

MONONGAHELA CAPITAL MANAGEMENT

PERCEPTIONS

2nd Quarter, June 30, 2021	6/30/2021	% Change 2 nd Quarter	% Change Year to date
Dow Jones Industrials	34,502.51	5.08 %*	13.79 %*
S & P 500	4,297.50	8.55 %*	15.25 %*
Russell 2000	2,310.55	4.29 %*	17.54 %*
BC Aggregate BD Index		1.83 %	(1.60) %
10 YR. Treasury Yield	1.47 %		
30 YR. Treasury Yield	2.09 %		

* Includes reinvested dividends

Research, Development and Persistence

“Research is creating new knowledge.” *Neil Armstrong*

ASML Holdings NV, based in Veldhoven, Netherlands, assembles photolithography machines which etch circuit patterns onto photosensitive silicon wafers. Their most advanced machines use extreme ultraviolet light (EUV) with a wavelength of 13.5 nanometers (a ten-thousandth width of a human hair) to etch the wafers. The EUV light is created by targeting pulses from a high-powered laser to 50,000 droplets of tin released every second. These systems go well beyond simple production machinery, costing more than \$150 million, weighing approximately 180 tons. As noted in a recent New York Times article (Clark B1), shipping just one machine requires 40 shipping containers, 20 trucks and three Boeing 747s. Assembly takes 18 weeks and once running, ASML engineers and support staff are on site full time for maintenance and upgrades. In the article, Darío Gil, Director of IBM research noted “It’s definitely the most complicated machine humans have built.” As one might imagine, the complexity of these systems required decades of research and development.

In “ASML’s Architects,” René Raaijmakers writes about the engineers behind the success of ASML and their long and difficult path to success. It is a fascinating story of research, patience and long-term vision. Raaijmakers reviews the pioneering years through the mid-90’s, when ASML breaks onto the world stage. We summarize very briefly, but to gain a perspective on the exhausting years of research, you may want to read Raaijmakers’ 663 page tome.

ASML was established as a joint venture between Dutch companies Royal Philips Electronics (Philips) and Advanced Semiconductor Materials International (ASM International) in 1984. ASM International had been founded in 1968 and had experience manufacturing semiconductor process

equipment. Philips was founded in 1891, had a much longer history with a focus on electronics and a world renown research lab (NatLab.) A brief timeline follows:

- 1973 - The first Wafer Stepper, a lithography machine that shrinks patterns and projects them, step by step, onto light sensitive substrate, is developed in Philips' NatLab.
- 1984 - ASML is established as a joint venture.
- 1986 - The PAS 2500 Wafer Stepper, building upon years of research and development, is a breakthrough product for ASML.
- 1991 - The PAS 5500 Wafer Stepper launches ASML's platform and becomes the foundation for the company to become the global leader in lithography.
- 1995 - ASML goes public on the Amsterdam and NASDAQ stock exchanges with a market capitalization of approximately \$600 million.
- 2010 - ASML begins shipping the NXE:3100, the first commercial machine to use extreme ultraviolet light, setting the company apart from traditional wafer lithography techniques.
- 2017 - ASML produces the NXE:3400B, intended for high-volume EUV manufacturing.

After a combined endeavor that spanned almost 50 years of research, ASML has a market capitalization approaching \$300 billion and is the neural center for worldwide high-end chip production. ASML's tools are essential for chip production and their clients include Samsung, Taiwan Semiconductor Manufacturing (Apple's supplier,) and Intel. From humble beginnings with the strength of extraordinary research and development, ASML has reached the pinnacle of success in the chip manufacturing industry.

A significant component of our due diligence in evaluating stocks is an assessment of corporate research and development programs with the commitment of time and capital to stay the course. While price discovery is essential in our work, the long-term success of your investments also depends on our understanding of the vision and strength of management and their ability to follow through on well-designed plans. Our investments in Abbott Labs, Badger Meter, Edwards Lifesciences, Hologic, II-VI, Eli Lilly & Co., Microsoft, and Target were initiated in part because of their well-planned and executed model for research and growth. Like ASML Holdings, each of these companies have committed to excellence in their particular sector and industry and have stayed the course, producing above market returns over time.

Our headquarters in Harmony, Pennsylvania, like ASML's offices in Veldhoven, Netherlands, allows us to focus most of our energy on research. We have been studying individual equities for more than 40 years, and like the progression of the Wafer Stepper, we are constantly trying to improve our process. We look forward to using our core research competencies over next 40 years to manage your portfolio.

Clark, Don. "A Dutch Machine Is Crucial for Chips. China Can't Buy It." *The New York Times*, 5 Jul. 2021, p. B1.