By Kruti Bharadva

# TRANSFORMING FOR THE FUTURE

Staying a step ahead and being future-ready can be a game-changer for any business. We spoke with **Rahul Kirloskar of The Kirloskar Group** of Companies on the recent move to transform the way they do business, and here is what we learnt.

In July 2021 Kirloskar Oil Engines, Kirloskar Chillers, Kirloskar Pneumatic, Kirloskar Ferrous Industries and Kirloskar Industries decided to refresh each of their business visions. The refreshed vision was aligned with the need to be future-ready in a constantly evolving world and stemmed from the desire to enhance the experience throughout the customer journey. We sat down virtually with Mr Rahul Kirloskar, Executive Chairman, Kirloskar Pneumatic and had a tête-à-tête with him – as he took us through the plans and vision of the group of companies.

**Please tell us briefly about your group of companies, their product offerings and the sectors to which they cater as well as manufacturing capacities?**

***Kirloskar Oil Engines Ltd*** is a leader in the manufacturing of diesel engines, agricultural pump sets and generator sets with a sizable presence in international markets. Kirloskar Oil Engines Ltd has a strong distribution network throughout the Middle East and Africa with offices in Dubai, South Africa and Kenya and representatives in Nigeria. The company specialises in manufacturing air-cooled and water-cooled engines, diesel generator sets across a wide range of power outputs (2.1 kW to 5200 kVA), diesel engines, diesel and electric pump sets, power tillers, specialised engines for fishing, among others. The research and engineering Facility of Kirloskar Oil Engines Ltd ensures all engines and diesel generator sets are certified for stringent noise and exhaust emission norms. The company also offers engines that operate on alternative fuels such as bio-diesel, natural gas, biogas and straight vegetable oil. In the power generation segment, Kirloskar Oil Engines Ltd is one of the largest

selling Genset brands in the world whereas the newly-entered railways' power car business has already become the second-largest player fuelling the growth of Indian Railways.

***Kirloskar Chillers Private Ltd*** has been at the forefront of HVAC technology in India since it commenced operations in 1996. For more than a decade after inception, it was the only company in India to manufacture centrifugal and screw chillers. Kirloskar Chillers Private Ltd.'s products are designed for a wide range of operating conditions and applications, from comfort air-conditioning to process cooling as well as low-temperature brine applications. In 2006, Kirloskar Chillers Private Ltd. was the first Indian chiller manufacturer to acquire AHRI certification for its products and the first to establish an AHRI-certified test facility in 2008. The company has been a pioneer in ozone-safe and low-GWP, eco-friendly technologies in India.

***Kirloskar Pneumatic Company Ltd*** -Founded in 1958, Kirloskar Pneumatic Company Ltd. is the market leader in CNG systems and oil and gas refrigeration in India, enjoying a market share of over 60 per cent in both business segments. The company has a wide range of offerings that include air compressors, refrigeration compressors and systems, process gas systems, vapour absorption chillers and industrial gearboxes. It serves a range of sectors like oil and gas, steel, cement, cold chains, food and beverages, pharmaceuticals, railways, defence and marine. Kirloskar Pneumatic Company Ltd. has established technology partnerships with leading global companies. It is also steadily enhancing its leadership position in the gas compression segment while being the world's largest manufacturer of industrial gas compressors.

***Kirloskar Ferrous Industries Ltd***

Founded in 1991, Kirloskar Ferrous Industries Ltd. is India's largest castings and pig iron manufacturer. The company caters to various industry sectors, such as tractors, automobiles and diesel engines. The manufacturing facilities at Koppal, Hiriyur and Solapur have the unique capability of producing a range of products that include grey iron castings up to 300-kg pieces. The company also produces various grades of pig iron such as SG iron grade, basic steel grade and foundry grade. The company is also expanding its manufacturing capacities in pig iron and casting. The company has introduced a 3D printing facility, enabling fast development of new products and capability ramp-ups and has also started machining castings and added a coke manufacturing facility with waste-heat recovery power to be used in the foundry.

***Kirloskar Industries Ltd***

Kirloskar Industries Ltd is a public limited company trading on the Bombay Stock Exchange and the National Stock Exchange. The company was incorporated in 1978 and is engaged in wind power generation and has diversified into real estate development activities through its wholly-owned subsidiary, Avante Spaces. The company also invests in securities of group companies and has rented out commercial spaces.

***Avante Spaces, the real estate business,*** a subsidiary of Kirloskar Industries, has embarked on its first project which is a mixed-development offering that includes retail and commercial space in smart buildings. It is exploring different models of real estate development keeping user-centric and future-forward principles in mind.

***Arka Fincap,*** a non-deposit taking systemically important NBFC, is a wholly-owned subsidiary of Kirloskar Oil Engines Ltd. Arka Fincap is a professionally managed company focused on providing structured term financing solutions to corporates, real estate and loans to micro, small and medium-sized enterprise borrowers. The company was started three and half years ago.

**Tell us about the large investments and growth strategies planned for all business lines in the coming years?**

Among the new consumer-facing businesses, there will be significant investment in the realty business Avante Spaces and Arka Fincap, the non-banking finance company (NBFC). Avante Spaces is developing the first of its land parcels based on customer-centric and future-forward principles. The business is looking at a mixed-development offering that includes retail and commercial space in smart buildings.

Arka Fincap was established last year as a subsidiary of Kirloskar Oil Engines and began operations with a seed capital of Rs 1,000 crore. It is focusing on structured term financing solutions for corporations and loans to MSME borrowers and the real estate sector. In three years, Arka Fincap will expand into retail lending and consumer finance.

