DIRECT FROM MIDREX

2ND QUARTER 2004

CONTENTS

30 YEARS

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Commentary

In Praise of a Pioneer

In this day and age, it is unusual to find anyone who has worked for the same company his entire career, but Winston Tennies is one of those rare individuals. He has spent over 38 years with Midrex and its predecessor companies, the last 12 as President, and most recently, CEO. Win has decided to retire from Midrex and embark on the next phase of his life (photos of Win's retirement dinner are included in News & Views). It is with great pleasure and gratitude, but with a lot of mixed emotions, that I assume leadership of the company. Needless to say, I have some mighty big shoes to fill.

To put Win's career in perspective, I'll review briefly his life story. Win is the son of missionaries and spent much of his formative years in South America. He enrolled at the University of Michigan, earning bachelors' and masters' degrees in civil engineering. He began work in the R&D group at Surface Combustion in Toledo, Ohio. Surface was a leader in thermal processing of minerals, and during the 1960s developed the concept for the MIDREX® Direct Reduction Process. Win was intimately involved in the design and start-up of the first MIDREX® Plant in Portland, Oregon, as described in the 1st quarter 2004 Direct from Midrex. Because of his efforts and their importance to the success of Midrex, Win was selected as one of the "Midrex Pioneers" and recognized on a plaque that hangs proudly in the lobby of our office.

Throughout his career, Win has held firm to the principles of innovation, technical excellence, and personal integrity. As evidenced by his longevity with Midrex, he avoids "quick fixes" and he realizes, like Thomas Edison, that genius is one percent inspiration and 99 percent perspiration. Win recognized that the key to success in direct reduction was to continually innovate and stay on the leading edge of technology. Over the years, he held positions in R&D, engineering, and project management. Since the start of Win's tenure as President in 1992, Midrex has designed and built 10 MIDREX® Modules with a total capacity of nearly 10 million tons per year and an installed value of about $1.5 billion. MIDREX Plants now produce over 30 million tons of DRI per year, enough iron for all the passenger vehicles produced in North America and Western Europe. The period also provided an array of technological developments, including the MEGAMOD® and direct hot charging (HOTLINK®). In addition, Midrex partnered with Kobe Steel to successfully develop coal-based ironmaking technology, including the FASTMET® family of processes and ITmk3®. There are now two operating FASTMET Plants in Japan and an ITmk3 pilot plant in Minnesota. Midrex also started on a diversification program to identify and pursue business opportunities in areas outside iron and steel.

James D. McClaskey
President
Midrex Technologies, Inc.

It has been my great pleasure and distinct honor to be mentored by Win during the 16 months since I became President of Midrex. This has also been a tremendous learning experience for me as I transitioned from PSI to Midrex. Due in large part to Win's hard work and dedication, I firmly believe Midrex is well positioned for long-term success. The recent surge in metallics prices and interest in new direct reduction plants bodes well for our future. Our goal is to remain the leader in direct reduction through technical innovation and commercial success. Midrex's diversification activities continue as well, and we expect that over time, these non-steel related ventures will contribute an appreciable portion of our income.

Win, it's been a great ride and you couldn't have picked a better time to begin the next phase of your life. On behalf of all of us at Midrex, we wish you all the best that life has to offer and know that we will miss your day-to-day presence.

MISSION STATEMENT

Midrex Technologies, Inc. will be a leader in design and integration of solids and gas processes. We will meet or exceed performance expectations, execute projects on time, enhance existing product lines, and provide value-added design, procurement, logistics and field services to our clients. We will develop new business opportunities that will challenge our employees and maintain the economic vitality of our company. Our employees are the key to our success, and we are committed to encouraging them to grow professionally and personally.

Usage of Oxygen Injection in QASCO

By Philip D'Souza,
Assistant Manager - DR Department

Located in Mesaieed Industrial City, 45 kilometers to the south of Doha, the Qatar Steel Company (QASCO) was the first integrated steel plant in the Arabian Gulf region. Established in 1974, QASCO consists primarily of four units: MIDREX® Direct Reduction Plant, electric arc furnace, continuous casting, and rolling mill.

The MIDREX® Plant is an integral part of QASCO and has helped it earn a reputation for delivering exceptional quality steel products.

Over the last three years, QASCO has become a net purchaser of DRI/HBI to meet new production needs. In October 2000, the company commissioned additional steel-making capacity with a 75 MVA UHP EBT electric arc furnace. The total DRI demand is now at 1.1 million metric tons per year, exceeding QASCO's best annual achieved DRI productivity of 776,000 metric tons.

