

Andrew Klein: Getting the good gigs



The 62nd president of the American Nuclear Society has a wide-ranging background in fusion energy, space nuclear power, and advanced reactor R&D—and he plays a mean tenor sax.

By Tim Gregoire

About seven years ago, Andy Klein was cleaning out his parent's house in eastern Pennsylvania, rummaging through a lifetime of collected memories, when he stumbled upon a long-forgotten science project of his from the 6th grade. It was a depiction of a uranium atom undergoing fission. "Like any parent, my mother would keep a lot of the stuff we made," Klein recalled, "and that was one of the things she kept. You could call it an omen."

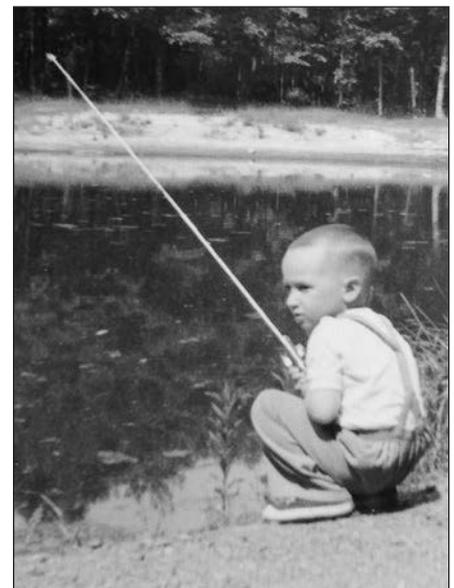
Indeed, Klein's interest in nuclear science and engineering has never waned, spurring him to explore everything from fusion to space energy to nuclear energy policy. It led him to earn a bachelor's degree from Pennsylvania State University and master's and doctoral degrees from the University of Wisconsin at Madison, all in nuclear engineering. And it culmi-

nated in a career of 31 years and counting as a professor of nuclear engineering at Oregon State University, where he also has served as head of the Department of Nuclear Engineering and Radiation Health Physics, now the School of Nuclear Science and Engineering. "I am a nuke, all the way through," Klein said.

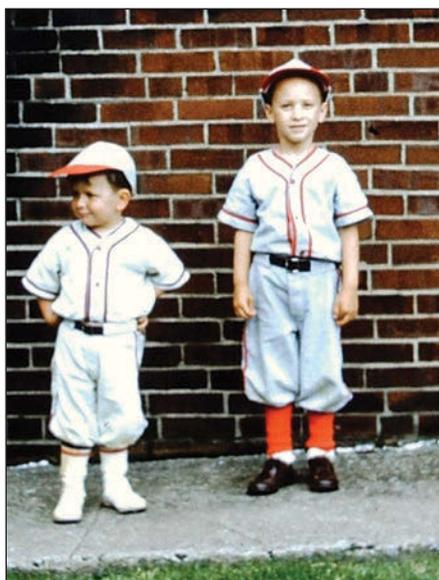
Berks County, Pa.

Andrew C. Klein was born on July 28, 1955, in Philadelphia, Pa., and grew up in western Berks County in the town of Lincoln Park, just west of Reading, Pa. Lincoln Park Elementary, the school where he completed the 6th-grade science project on fission, was across the street from the house where he and his younger brother, Kevin, who is now a retired accountant, were raised.

Klein's father, Donald, was an industrial engineer for Western Electric's Reading Works, which manufactured electron-



A 3-year-old Andy Klein discovers the joys of fishing.



Klein, right, and his brother, Kevin, suit up for baseball.

ic components for telecommunications equipment, and his mother, Mary, was a homemaker. Both parents are natives of eastern Pennsylvania and still live there in a retirement center in Berks County. “When people mention Three Mile Island, I like to tell the story of how my parents have lived all their lives 40 miles downwind from the plant, and my dad is turning 90 this summer and my mother is turning 87 this fall,” Klein said.

Klein graduated from Wilson High School in West Lawn, Pa., in 1973. He credits his advanced mathematics teacher, Ray Richie, for planting the seeds for what would eventually become a career in nuclear engineering. “I learned calculus from him as a senior, and I remember taking a physics class, and tying the physics together with the math was always very interesting to me,” he said. “The combination of math and physics is, quite frankly, engineering.”

In high school, Klein’s interests extended beyond math and science. He played tennis his sophomore through senior years, becoming the top-ranked player his senior year. “But I wasn’t that good—I was the only senior on the team,” he admitted. “But it was fun playing.”

