for the research that you want to conduct.* I could manipulate non-Hermitian matrices blindfolded with one arm tied behind my back. I had successfully passed physics courses at Caltech taught by Nobel Prize Winners for students who would become future Nobel Prize Winners. During my four years at Caltech I had been coddled; someone else obtained the research funding. In 1959, what Professor von Karman and Mr. Rockefeller needed was someone more experienced than I. My role as a participant in this story ended as I paid the 50¢ parking fee and drove away from LAX. I became an interested observer curious about the ending of the tale.

Why the Job Offer?

What was von Karman's and Rockefeller's motivation for the job offer discussed at LAX? In 1959 and 2020 in my memory I had one answer. After researching this topic, I have another somewhat different answer.

From my memory

Upon their return to the East Coast, Professor von Karman and Laurance Rockefeller formed their new Aerospace R&D Co. with a watch corporation as partners. The company closed after a short life.

From Research

As a stroke of good fortune, I found a former employee of General Applied Science Laboratories, or rather he found me. The unknown watch company was Gruen. This fact opened the door for more detective work.

According to Wikipedia, Gruen Applied Science Laboratory (GASL) was founded in 1956 by Antonio Ferri and Theodore von Karman. Later in 1958 the name was changed to General Applied Sciences. The facilities of GASL still exist today in Ronkonkoma, N.Y., on Long Island. Further research failed to find an email address or phone number. GASL focused on hypersonic flight including propulsion.

In 1958, I interviewed with Professor Antonio Ferri for faculty position at NYU; the interview was on Long Island at Ferri's blow down hypersonic tunnel. The interview might have been at Ronkonkoma. Later he and I shared about 8 to 10

Propulsion Panel Meetings as part of AGARD NATO, which was another example of Dr. von Karman's influence. Professor Von Karman was the spark plug that started AGARD. I never remember discussing GASL with Antonio..

I searched newspaper archives (for example *Los Angeles Times* and *New York Times*). I asked various organizations for help; most ignored my requests. I sent a letter to GASL asking questions about von Karman's role in GASL. No reply. Even today USPS delivers almost all mail. USPS likely did not lose the letter to GASL.

I attempted to obtain the telephone number or email address for GASL and did not succeed. I even sent an email to Chamber of Commerce in Ronkonkoma. Mr. Kevin Hyms, President of Ronkonkoma Chamber of Commerce, drove by and visited the address of GASL. He was not allowed to speak with anyone at the facility, and he handed the receptionist his business card and the Chamber of Commerce information. She was not allowed to disclose any names, phone numbers or email addresses and handed to Kevin a card. The phone number on the card is non-functioning and apparently each employee has their own unique phone number and email address. (This sounds to me like GASL has a contract in the Black World of security.) The Chamber of Commerce sent an article from the local newspaper that GASL had received $1M grant from ARPA-E to study removal of carbon dioxide from atmosphere using a hypersonic wind tunnel.

Professor Theodore von Karmann, after receiving the first National Medal of Science from President John F. Kennedy on White House lawn, introduces Professor Antonio Ferri to JFK. Professor Antonio Ferri accompanied Karman to the White House for the Award ceremony. JFK asked "Should I know him?" Dr. von Karman replied "Don't you know Toni Ferri, everybody knows him!" Note the Generals in the background. Also observe Lee Arnold in photograph. (Photo from JFK Presidential Library)

What a fantastic punchline to be told for this story on von Karman and hypersonics. Hypersonics initially seemed to offer help with climate change. Apparently the GASL study funded by ARPA-E did not show promise.

Why the interest in GASL? Part of Karman's legacy is hypersonics. GASL, which was partly a creation of Karman, specializes in hypersonics and becomes the connecting thread. The best description of the early years of GASL come from John Erdos, PhD., who stated:

> My knowledge of the early (pre-1968) GASL history is based in large part on the oral history from Gertrude Weilerstein. Her first job after graduation from Hunter College (circa 1953 or so) was as a "computer" (she did calculations on a Friden mechanical calculator) for the consulting firm of Biot and Arnold (both on the faculty of Columbia University). Biot and Arnold begat Lee Arnold Associates. Lee Arnold Associates begat KAHFCO (Karman, Arnold, Hoff, and Ferri's Company.) KAHFCO begat Gruen Applied Science Laboratories. Gruen morphed into General, and General Applied Science Laboratories eventually morphed into GASL.
>
> It appears to me that the formation of Gruen Applied Science Labs (a subsidiary of the Gruen Watch Co.) coincided closely with an international symposium on high speed aeronautics held at Brooklyn Poly in 1955 (which may or may not have been where von Karman and Ferri first met). In any case, Gruen Watch Co. formed this little company in about 1955 or 1956 to gain entry into the growing aerospace and defense business. The principals were Antonio Ferri and Nicholas Hoff, both of the Polytechnic Institute of Brooklyn, and Lee Arnold, of Columbia, with Theodore von Karman, of the California Institute of Technology, on Board of Directors. (Lee Arnold got his MS from CalTech under von Karman, and Biot co-authored a famous book with von Karman. Hoff subsequently became head of the aero department at Stanford.)
>
> The first location for the company was in the bank building (then Franklin National Bank) at the entrance to Roosevelt Field Mall on Old Country Road. About a year into it, Gruen decided it was not a good idea, and spun it off. Laurance Rockefeller Associates had a Technical Advisor named Teddy Walkowicz who was a former student of von Karman, as well as a former Air Force officer. He presumably got Rockefeller interested and Rockefeller Associates bankrolled a "management buyout" of the firm from Gruen. (Legend has it that the acronym GASL already had name recognition, and the company had an ample supply of stationary with GASL on the letterhead, so Ferri recommended changing Gruen to General, to avoid buying new stationery.) As far as I know, Rockefeller Associates were the owners.
>
> The company needed space for a couple of wind tunnel facilities and took a 99-year lease on the former Meadow Brook Country Club at the corner of Merrick and Steward

Aves in Westbury, which had been converted to an industrial property during WWII. That move happened sometime around 1960.

