FOR IMMEDIATE RELEASE:

Almex Sets Record for Largest Hard Alloy Slab Casting

Buena Park, California - June, 2005 - Based in Fontana, California, Vista Metals Corporation is a specialty alloy caster committed to continuously diversifying its product line. In doing so, the company has pushed technological limits and set new records for hard alloy casting and homogenizing capabilities. Having re-invested millions back into its business in the last two years, the company's latest achievements, completed in the fall of 2004, include commissioning Almex casting technology to create what is believed to be the world's largest hard alloy slab. The record-setting hard alloy slab measures 96" wide, 42" thick, 172" long, and weighs 70,000 lbs and is made of a proprietary alloy similar to AA 2618. This alloy contains as much as 4% copper with 1% iron and 1% nickel. According to Vista Metals, a key reason Almex was chosen was because Almex provides casting recipes and metallurgical standard practices with guaranteed results on the finished product quality. For the super slab product, this guarantee means that production slabs are free from shrinkage and gas porosity and the microstructure of the cast product has fine grain and ultra-fine cell size. *(Complete story in .pdf article below)*

70,000 lb Super Slab Being Removed from Casting Pit

About Almex USA Inc.

Almex USA is the leading supplier of commercial and aerospace aluminum billet and slab casting technology and equipment. The Company's products include LARS® Degassing Systems, Mega™ DC Casting Machines, Billet/Ingot Casting Systems, and CastRightII™ Automated Process Control. Almex is also engaged in equipment and process research involving new capabilities and green technology for efficient recycling of aluminum alloys and has supported the aluminum industry since 1995. Almex is also the recipient of the "Excellence in Exports" Award from the United States Department of Commerce. Trade and Service Marks of Almex USA Inc. are property of the company registered and protected in the United States and other countries.

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Vista Metals Adds to Hard Alloy Super Slab and Homogenizing Capacity Record

Based in Fontana, California, Vista Metals Corporation is a specialty alloy caster committed to continuously diversifying its product line. In doing so, the company has pushed technological limits and set new records for hard alloy casting and homogenizing capabilities. Having re-invested millions back into its business in the last two years, the company's latest achievements, completed in the fall of 2004, include commissioning Almex casting technology to create what is believed to be the world's largest hard alloy slab. Additionally, Vista Metals has installed its sixth homogenizing furnace from Thorpe Technologies, Inc., reportedly making Vista Metals the largest batch homogenizing facility in the Western United States.

Super Slab Production

The record-setting hard alloy slab measures 96″ wide, 42″ thick, 172″ long, and weighs 70,000 lbs and is made of a proprietary alloy similar to AA 2618 (Figure 1). This alloy contains as much as 4% copper with 1% iron and 1% nickel. The forging and tooling plate industry uses the slab to create single-piece mold bodies for large trucks. The alloy imparts superior high temperature strength and excellent dimensional stability to the mold body stock; however, its high solidification shrinkage tendencies add extra complexity to the casting challenge, already made acute by the sheer size of the slab.

Figure 1. Vista Metals' 70,000 lb super slab being removed from casting pit.

When Vista Metals decided to pursue this product line, it selected Almex, based in Long Beach, California, to design and supply the super-size DC casting mold. Already an established solutions provider to Vista Metals, in January 2003 Almex helped Vista Metals generate one of the world's largest billets: a 42″ diameter billet weighing 36,000 lbs cast in AA 7175, AA 7050, AA 6061 and AA 2219 for the aerospace industry. (See "Largest Diameter Hard Alloy Billet DC Cast at Vista Metals, *Light Metal Age*, February 2003.) Vista Metals also uses Almex LARS™ degassing and filtration systems, and CASTRIGHT II™ tables for casting billets in 5, 7, 10, 15.5, 21, 26, and 36″diameters.

According to Vista Metals, a key reason Almex was chosen was because Almex provides casting recipes and metallurgical standard practices with guaranteed results on the finished product quality. For the super slab product, this guarantee means that production slabs are free from shrinkage and gas porosity and the microstructure of the cast product has fine grain and ultra-fine cell size. The typical values are hydrogen content of less than 0.12 cc per 100 grams of aluminum. Sodium, calcium, and lithium are each controlled and the alkali salt content is such that the slab metal is capable of passing ultrasonic inspection per Military Standard (MilStd) 2154 Class A.