To address this situation, over the past year Midrex has worked with QASCO to design and implement various technological improvements to increase capacity via oxygen use at QASCO's MIDREX Plant. This paper deals with the steps taken to increase DRI Production.

Background

In April 2001, QASCO commissioned Midrex to study a low-cost approach to increase DRI Production. The result was a proposal for implementing oxygen injection. In February 2002, QASCO determined that the existing oxygen plant currently has more than 2000 Nm3/hr excess capacity. This plant will have approximately 850 Nm3/hr excess capacity after future steel mill modifications are completed.

QASCO signed a contract with Midrex in May 2002 to implement oxygen injection utilizing this excess oxygen. The contracted modifications aimed at a productivity gain of five metric tons per hour.

Project Description

The project work carried out by Midrex and QASCO is summarized below:

- **Oxide Coating System**
  An on-site coating system was installed to ensure that the required furnace bed temperatures could be achieved without clustering, even though pre-coated pellets are used.
- **Oxygen Injection System**
  The available oxygen was used to increase the bustle gas temperature from approximately 900°C to 980-990°C. An oxygen injection system with relevant controls and injection nozzles capable of much higher flow rates for further enhancement was designed and installed.
- **Transition Zone Natural Gas Injection**
  The additional thermal energy in the reduction furnace was partly utilized to maximize the in-situ reaction with a system of natural gas injection to transition zone. The installed system has automated flow control with flow measurement to each segment. For control of flow to each segment, hand valves have been provided.
- **Natural Gas Piping Modification**
  The increased Natural Gas flow rate was expected to worsen the existing high pressure drops, gas velocities and consequent noise levels in the Natural Gas distribution network from the Receiving Station to the metering station in the Direct Reduction Plant. Thus, modifications included changes to the metering orifice plates, pressure control valve, piping sizes and control systems.

Project Implementation

The QASCO project was handled by Midrex Solutions®, a dedicated group within Midrex Technologies, Inc. empowered to assist clients in developing cost-effective engineered solutions and equipment designs that increase plant availability, capacity and reduce operating cost.

Midrex Solutions supplied detailed engineering, field services during initial startup, and equipment such as the oxygen injection skid and control station. Oxygen injection nozzles equipped with sequential valves and key components for the oxide coating system were also supplied by Midrex.

QASCO has a control system that cannot be expanded. As a result, a dedicated mini-control, module-based PCS-7 system was engineered, manufactured and tested in Germany, jointly by SIEMENS and QASCO engineering teams. It was tied in using a gateway for two-way communication between the existing Teleperm-M and the added new control systems.

The oxygen injection system was tied in to the plant during the scheduled plant shutdown in July 2003. The overall project schedule and results in Table 1 are given below:

Project Schedule

	2002				2003			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
FEASIBLITY STUDY	↔							
ORDER PLACING		★						
ENGINEERING			↔					
EQUIPMENT SUPPLY				↔				
FABRICATION					↔			
ERECTION							↔	
COMMISSIONING							★	
STABILIZATION								★

Results

	ITEM	BEFORE	TARGET	AFTER
1	**Production rate**	91 Metric tons/hr	96.0 Metric tons/hr	>96 Metric tons/hr
2	**Metallization**	95% Minimum	95% Minimum	>95%
3	**Carbon**	1.5% Minimum	2% Minimum	1.8 – 2.0%

Table 1 Project Schedule and Results

Productivity

The guaranteed productivity gain has been handily exceeded. As can be seen in Table 2 below, production levels of 99 t/h have been achieved, with metallizations exceeding the guaranteed value of 95% by more than 1%.

Reliability

- The system availability, due to reasons other than the original process, has been 100%.
- QASCO decided upon and sourced calcined lime/dolime from the Kingdom of Saudi Arabia as coating material. The supplies are being loaded to the storage bin using a pneumatic transport system developed with the lime supplier. The reliability of both supplies and the bin filling system has been 100%.
- The coating operation is fully automated. Some additional maintenance is required in the oxide handling equipment, lime tank and dust collectors due to buildup.

Other Impacts

- The noise levels in the Natural Gas piping system has dropped considerably from a level of 120 decibels to a level of under 80 decibels.
- Scale dispersant in the process water system had to be used to deal with the increased Calcium hardness.