Avante Spaces is our first real estate project. The development potential of our first land parcel is about 2 million square feet and it will be ready by 2024. At Kirloskar Ferrous, we are setting up a phase-II coke oven and power plants to achieve self-sufficiency and cost reduction for the present facilities. At Arka Fincap, our NBFC setup, we had started with a commitment to invest Rs 1,000 crore as seed capital over four years. We have already infused about Rs 800 crore in it. We plan to invest the rest over the next 12 months or so.

**Explain the infusion of industry 4.0 technologies such as digitisation and 3D printing into your business and how is this transforming the way you manufacture, the way you process, etc.?**

We have adopted many new-age tech solutions. These include 3D printing, artificial intelligence (AI), Industry 4.0, IoT-powered gensets (over 50,000 already supplied), customer service, remote monitoring, digital transformation in after-sales service with the help of EFSR, among others. We leveraged technology to equip our employees with better tools, seamless and transparent flow of information, and learnings, along with AI-driven e-learning systems that can be accessed from anywhere in the world.

This, coupled with the right policies and processes, will allow our people to grow vertically and horizontally within companies, ensuring their learnings, as well as their potential to deliver, are limitless.

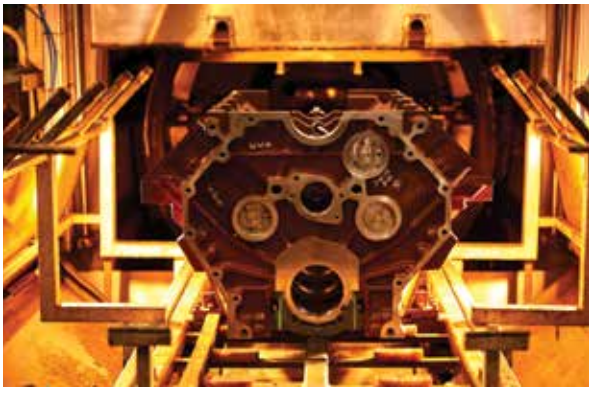
**Kirloskar is on a transformation journey - with a vision now aligned to be being future-ready. Please explain this ethos and the need to transform. Especially keeping in mind, the current market scenario, wherein survival and adaption is the general norm?**

Our businesses have always been agile and unafraid to transform in step with a transforming world. So, the refreshed vision is aligned with the need to be future-ready in a constantly evolving world and stems from the desire to enhance the experience throughout the customer journey.

The exercise involves not just a revitalisation of the businesses from robust, engineering-led firms to solution providers that lead today's transformed industrial landscape, but also being more customer-centric than ever before.

It is very much in line with our founder's vision of ensuring that all products are a step ahead of time, the companies will constantly innovate with an eye on the future. So, it wasn't tough once we decided to move ahead.

We were very clear about the values we would adhere to Innovative thinking, Empathy, Collaboration, Integrity, Excellence and Value-creation. These will be deeply entrenched in the operations going forward. In the past, we were more B2B. About four or five years ago, we started our journey towards being a digital company – we were probably one of the first companies to go digital. We took this decision because we were a 130-year-old group and we needed to move with the times.



**Customer focus will form the core of your new mission. Kindly explain the shift?**

The exercise involves not just a revitalisation of the businesses from robust, engineering-led firms to solution providers that lead today's transformed industrial landscape, but also being more customer-centric than ever before.

To ensure that all products are a step ahead of time, the companies will constantly innovate with an eye on the future. The expanded vision implies a promise to all customers that their dreams can now be truly limitless and will be fulfilled. We have always taken pride in ourselves for the fact that we probably have the best service networks across the country.

The customer is at the heart of everything we do, and we constantly evolve to exceed their expectations. We are now expanding our horizons and have made leaps from just products to solutions, to customer centricity and now to digital architecture. This change is reflective of our new philosophy to create better lives, better opportunities and a better tomorrow for our customers and society.

**Kirloskar Industries reported a consolidated net profit of Rs 72.73 crore in the June 2021 quarter. Please tell us in detail how the numbers have been in the past financial year and your expectations of the coming quarter/year?**

We cannot compare the results from last year because of the pandemic and our facilities being shut and we reported a loss of Rs 6-7 crore. We are hopeful to continue with the good performance of the company made in the first quarter.

**How important is sustainability to your business ethos? What steps is the group taking towards incorporating sustainability into its products and services?**

We are focused on creating maximum value for the customer through new businesses, new offerings and also through our strong, committed sustainability focus – green energy, new technology, community efforts. Our companies are responding to climate change. The Kagal plant, for example, is carbon-neutral. There is a waste heat recovery plant at KFIL and we have invested in solar energy with a total of approximately 20 MW of solar power across the group to reduce our dependence on grid power.

We believe business and environmental impact are correlated. So, we are imbibing renewable energy in our attempt to create a truly sustainable business with the use of solar power at our manufacturing facilities. We are moving towards a greener and energy-efficient technologies. This includes compliance with international standards in energy efficiency from Bharat Stage IV emissions to Euro VI and low GWP.

**Tell us more about the new vision and how the company is planning to transform?**

A refreshed brand identity and colours have been adopted as a part of this exercise. While the logo has elements of human-centricity and future-readiness, the colours allude to the legacy that the 130-year-old name carries, and the years put in to fulfil the dreams of those it has touched. The values of innovative thinking, empathy, collaboration, integrity, excellence and value-creation will be deeply entrenched in the operations going forward.

The refreshed logo symbolises our transformation and the journey towards a 'Limitless' future. The 'i' combines a human icon and a forward-looking arrow that shows the progression and growth of the people impacted. It also indicates that the companies are future-ready and will always strive to satisfy the needs of the customers. The inspiration was drawn from the colour copper that naturally evolves every day. Hence, the copper patina colour palette has been used – from shiny browns to darker browns, blues and finally greens. Teal is the final stage of this patina, that protects every element within it. This is the inspiration behind the colours of the identity you see today.

