



New Hampshire Ball Bearings, Inc.
— MinebeaMitsumi Group —

inside track

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NHBB's Parent Company Acquires C&A Tool Engineering, Inc.

MinebeaMitsumi Inc. has closed on the previously announced acquisition of **C&A Tool Engineering, Inc.**, a leading advanced manufacturing company offering high-precision, technically complex parts to the medical, aerospace & defense, fuel system, and industrial markets.



**C&A Tool Engineering, Inc. Headquarters
in Churubusco, Indiana**

C&A Tool Engineering was founded in 1969 as a local tool and die shop and has grown into a premier national and international contract manufacturer. C&A currently operates three major manufacturing locations in northeastern Indiana and employs over 550 people.

The company provides customized solutions to top OEMs in their diverse markets. Services include design, planning, fabrication, and final inspection. In addition to custom components for the aerospace, fuel system, and industrial markets, C&A also manufactures surgical implants and instruments for spine, knee, and hip applications.

Their early adoption of additive manufacturing is a competitive advantage, as their backlog in this area continues to grow. C&A is one of the first companies to have their direct metal laser sintering (DMLS) operational process permitted to support customer products approved by the Food and Drug Administration (FDA).



**Blisk fabricated
through additive
manufacturing process**

Its manufacturing operations are certified to AS 9100, ISO 9001, ISO/TS 16949, and ISO 13485. The company also holds a Nadcap accreditation for Nonconventional Machining (EDM).

C&A Tool Engineering, Inc., is joining the NHBB/myonic Business Unit, which includes NHBB, myonic GmbH, and CEROBEAR GmbH. This Business Unit of the MinebeaMitsumi Group will now operate a total of eight manufacturing facilities: five in the United States, two in Germany, and one in Czech Republic.

The move increases the company's footprint in the aerospace and medical markets and expands its offering of machined components within its competencies of manufacturing to tight tolerances and extreme complexity.

For more information about C&A Tool Engineering, Inc., please visit catool.com.

New Executive VP Chosen

New Hampshire Ball Bearings, Inc., has named Gerry Fay executive vice president of NHBB following Jim Geary's retirement announcement. Gerry is head of operations for the factories in Peterborough, New Hampshire and Chatsworth, California. He is also in charge of sales and marketing. His official start-date as executive vice president was July 1, 2017.



Gerry Fay

Gerry comes to NHBB with a proven track record of success and an aptitude for managing change. He joined MinebeaMitsumi in August of 1990 in the United Kingdom and has held various management positions within the MinebeaMitsumi company for the past 27 years. For the last eight years, Gerry served as president of NMB Technologies Corp, NHBB's sister company in the US. He was appointed group executive officer of MinebeaMitsumi in July of 2015.

Gerry succeeded Jim Geary, who announced his retirement earlier this year. Jim plans to stay on with NHBB in a reduced role for a time, providing continuity, taking on some special project work, and assisting with the transition of responsibilities.

Read Jim's retirement letter at nhbb.com/about/press/06_02_17.aspx.

A Message From NHBB'S President



Dan Lemieux

At NHBB, we view acquisitions through the lens of long-term growth, and we select companies with advanced capabilities that will enable us to better serve our customers. Viable candidates are companies that would increase our technology portfolio, expand our advanced manufacturing know-how, or provide specialized expertise we do not yet possess. We focus our targeted search on companies with complementary products and services that operate in most of the same industries as NHBB. The best candidates are companies with unique capabilities that we can leverage to create synergies among our various businesses.

In light of this strategic acquisition mindset, we are especially pleased to add C&A Tool Engineering to our Business Unit. C&A is a highly advanced contract manufacturer that specializes in tackling difficult projects in the aerospace, medical, transportation, and industrial markets. In addition to being highly skilled at high-precision machining techniques, it is an experienced practitioner of additive manufacturing, specifically direct metal laser sintering (DMLS). In fact, it is one of the first companies to have its DMLS process permitted to support customer products approved by the Food and

Drug Administration (FDA). The company has also developed a business model for efficiently managing prototype orders, interim production runs, and long-term manufacturing contracts – whatever their customers require.

These strengths will provide us with ample opportunities to further transform our business. C&A's flexible approach and complex machining capabilities will have an immediate positive impact on our customers that are not already working with C&A. The company's unique capabilities will allow NHBB and the MinebeaMitsumi Group to provide additional services not previously available through our business unit. Plus, C&A's expertise in additive manufacturing will enable us to advance our manufacturing capabilities, company wide.