Conclusions

QASCO has successfully implemented a Midrex Solutions designed oxygen injection system that has had a positive effect on the operation of the Midrex Plant. By increasing the bustle gas temperature, the plant production has increased with improved product quality. Even though the bustle gas quality is reduced by the combustion of CO and H_2, the increased bustle gas utilization at higher temperature not only compensates for the quality loss in the bustle gas, but also results in important improvements of the entire plant operation.

MONTH	PROD.	MET	C	O_2	Lime	POWER	GAS	WATER	BG
	T/H	%	%	NCM/TON	KG/TON	KWH/T	NM^3/T	M^3/T	TEMP
BEFORE OXYGEN INJECTION									
JAN 03	91.0	95.4	1.63	0.0	0.0	102	293	0.25	908
FEB 03	92.7	95.4	1.67	0.0	0.0	100	291	0.25	906
MAR 03	92.1	96.0	1.74	0.0	0.0	101	292	0.28	903
APR 03	92.3	96.1	1.69	0.0	0.0	100	287	0.29	904
AFTER OXYGEN INJECTION									
OCT 03	95.4	95.8	1.72	10.7	1.0	99	293	0.27	968
NOV 03	96.1	96.1	1.64	7.7	1.0	99	289	0.30	965
DEC 03	96.8	96.7	1.78	5.4	0.5	99	291	0.31	921
JAN 04	99.1	96.7	1.91	14.9	0.8	98	301	0.30	964

Table 2 Process Parameters Comparison

A Better Mousetrap: The History of Midrex Technologies Part 2

By John T. Kopfle.
Director - New Business Development

Note: Part 1 of this series traced the founding of Midrex's predecessor company, the development of the MIDREX® Direct Reduction Process, and the building of the first commercial plant at Oregon Steel Mills.

A GERMAN VISIONARY APPEARS

In 1948, a nineteen-year-old German named Willy Korf became a general partner in his family's trading company following the death of his father. In the early 1950s, the company grew successfully by selling building materials, including lumber, roofing tiles, and reinforcing steel for rebuilding Germany after World War II.

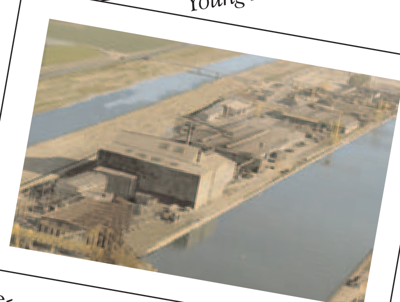
In 1953, the company began selling welded wire mesh in partnership with another firm. However, difficulties in procuring the material persuaded Korf to begin producing it himself, and he began doing so in 1955 in Kehl, Germany. This enterprise soon faced another problem - obtaining wire rod, the feedstock for mesh. Korf was able to procure rod from France and Belgium. Several of the German steel companies, however, resented Korf's competition, and in 1961 he signed an agreement not to sell wire mesh in Europe, except for Switzerland and Austria, for ten years. Eventually, due to this and other problems, Korf sold his wire mesh operations.

Undaunted, the German entrepreneur began producing other kinds of steel products at home and abroad, including joists, wire, and rebar. This led to more disputes with German steelmakers. In 1968, Korf decided to produce his own steel and he started up a mini-mill in Kehl with scrap as the feedstock. The mill was later named Badische Stahlwerke.

Georgetown Steel

Young Korf and family

Willy Korf



Badische Stahlwerke

Again, the steel companies took offense to Korf's aggressiveness and tried to force him out of business. Their strategy was to manipulate scrap prices to make it difficult for independent steelmakers. Korf decided to find a way to make steel without scrap. In 1968, Midland-Ross presented a paper on the MIDREX® Technology at the AIME General Meeting in New York City. In the audience was Dr. Menthertz Gaier of Korf Industries. A short time later, a meeting was arranged in Toledo between Willy Korf and the Surface Combustion Division of Midland-Ross. Korf told his hosts that he wanted a direct reduction plant designed for him immediately for Georgetown Steel in South Carolina, where he was building a mini-mill, and for Hamburg, Germany, where he planned to develop a steel complex. The SCD people were reluctant, because the Oregon Steel direct reduction plant was just completing construction and would not be operating for several weeks. Korf persisted, and wrote a check on the spot for SCD to begin design work. Both plants were rated at 400,000 tons per year, included 4.9 m diameter furnaces, and started up in 1971.

