

# Addressing the Critical Shortage of Optics Technicians

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## ABSTRACT

The global optics industry is growing faster than the overall U.S. economy, but the technical workforce for the industry is shrinking at an alarming rate. The absence of a single technician can delay shipments and impede the productivity of an optics company. The shortage of technicians is stifling innovation and requiring engineers with advanced degrees to complete the work of technicians. Development of the current and next-generation optics manufacturing workforce is vital. To meet the growing demand for skilled optics technicians, the Monroe Community College Optical Systems Technology program created the *Defense Engineering Education Program in Optics (DEEP OPS)* to increase the national optics workforce. Funded by the Department of the Navy Office of Naval Research (Award #N00014-19-1-2740), the DEEP OPS initiative is strengthening and expanding the national precision optics workforce to ensure technological superiority for the Department of Defense. This initiative has: 1) Extensively enhanced precision optics technician training with innovative approaches that meet the needs of the optics industry and students; 2) Increased the number and diversity of optics technicians nationwide; and 3) Established opportunities for student and faculty engagement with the optics industry. The DEEP OPS program is providing strategic solutions to defense challenges and is supplying the intellectual know-how that is being transferred to a national base in the AmeriCOM Workforce Initiative. This paper describes how Monroe Community College has become a national model for educating diverse optics and photonics technicians.

**Keywords:** Apprenticeship, Optics technician, Training, Diversity, Workforce development, Industry partnerships, Online curriculum, Precision optics

## INTRODUCTION

The optics industry is responsible for remarkable innovations that have revolutionized our world and improved our day-to-day lives. Smartphones, medical imaging devices, banking technology, autonomous vehicles, and more all rely on precision optics manufacturing. In addition, the optics industry is critical to our national security as it supports many military resources and systems ranging from night-vision goggles, to satellites, to weapons guidance systems.

Optics technicians work with scientists and engineers in research, design, development, manufacturing, and quality control. Technicians not only manufacture optics, but they also perform testing and evaluation of optical components and systems. Without technicians, we would not have the innovative products we rely upon every day. Unfortunately, a worldwide shortage of optics technicians is stifling our industry's growth. Further, the lack of a robust precision optics manufacturing workforce in the U.S. is a matter of national security.

We need more optics and photonics technicians for continued growth and innovation, and to meet our current and future national security demands. For every optics engineer focused on innovation, we need 10 optics technicians to bring that innovation to market. Currently, there are over 2,500 open positions nationwide in the optics and photonics fields [1], and 98% of optics technician jobs currently go unfilled.

Established in 1963, the Optical Systems Technology program at Monroe Community College (MCC) was the first in the nation to train students to work as technicians in the precision optics industry. Today, MCC has become a national model for educating a diverse workforce, by breaking down barriers to entry into the precision optics manufacturing field.

## METHODOLOGY

MCC established its Optical Systems Technology program in 1963—the first of its kind in the country to train precision optics technicians to work in the industry. The program offers a 1-year certificate, 2-year Associate of Applied Science (AAS) Degree, and a 2+2 transfer opportunity where students start at MCC and then transfer to another academic institution after two years to complete a Bachelors of Science degree. Despite its longevity, the program was nearly defunct six years ago due to low enrollment and inconsistent leadership.

MCC began addressing the critical shortage of optics technicians by first securing funding for its program. In the last six years, the MCC Optical Systems Technology team has secured more than six million dollars in grants and corporate support. With the newfound financial support, MCC set two goals to address the shortage of optics technicians: 1. Strengthen the MCC Optical Systems Technology Program and academic pipeline, and 2. Broaden and strengthen industry and community partnerships.

To improve its own program, MCC invested in its own facility. The department spent millions of dollars to purchase and install new advanced manufacturing equipment. Next, MCC examined and revised its curriculum to better align with the knowledge and skills employers sought. Finally, the college improved efforts to recruit and retain underrepresented populations within the precision optics industry by engaging students through pre-collegiate partnerships. For example, MCC engaged 16 high schools in a newly created dual enrollment optics program. MCC Optical Systems Technology faculty provide all instructional material and training to the high school teachers who then instruct the students in their own classrooms. Students who successfully complete the program receive college credit.

Simultaneously, the Optical Systems Technology department launched marketing and outreach initiatives with community partners and created experiential learning opportunities for students and faculty with local employers. This included an Optics Advisory Board made up of industry representatives. This Board helps guide program decisions to help ensure MCC is training students on the latest and most relevant processes and equipment. The Board also helped facilitate tours for students and faculty at optics manufacturing companies, including virtual tours at companies around the country.

Outreach with community and industry partners also led to the launch of a nationwide precision optics manufacturing apprenticeship program. This is a structured “earn and learn” program with on-the-job training combined with related technical instruction. MCC also created an online curriculum to engage interested and eligible employees from around the world. The college has registered optics apprenticeship programs with Optimax, JML Optical, Sydor Optics, OptiPro, and LaCroix Precision Optics, and has engaged community partners to help launch youth apprenticeship programs for high school students.

## DATA

MCC’s efforts to improve its Optical Systems Program and academic pipeline while strengthening its industry and community partnerships directly led to an increase in the number of students and industry partners engaged with the program. The data show enrollment has increased, especially among previously underrepresented populations.

