DIRECT FROM MIDREX

4TH QUARTER 2004

CONTENTS

30 YEARS

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Commentary

We have certainly come a long way...

Editor's Note:

Midrex finished the celebration of the 30th anniversary in December 2004. As we looked back, we were reminded of how we've grown in those 30 years, not just Midrex, but also the Direct Reduction Industry that we have been part of for that time.

At one time, DRI & HBI were viewed as an uncertain alternative to scrap and other metallics, but now in today's iron and steel industry, they have found a home.

Like the Steel Industry itself, the DR industry has had its share of highs and lows, but the importance and use of the products have continually grown.

For example, consider the US steel industry's situation vis-à-vis direct reduction over the past 30 years.

In 1974, only 260,000 tons of DRI were made in the US. All of it produced by Georgetown Steel, and virtually all of it melted by Georgetown Steel. Steelmakers outside of Georgetown Steel (that is, the other 99.5% of the US industry) had virtually no experience with DRI and very little information about what this new substance was, how to use it, or why to use it.

In contrast, today we see about two million tons of DRI/HBI imported into the US every year. In 2004, the figure appears to be higher; extrapolating from the first ten months of data from the US Commerce Department gives a figure of 2.65 million tons. Steel makers across the country employ DRI and HBI to produce low residual steels (fine wire, SBQ, sheet, forging steels, etc.) or to boost the productivity of blast furnaces. The knowledge of how and why direct reduced iron is used is widespread. DRI has become a well known entity.

Today, interest in Direct Reduction Plants is at its highest level since the mid-1990s because of record high steel and DRI prices. At Midrex, we've been working diligently on upcoming projects for 2005 and do we have news to tell…new Direct Reduction Plants are on the way!!!

In December, we announced that Midrex, along with Saudi Iron & Steel Company (Hadeed), and together with its consortium partner, Voest Alpine Industrienlagenbau, GmbH (VAI) of Austria, will design, supply and erect a 1.76 million tonne per year Hot DRI Plant on a turnkey basis. This new project will be the largest MIDREX® Plant ever built, and it will also provide continuous charging to an adjacent melt shop. (For more on this project, see page 9).

Also, as of publication of this issue, we had several stories that were on the verge of being ready for release, but because of time constraints, we'll have to save them for our next issue.

As we embark upon our fourth decade in the Iron and Steel industry, it looks as though 2005 will be a very good year for direct reduction.

Chris Ravenscroft
Marketing Manager

Christopher M. Ravenscroft: Editor

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Mission Possible: COMSIGUA's Cooling Tower Experience

By Chris Ravenscroft
Midrex Technologies, Inc.

At the height of an incredible bull market with high alternative iron prices and peak demand for Hot Briquetted Iron (HBI), the COMSIGUA MIDREX® Plant in Venezuela was faced with an unexpected event that should have had the plant shut down for months. However, thanks to quick thinking and action by both Midrex and COMSIGUA, the two companies turned what could have been a six to seven month ordeal into a two-week crash course in problem solving.

In late August COMSIGUA contacted Midrex with a dire situation. Midrex received word that an accident occurred that caused the plant's cooling tower to collapse. No injuries were caused by the accident, but COMSIGUA was left with the problem of restoring its cooling capabilities.

Saving the Day – Part One

Finding a Solution

COMSIGUA has an ongoing contract with Midrex to provide all equipment and spare parts on a Maintenance Repair and Operations basis and has had this relationship since the plant's operation began in 1998. Thus, when the plant shutdown Midrex was quickly alerted.

The call came on a Saturday and Midrex wasted no time in taking action. Both Midrex and COMSIGUA were eager to find a quick and viable solution to this dilemma.

Working over the weekend and even over a national holiday in the United States, Midrex searched for a workable solution.

Photographs and information were gathered and sent to Midrex regarding the tower. Midrex also had support staff on hand at the plant in Puerto Ordaz to review the damage. They analyzed the situation, then began to formulate possible solutions. Together it was determined that the cooling tower needed to be replaced and replaced quickly as not to incur greater loss.