Ultimately, our goal is to serve our customers so well that they make us their number-one supplier. We believe that a strategic acquisition approach is an important component to achieving this objective. As we continue to expand our business by adding highly skilled companies like C&A, we shall work hard to create synergies that strengthen our position as a strategic supplier of complex products and valuable services – because it's what our customers deserve and expect from NHBB.

NHBB Executive Joins Federal Advisory Board Related to Manufacturing Industry



Gary Groleau

Gary Groleau has been appointed to the Advisory Board for the National Institute of Standards Manufacturing Extension Partnership (NIST MEP), becoming one of 10 manufacturing professionals in the US who provide advice and guidance to the national organization.

The NIST MEP Advisory Board is a national board that is legislatively mandated and established pursuant to the Federal Advisory Committee Act (FACA). The organization's Advisory Board is tasked with identifying proactive actions that will enable small manufacturers to successfully address and implement changes in technology and the business environment in the future.

Throughout his career, Gary has been a strong advocate for issues that are critically important to manufacturers, most notably the skills gap in advanced manufacturing and technical education and training at all levels of education.

As NHBB's corporate manager of labor relations and organizational development, Gary is responsible for union labor relations, workforce training and development, NHBB's Professional Development Process (PDP), job skills training, and short- and long-term workforce recruitment strategies.

Annual Awareness Campaign Spotlights NH's Manufacturers

This year, New Hampshire Manufacturing Week becomes a month-long initiative, with activities extended throughout October. NHBB will again actively support the program. Our two NH-based facilities will host tours for local high school and middle school students. Employees plan to participate in the Advanced Manufacturing and Technology Summit, which is scheduled for October 27, 2017. In particular, Gary Groleau will facilitate a breakout session, titled Workforce Development Skills Gap, which will feature innovative manufacturing education and training programs from around the state. For more information, please visit nhmep.org.

Choosing the Right Bearing Alloy for Highly Corrosive Medical Applications

Extremely corrosive operating environments require a thorough analysis of bearing ring materials in order to specify the most suitable option. While a majority of situations might ultimately call for the most common and reliable stainless steel, AISI 440C, certain applications demand a more resistant alloy — especially those that constantly expose bearings to high levels of contaminants, water vapor, or acidic solutions. The choice of an alternative stainless steel ring material that is durable enough to withstand such abuse is increasingly likely to be Corrosion-Resistant Nitrogen-Enriched Stainless Steel (CREN).

CREN stainless steel, as defined by the AMS 5898 specification, is a martensitic steel that possesses high tempering resistance, great fatigue resistance, and high hardness levels ranging from 60 to 64 HRc. The increased concentration of nitrogen produces a higher resistance to corrosion and wear than 440C stainless steel. As a result, CREN is finding its way into a variety of aerospace, food and beverage, and medical device applications that expose bearings to highly corrosive substances.

CREN's superior corrosion resistance proved to be a very useful solution for one of our customers in the medical device manufacturing industry. The customer requested our help with resolving a problem related to a pulmonary application. Their original specification called for a radial bearing with 440C stainless steel rings, silicon nitride ceramic balls, a polyamide-imide retainer, and two shields. However, the 440C stainless steel bearing it had specified through another supplier was rapidly corroding in the application's saline solution. Our preliminary recommendation was to consider using CREN for the bearing rings instead of 440C because of CREN's superior corrosion resistance.

TABLE 1. Stainless Steel Materials Available Through NHBB

Material	Specification	Ring Hardness (HRc) at Room Temp.	Key Attributes
AISI 440C	AMS 5618	58–62	Corrosion resistance
BG42®	AMS 5749	61–65	High temperature tolerance, corrosion resistance
CREN	AMS 5898	60–64	Extreme corrosion resistance, long life

*BG42® is a registered trademark of Latrobe Specialty Steel Company.

Our customer tested the CREN material by submerging a CREN stainless steel bearing in a proprietary saline solution for several weeks. They reported favorable preliminary results. In order to better understand CREN's characteristics and validate the specification of the CREN material, we consulted the alloy supplier, reviewed the raw material and processing specifications, then initiated a series of experiments in the product development and testing lab. The tests were designed to evaluate the corrosion resistance of different batches of CREN material that had undergone alternative processing sequences. The positive results of these experiments enabled us to adjust our production process in a way that best achieved the required outcome.