In 1969, Midland-Ross formed the Midrex Division to exploit the market potential of the MIDREX Process. How was the name chosen? The story is that William Marston, Vice President and General Manager of the SCD, had received 32 potential names from the Midland-Ross public relations department, which were written on a page in two columns of 16 each. Marston closed his eyes, stabbed at the paper with his pencil, and selected the name "Midrex."

Sidbec MIDREX® Plants

In 1970, Midrex contracted to build a MIDREX® Series 400 Module for Sidbec-Dosco in Quebec, Canada. In April, 1973, Midrex achieved what became known as "direct reduction's finest hour." Iron Age Magazine stated:

"The direct reduction plant at Sidbec-Dosco went onstream in April of 1973. Within a week, the Midrex Plant was up to its rated capacity of 1,000 tons a day. This was something of a landmark because the commercialization of direct reduction has seen a goodly number of set-backs and disasters."

In December, Midland-Ross agreed to sell the Midrex Division to Korf. To paraphrase a noteworthy television commercial, Korf liked the technology so much he bought the company. Midrex Corporation was formed and moved to Charlotte, NC in 1974. Two reasons for the move were Korf's desire for Midrex to be close to the Georgetown mill and to North Carolina National Bank, a source of financing for the fledgling company.

A SUCCESSFUL DECADE

By 1974, there were MIDREX Plants operating in the United States, Germany, and Canada. During the later part of the 1970s, numerous plants were sold, many in the developing world. Countries such as Argentina, Qatar, and Venezuela needed steel to support development, and possessed the capital (some via revenues from petroleum sales) and natural gas required for direct reduction. The facilities were often government-owned. By 1979, Midrex had started up over five million tons (Mt) of DR capacity. Annual world direct reduced iron production grew from 0.8 Mt in 1970 to 7 Mt in 1980. During the early to mid-1970s, there was considerable optimism regarding future steel and DRI production. In 1975 some analysts, including the International Iron and Steel Institute and Battelle Laboratories, were forecasting that annual world steel production would reach 1 billion tons and annual DRI production would be 130 Mt by 1985. The actual figures were 719 Mt and 11 Mt!

During the decade of the 1970s, numerous innovations were developed for the MIDREX Process, including larger shaft furnaces, in-situ reforming, heat recovery and cold briquetting.