Midrex immediately contacted the Original Equipment Manufacturer that supplied the cooling tower to expedite new equipment only to find that manufacturing alone for a replacement unit would take four months with possibly an additional two-three months to transport, erect and start operations. A total of a six-seven month period of shutdown was not acceptable to either COMSIGUA or Midrex.

COMSIGUA looked to Midrex for ideas on how to operate the plant at some reduced capacity while waiting for a permanent repair or replacement. With alternative iron prices at such high levels, a half year shutdown was too significant a loss to allow.

Midrex immediately searched for alternatives to get COMSIGUA up and running, making it a priority to initiate interim measures to provide some level of production or perhaps even production at full capacity.

Several options were first considered, unfortunately all of which would only get the plant to minimal levels of production.

Then a viable solution was discovered.

Midrex found a North American-based supplier of rental cooling towers. These cooling towers are typically used by utilities, factories, refineries and other plants that are heavy users of process water.

After examination of plant requirements and specifications, it was determined that six rental units could provide a temporary solution that would get COMSIGUA up to regular production levels within weeks.

Saving the Day – Part Two

Finding a Way

With a solution now in hand, the next issue was to implement this plan as quickly as possible to avoid a prolonged shutdown. At the same time Midrex researched alternative solutions for COMSIGUA's cooling tower, the company began investigating how to transport the equipment and expedite the project.

As the old adage goes "time is money" and that was certainly the case as COMSIGUA was losing hundreds of thousands of dollars each day the plant was down.

With the rental units ordered, Midrex was charged with finding the best way possible to get these large units to their destination.

Enter Forwarding Services International, Inc. (FSI), Midrex's full service in-house freight forwarder.

With time playing the crucial factor, normal means of transport via ocean freight were not feasible. Thus, FSI looked to air-freight, but needed to contend with the modular cooling towers' oversized dimensions and weight. The towers were simply too large for conventional air-freighters.

However, FSI had the experience to handle shipments regardless of size and coordinated the special arrangements necessary for the oversize and overweight cargo.

Their solution was to use a Russian-made Antonov AN-124-100 commercial aircraft upgraded from an ex-military version of the airplane.

FSI contracted one of only three carriers in the world that owned and operated Antonov AN-124-100 airliners to transport the rental units to Venezuela. The aircraft proved to be ideal since in addition to its large cargo hold and weight capacity, the aircraft was equipped with loading equipment and an on-board traveling crane with a total lift capacity of 20,000 kg (44,000 lb).

After finding a suitable aircraft, FSI next needed to arrange a landing site and transportation of the materials to the plant site. Although located in Puerto Ordaz, COMSIGUA had to find an alternate airport for the aircraft to land since the city's airport was too small for the cargo plane.

The AN-124-100 needs a 10,000 ft runway; unfortunately Puerto Ordaz's airfield was only 8,000 ft. The choice was made to fly into Barcelona, Venezuela using a military airport and transport the equipment by truck to the plant site. COMSIGUA's staff was instrumental in arranging logistics that included a military escort by the national guard to transport equipment on Sunday from the airport to Puerto Ordaz.

Within a few days, FSI arranged and expedited the entire shipping program. Landing rights were acquired and once the details were worked out, the plane was loaded. Two trips over a two-day period transported six cooling towers and one 20 ft container of replacement parts from North America to South America.

Within eight days from the time Midrex was first alerted to COMSIGUA's plight, the first batch of cooling towers reached their destination. Midrex had personnel on-site and helped coordinate logistics including working with the Venezuelan government to allow the rental units into the country.

Meanwhile, as all of this transpired, COMSIGUA prepared the plant for the temporary cooling units so as not to waste any time. First, existing pipes were modified to supply water to the new cooling towers. New return water lines from the cooling tower to the cold water basin were also configured and installed.