Somewhere in the late 1960s, GASL got into financial difficulties that threatened the viability of the company. Rockefeller Associates also owned The Marquardt Co. in Van Nuys, CA, which was a ramjet manufacturer, with some R&D underway on scramjets. Rockefeller had Marquardt buy General Applied Science Labs to avoid having the latter go bankrupt. GASL became a wholly-owned subsidiary of Marquardt. I suspect Roy Marquardt and Tony Ferri mixed about as well as oil and vinegar. In any case, Ferri became a VP of Marquardt and put Lou Nucci in charge at GASL. Again, legend has it "that he spent three days per week at Poly, three days per week at GASL and three days per week at Marquardt." Even he could not keep up that pace. I don't know what happened, but after a year or two, Ferri either quit or was fired. That was about 1967 or so. Also, a bit earlier, Ferri, Victor Zakkay and Roberto Vaglio-Laurin moved from Poly to NYU. (I think Ferri got passed over for Department Chair at Poly.) All I know for sure was that he showed up at NYU in 1967 where I was then studying for my Ph.D., as a fulltime professor in the Aerospace Engineering department, then headed by Lee Arnold (who had moved there from Columbia). About a year later, Ferri, Zakkay and Vaglio-Laurin formed a new company – Advanced Technology Laboratories, Inc (ATL). Ferri stole Roffe and Trucco away from GASL, which was at that point self-destructing, to become the first two engineers at ATL. I became the third in the spring of 1968, when I finished my Ph.D. ATL, located in Jericho, grew to about 24 people, doing only "paper studies."

Marquart was getting ready to shut down GASL in about 1970. Ferri got word of this, probably through Nucci, and was determined to regain control of the company. "We must save the facilities." Lou Nucci, Ed Kush and Ernie Sanlorenzo (NKS, Inc.) bought GASL back from Marquart and promptly sold it to ATL. (Ferri refused to have any dealings directly with Marquardt.) ATL did a "reverse merger" in which ATL transferred its contracts to GASL and GASL emerged as the surviving entity. And ATL's personnel moved to GASL's building in Westbury and became GASL employees.

Things went well for a while, but then Ferri suddenly died of a heart attack in 1976. Roffe, Sanlorenzo, Trucco and Erdos eventually took over management of the company. GASL got pretty small for a while - down to about 12 employees at one point – before it got healthy again, in large part due to a classified program called COPPER CANYON, which eventually emerged as The National AeroSpace Plane Program (NASP). The company outgrew its property in Westbury due to work on the NASP program, and selected a new location (twice the acreage of the Westbury property) on which to build a new home in Ronkonkoma.

Aerojet was one of two engine companies initially involved in NASP. Pratt & Whitney was the other. Then General Electric came onboard, followed by Rocketdyne. GASL worked closely with Aerojet on development of a large engine test facility that Aerojet was building in Sacramento. Then Aerojet made and offer to buy GASL, believing (incorrectly) that owning GASL would give them and unbeatable competitive advantage in the NASP program. It didn't work out that way at all, and to make matters worse, the Berlin wall fell, peace broke out, and Aerojet's two bread-and-butter rocket programs were cancelled. About five years later, when Aerojet's parent company GenCorp, decided there were no buyers out there for Aerojet, and they had better trim the fat off the company and focus on their core business, they decided to divest themselves of GASL. As the only alternative to being shut down, Roffe and Erdos did a management buyout, or actually an "earnout" – we bought the building and paid for the company out of its earnings over the next couple of years.

A few years later, a private equity firm, Kohlberg and Company, made Roffe and Erdos an offer for the company that they could not refuse. I think you know as well as I how that went, and more than I do about how GASL became part of ATK."

The famous book mentioned by Dr. Erdos and co-authored by Theodore Von Karman and Maurice Biot is *Mathematical Methods in Engineering.*

The final days of GASL involved a series of mergers that are outlined here for completeness. In 2015 Orbital Sciences merged with ATK the rocket company. Since GASL was part of ATK, GASL now became part of Orbital-ATK. When Orbital-ATK merged with Northrop-Grumman in 2018, GASL became part of Northrop-Grumman. Apparently, the name of GASL has disappeared into Northrop-Grumman.

Professor von Karman served as Honorary Chairman of the Board of GASL in 1956. Being "Honorary", von Karman could share his vast knowledge of hypersonics without conflict. Had von Karman had a financial interest in GASL, he would have had a conflict of interest since GASL acquired USAF contracts and Dr. von Karman was Chairman of the USAF Scientific Advisory Board.

Why the Job Offer?

All this said, my answer to the question stated at the start of this article has evolved. What was Professor von Karman's and Laurance Rockefeller's motivation for the job offer discussed at LAX?

After I resigned my position at Northwestern University, I visited the faculty at Caltech who were my teachers for my PhD. I was searching for a position in Southern California, and my intent was to inform my teachers I was available. In the years immediately following the launch of the USSR Sputnik, true rocket scientists were in short supply. A true rocket scientist actually studied rockets as I had done. A conversation between Karman and the Caltech faculty likely indicated I was available. Professors are like mother hens relative to their chicks and students. Professor von Karman realized I was looking for a new position, and he offered the job discussed earlier. This is what I believe today. This indicates that not only was Karman an exceptional engineer but he was also a generous person with empathy. ✈