To strengthen their businesses, the companies are also expanding their leadership. Industry veterans that have joined in the recent past include ***Mahesh Chhabria at Kirloskar Industries, Vimal Bhandari at Arka Fincap, Vinesh Jairath for the real estate business and K Srinivasan at Kirloskar Pneumatic. Industry veterans RV Gumaste, Sanjeev Nimkar and Avinash Manjul continue to lead Kirloskar Ferrous Industries, Kirloskar Oil Engines and Kirloskar Chillers*** respectively.

By Kruti Bharadva

# SUSTAINABILITY IS IN OUR DNA!

**George Rajkumar, Country President, Grundfos India,** talks about how efficient water and wastewater management is vital to the manufacturing sector and the role Grundfos plays in enabling this

**Grundfos is a leading water solutions and technology company. Please describe for us the core business activities of Grundfos in India, including your production facilities**

We started our operations in India in 1998. Currently Grundfos India has more than 450 employees and works with more than 250 distributors and dealers with 8 branch offices and many more home offices across India. We also have two manufacturing centers in Chennai and Ahmedabad. Furthermore, Grundfos India takes care of sales operations in Bangladesh, Bhutan, Nepal and Maldives.

Sustainability is in our DNA and is at the core of Grundfos' principles, dictating how we do business. We implement principles of sustainability into our products and solutions, aligning with the United Nation's Sustainable Development Goals (SDG) 6 which aims to improve sanitation and access to clean water and, SDG 13 on climate action

We have transformed globally to strengthen our position and responded to changing customer needs by reorganising our organisation for simplicity and speed, and by investing significantly into innovation and digital capabilities. We have organised our sales, marketing, technology and operations functions to serve four different customer segments: commercial building services, domestic building services, industry, and water utility. This creates a more customer centric structure, where the whole value chain is focused on meeting customers' unique needs.

**Sustainability is the need of the hour. How is Grundfos actively working towards sustainable solutions through its products and services?**

Sustainability is in our DNA and is at the core of Grundfos' principles, dictating how we do business. We implement principles of sustainability into our products and solutions, aligning with the United Nation's Sustainable Development Goals (SDG) 6 which aims to improve sanitation and access to clean water and, SDG 13 on climate action. Going by our purpose statement, we are committed towards creating solutions to address the world's water and climate challenges, thereby improving the quality of life for people across the globe.

We have a range of products and services that, while providing our clients top-of-the-line performance also ensures that they can run in a energy-efficient and sustainable and eco-friendly operations after installation. The pumps that we have sold throughout 2020 alone have helped our end-users reuse 1.5 billion m3 of water. We have set our sights on facilitating our end-users to save a total of 50 billion m3 of water by 2030.

At Grundfos, we have set our own goals of reducing water usage and CO2 emissions by 50 per cent within 2025 as compared to the year 2018. We also aim to be a climate positive organisation by the end of 2030. These are the main ambitions driving our sustainability initiatives. Even our Chennai facility in

# smart plastics

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India is a LEED certified green building with a ZLD installations and a renewable energy setup through rooftop solar photovoltaics. Grundfos is also moving towards a circular economy, our products are designed to allow recycling and reuse. For example, most intelligent pumps use permanent magnets to run at high speed and are highly hazardous material to dispose. We have taken the initiative to collect our pumps from our customers after they reach their end of life period to ensure that it is recycled. We also provide consumers with the information to identify when a pump would reach its end-of-life period, so that the disposal can be done in a responsible manner.

Our current product highlights include iSOLUTIONS, a cloud-based application to monitor and optimise water networks, and Demand Driven Distribution (DDD) systems that control and measure water supply systems on a real-time basis to ensure water is only being utilised in required quantities. Our products utilise cutting edge predictive technology and high-end pumps to make sure water wastage is either minimised or nullified altogether.

"

Powered by our deep understanding of water, Grundfos iSOLUTIONS utilises intelligent pumps, cloud connectivity and digital services. Together they enable real-time monitoring, remote control, fault prediction and system optimisation to help you reach a new level of performance

To reduce water losses in one of its networks, an Italian utility installed the Grundfos Demand Driven Distribution controller to monitor and adjust the pressure continually all the way to the end of the line. The result was a 30 per cent reduction in water losses and 17 per cent energy savings .

**What 'green' strategies have Grundfos adopted at its facilities? Please describe for us the accreditation your Chennai facility has received.**

Grundfos India's Chennai production unit is a zero-liquid discharge plant with in-house sewage treatment and effluent treatment plants, making it India's first commercial gold-rated green building (LEED certification by USGBC in 2005). Grundfos India's factory has also received the gold certification in 2011 from the Indian Green Building Council (IGBC). In August 2013, our office building was further elevated to a LEED EB Platinum certification. In 2019, the entire Chennai facility is a LEED Platinum rated Green building along with its assembly/manufacturing area.

With sustainability as a core element of our ethos, our facilities are designed to minimise their impact on the environment through focus on recycling wastewater and usage of solar energy. Our underground water tanks with a capacity of 3,50,000 litres, collect 53 per cent of precipitation through rainwater harvesting. Solar collectors at our plants generate about 227 MWh from our roof top solar panels that is used within our plant contributing to a green cause.

The domestic wastewater generated in the facility is treated at our sewage treatment plant and the treated water is used for gardening and landscaping activities. The industrial wastewater is treated at our effluent treatment unit and is used back for processes at the plant.