It was also during high school that Klein developed a lifelong love of music, particularly jazz. Having learned to play the clarinet in elementary school, he switched to the tenor saxophone when he was in 8th grade at Wilson Junior High to join the school’s jazz band. In one of his first leadership roles, Klein became president of the Wilson High School marching band in his senior year. The Wilson High marching band had a reputation as a competitive, high-quality band and competed up and down the East Coast in parades, field shows, and the occasional concert. “We were the top-ranked field show in the country for a number of years running,” Klein said.



Klein in 1964 with his clarinet, the first musical instrument he learned to play.

Since then, Klein has picked up a number of other woodwind instruments, including the flute and alto and soprano saxophones. He still plays music, although, he admits, not nearly as much as he would like to. He led a community big band in Corvallis, Ore., in the 1990s, and although he’s no longer a member of a band, he’ll occasionally sit in with friends, or even students. “The last time I played my saxophone was with one of my Ph.D. students who led a jazz combo,” he said. “They welcomed me to sit in and play a few songs with them at some of their gigs.”

Academics, sports, and music, however, were not the only things Klein fell in love with in high school. In his homeroom class, sitting in alphabetical order two seats behind him, was Tracy Klopp, who took notice of the nice, smart boy in front of her. “I was attracted to him from the start,” Tracy said, “and for some reason, I just knew he would be my husband someday.” The two went on a few dates, but it wasn’t until they went on a trip to Florida with the marching band for a week of competitions (Tracy was in the color guard) that things got serious.

After high school, the couple parted for college, with Tracy going to Brandywine College in Delaware (now Weidner University Law School) to study healthcare management. “That time apart at different colleges was tough for both of us, but we muddled through,” Tracy said.

Penn State

For Klein, the decision to attend Penn State was an easy one. The university’s reputation as a world-class institution for nuclear science and engineering has continued ever since President Dwight D. Eisenhower delivered his “Atoms for Peace” speech to the United Nations and his brother, Penn State University President



As the president of the Wilson High School band, Klein receives a competition trophy for first place.

Milton Eisenhower, provided Engineering Dean Eric Walker with \$250,000 in equity from a decommissioned coffee shop to build a nuclear research reactor.

“Penn State was an outstanding undergraduate education,” Klein said. “I had outstanding nuclear engineering instructors, some of whom I am still friends with and keep in touch with today.”

Klein continued to play music, joining Penn State’s jazz band his freshman year. While he enjoyed playing in the band, something happened that confirmed for him that his decision to follow the path of nuclear engineering was the correct one. “We had an alto sax player who was a music education major and just a phenomenal player—and likely a really good teacher—but he was struggling to find a job in music education. I was nowhere near as good as he was, and I thought to myself, ‘Well, if he’s struggling to find a job, I had better stick with my engineering studies.’ As they say in music: Keep your day job.”

The nuclear engineering program at Penn State had just the right mix of physics and math that appealed to Klein, who had decided that he did not want to follow his father into industrial engineering. Neither did mechanical or any of the other traditional engineering disciplines interest him. This was still six years before Three Mile Island, and nuclear science was a vibrant and active field. “There was a lot going on, and nuclear engineering was one of the more exciting majors on campus, for an engineer at least,” Klein said.

Penn State’s Department of Nuclear Engineering was led at the time by ANS Fellow Warren Witzig, one of the pioneers of



Klein competes in an ultimate frisbee match in 1976 between Penn State and Rutgers University.

nuclear power in the United States. Klein describes Witzig as a hard taskmaster but a great leader. “He was an outstanding, overall good instructor,” he said. It was, however, Edward Klevans, also an ANS Fellow, whom Klein credits with being an important mentor and his “unofficial” advisor at Penn State. “He was and still remains an important advisor to me,” Klein said.

Klevans taught controlled fusion and plasma physics, and Klein says it was from him that he became infected with the fusion energy bug. “I knew I wanted to get into this really new area called fusion,” he said, “and in doing so, I learned that at the time, you really could not work in the fusion area unless you had a Ph.D.” So when the University of Wisconsin at Madison, which had a fusion program, offered him a research assistantship, he accepted.

Before moving to the Midwest, however, Klein had one more important milestone to complete: On May 27, 1977, after seven years of dating, he and Tracy, his high school sweetheart, were married. “I skipped my graduation commencement at Penn State to go on my honeymoon,” he said. Borrowing Klein’s new father-in-law’s van, the couple drove up the New England coast. They attended a concert of the Boston Pops Orchestra when the late, great Arthur Fiedler was still its conductor. At the historic seaport of Mystic, Conn., the couple booked an overnight passage on the schooner *Mystic Whaler*, sailing across the sound to Long Island. While an overnight sail in a tall ship may sound romantic, the couple would be in for a surprise. “We ended up sharing the boat with a Girl Scout troop for our honeymoon,” Klein said. “It was certainly memorable.”