COMSIGUA provided fabrication of the support framework for the temporary cooling towers. The framework was necessary to get the required elevation to allow COMSIGUA's existing pumps to supply water without additional pumps that would normally be needed to supply these rental units.

In order to operate the six new towers, COMSIGUA arranged for power to supply the 10 cooling fans in each of the interim cooling towers. COMSIGUA's quick actions not only helped to speed up the project but also helped keep costs from escalating.

Because of this coordination and initiative, the new temporary cooling system was up and running in a matter of a few days after delivery, and so was COMSIGUA.

Saving the Day – Part Three

Two Weeks Later - A Happy Ending

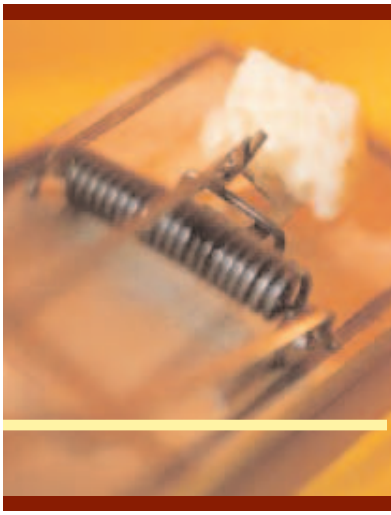
COMSIGUA started up two-weeks to the day following the cooling tower incident and shortly after was back to the same previous high level of production.

Within two days of shutdown Midrex presented a plan of action. After realizing the solution, all efforts were focused on getting the equipment to the plant site as fast as possible. Thanks to the help of FSI and the hard work, coordination, expertise and ingenuity from COMSIGUA and Midrex, disaster was averted, with only a two-week shutdown occurring.

In fact, the two-week shutdown took the place of a shorter scheduled shutdown intended to replace various spares and equipment. Thus, COMSIGUA was able to take advantage of the situation, minimizing the overall impact of the shutdown.

The unique solution implemented has also enabled COMSIGUA to take time in replacing its cooling tower, without suffering from loss of production. Now the plant can continue operation until they are ready to replace their original unit for the long term.

At a time in the industry when alternative iron prices are high, loss of production means a huge loss of revenue. Together with Midrex, COMSIGUA turned what could have been a disaster into a great example of how groups can react quickly and through effort and expertise solve almost any problem.



A Better Mousetrap: The History of Midrex Technologies Part 4

By John T. Kopfle.
Midrex Technologies, Inc.

Note: Part 3 of this series covered the purchase of Midrex by Kobe Steel, the strong direct reduction market of the 1990s, and Midrex's continuing technological improvements.

THE BUST

Steel cycles typically last five to ten years, and by the late 1990s, the strong run was coming to an end. In addition, the "Dot-com" boom, driven by the growth in Internet stocks, came to a crashing halt, and the US stock market plummeted. The combination of these factors resulted in a downturn in the metals industries beginning around 1997. The steel industry was included, and from January 1998 to January 1999, the prices of scrap and HBI dropped by about $50/t. By late 2001, selling prices for HBI were below production cost. (See Figure 1).