**Digitisation is key to manufacturing today. Please tell us about the iSOLUTIONS of Grundfos.**

Grundfos iSOLUTIONS brings a new era of intelligence to pump systems and water technology with

solutions that look beyond individual components and optimise the entire system. Powered by our deep understanding of water, Grundfos iSOLUTIONS utilises intelligent pumps, cloud connectivity and digital services. Together they enable real-time monitoring, remote control, fault prediction and system optimisation to help you reach a new level of performance.

Grundfos offers iSOLUTIONS as an effective way to optimise water and wastewater networks. It is a cloud-based offering that augments operation and eases expansion or repair of water and wastewater networks. This can identify infiltration of water by monitoring actual flow in sewers and predict maintenance to save energy and labour before a breakdown occurs. Our optimisation module for wastewater collection systems improves knowledge of what is going on in the network, thereby saving valuable operation time and increasing efficiency.

iSOLUTIONS needs sensor-based smart pumps to gather data as well monitor the network and perform diagnostics. When used properly, it has the potential to save massively on wastewater loss and increase reuse to a great extent.

At the Pharmez SEZ in Ahmedabad, a common effluent treatment plant was setup to treat wastewater discharge by 12 pharmaceutical companies in the zone. Grundfos India provided the right energy efficient products for the setup of this plant from digital dosing pumps, dosing tank stations, hydro-pneumatic systems, high-pressure pumps, and solar surface pumps. All these connected through iSOLUTIONS helped achieve a significant reduction in power consumption and minimal maintenance and downtime.

**How was the last fiscal for you in terms of business numbers and what were the key takeaways from the tough 2020?**

The year 2020 was a challenging year for industries across sectors. After having been significantly impacted by COVID-19 during the first half of 2020, Grundfos returned to stronger sales traction in the second half of 2020. Return on sales reached 9.9 per cent and in a challenging year, Grundfos maintained a high customer satisfaction score and continued to deliver on its sustainability ambitions.

**What are the key areas for efficient utilisation of recycled wastewater?**

Reclaimed or recycled water can be used for many non-potable purposes in municipalities, commercial buildings and industries. A significant portion goes toward watering parks and landscaping alongside public roads, etc. Another avenue of reuse is in industries, which have the capability to use reclaimed wastewater such as power plants. A lot of water is needed to cool power-generation equipment. The water can also be used for concrete mixing, artificial lakes etc.

It can also be used in residential complexes for washing cars, flushing toilets, and maintaining landscapes. Both domestic and commercial/industrial water networks can run a dual piping system to keep the recycled water separate from the potable water. Deploying the right solution and technology can ensure that wastewater be recycled and used for drinking purposes as well. This would be particularly beneficial in water scarce areas to improve accessibility.

An example for the reuse of wastewater: The Grundfos plant in Suzhou was struggling to meet its water consumption targets in the last few years. As a result, the water being consumed at the site was monitored, which provided an opportunity to reuse grey water (water used in shower and production facilities) in the cooling towers and Deionized Water Systems. By utilising a Reverse Osmosis (RO) system and constructing grey water collection tanks, the site was able to biochemically cleanse the grey water of impurities and use the water for other production processes. It is estimated that water saved is over 10,000m3 (1,000,000 litres) per year.

**What is the current scenario of wastewater management in factories?**

Smart factories are leveraging new technologies to boost the efficiency of their manufacturing facilities. Wastewater treatment

has also been positively impacted by these technologies. Wastewater treatment in smart factories should be integrated with IoT and can be made more efficient when it is decentralised and modular in nature. This helps save energy and operational cost significantly by avoiding any major breakdowns, as parts that have been diagnosed to be malfunctioning by the software can be removed and replaced easily. It also provides real-time monitoring at remote locations, thereby reducing the need for direct human intervention.

A water treatment plant in Poland was proving to be inefficient in its process due to obsolete machinery present. Grundfos products such as pumps, dosing equipment and boosters, plus all the equipment for the bioreactors, including aeration grids, mixers and blowers were chosen by the plant to upgrade to help them become efficient in their process. The plant that previously could not maintain the low level of effluents in their treated water, now had become one of the only few treatment plants that could lower nitrogen in the water to 4-5 mg/l at the outflow and the phosphorus level to 0.4 mg/l. The plant helped reduce energy consumption by 50 per cent after the upgrade.

**What are your views on having decentralised industrial wastewater treatment for a country like India?**

With a country as big as ours, decentralised wastewater management systems should be the focus for effective treatment and management of wastewater in India. Decentralised plants are usually installed near the wastewater generation sites and aid in the most efficient treatment and use of wastewater helping reduce water pollution significantly. They are also seen as a popular alternative due to their flexibility as they can be changed as per the treatment need for the discharge. For the long run, they help in cutting costs and improve on the sustainability of the industry. Through proper decision making, industries will be able to set up, maintain and operate these plants with minimal capital spent.

Considering the relatively underdeveloped wastewater treatment sector in India and the increased scope for participation from private companies, there exists a gap in the market which can be filled with decentralised treatment solutions that can meet the country's complex water challenges. Decentralisation of wastewater includes utilisation of new technologies and cost-effective innovations that help democratize wastewater treatment solutions, allowing smaller local-level bodies to set up their own facilities and consequently leading to higher overall rates of wastewater treatment and processing. These systems could be a feasible alternative for areas which are not connected to sewer networks or those that are newly developed. However, these decentralised systems must be properly designed, maintained, and operated to provide optimum benefits.

Example using solutions like the Grundfos' Prefabricated Pumping Stations will help cut down cost and are easily customizable. They are supplied with piping, valves, auto-couplings, guide rails, pumps and level control. Ready to lower the pumps down to the auto-couplings, all these components are delivered by the same supplier as well as in the same unit, securing a cost-effective operation and ensuring that all parts fit perfectly. Moreover, concrete installations can crack over time, which creates leakages meaning that groundwater can enter the tank and while wastewater leaks out of it. Such leakages don't occur in prefabricated pumping stations.