Table 1. Student enrollment in Monroe Community College’s Optical Systems Technology program

<b>Enrollment</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
Optics Students	46	79	101
Female Students	10 (22%)	20 (25%)	30 (30%)
Students of Color	7 (15%)	17 (22%)	28 (28%)

Enrollment from Fall 2019 to Fall 2020 increased 72%. As a comparison, the overall enrollment rate at MCC decreased 12% during that same time period. Further, the Spring 2021 enrollment in the Optical Systems program remained at 79 achieving a 100% retention rate while the overall retention rate for MCC was 69% for the spring semester. From Fall

2020 to Fall 2021, the number of students taking Optics classes increased another 28% to an all-time record high of 101 students.

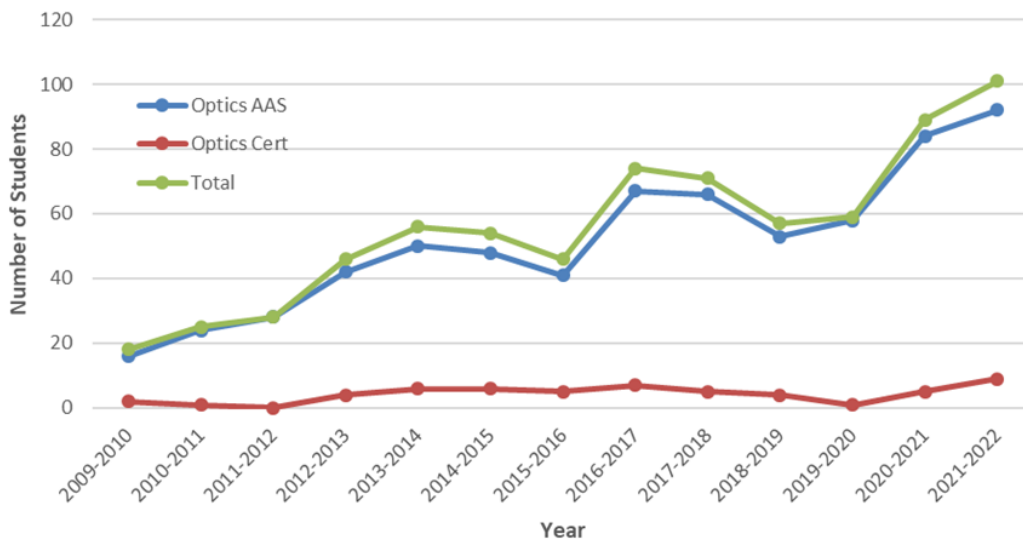


Figure 1. Student enrollment in Monroe Community College’s Optical Systems Program

Interest in optics courses among students enrolled in other MCC programs and majors reached historically high levels. More than 300 students took an optics course during the 2020-2021 academic year, compared to 55 during the prior year. This was largely attributed to non-matriculated students who registered for classes because of an extensive Optical Systems Technology marketing campaign, both internal to the college and externally. The table below shows the academic programs for students taking optics courses outside of the major.

Table 2. Programs of Non-Optics Students Taking Optics Courses (2020-2021)

Program	Students
Non-Matriculated	277
Mechanical Technology (A.A.S.)	19
Liberal Arts (A.S.)	4
Business Administration (A.S.)	1
Construction Technology (A.A.S.)	1
Precision Machining (A.A.S.)	1
Precision Machining (Cert.)	1
Apprentice Training: Machine Trades (A.A.S.)	1
Visual Communication Technology – Photo/TV (A.A.S)	1
<b>Total</b>	<b>306</b>

## RESULTS

Beyond enrollment growth, efforts made by Optical Systems Technology faculty and staff to promote student retention helped to grow the number of program graduates. This included advising and mentoring students to ensure they stay on track in their courses and connecting them to on-campus and community-based resources to help resolve non-academic barriers to retention and completion. The addition of a community liaison to the optics program staff, a position funded through the DEEP OPS initiative, has provided students with navigation services to ensure they have the resources they

need to stay in school. As a result, MCC saw an historic number of students completing a certificate or AAS degree in Optical Systems Technology.

Table 3. MCC Optics Graduates.

<b>Academic Year</b>	<b>Number of Graduates</b>
2018-2019	13
2019-2020	20
2020-2021	41
2021-2022	47

The 47 total graduates (21 Associates degrees and 26 certificates) marked a record high for the Optical Systems Technology program. Meanwhile, efforts to engage industry and community partners have led to students participating in paid internships at companies like Corning, Lockheed Martin, MIT Lincoln Laboratories, Optimax, and Sydor over the last six years. And more than 1,000 high school students have participated in optics dual enrollment courses at their respective high schools.

The optics industry has proven to be a reliable career pathway that offers tremendous growth opportunities to the best and brightest optics technicians. Interest in MCC’s optics program is at an all-time high and is reflected in its extraordinary enrollment growth. The transition to hybrid course delivery with lectures given online and laboratories offered in-person is attractive to students and incumbent workers who want to work while pursuing their degree. The construction of a fourth optics lab with more than \$1.5 million in state-of-the-art optics equipment and the implementation of a comprehensive digital marketing campaign have generated an unprecedented amount of energy and excitement in the program. The program has extended its reach nationally and is developing apprenticeship opportunities with optics companies across the U.S. to drive additional enrollment growth.

## **CONCLUSION**

Through the DEEP OPS program, Monroe Community College has become a national model for educating diverse optics and photonics technicians. But the efforts at Monroe Community College alone cannot supply the number of needed optics technicians in the United States. The AmeriCOM Workforce Initiative is extending the success of the MCC Optical Systems Technology program by establishing precision optics technician training programs at community colleges across the United States.

## **REFERENCES**

[1] “Training of Skilled Technicians for the Defense Industrial Base” (Briefing to the Senate Arms Services Committee, September 2021)