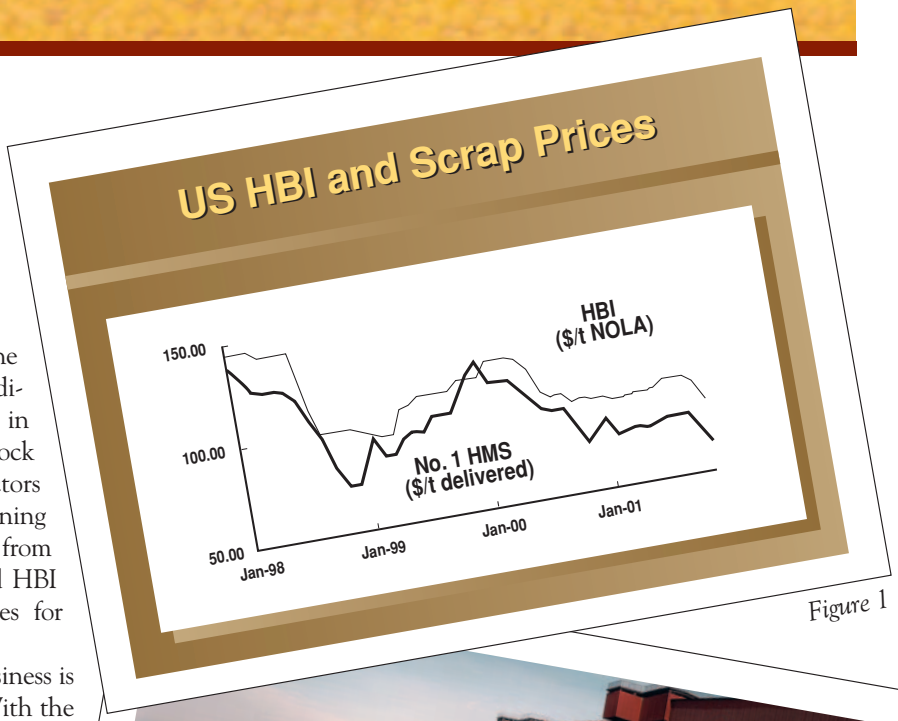


Figure 1

One constant in the direct reduction technology business is that demand for plants follows steel and DRI prices. With the downturn that began in 1998, direct reduction project development activity also dropped. Midrex, however, and its parent Kobe Steel realized that it was essential to develop new technologies to position the business for the inevitable recovery in three to five years. Thus, the significant development program that Midrex has maintained over the years was continued. Benefits of these enhancements include reduced capital and operating costs, lower energy consumption, and greater flexibility in operations. Among the areas of work were oxygen use, hot charging, process control, and coal-based technology.

OEMK

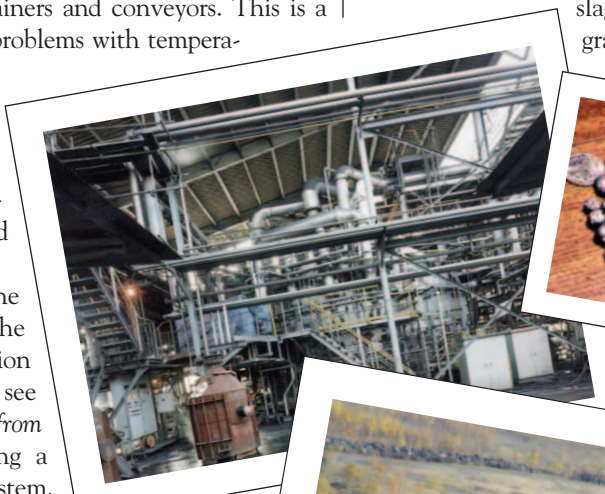
Oxygen Use – MIDREX® Plant operators are continually developing methods to increase productivity. It has long been known that oxygen can provide for higher reducing gas temperatures and can increase production of H_2 and CO from methane. In the early 1990s, several MIDREX Plants, including SIDOR and Acindar, began experimenting with oxygen injection to the bustle gas. The higher temperature obtained was useful in overcoming the temperature drop in the shaft furnace caused by in-situ reforming. The net result was a productivity increase of up to 10 percent.

At present, 19 MIDREX Plants employ oxygen injection. More details on oxygen use can be found in the article, "Tendencies in In-Situ Reforming" in the third quarter 2004 *Direct from Midrex*.

There is, however, a limit to oxygen injection because excessive bustle gas temperatures can cause clustering in the shaft furnace. Midrex has now developed the OXY+® System, which uses a partial oxidation reactor to generate additional reductants and avoid the problem of high bustle gas temperature. With OXY+, MIDREX Plants have the potential economically to increase productivity. The first OXY+ System is now being installed at OEMK in Russia.