**With limited budgets, lack of private participation and capacity building - how can local authorities take advantage of 'smart-city' technology in an affordable and realistic way?**

It is crucial for the authorities to consider the 'life cycle costs' of technologies they choose to invest in and solutions they plan to incorporate in smart cities and not just the initial capital investment required. This approach will ensure that they can source the ideal technology that is efficient and can help in long term sustainable infrastructure. They can also consider a PPP model and incorporate the most efficient solutions. It is critical to involve all key stakeholders, public and private to ensure that there is good collaboration and partnership all through the process – from planning to implementation and monitoring.

Within municipal water supply, water leakages are majorly caused due to excessive pressure. The combination of inefficient and older pumping units and process equipment, combined with outdated water management practices can result in higher operating costs and lower revenue, thereby negatively impacting the city's water management. Through the right technology and the technical know-how, a pumping system can not only save space, energy and human intervention, it can also cut down the costs and in turn manage the water efficiently without any losses.

For example, Grundfos DDD, offers water distribution with critical point measurement and advanced flow adoption. This DDD system can be designed in a city for an efficient water distribution network at the pumping station. In general, the controller in the distribution system should control the pumps based on the demand at the critical points. This can help reduce water leakages and conserve energy too. DDD can help reduce water leakages by 20 per cent and energy consumption by 25 per cent in a city.

By Kruti Bharadva

# TOOL CRAFT FOR AIRCRAFT

A closer look at machining for the aerospace industry through the solutions provided by ISCAR

In machining aerospace components, the main challenges relate to component materials. Titanium, high-temperature superalloys (HTSA), and creep-resisting steel are difficult to cut and machining is a real bottleneck in the whole aircraft supply chain. Poor machinability of these materials results in low cutting speeds, which significantly reduces productivity and shortens tool life. Both these factors are directly connected with cutting tools.

When dealing with hard-to-machine typical aerospace materials, cutting tool functionality defines the existing level of productivity. The truth is, cutting tools in their development lag machine tools, and this development gap limits the capabilities of leading-edge machines in the manufacturing of aerospace components.

Modern aircraft, especially unmanned aerial vehicles (UAV), feature a considerably increased share of composite materials. Effective machining composites demand specific cutting tools, which is the focus of a technological leap in the aerospace industry.

Aircraft-grade aluminium continues to be a widely used material for fuselage elements. It may seem that machining aluminium is simple, however, selecting the right cutting tool is a necessary key to success in the high-efficiency machining of aluminium.

A complex part shape is a specific feature of the turbine engine technology. Most geometrically complicated parts of aero engines work in highly corrosive environments and are made from hard-to-cut materials, such as titanium and HTSA, to ensure the required life cycle. A combination of complex shape, low material machinability, and high accuracy requirements are the main difficulties in producing these parts. Leading multi-axis machining centres enable various chip removal strategies to provide complex profiles more effectively. But a cutting tool, which comes into direct contact with a part, has a strong impact on the success of machining. Intensive tool wear affects surface accuracy, while an unpredictable tool breakage may lead to the discarding of a whole part.

Advanced multitasking machines, Swiss-type lathes, and live tooling lathes have profoundly changed manufacturing small-size parts of various hydraulic and pneumatic systems, actuators, and accessories, which

**Figure 1**

are used in aircraft. Consequently, the aerospace industry requires more and more cutting tools that are designed specifically for such machines to achieve maximum machining efficiency.

A cutting tool – the smallest element of a manufacturing system – turns into a key pillar for substantially improved performance. Therefore, aerospace part manufacturers and machine tool builders are waiting for innovative solutions for a new level of chip removal processes from their cutting tool producers. The solution targets are evident: more productivity and more tool life. Machining complex shapes of specific aerospace parts and large-sized fuselage components demand a predictable tool life period for reliable process planning and a well-timed replacement of worn tools or their exchangeable cutting components.

The cutting tool manufacturer has a limited choice of sources for finding an ideal solution and may only have cutting tool materials, a cutting geometry, and an intelligent robust design as the main instruments to progress. However, despite these limited choices, the cutting tool manufacturer continues all efforts to provide a new generation of tools to meet the growing requirements of the aerospace industry. COVID 19 has seriously slowed down industry development, but this

**Figure 2**

does not make the industry demands any less actual. The latest tool designs are good evidence of the cutting tool manufacturer's response to the demand for aerospace component production.

**COOLANT JET**

In machining titanium, HTSA and creep-resisting steel, high-pressure cooling (HPC) is an efficient tool for improving performance and increasing productivity. Pinpointed HPC significantly reduces the temperature at the cutting edge, ensures better chip formation and provides small, segmented chips. This contributes to higher cutting data and better tool life when compared with conventional cooling methods. More and more intensive applying HPC to machining difficult-to-cut materials is a clear trend in manufacturing aerospace components. Understandably, cutting tool manufacturers consider HPC tooling an important direction of development.

ISCAR, one of leaders in cutting tool manufacturing, has a vast product range for machining with HPC. In the last year, ISCAR has expanded its range by introducing new milling cutters carrying "classical" HELI200 and HELIMILL indexable inserts with 2 cutting edges (Fig. 1). This step brings an entire page of history to ISCAR's product line.

In the 1990's, ISCAR introduced the HELIMILL – a family of indexable milling tools, which carried inserts with a helical cutting edge. The new design provides constant rake and relief angles along a mill cutting edge and results in a smooth and light cut with a significant reduction in power consumption. The HELIMILL principle turned into a recognised concept in the design of the 90° indexable milling cutters.

