

## Joseph Shaw, PhD, 1996

### What influenced your decision to attend graduate school at OSC?

My earliest memories are from Tucson in the late 1960s while my father, Glenn, was a PhD student—first in Astronomy, then in electrical engineering and atmospheric physics. I often heard stories of him as a graduate student visiting with Aden Meinel in the 1960s when Aden was “digging a big hole in the ground” to build the Optical Sciences Center (OSC). When I was 9 years old we moved to Alaska (yes, really, from Arizona to Alaska!) where I became fascinated with the Aurora Borealis and photography. This helped me discover an interest in optics and electromagnetics as an undergraduate student at the University of Alaska, so I started choosing electives to prepare for studying optical sciences in graduate school.



Glenn Shaw, John Reagan and Joseph Shaw, Dec. 1996

### What do you wish you would have known your first day of graduate school?

#### Was there anything you wish you had done to prepare more for graduate school?

I could have benefited from knowing how much I was really going to love optics. I actually got so excited about electromagnetics in undergraduate school that I started wondering if I should pursue microwave engineering in graduate school. This led me to enroll as a master’s student in the University of Utah’s “electromagnetics and applied optics” program where I could explore both. I’m actually really grateful for that 2-year “diversion” because I learned some super-rigorous electromagnetic theory that provided an outstanding foundation for my later optics studies and career.

#### Which classes did you find most enjoyable? Which ones did you find most difficult?

I just thoroughly loved being a student at OSC! It’s impossible for me to choose a favorite class, but I particularly enjoyed classes that dealt with optical engineering and remote sensing because I went to OSC as a full-time employee of the National Oceanic and Atmospheric Administration (NOAA) Environmental Research Labs. The newest concepts for me were in solid state optics and the most challenging class was Roy Frieden’s statistics class because I had very little background in that area, but I enjoyed it tremendously.

#### Was there an individual (professor, advisor, staff, friend, family member) who played a particularly important role in your education?

There were SO many important people, but I’ll highlight several: 1) before drilling me endlessly on Fourier transforms, Jack Gaskill talked me through the admissions process and then “inspired” me by triggering my competitiveness when he told us at orientation that it was extremely unlikely for a student to actually finish a PhD dissertation if they went away after taking classes; 2) Eustace Dereniak let me conduct experiments in his lab so I could justify an additional semester away from work, and our mutual optical sensing interests made him a life-long friend; 3) Arvind Marathay shared my fascination of polarized light and had many inspiring conversations with me; 4) John Reagan (joint professor with ECE and OSC) was a perfect PhD advisor for my unique situation because he knew and was known by many of my supervisors and coworkers at NOAA, he was interested in the research I was conducting, and he was willing to take me on as a remote PhD student!

#### What was your research while attending OSC?

I did my first experiments with infrared polarization imaging in Eustace Dereniak’s lab and originally intended to make that my PhD topic. However, different priorities in my job at NOAA led me to set polarimetry aside after I wrote my first paper in that field, but I returned to it after graduation and made it a major theme of my career (winning the Stokes Award from SPIE in 2019 was a wonderful honor). For my PhD dissertation, I built and deployed two laser remote sensing instruments for studying the statistics of sea-surface roughness. I may be the only OSC student who conducted their PhD research in the Pacific Ocean while earning a degree in the desert!

#### What was the cost of rent in Tucson while you were in school?

We paid about \$450/month for a 2-bedroom apartment for me, my wife, and our two children. It was low enough that we saved a down payment for our first house during those years!

#### If you owned a car during graduate school, what year and model was it?

We had a gray 1978 GMC pickup truck and a white 1986 Toyota Camry.

**What was your favorite restaurant/student hangout near campus?**

I was married and had two kids, so I never really got to know the student hangouts. We did, however, have a family tradition of going to La Indita on Fourth Avenue for stuffed sopapillas.

**What did you do for fun during your time in graduate school?**

I was a full-time NOAA employee with a very short time to take all my classes and exams, so I was taking 16-18 credits each semester. That didn't leave a lot of time for other things. Nevertheless, I always took a break on Sunday to be with my family. We had a lot of fun hiking at Saguaro East.

**What was most memorable about your commencement ceremony?**

I only vaguely remember the actual ceremony, but my favorite memory is being together with my wife and children, parents, and grandparents, and one of my most influential undergraduate professors from the University of Alaska who just happened to be in Phoenix that week and drove down to share the day with us. Another fun thing was that Kathy Creath, who taught several of the optical sciences courses I had taken, received a music degree the same day I received my PhD, so we have pictures together. I also have pictures together with my advisor John Reagan and my father, who happens to have been one of John Reagan's first PhD students (I was one of his last.)!

**At the time of your graduation, what were the most sought-after jobs/most popular industries/most popular companies?**

It's a little hard to remember those details because I was already employed. However, I do remember that a lot of OSC graduates were going to aerospace companies and a number of students with whom I studied were employed by the Air Force Research Lab and Sandia National Lab. A few years later, the telecom boom led to numerous job opportunities for people who could spell optical fiber (even better jobs for those who could actually design with optical fiber).

**What was your first job after graduation?**

Before, during, and for five years after my PhD studies, I worked at the NOAA Environmental Research Labs in Boulder, Colorado. It was a great job where we developed optical remote sensing instruments and methods. I still work in that field after being at Montana State University for 19 years.

**What was the most significant world event during your time in graduate school. How were you affected by this event?**

The year before I graduated was the first major U. S. government shutdown, which threatened to leave me and my young family without a paycheck during the Thanksgiving and Christmas holiday season. That experience still strongly influences my political opinions and voting.

**Was there a campus or community event in Tucson that was especially important to you?**

I greatly enjoyed lunches with John Reagan's research group and OSC's social gatherings at places like Jack Gaskill's house. On a more humorous note, I remember being intimidated by how TALL the women volleyball players were when they walked by me one day in the hall outside of Dr. Dereniak's lab in the McKale Center!

**What advice would you give to this year's graduating class?**

I find it a useful exercise every five years or so to take some time to evaluate (in writing) what you're doing and what you really WANT to do. A career goes by surprisingly fast and takes unexpected turns, so writing notes about things you really want to do helps guide your decisions along the way. Finally, always enjoy staying connected to the broader OSC family!