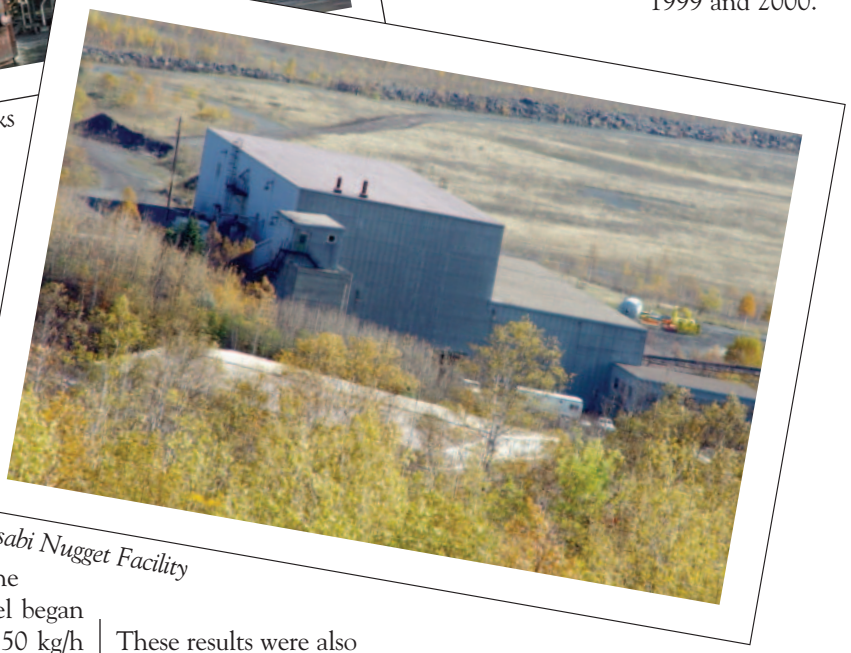
Hot Charging – Nearly all captive MIDREX Plants (those with an adjacent steel mill) cool the DRI after it is discharged from the shaft furnace. The cooled DRI is stored and later charged into the EAF, where it is reheated and melted. An alternative is to feed hot DRI from the shaft furnace into the EAF and thereby utilize the DRI's sensible heat. This saves energy, increases productivity, and reduces electrode and refractory consumption. Some DR plants practice hot charging via use of transport containers and conveyors. This is a viable approach, but there can be problems with temperature loss, availability, and product degradation. To address these issues, Midrex developed the HOTLINK® System, in which the EAF is placed beneath the shaft furnace and hot DRI (HDRI) is charged by gravity.

HOTLINK delivers HDRI to the EAF at 700-750° C. It also has the flexibility to produce any combination of HDRI and DRI. For more details, see the fourth quarter 2003 *Direct from Midrex*. Midrex is now negotiating a contract for the first HOTLINK System.



Kakogawa Works

ITmk3 Nuggets



Mesabi Nugget Facility

Process Control – There has been a tremendous evolution of process control technology during the 35 years since start-up of the first MIDREX Plant. Midrex, in cooperation with Siemens, has now developed SIMPAX®, a suite of control software for MIDREX Plants that will provide enhanced optimization and equipment protection. The software runs on its own separate workstation linked to the existing Basic Automation System. This output can be used to determine the most efficient mode of operation and will be interlocked to the existing control system to provide additional equipment protection. The benefits of SIMPAX include higher product quality and enhanced process control in real time.

Coal-based Technology – As mentioned in part 3 of the "Better Mousetrap" series, in 1989 Midrex and Kobe Steel began development of the coal-based FASTMET® Process. A 150 kg/h process simulator was built and operated at the Midrex Technical Center and a 2.5 t/h demonstration plant was constructed at KSL's Kakogawa Works in Japan. The first FASTMET facility was sold to Nippon Steel and started up in 2000. This 190,000 t/y plant processes steel mill waste at the company's Hirohata Works, producing DRI that is fed to a BOF. KSL also built a 14,000 t/y plant at its Kakogawa Works for recycling zinc-bearing wastes. This facility started up in 2001. With these successes, FASTMET has become the leading rotary hearth reduction technology.