The HELIMILL was modified and underwent changes which led to additional milling families and inserts with more cutting edges. The excellent performance and its close derivatives of the original tools ensured their phenomenal popularity in metalworking. Therefore, adding a modern HPC tool design to the proven HELIMILL family was a direct response to customer demand and the next logical tool line to develop.

In Turning, ISCAR considerably expanded its line of assembled modular tools comprising of bars and exchangeable heads with indexable inserts. With the use of a serrated connection, these tools fit a wide range of heads with a range of different insert geometries, including threading and standard ISO turning inserts for different applications for greater flexibility.

The bars have both traditional and anti-vibration designs and differ by their adaptation: cylindrical or polygonal taper shank. A common feature for the nodular tools is the delivery of internal coolant to be supplied directly to the required insert cutting edge (Fig. 2). Depending on the diameter of a cylindrical-shank tool, the maximum coolant pressure varies from 30 to 70 bars, while the tools with polygonal taper shank facilitate ultra HPC at a pressure of up to 300 bars. The efficient distribution of coolant increases the insert's tool life by reducing the temperature and improving chip control and chip evacuation; substantially increasing this application line in the aerospace industry.

**DRILLING SOLUTIONS**

Machining composite materials is filled with various traps and pitfalls. The high abrasiveness of composites intensifies wear rate which shortens tool life and affects the performance. Drilling is the most common cutting operation in machining composites, hence even a small improvement in the functionality of drilling tools is of key importance.

ISCAR developed a range of new drills that are in-

**Figure 3**

Figure 4

Figure 5

tended especially for composite materials. To increase abrasion resistance, these drills have a cutting part made from extra hard polycrystalline diamond (PCD) or diamond coating. Depending on the drill diameter, the PCD cutting part is known as a nib or a wafer; and in both cases is suitable for regrinding up to 5 times. The CVD diamond-coated solid carbide drills are attractive because of another specific design feature: the wavy shape of the main cutting edges. In machining composite materials, a tool produces more chattering than a cutting effect. The wavy shape of the cutting edge considerably reduces delamination and burrs, especially when drilling carbon fibre reinforced plastics (CFRP) and carbon laminates.

In addition to composites, the diamond-coated drills are suitable for machining other high-abrasive engineering materials. If necessary, these drills can be delivered with an optional tool through coolant holes.

Drilling deep, small-in-diameter holes is a common operation in manufacturing aerospace components. ISCAR's new solid carbide drills in the diameter range of 3-10 mm (0.125"-0.391") (Fig. 3) are intended specifically for such an operation. The combination of a split point geometry, a double-margin design, polished flutes, a multi-layer coating and coolant holes provides a noteworthy tool family for effective one-pass drilling holes with a depth of up to 50 hole diameters in difficult-to-cut austenitic and creep-resisting steels and Ferrum-based alloys.

## FOR ANY COMPLEXITY

Airfoils of aero-engine turbines and compressors, impellers, and integrally bladed rotors (IBR) have a complex shape that is defined by aerodynamic requirements. New developments, which are directed at improving aero-engine efficiency, add to this complexity. The advancement of technology brought new methods for producing formed parts, in particular 3D printing, which significantly diminishes material stock for chip removal. However, machining remains the most common method for the final shaping method in manufacturing geometrically complex aerospace components. The progress in 5-axis machining and CAD/CAM systems has enriched the manufacturer's solution pool to overcome difficulties in component production.

Barrel-shaped milling cutters have good prospects in the 5-axis machining of aerospace components with complex surfaces. ISCAR has developed a series of barrel-shaped cutters of 8 - 16 mm (.312" - .500") in diameter in two designed configurations: solid carbide endmills and exchangeable heads with a Multi-Master threaded connection. The introduction of these tools into the machining processes is a major advantage of intensifying blade manufacturing.

## PROMISING MULTITASKING

Recently, ISCAR introduced NEOCOLLET, a new tool holding family, which provides an alternative to clamping tools with spring collets. One of the typical tool holders in this family has a tapered shank that can be mounted in a collet chuck directly (Fig. 4), ensuring a rigid and reliable connection to improve tool performance. The new family includes the holders for ISCAR T-SLOT exchangeable slot and face milling heads from cemented carbide.

As mentioned, applying high-pressure cooling can substantially change machining results especially when dealing with titanium, HTSA and difficult-to-cut stainless steel – the main materials for aircraft hydraulic and pneumatic systems and light-sized accessories. The new turning tools with a square shank and a reliable screw clamping mechanism for 55° rhombic insert facilitate HPC in longitudinal, face and profile turning operations on small-diameter parts (Fig. 5).

By Kruti Bharadva

# AT THE HEART OF INTELLIGENT TRANSFORMATION

The implied effects of the pandemic in the manufacturing sector has led to an exploration of how to use robotics, 3D printing, and AI to improve the R&D process and reduce uncertainty when launching production. **Vivek Sharma, MD – India, Lenovo ISG,** discusses in detail the potential of emerging technologies in the manufacturing sector and how 'Smart Factories' are beginning to make inroads across myriad industrial sectors

**Please tell us a bit about Lenovo ISG and the sectors in India you cater to. What is the portfolio/solutions that you provide?**

As an organisation that has an offering spanning pocket devices to data centers, we have a complete suite of solutions that address the technology needs of businesses across a range of industries including automotive, healthcare, manufacturing, government, retail, BFSI, etc.

**Storage:** Customers continue to face challenges implementing a cohesive data management system to analyse and process data more efficiently. Lenovo ISG's unique state-of-the-art data management architecture, in combination with the industry's most reliable ThinkSystem servers, enables customers to accelerate analytics and AI within a single platform.

