History

Tamarack Scientific Co. Inc. was founded in 1966 in Orange County California to design and build High Intensity Thermal Radiation Arc Sources. At that time there was a strong need by the US government research labs and the aerospace industry for high intensity radiation sources to test re-entry materials for ICBM and manned Spacecraft. To meet this requirement the company developed a dynamic Jet Pinched Xenon plasma radiation source. This high radiance source is accomplished by circulating high pressure Xenon gas around the discharge to provide an aerodynamic pinch of the plasma arc, which increases the current density and radiance. This high radiance source of radiation was the key to optically coupling the optical radiation onto targets.

During the development of these dynamic radiation arc sources which operated at 50,000 watts input power, the company also developed the technology to image the high intensity radiation onto small models using reflecting and refracting optics. These systems provided radiance levels from 2,000 watts per cm squared to 15,000 watts per cm squared. Our major customers were primarily in the aerospace industry and these systems were used to radiantly heat material samples used in the development of space re-entry materials, terrain illumination and slab laser pumping.

Based on the power optical technology we developed building systems for the aerospace industry we were able to leverage this technology into the semiconductor industry. In early 1970 we developed a new method of providing uniform UV illumination systems for projection printing. Our first products were UV g-line illuminators for Step and Repeat generation of master masks for an OEM customer. We followed up with our own line of UV illuminators, which provided very uniform collimated light over large target areas.

By 1975 Tamarack continued to innovate with the development of a new Photomask Contact Printer which provided excellent resolution, accuracy and high throughput of working photomask used in the contact wafer aligners, which were currently in use at that time for wafer fabrication. The Tamarack Model 142 &155 contact printer was a very successful product with over 400 systems sold worldwide from 1975 to 1990.

In 1981, with the push towards automation in the semiconductor and thin film hybrid industries, Tamarack began to automate its product line and introduced the Model 166 the first automatic contact printer.

In 1982 Tamarack developed the first projection systems for Hybrid circuits (multi-chip modules) fabrication on ceramic substrates for Western Electric and Bell Labs. These modules were used in a wide variety of telecommunication products that Western Electric manufactured at that time. **Projection lithography has proven to be a key element in Tamarack's ability to provide production worthy manufacturing solutions for our customers.**

In the early 80's prompted by the PCB industry's requirement for finer line resolution, Tamarack introduced a new automatic Printed Circuit Board exposure system. This product line has expanded to also include manual systems and Tamarack has added automatic pattern recognition alignment capability.

In 1985 we continued to expand our projection technology base with the development of I-line projection Step and Repeat system for the High-Density Interconnect packaging for IBM, a major computer manufacturer. In 1987 we further expanded our Step and Repeat product line with the development of an Excimer laser based Stepper used to drill high density vias for the same interconnect packages.

In early 1990 we expanded our Excimer system technology with the development of a micro-machining system for fabrication of ink jet printer heads, high density interconnect packaging and medical devices. Our first machine for the medical device industry provides a real break through for pulmonary application of insulin without the dreaded need for using a needle.

In 1995 we developed a unique scanning projection printer for the flat panel display industry. This machine has the ability to projection expose panels up to a meter in size with resolution in the 3 to 4 micron range. The basic scanning projection technology has also been extended to an Excimer Laser based system which can generate micro-vias used in high density interconnect and micro-fluidic applications.

In the first quarter of 2000 Tamarack moved into a new 75,000 square foot building in Corona, California. This building was custom designed for the manufacture of high technology capital equipment for semiconductor and medical device manufacturers. The facility has a complete machine shop with eight NC machining centers, sheet metal fabrication, welding and optical lens manufacturing. Final assembly and check out of lithography and laser machines is conducted in a 7,000 sqruare foot clean room.

As mentioned before, projection lithography has become one of the main methods of fabricating semiconductor packaging circuits and is a key technology element in Tamaracks product line. One of the latest new requirements of the industry is a process refereed to as wafer bumping. This is a process where several thousand connections to a single chip measuring about ½ inch by ½ inch are accomplished by making small solder balls (bumps) on the wafer. These solder bumped chips are then inverted, and the solder is melted to connect the chip directly to the printed circuit board.