In 1996, KSL began experimenting with the melting of FASTMET-type pellets containing iron ore and carbon. A unique phenomenon was discovered, that if the temperature was raised to about 1,450° C after reducing the iron ore, the iron and slag separate, resulting in a nugget of nearly pure iron plus carbon. This process was named ITmk3, for "ironmaking technology mark three," with Mark I being blast furnace ironmaking and Mark II natural gas-based direct reduction. The ITmk3 reaction occurs in the solid/liquid co-existence phase of the iron-carbon diagram, which is different than traditional ironmaking processes. ITmk3 promises to be a revolutionary process, enabling production of a premium grade iron product without use of coke. It offers the following benefits: reduction and slag separation in one step, low process temperature, minimal FeO refractory attack, clean slag separation, and the ability to use low grade iron ores and wastes.

Based on these promising results, tests were conducted on the Midrex FASTMET Process Simulator. KSL then built a four-meter diameter pilot plant at the Kakogawa Works and tested the process in 1999 and 2000. These results were also successful, and an effort was begun to site a demonstration plant. Ultimately, a partnership of the State of Minnesota, KSL, Ferrometrics, Cleveland-Cliffs, and Steel Dynamics was formed. A 25,000 t/y facility, named Mesabi Nugget, was built in Silver Bay, Minnesota, USA, in the "Iron Range." Start-up was in 2003 and several campaigns were conducted

through the summer of 2004 to test the process at larger scale and confirm operating parameters.

The partners are now developing the first commercial plant.

The China Juggernaut

Although there were many "gloom and doom" predictions about steel and DRI prices early in the new millennium, the steel cycle performed as always, and a recovery began in early 2002. The major factor was China, whose development created tremendous demand for all commodities, including steel and DRI.

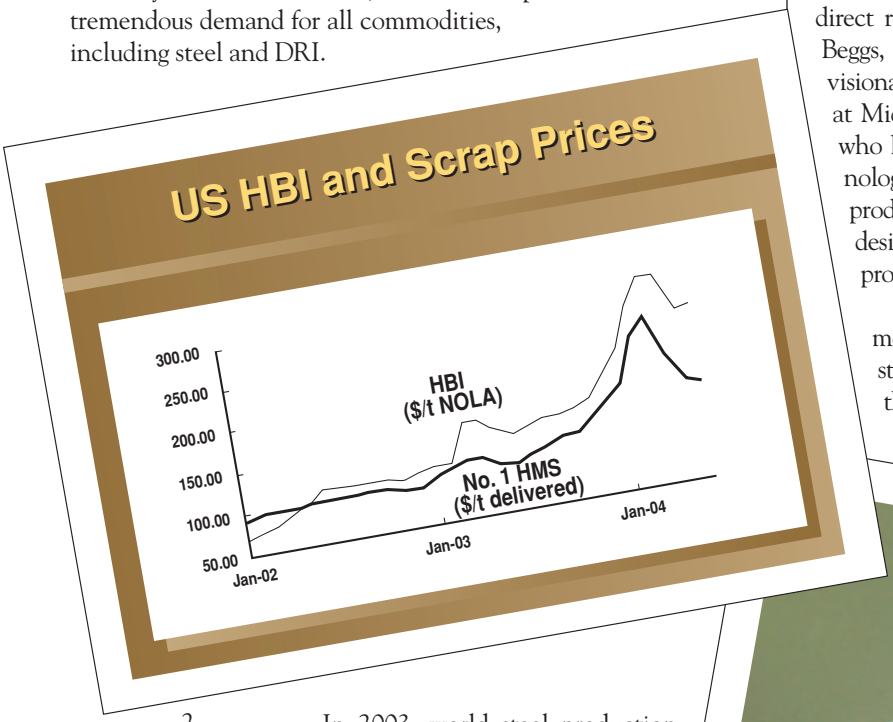


Figure 2

In 2003, world steel production reached an all-time high of 950 million tons. Due to strong Chinese demand, declines in the value of the dollar, metallics supply restraints, and high freight rates, prices of metallics skyrocketed, as shown in Figure 2. In early 2004, merchant HBI prices reached $275/t FOB Venezuela. Prices dipped in May and June of 2004, but subsequently returned to the $300/t level and remain there as of November.