UW-Madison

In August 1977, Klein moved to Madison, Wis., with the intent of becoming a fusion engineer. At UW-Madison, he studied under Bill Vogelsang and ANS

Fellows Gerry Kulcinski, Max Carbon, and Gregory Moses, among others. In 1981, ANS past president (2012–2013) Michael Corradini joined the UW-Madison faculty, and although Klein did not have any classes taught by Corradini, the two ended up playing together on an intramural basketball team.

In addition to his interest in fusion energy, Klein brought another, more physical obsession with him to Madison. While at Penn State, he became involved in the sport of ultimate frisbee, becoming a leader in the university’s fledgling team. Now just referred to as “ultimate,” the sport combines the fast-paced, nonstop action of soccer with the aerial passing skills of football—all played with a flying disc. Born of

the counterculture of the 1960s, ultimate is noted for not using referees, instead relying on the sportsmanship and integrity of the players to maintain fair play.

“Ultimate frisbee was something I got into in a big way,” Klein said. At Madison, he and Tracy became founding members of the university’s ultimate team and helped write the bylaws of the then new Ultimate Players Association. He also worked to bring more representation of the Midwest to the sport, which was dominated by the East Coast, where ultimate had begun. “We thought it was unfair that we had to go out to Amherst, Mass., to play in a tournament, so I wrote to the powers that were, and that was part of the catalyst for the initial stages of the Ultimate Players Association,” he said.

While UW-Madison’s nuclear engineering program was and remains highly regarded, Klein admits that the town and campus life were, at times, too much fun. “The distractions in Madison are many,” he said. Klein was there during the time of the infamous Pail and Shovel Party, the UW-Madison student government group led by the pranksters Jim Mallon and the late Leon Varjian. Among the group’s more memorable pranks was placing a replica of the top of the Statue of Liberty on a frozen Lake Mendota one winter. Sitting on the ice, it appeared that Lady Liberty was frozen up to her nose in the lake. The Pail and Shovel Party was also responsible for covering Bascom Hill with more than 1,000 plastic pink flamingos, a tradition that continues to this day. “More than any other student government at any university I’ve



Just graduated from college, high school sweethearts Andy Klein and Tracy Klopp marry in 1977.



While working on his master's degree at the University of Wisconsin at Madison in 1979, Klein witnessed the Pail and Shovel Party's stunt of placing a replica of the Statue of Liberty on a frozen Lake Mendota.

ever had any connection with, they gave us a great laugh," Klein said. "They promised corruption and graft as part of their campaign, and boy, did they deliver."

Despite the distractions, Klein earned his master's in nuclear engineering in 1979. Those same distractions, however, may be to blame for a short pause in Klein's academic career. "After getting my master's, I took my qualifying exams. I didn't do so great, so I had to go out and work for a while," he said.

Klein took a job back on the East Coast with Combustion Engineering, doing sequence-of-events analysis following the accident at Three Mile Island. It didn't take Klein long, however, to decide that it was not a good fit. "I realized that I probably didn't have a commercial bone in my body," he said. Also, seeing that almost everyone around him at Combustion Engineering had a Ph.D., Klein thought it would be a good idea to continue his education. So in January 1980, he and Tracy packed up a U-Haul truck and moved back to Madison, where, Klein said, "I studied my tail off, passed the qualifying exams, and started working on my thesis."

In November 1981, while Klein was working on his Ph.D., his daughter, Brianna, was born. Three years later, when he was a faculty member at the University of Cincinnati, his son, Timothy, was born. Today, Brianna is a postdoctoral fellow in biochemistry at the University of Colora-

do Hospital in Aurora, Colo., and Tim is a mechanical engineer at Northwest UAV, an unmanned aerial vehicles company based in McMinnville, Ore.

In academia

While starting a family, playing ultimate frisbee, and managing all of Madison's other distractions, Klein earned his Ph.D. in 1983. He was soon offered a position as a visiting assistant professor at the University of Cincinnati. The position opened up because one of the members of the university's nuclear engineering faculty took a leave of absence to set up a consulting firm for what was then the William H. Zimmer nuclear power plant, which was under construction in nearby Moscow, Ohio. Klein's career at Cincinnati, however, was short lived. In 1984 it was decided that due to financial and safety issues, the Zimmer plant would be converted to a coal-fired generation plant, and the faculty-member-turned-consultant returned to resume his faculty position.