To create a product of this size and quality, virtually every aspect of mold development has been challenged, including mold material selection and fabrication, starting head design, mold design, and molten metal delivery.

Mold Material & Construction: After evaluating the traditional alloys used for molds, such as AA 5052 and AA 6061, Almex determined that an alloy with higher structural strength was needed, and elected to use a high strength tempered T6 alloy. However, after machining the mold to a near-finished state, the mold began to structurally bend, indicating that the flexural strength of the alloy was not suitable to overcome the locked-up internal stress. At that juncture, two options were considered: increase the wall size of the mold, or create a new mold design. Because changing the wall thickness would adversely impact the heat exchange characteristics of the mold, Almex elected to develop a new design.

The resulting design is a mold that is made of AA 6061 in stress-relieved T651 temper. Instead of machining a single plate, the mold is comprised of four separately-machined pieces that are welded at the corners in a picture frame fashion.

While this approach resolved the structural and flexural strength issues, it created a new challenge: making the welded seams integral with the machined walls. Creating a uniform surface area around the entire perimeter of the mold was essential for achieving streamlined water cooling. Almex overcame this obstacle by creating a new CNC design program.

Mold Design: To finalize the mold design, Almex used modeling programs to investigate wall size, heat transfer regimes, and baffle designs. Results were extrapolated and adjusted based on practical engineering experience. Today's production mold has four water ports placed at the mold's edge, which are 2.5″ in diameter. To provide variable pressure and water flow rates around the entire mold, Almex developed a specially-designed baffle. The baffle promotes a tiered cooling water pressure control system. Oil for this tooling is a proprietary, non-synthetic lubricant.

Three starting head designs were evaluated: a flat starting head, a tray starting head with a rectangular base, and a double radius starting head. The last design is being used for a couple reasons. First, given the solidification shrinkage of the AA 2618-type alloy, the propensity for butt curl is high. Second, the aspect ratio, which is higher than 2.25, adds further to the butt curl phenomena. The double radius design provides natural relief during the initial stages of solidification.

With the design style established, the next consideration was the material. One of the first options considered for the starting head design was aluminum. However, given the size of the mold and aluminum's high coefficient of linear expansion, it was believed that if used, the aluminum had the potential to gouge the mold. Because the chosen starting head design holds approximately 5.5″ of molten metal, which weighs approximately 2,000 lbs, the option of using a starting head sized to compensate for the expansion paired with a rope gasket was rejected for safety reasons. The final design uses a proprietary specialty

alloy that has a low heat coefficient and low linear expansion coefficient.

Molten Metal Delivery & Mold Feeding: Molten metal passes through a LARS degassing unit where it is treated by a chlorine and argon mixture in the first chamber before being exposed to pure argon in the second chamber. After this treatment, the metal passes through a 40 ppi ceramic foam filter. This ceramic foam material must filter metal throughout the entire cast without generating any change in the head level. The supply runner is designed to contain up to 10″ of metal head level depth.

After the filter, a single fill point delivers metal to the mold through a double-based, double-lever spout and feed actuating mechanism. The feed rate is approximately 500 lbs per minute and requires that the spout and controlling pin have an adjustable range of just 30 lbs per minute. To meet these parameters, the system uses a custom feeder tube and controller pin, designed by Almex and manufactured by Permatech from a fibrous moldable refractory. Critical to the design is that the pressure of the molten metal at the bottom of the downspout be sufficient to push the metal to the long edge of the mold. To minimize turbulence and optimize metal flow, an Almex-designed distribution bag, manufactured by Kabert Industries, is used.

Casting Practices: The success of the drop is dependent on the delivery of almost 3,000 lbs of molten metal being delivered to the starting head in the least amount of time possible. This has been achieved through the use of proprietary techniques developed collaboratively by Almex and Vista Metals.