As happened in the 1990s, these high metallics prices spurred demand for direct reduction facilities, and Midrex has contracts for plants in Trinidad, Saudi Arabia, and Malaysia, and is negotiating with potential clients in the Middle East and Russia. These projects contain a number of unique features, including plant relocation, HOTLINK, hot charging, and oxygen use and will further advance the MIDREX Technology and experience base.

Despite the strong DR market now, steel cycles will continue and there will be downturns in the future. To help offset those periods, Midrex is engaged in an effort to identify and pursue opportunities in areas other than iron and steel. The intent is to apply the company's skills in engineering, procurement, and construction management to promising process technologies in areas such as non-ferrous metals, energy, and environmental. The strategy is to obtain rights to proprietary technologies via licenses or partnerships. Midrex hopes to partner with several technology owners over the next few years.

A Storied Past, an Exciting Future

This concludes the remarkable story of the men and women who made Midrex the leading direct reduction technology company. We salute all of them, from the early researchers who worked on four direct reduction concepts before finding success, through Donald Beggs, the "Father" of the MIDREX Process, to Willy Korf, the visionary who grew the company, to the countless men and women at Midrex, Kobe Steel, MIDREX Process Licensees and partners who have dedicated their careers to direct reduction. The technology is a tremendous success: since 1969, MIDREX Plants have produced over 400 million tons of DRI and they routinely exceed design capacity. Each year since 1987, MIDREX Plants have produced over 60 percent of the world's DRI.

What does the future hold? Given the strong steel and metallics markets, prospects for sales of MIDREX Plants are outstanding for the next several years. Midrex realizes, however, that prosperity is never assured, and we must continue refining and enhancing the MIDREX Process to ensure that it remains the leading gas-based reduction technology.

Susumu Okushima, Kobe Steel, pictured with James D. McClaskey, Midrex Technologies, Inc., celebrating the 20th anniversary of Kobe Steel's purchase of Midrex

Development and commercialization of coal-based technology by Midrex and Kobe Steel continues, and this should be a major contributor in coming years. Diversification into non-steel areas is promising and will expand in the future.

As we stated in the first quarter 2004 *Direct from Midrex* commentary, Midrex has a storied past, and we look forward to an exciting future.

Midrex and Hadeed to Begin Landmark Project

for 1.76 Million Ton MIDREX® HOT DRI Plant

Midrex Technologies, Inc. has announced that the company has begun a landmark project for Hadeed to build the largest MIDREX Direct Reduction Plant to date for continuous charging of hot DRI to an adjacent melt shop.

Saudi Basic Industries Corp. (SABIC) signed deals Monday October 25, 2004 with Midrex Technologies Inc., and Voest AIpine (VAI) to construct the plant with a rated capacity of 1.76 million metric tons/year, which will charge Hot DRI to the melt shop at constant high temperatures of more than 600 degrees Celsius.

According to SABIC, this is part of its plan to raise output of long and flat steel products by over 40 percent to 5.5 million tons by 2007.

"These agreements and expansions represent part of SABIC's strategic plan to meet the market's growing demands and improve its position worldwide," said SABIC Vice Chairman and CEO Mohamed Al-Mady.

"This also marks the third time in recent months that Midrex has been favored over competitors as the preferred technology for new Direct Reduction Plants," noted Robert Klawonn, Vice-President of the Commercial group for Midrex Technologies, Inc. "In addition to these, Nucor has signed a contract to relocate the American Iron Reduction module, while other projects have begun engineering with the Lion Group in Malaysia and Hamil Steel in the UAE."

In total, more than 8.5 million tonnes of project capacity have been committed to the MIDREX Technology in 2004, with more than 80% of the capacity designed for Hot Discharge.