Fortunately, a position opened up across the country at Oregon State University. In 1985, with Tim still less than a year old, the Kleins moved to Corvallis, Ore. "I convinced Tracy to move this far away from family in eastern Pennsylvania by estimating that I wasn't good enough to get tenure anyway," Klein said. "I told her that we would come out here, explore the Northwest, let our kids grow up a little bit,

and then I would look for a real job. And I've been here ever since."

Although he spent only two years at the University of Cincinnati, Klein said he learned a lot about the art of teaching, developing his pedagogical skills as an instructor of undergraduate and graduate courses. Klein was greatly influenced by his fellow nuclear engineering professor John Christenson. The two became great friends, and long after Klein left Cincinnati, they could be seen catching up on each other's lives at ANS meetings as they jogged along during the Tuesday morning "fun runs." Christenson continued teaching at UC until he passed away in 2010.

Joining OSU as a junior faculty member, Klein found the Nuclear Engineering Department, as well as the entire College of Engineering, to be primarily focused on undergraduate education. While the Nuclear Engineering Department was, and still is, closely associated with the OSU Radiation Center, which was established as a multidisciplinary radiation and radioactive materials research center, nuclear engineering at that time had a fairly small research program. That has changed, Klein said, noting that OSU's College of Engineering, including nuclear engineering, has grown into a significant research school over the years.

"I am very proud of the fact that we have maintained the Department of Nuclear Engineering and Radiation Health Phys-



Klein enjoys a fall day outdoors during his graduate studies in Madison with Tracy and their dog, Tara.

ics, now the School of Nuclear Science and Engineering, through some very lean years,” Klein said. “In addition to still being here and expanding our research programs and improving our visibility and national rankings, just the way we have done things and established world-class facilities here in Corvallis—which is not a place that the world flows through—is something to be proud of.”

One of the most notable products of nuclear engineering research at OSU was the development of NuScale Power, the company that emerged from a research project conducted in collaboration with the Department of Energy’s Idaho National Laboratory and Bechtel. NuScale is now developing a small modular reactor based on the OSU research. While not directly involved with the NuScale project, Klein was head of the Nuclear Engineering Department when Jose Reyes, who is now the company’s chief technology officer, began the research.

Klein also emphasized that OSU continues to make many important experimental and analytical advancements in other areas of nuclear energy, including high-temperature gas reactors, reactor safety and design, computational methods development, and radioecology and radiochemistry. Klein recently conducted research into advanced nuclear fuel concepts for General Atomics’ new Energy Multiplier Module (EM²) reactor. He currently is investigating helium and air-flow dynamics during accidents in high-temperature gas reactors, as well as researching economic safety evaluations as a means of developing tools for the nu-



The Kleins with daughter, Brianna, and son, Tim, in 1990

clear industry to use when deciding what plant upgrades to implement.

“I would characterize my research as the ‘lunatic fringe’ of nuclear engineering,” Klein said, adding that he has an insatiable curiosity and is always interested in new technologies and projects. “I have worked in fusion, space reactors, and about every kind of fission reactor that you can think of. From economics to corrosion to you name it, my span of research is broad.”

Those broad interests would lead Klein to positions outside OSU, including three summers (1986–1988) at NASA’s Glenn Research Center in Cleveland, working on nuclear power applications for space, and directing the Oregon Space Grant consortium for nine years (1993–2002). As a member of Battelle Energy Alliance’s leadership and management team, Klein participated in the merger in 2005 of Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory–West into the current Idaho National Laboratory. Having chaired the subcommittee of the Nuclear Energy Re-

search Advisory Committee that provided input on what a world-class nuclear energy research and development lab should look like, Klein said that being invited to be a part of the Idaho leadership and management team was an opportunity to “help shape the future of the laboratory.” He served as the director of educational partnerships at INL from March 2005 to September 2009. During his time at Idaho, and because of the work being done there by collaborating universities, Klein was also granted visiting professor status at the Massachusetts Institute of Technology.