Tamarack projection lithography technology is ideally suited for wafer bumping, and we are presently under contract by IBM to provide two systems for their new 300 mm wafer line. This contract will provide an excellent entry into this new market, which has a projected growth of 15 to 20 percent per year.

As we move forward into the next century we are continuing to develop new products to meet the needs of the industries we serve. Our primary company philosophies have

remained steadfast: helping our customers meet their production requirements and maintaining the highest product standards. Reliable equipment, together with dependable customer support and over 30 years of industry experience, have earned Tamarack its excellent reputation.

Tamarack Scientific Company Product Development History

CONTACT/PROXIMITY

Model Number Introduced	Product Description	Year Introduced
Model 131	U.V. Exposure System for Photoresist – Projection (OEM) and Contact/Proximity	1972
Model 142	Photomask Replicator Using Collimated U.V. Light (2” x 2” to 5” x 5” Masks)	1975
Model 155	Photomask – Replicator for 4” x 4” to 8” x 8”	1978
Model 143	Rotary Off – Contact Circuit Printer for LCD’s and Hybrids	1975
Model 152R	Optical Alignment and Exposure System for Large (12” x 12”) Substrates, LCD’s, and Hybrids	1979

CONTACT

Model Number Introduced	Product Description	Year Introduced
Model 170	Automatic Collimated Printed Circuit Board Exposure System	1982
Model 161	Manual Collimated Printed Circuit Board Exposure System	1983
Model 161-OA	High Resolution Collimated Printed Circuit Board Exposure System with Micro Adjust Drawer and Optical Alignment	1990

PROJECTION SYSTEMS

Model Number Introduced	Product Description	Year Introduced
Model 162	Projection Aligner for Thin Film Hybrids, Solar Cells, GaAs, HgCdTe, etc. Lens Selection: a) 150 mm field, 1:1, f-5.0, 350-450 nm b) 150 mm field, 1:1, f-3.5, 365 ± 5 nm c) 250 mm field, 1:1, f-5.0, 365 ± 5 nm Configurations: a) Cassette – cassette b) Carousel cassette – cassette c) Pattern recognition alignment d) Dual sided Customers Include: Western Electric (AT&T), Bell Labs, IBM, Grummon, Hughes, Motorola, NEC, OKI, etc.	1980

PROJECTION STEP AND REPEAT

Model Number Introduced	Product Description	Year Introduced
Model 190	Step and Repeat U.V., 1:1 Projection Exposure Tool for MCM/TCM Production Features: • Automatic Reticle Changing • Automatic Cassette – Cassette Substrate Handling • Automatic Pattern Recognition Alignment • Variable Magnification • 200 x 200 mm Laser Interferometer Controlled Substrate State	1985
Model 195	Step and Repeat U.V., 1:1 Projection Exposure Tool for MCM/TCM Development Features: • 300 x 300 mm Laser Interferometer Controlled Substrate Stage	1987

ABLATION

Model Number Introduced	Product Description	Year Introduced
Model 290	Excimer Laser Projection Ablation Step and Repeat Tool. XeCl Laser, λ = 308, 6 μm Feature Size, Fluence 100-250 mJ/cm^2.	1988
Model 390	Excimer Laser Projection Ablation Step and Repeat Tool (Second Generation). Wavelength = 308 nm (XeCl), 6 μm Feature Size, Fluence 100-250 mJ/cm^2, Accuracy ±1 μm.	1993
Model 410	Excimer Laser Projection Ablation Step and Repeat Tool for 300 mm Wofers.	2001

LARGE AREA SCANNING PROJECTION

Model Number Introduced	**Product Description**	**Year Introduced**
Model 300 LGPX	Projection Scanning U.V. Exposure System for 500 x 600 mm Flat Panel Display Production Lens: Broad Band U.V., λ = 350-450 nm, 1:1 Dyson	1993
Model 330	Projection Scanning Laser Ablation System for 200 x 200 mm HDI Circuits	1998
Model 335	Projection Scanning U.V. Exposure System for 200 x 200 mm HDI Circuits	2000
Model 336	Projection Scanning U.V. exposure System for 300 mm Wafer Bumping	2002