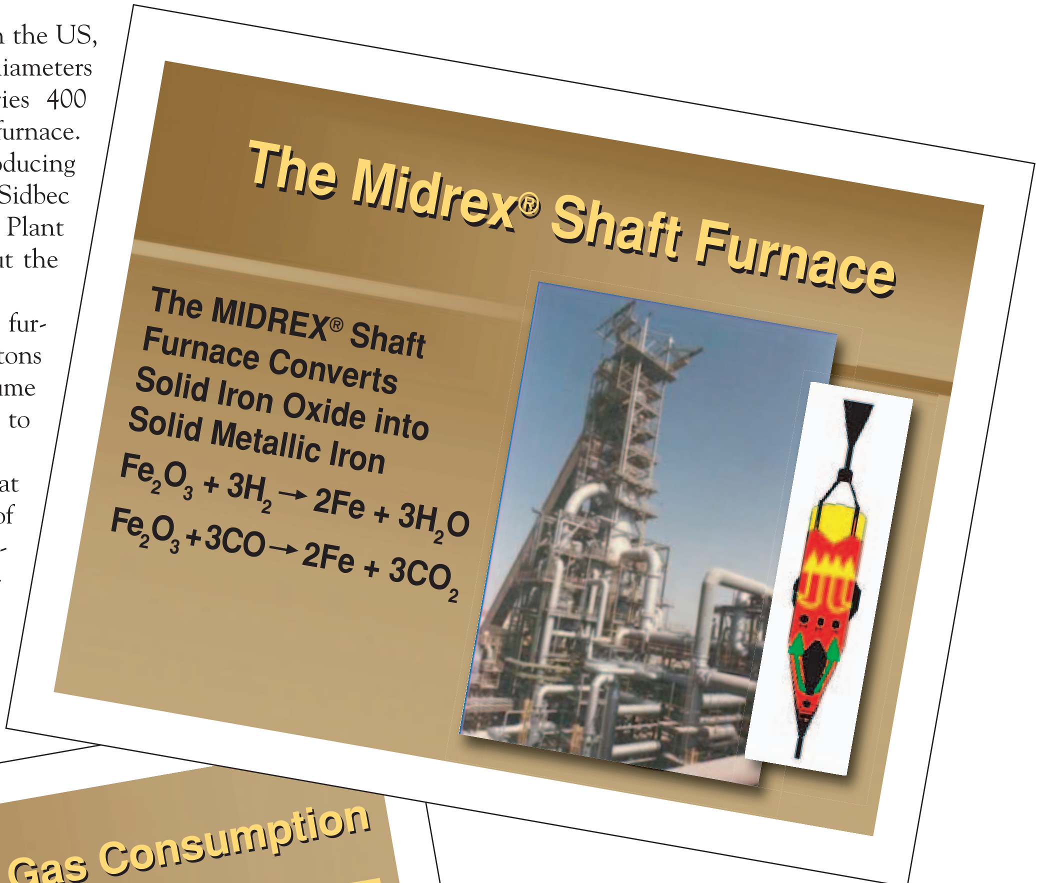
Larger shaft furnaces

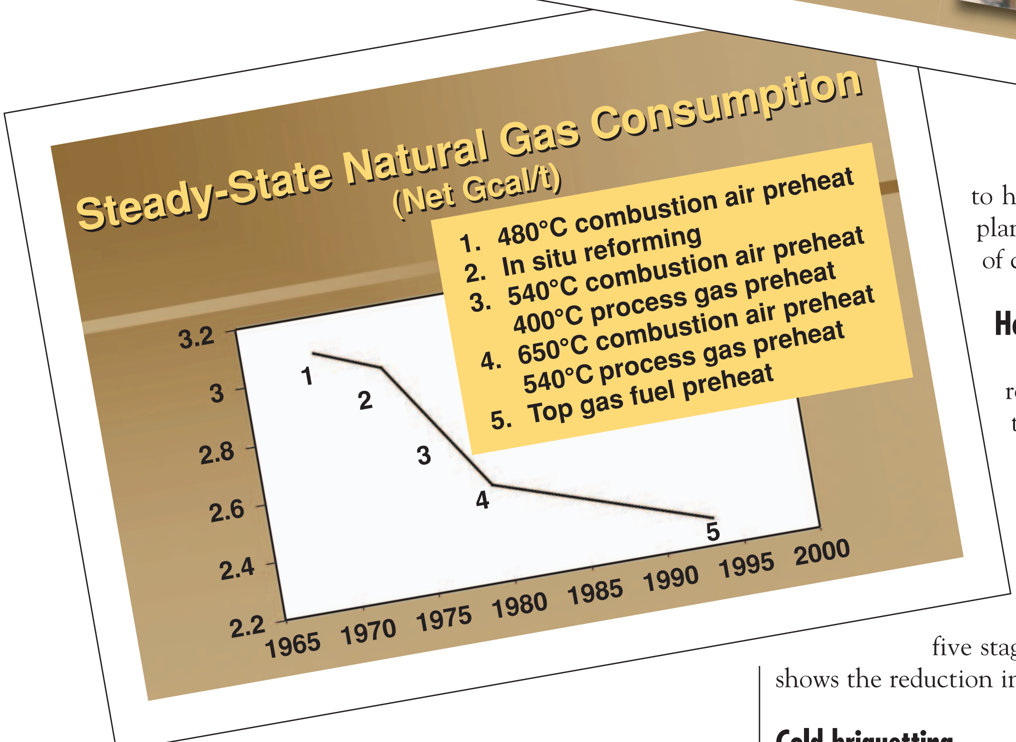
Much of the success of the MIDREX Process has been due to the development and refinement of shaft furnace technology by Surface Combustion and later Midrex. Initial pilot plant tests began in the 1960s on a vessel with a diameter of 0.4 m. The first prototype commercial units at Portland had an inside diameter of

3.7 m. The next four modules installed in the US, Germany, Canada, and Argentina, had diameters of 4.9 m. After 1973, MIDREX® Series 400 Modules generally had a 5.0 m diameter furnace. The first 5.5 m furnace, capable of producing 600,000 t/y of DRI, began operations at Sidbec in 1977. The MIDREX MEGAMOD® Plant incorporates a 6.5 m furnace (more about the MEGAMOD in Part 3).

Today, Midrex typically designs shaft furnaces for a specific production rate of 10 tons per day cubic meter of reduction volume (t/d-m³). Midrex can provide facilities to produce from 300,000 t/y to over 2 Mt/y.