The ThinkSystem DM series delivers a portfolio of enterprise-grade, multiprotocol storage systems that increases performance and capacity. Our second portfolio, the ThinkSystem DE series, is designed for mid-sized IT environments and supports block storage protocols.

**Edge Computing/ IoT:** Today, you need computing resources, and therefore servers, almost everywhere — not just in the data center, but also remotely. However, for performance reasons, remote data-generating devices must be close to computing and storage resources.

The Lenovo ThinkSystem SE350 Edge server's small footprint and power efficiency allow for reliable server-class performance at many Edge locations. The rugged SE350 can handle temperatures from 0° to 55°C, as well as tolerate locations with high-dust and vibration—such as construction site trailers and manufacturing floors.

**HPC and AI:** Our HPC and AI powered solutions look beyond breaking known barriers of performance and efficiency to solve humanity's greatest challenges. From cancer research to supercomputing that helps met departments predict the weather, we have an answer.

The data center market in Asia Pacific is forecasted to reach US$32 billion by 2023, and India stands as one of the fastest growing data center markets in the APAC region with a market size that is expected to cross US$4.5 billion by 2025

One such solution is GOAST. Traditionally, genome processing requires days (150 hrs) to complete, but with Lenovo's GOAST system, results can be delivered in under an hour (48 - 53 mins) using standard x86 hardware built on high-performance, high-reliability Lenovo ThinkSystem servers.

Lenovo is a global industry leader in supercomputing with 180+ systems across 20 markets, and the largest global provider of TOP500 installations. Seventeen out of twenty-five top research universities are powered by Lenovo.

We are unique in our ability to unify and offer a wide portfolio of cutting-edge solutions and continue to invest in key technologies such as IoT, Edge Computing, Cloud, 5G and AI, and will ride on their capabilities to lead the era of 'smart normal' after COVID-19.

**How has the market for data center solutions evolved in India in recent times?**

The data center space has witnessed explosive growth over the last few years. More so, growth reached a new high once the pandemic hit, as businesses and people across the world headed online for work, entertainment, and education. The data center market in Asia Pacific is forecasted to reach US$32 billion by 2023, and India stands as one of the fastest growing data center markets in the APAC region with a market size that is expected to cross US$4.5 billion by 2025.

As we inch closer to a post-COVID world, we are seeing verticals like education, BFSI, retail and even hospitality increasingly adopt technologies like AI, IoT and edge computing, to support business growth. Increasing digitisation across sectors is creating growth opportunities for hybrid cloud solutions as organisations look to mitigate the impact of COVID-19 and focus on business continuity while ensuring data privacy and security.

**The two most powerful trends in our industry are the advent of cloud computing and the desire to digitise entire businesses to make them more agile – how does ISG fit into this trend?**

At Lenovo, Intelligent Transformation is at the heart of everything we do. Extending this belief as a value proposition to our customers and partners, we focus on three key building blocks for enabling Intelligent Transformation: **data, computing power and algorithms:**

- ***Data*** fuels all possibilities and smart devices play an important role in generating and connecting this data
- ***Computing power*** is the engine that turns this fuel into power
- ***Advanced algorithms*** combined with Big Data and industry know-how produce valuable insights that create value for every industry

Technology will underpin the transition to remote working with greater demand for both IT services and devices. Cloud and Software-Defined Infrastructure (SDI) will be a huge focus, with everyone having moved quickly to the public cloud in the wake of the pandemic, but now looking at SDI to build longer-term solutions. For example, when it comes to remote working, Virtual Desktop Infrastructure (VDI) solutions are already resonating as it offers a good balance between security and accessibility, without burning through capital expenditure.

We have always worked with a 3S strategy – Smart IoT, Smart Infrastructure and Smart Vertical. Smart IoT becomes the essential tissue for the connected world. With Smart Infrastructure, Lenovo ISG comes in providing computing, storage, networking, software power to support this intelligence. Lastly, Smart Verticals are those that can be customised with Smart IoT and powered with Smart infrastructure. This takes us towards an intelligent transformation where devices and data center infrastructure work together to create a holistic solution.

All of this, offered with Lenovo's TruScale subscription-based offering provides flexibility to scale up and down as needed and can help address CapEx/OpEx concerns amidst this uncertain market environment so that businesses, especially SMEs with smaller budgets can better prioritise their spends and get on the digital transformation bandwagon.

**What is the difference between Industry 4.0 and 5.0?**

Innovations in the last one decade are proof that we have progressed in many ways and leveraged technology to its full potential. Industry 4.0 combines IoT, AI, cyber-physical systems, Cloud, and cognitive computing. It has brought automation to the manufacturing industry, enabling businesses to adopt smart technologies for advanced capabilities. It has always been a one-sided approach - we relied on technology and process automation was a priority.

Industry 5.0 has taken this to the next step. Now, we are leveraging smart technology and our intelligence

to make accurate decisions. Instead of terming industry 5.0 as different from 4.0, we can say that it is a progressive way to drive transformation in production and customer experience.

Industry 4.0 technology allows production processes to be more flexible, and robots are already a standard in the industry. Industry 5.0 combines the speed, productivity, and consistency of robotics with human innovation and skill. It improves personalisation and creativity, and emergence of sustainable policies are driving greener technology at optimised costs.

**We have been talking about industry 4.0 for some years and continue to do so, in terms of being 4.0 ready in India – is the country ready for the next level? Please answer this in terms of infrastructure, readiness, and willingness to adapt, technology available, training, etc.**

As we head into industry 5.0, the pandemic has impacted India in different ways, such as potential delays to 5G rollout in India to more long-lasting changes in the economy.