Working closely with the customer to understand their application challenges and then engaging in a development and testing cycle to specify the right solution is a routine practice at NHBB. It's a great way to partner with customers, demonstrate our expertise and value, and open possibilities for new projects.

Aero Engine Bearings the Focus of New Test Rigs

Comprehensive product development and testing of rolling element bearings has become one of NHBB's noteworthy technical capabilities. For well over three years now, NHBB's New Product Development Center (NPDC) has been partnering with NHBB HiTech Division and CEROBEAR GmbH to support the next-generation aero engine development initiatives of a select group of customers.



With the advent of rolling element testing within NPDC, NHBB has achieved a higher degree of technical readiness as an aero engine bearing specialist.

Since September of 2013, when NHBB acquired and installed two endurance test rigs and one high-speed test rig, the NPDC has been running accelerated life tests and high-speed tests on ball and roller bearings with a bore size of up to four inches. This covers a significant cross section of bearings used in aero engine mainshafts, gearboxes, and accessories.

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Need answers to technical questions?

Visit: nhbb.com/reference/index.aspx

NHBB Fills Open Sales and Applications Engineering Positions



Rebecca Levesque

The Astro Division filled two open positions in the sales department in the first half of 2017. Rebecca Levesque joined NHBB as an inside sales representative in January. Rebecca is responsible for accounts in the eastern half of the United States. Prior to NHBB, Rebecca worked as an inside sales representative for Measured Progress and Liberty Mutual. She holds a bachelor of science degree in business administration from Southern New Hampshire University.



Joe Beddia

The newest member of Astro's Inside Sales team is a skilled professional with over 15 years of experience in sales and customer service. Joe Beddia was promoted to inside sales representative in June, a year after he was hired to fill a shop floor position. Joe supports customers in the central United States. He holds a bachelor of science degree from Plymouth State University.



Aaron Tan

The Precision Division in Chatsworth, California, has filled two open positions in its Applications Engineering department. The first opening was filled by Aaron Tan, a mechanical engineer who has worked at NHBB for nine years. Aaron transitioned from the Quality Department to Applications Engineering in February of this year. He holds a bachelor of science in mechanical engineering from Mapua Institute of Technology (Philippines).



Michael Cleary

In July, the Precision Division hired Michael Cleary to fill the remaining open position within the Applications Engineering department. Before joining NHBB, he worked as an applications engineer for LINAK and as a designer of tooling and fixtures for Quality Manufacturing Inc. Michael graduated from the University of Kentucky in 2013 with a degree in mechanical engineering.

Rolling Element Test Rigs continued...

The first endurance test rig is equipped to perform accelerated life tests on roller bearings under radial load. Currently, this rig is being used in a joint research project between NHBB and CEROBEAR to study the effects of a proprietary advanced manufacturing methodology on the life of aero engine roller bearings.

The second rig is built to conduct accelerated life testing of ball bearings under axial load and is being used to study the performance of aero engine ball bearings containing ceramic balls. A subsequent collaboration between NHBB and CEROBEAR will focus on the effects of contamination on the life of hybrid ball bearings.

The third and most sophisticated test rig is dedicated to high-speed testing of rolling element bearings for main shaft and gearbox applications. This rig is designed and equipped to replicate the actual operating conditions of an aero engine. The shaft rotates up to 45,000 rpm. Oil inlet temperatures can reach 250°F and ring temperatures can reach 450°F using high velocity jets.

With this rig, the NPDC is collecting data on a myriad of variables, including load, speed, shaft torque, inlet oil flow rates, inlet oil temperature, outer ring temperature, inner ring temperature, oil debris monitoring, and vibration. The information will give engine manufacturers a complete picture of bearing performance. At the moment, this rig is being used in a joint research project to study the high-speed performance of hybrid ceramic bearings.

Customers interested in learning more about the new product development and testing capabilities of the NPDC are invited to contact NHBB. Visit nhbb.com for more details.

Landing Gear Rig Simulates Operation



NPDC engineer sets up landing gear test rig.

This spring, NHBB's New Product Development Center unveiled its brand new landing gear test rig and began running its first series of wear tests of self-lubricating bushings. The new rig expands the NPDC's product development capabilities to include the testing of axial sliding motion of landing gear struts. Designed and built in-house, the rig is programmable to simulate a full landing gear sequence – taxiing, takeoff, and landing. The rig is also equipped to test product performance under a wide temperature range, from -40°F to +325°F. Contact NHBB to learn more.