Though both companies had been prepared to make at least half a dozen start-up trial runs before a reliable recipe was developed, casting success was achieved with only one R&D test cast. Surprisingly, while the 36,000 lb, 42″ thick billet in AA 7050 takes up to nine hours to cast, the drop to create this 70,000 lb slab takes approximately two hours.

Huge Homogenizing Capacity

As Vista Metals expands its specialty alloy line with products such as the AA 2618-type slab, the company's homogenizing needs have grown more complex. Cycles are longer and more precise. To prevent a production bottle neck, Vista Metals installed three new homogenizing furnaces from Thorpe Technologies, Inc. over the past year (Figure 2). Combined with the plant's other three furnaces, Vista Metals has batch homogenizing capacity of over 800,000 lbs, which is believed to be the most owned an operated by any company on the West Coast.

All of the Thorpe furnaces at Vista Metals are shuttle-type, meaning that the furnaces shuttle on railroad-type tracks between loads located on stationary load pads. At Vista Metals, each furnace operates over two separate load pads. Plant personnel unload a homogenized load and then re-stack the pad with a new load to be processed while the furnace is processing on the other load pad. The load pads for the new furnaces at Vista are 25.5′ long by 12.5′ wide. All of the new furnaces feature sophisticated controls, low NOx emissions, and optimized air circulation.

Controls: Each of the three new furnaces are PLC-controlled with operator-friendly touch screen interfaces. Thorpe has placed one screen on the furnace, where operators use the screens to select the alloy recipe set points and control door operations. Based on the selected recipe, the furnace's controls automatically adjust the furnace temperature set point and heat up and soak cycle times.

The other control panel, located in the control panel room, provides process trending and data logging functions. This system is used to display current and historical furnace temperature set points and actual furnace and load temperatures. To simplify maintenance and troubleshooting, the panel also provides extensive fault annunciation.

Figure 2. One of three new Thorpe homogenizing furnaces added at Vista Metals.

Use of reversing circulation fans and Thorpe's "heat head" temperature control module minimize heat up time of the load. Essentially, during the initial stages of heat up, the heat head control module increases heat transfer to the load by setting the furnace temperature set point above the desired load temperature. This control module decreases the heat head as the load temperatures approach the desired load temperature. The reversing circulation fans reverse the flow of gasses across the load every 20 to 30 minutes, speeding up the load heat up by distributing the heat in the load more uniformly.

Temperature Uniformity: To enhance flow uniformity across the load, the new furnaces have leveraged computational fluid dynamic computer modeling. Based on this work, the new furnaces at Vista Metals achieve a temperature uniformity of ±5°F at the end of soak. Four factors contribute to this uniformity. The first factor is the aerodynamic design of the furnace chamber. Second, excellent furnace seals compress on the load pad under the full weight of the furnace, forming a virtually airtight seal. Third, large volumes of circulation gases are moved. This movement is achieved through the fourth contributing factor: reversing circulation fans. These fans have 54″ stainless steel blades that operate at approximately 1,000 rpms. Fan-specific variable speed controls, which operate automatically, control the fans to slow, stop, and begin operating in the opposite direction in less than 30 seconds. The result is that the furnaces offer more advanced air circulation and temperature uniformity than any prior model offered by Thorpe Technologies, Inc.

Environmental Improvements: Vista Metals operates in one of the most rigorously regulated air quality regions of the U.S. To meet the South Coast Air Quality Management Department's standard NOx emissions requirements throughout the operating range of the homogenizing process, the furnace features a unique combustion system. Meeting these requirements throughout duration of the homogenizing cycle is a significant achievement, since the rate of NOx emissions from all burners, including the low NOx burners, increases as the burner is turned down to low fire. The achievement is made possible through the use of staged burner firing and the deployment of low NOx burners.

Future

As Vista Metals pursues its leadership of the specialty alloy market, more innovations and records are sure to follow. Currently, the company is working to expand its offerings to its primary markets of the aerospace, automotive, and tooling industries by adding more products in scandium-based alloys, alloys with 10% zinc, and rolling large sheet ingot in hard alloys.