When Klein left to take the position at INL, he was head of OSU’s Department of Nuclear Engineering and Radiation Health Physics, a position he had held since 1996. He had also served as director of the OSU Radiation Center from 2002 to 2005. When he rejoined OSU in 2009, however, he returned to his role as a professor. Klein said that while his past role as an administrator was a satisfying one, returning to the faculty has been a welcome change. “I have really enjoyed myself, coming back to academia as a pro-



Klein and Tracy share a tandem bicycle ride during the Northwest Tandem Rally in Bellingham, Wash.

fessor,” he said. “Rebuilding my research career and working with undergraduate and graduate students again has been very rewarding. It is the reason I became a professor in the first place.”

Participating in ANS

Klein can remember his first ANS meeting in November 1976. “It was at the Wardman Park Hotel in Washington, D.C., the same hotel where the 2015 Winter Meeting was held,” he said. In the spring of 1977, Klein found himself in charge of his ANS student chapter’s annual banquet, where the then ANS president, Vincent Boyer, was invited to speak.

Since then, Klein has been active in a number of roles within the society. Most recently, he was appointed editor of the ANS journal *Nuclear Technology* following the retirement last spring of the journal’s previous editor, Nicholas Tsoulfanidis. It is a position his former advisor Bill Vogelsang held and one he holds in high regard. “Having archival journals is a valuable part of any professional society’s activities, and it is important to put our technical results into usable journals so that they are available to users who can take those ideas and expand them, refine them, and continually develop our technology,” he said.

Klein said that as ANS president, he hopes to continue the work done to improve the financial standing of the society and to ensure that ANS remains a valuable asset for current members, as well as an attractive organization for new members. This includes implementing the recommendations of a special committee established by outgoing ANS President Gene Grecheck that looked at what the society

can do differently and what activities it can possibly discontinue, which Klein admitted can be a challenge. “The hardest thing for any organization to do is deciding on those things that it should stop doing, and we are no different from any other organization in that respect.”

Klein’s plans for his term, however, don’t stop there. At the recent ANS Annual Meeting in New Orleans, Klein unveiled an ANS initiative to develop a set of nuclear technology “grand challenges.” Similar to the grand challenges put forth by the National Academy of Engineering and the National Science Founda-

tion, the challenges are intended to identify some of the pressing issues in the continued development of peaceful uses of nuclear technology. Using the society’s professional division structure to identify and prioritize possible challenges, Klein said that he hopes to have a final set of ANS-branded grand challenges by the end of his term.

“This is an exciting activity for the society to get behind,” Klein said. “From a technical standpoint, this would provide focus for our activities and our members. It would also provide focus for industry, legislators, the Department of Energy, and others as to where we as a nation need to go.”

As for the future of nuclear power, Klein said that he likes what he is seeing and feels that there is great potential for the development of new technology. “I think it is a very exciting time, especially with the advanced reactors and the small modular reactors that are currently being developed,” he said. Part of his optimism comes from the fact that in addition to the support shown for such technologies by the government and industry, venture capitalists have become involved, providing new pathways for the financing and development of different types of reactors, including SMRs, molten salt reactors, and high-temperature gas and liquid metal-cooled reactors. “There are even small venture capital companies out there trying to build fusion reactors and develop fusion as a technology for delivering electrons to the grid,” he noted.

Klein acknowledges, however, that there are hurdles to developing new nuclear technologies, including a regulatory system that remains largely skewed toward light-water



The Kleins gathered at the family home in Corvallis, Ore., last summer. Clockwise from top left: Tim, Tracy, Andy, Brianna, and Tim’s wife, Stacy, with their son, Jacob.



Klein at work at Oregon State University.

reactors. “When we start looking at these advanced reactors with vastly different coolants and safety regimes, the regulator needs to adjust and recalibrate to be able to provide the regulatory services necessary to protect public health and safety while at the same time removing the barriers to the development and deployment of new technologies,” he said. In addition, Klein said that industry has become comfortable with the current LWRs and needs to be encouraged to embrace new technologies. At the same time, a workforce capable of operating different technologies needs to be developed, while the general public also needs to be educated about advanced nuclear concepts, he said. “We have a regulatory, technical,

and public education movement that needs to take place to make these advanced reactors possible.”

Whatever the future of nuclear, Klein is certain to find something to capture his attention. Looking back at his career as an engineer, researcher, and instructor, Klein said he is unable to pick out any one activity that hasn’t been engaging, fun, or fulfilling. Each one has been “a good gig while it lasted,” he said, using the jargon of a musician. “They have all been interesting,” Klein said of his many roles. “I am very blessed and very lucky to have been able to be adaptable to do multiple different things in my career, and they have all been opportunities that I have embraced.” **NN**



Klein looking forward to the 2016 spring fly fishing season in Oregon.