The MIDREX® Shaft Furnace operates at low pressure, which provides a number of benefits, including easy charging and discharging and the ability to use burden-feeders to facilitate material flow. These features have enabled MIDREX Plants to use a wide variety of iron ores, including lump ores.





To date, MIDREX Plants have run on more than 25 types of pellets and more than 30 types of lump ores. Several MIDREX Plants operate with 50 percent and more lump ore on a routine basis.

In-situ reforming

Iron is an excellent catalyst for reforming natural gas. Thus, Midrex developed the idea of adding a small amount of natural gas to the furnace cooling zone, which is converted via reforming to hydrogen and carbon monoxide, increasing plant capacity. This also provides the benefit of carbon addition to the DRI.

Heat recovery

The first generation MIDREX Plants recovered a minimal amount of heat from the flue gas. The capital expenditure required for more extensive heat recovery was not justified because of the low cost of natural gas. However, soon afterward, the price of gas increased, and more heat recovery was added. At present, MIDREX Plants can be designed with five stages of heat recovery. The graph on the left shows the reduction in gas consumption over the years.

Cold briquetting

Direct reduction plants generate metallized fines, and if they are charged directly to the electric arc furnace, they are often lost in the slag and baghouse. To remedy this situation, plants began screening out fines and producing cold briquettes, which are more effectively charged to the EAF. Today, this is the most common means for recovering metallized fines.

Part 3 in this series will discuss the sale of Midrex to Kobe Steel and the development of hot briquetting and the MIDREX MEGAMOD®.

Midrex News & Views

A Fond Farewell

Celebrating a Man of Midrex

After nearly four decades with Midrex, Winston Tennies, CEO and co-founder of the MIDREX® Direct Reduction Process, decided to retire from the company he helped mold. In May Midrex, Kobe Steel and various friends, family and colleagues saluted Win on his celebrated career and wished him the best in his future retirement.

Midrex News & Views

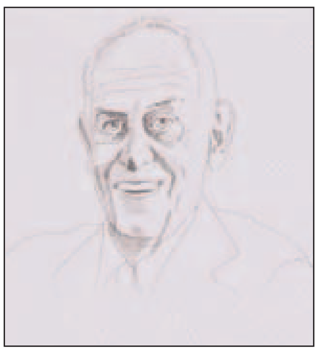
James D. McClaskey
President

McClaskey, Announced as New CEO

Charlotte, North Carolina — Midrex Technologies, Inc. announced that **James D. McClaskey** has been appointed as the company's new Chief Executive Officer. McClaskey who has spent 30 years with Midrex and affiliated companies now serves as both President and Chief Operating Officer, responsible for operating the company on a day-to-day basis. He replaces **Winston L. Tennies**, former CEO, who has recently retired from Midrex after more than 38 years of service and leadership

For the latest information, visit www.midrex.com

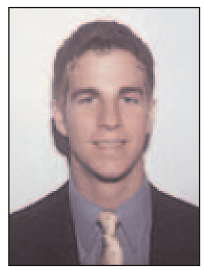
Midrex Announces Donald Beggs Scholarship Recipients



Donald Beggs

Midrex is pleased to announce Patrick Elliot and Angela Kakaley as the 2004 recipients of the Donald Beggs Scholarship Program. Named for Donald Beggs, who conceived the idea for MIDREX® Direct Reduction Process in the early 1960s, this scholarship is awarded to college-age sons and daughters of Midrex employees and is meant to acknowledge and reward the hard work and academics of these students. Each recipient will receive a $3,000 scholarship.

Patrick Elliot is the son of Antonio Elliot, Manager of Technical Services at Midrex. He is a junior at the University of North Carolina at Chapel Hill (UNC) working towards a degree in Biochemistry. Patrick's activities at UNC include President of the University's Amnesty International chapter.



Patrick Elliot

Angela Kakaley

Angela Kakaley is the daughter of Russ Kakaley, Senior Process Engineer. Angela will be a freshman this fall at Wake Forest University, where she plans to study genetics. During highschool Angela was a cheerleader for the football and basketball teams. She also ran hurdles on her track team, and was the valedictorian of her class. Angela is a member of the National Honor Society and is working this summer as a lifeguard.

Congratulations to Patrick and Angela, and thank you to all applicants who participated in this year's program.

Christopher M. Ravenscroft: Editor

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