Things will never be the way they were before - and we strongly believe that companies in India will no longer work in the same capacity with regards to their workforce distribution. In industry 5.0, the smart normal asks businesses of all sizes to rethink where their employees need to be to deliver value, which will impact the relationship between companies and traditional office space.

**My advice to businesses is to ask where they see themselves in the scale of 0-100 per cent economy? Instead of just being reactive to the situation around us, companies need to ask themselves where they want to be - whether it's 60, 70 or 90. Accept the changes and use them to your advantage - your workforce will be virtual so why not capitalise on your new options for increasing talent diversity?**

In addition, the tech that powers industry 5.0 will be different. Lenovo sees the data center evolving from the "core-centric" data center of today, to the "edge-to-core" data center in the near future. This has two parts:

- ***Distributed Edge IT*** – Where the 'local' work happens - where the worlds will meet most of the time – innovation will be focused on the enabling infrastructure (5G), and new data center designs customised for any environment (ruggedized, unique shapes and sizes, etc.)
- ***Core IT*** – Where the majority of business operations work happens - not just limited to the data center, it also encompasses how an IT organisation leverages private, multi-and hybrid cloud

Lenovo believes eventually everything will become software-defined – including both in the edge and in the cloud.

**Why is data important to the manufacturing sector in India, and how does Lenovo ISG help channelize its importance?**

Data is the new currency and IT decision-makers are the new bankers – making it important for organisations to manage their data to not just survive but thrive. Our strategy in India and worldwide focuses on enabling the 'Data-Centered': businesses and people who leverage data to better cater to their customer bases.

An EY survey revealed that big data and predictive analytics ranked as the top investment priority in technology by 66 per cent manufacturing firms in India. This clearly indicates that manufacturers are in a better position to leverage data and gain maximum benefit of digital manufacturing to monitor and visualize key performance indicators (KPIs). This can be seen across automotive, textiles, pharmaceutical, electrical, etc. industries.

**Please tell us about industrial 5G and its integration into existing technologies.**

As 5G becomes more widely available, it will be the key driver of IoT and other intelligent automation applications. Edge Computing, IoT, AI, blockchain, etc. will all benefit from 5G's lightning-fast connection and low-latency.

5G can help shape the future of IoT by allowing billions of smart devices to communicate and share data autonomously. Especially in the auto sector, manufacturers are racing to perfect the technology that will power self-driving vehicles. Smart automobiles consume a lot of bandwidth, demand faster network responses, and require constant network connectivity. Smart Cars can operate more efficiently with 5G's increased bandwidth and lower latencies.

5G and IoT play a significant role in the manufacturing sector by advancing technologies like robotics, warehouse automation, smart factories, and flexible manufacturing that improve efficiency and reduce costs. It will enable manufacturers to develop smart facilities and fully utilise technologies like automation, AI, AR, etc. for troubleshooting.

5G will transform the way industries' function, businesses operate and how a consumer reacts to the changing environments.

**Please share with us actual case studies, wherein a manufacturing company has applied your solutions successfully.**

In a data-driven market, the most effective method to increase efficiency, quality, and production is to turn data into actionable insights. Manufacturers are using Internet of Things (IoT) and the generated streaming data to better industrial operations.

For example, Hero MotoCorp, the world's largest two-wheeler manufacturer, manufactures over 9 million bikes and scooters a year. Demand continues to grow, and they rely on an automated system operating 24/7 to control the hundreds of robotic crane arms that handle more than 12000 spare parts every day. However, their previous legacy server infrastructure kept crashing — wiping out the cranes' instructions every time and halting operations. Lenovo ISG was engaged to design and deploy a high-availability technology solution which comprised the Lenovo ThinkSystem SR650. In addition to being built on robust, highly reliable Lenovo systems, the active configuration means that the memory content of the robotic arms is protected even in the unlikely event of unplanned downtime.

> "At Lenovo, Intelligent Transformation is at the heart of everything we do. Extending this belief as a value proposition to our customers and partners, we focus on three key building blocks for enabling Intelligent Transformation: data, computing power and algorithms

**Any innovations/ new launches coming up in the near future?**

We see ourselves as a service-oriented partner to organisations and not a hardware supplier, recently introducing a range of new and updated hyperconverged infrastructure (HCI) solutions and cloud-based services to enable customers to keep pace with evolving business needs in the new 'Smart Normal'.

- The Lenovo ThinkSystem DM Series Storage Manager OS allows customers of all sizes to harness data more securely and efficiently, from edge to core to cloud, with a single set of tools and capabilities for a smarter way forward
- In collaboration with Microsoft, our new Lenovo ThinkAgile MX Azure Stack HCI Edge and Data Center Solutions enables customers to rapidly deploy a hybrid cloud infrastructure
- The Lenovo ThinkAgile VX HCI Solutions improve agility and reliability for SAP HANA database deployments, launched in collaboration with VMware

Additionally, our Desktop-as-a-service solution provides a more secure remote work solution, with cloud-like simplicity and on-premise performance, with the convenience of a single monthly payment and single point of contact for support. We are also continuing to invest in key technologies such as IoT, Edge Computing, Cloud, 5G and AI, and will ride on their capabilities to lead the era of 'new normal' after COVID-19.

**How has the pandemic changed the way manufacturing sectors function and how has Lenovo ISG facilitated this change?**

As virtual, decentralised and smart workplaces become the norm, this transformation to a data-driven environment will mean bigger workloads need to be processed in shorter timeframes at the edge and in the cloud. The manufacturing sector will benefit from data analytics, driving higher productivity through integrated planning, and superior product quality. From analytics to collaboration and communications, manufacturers require cutting-edge computing devices, from the plant floor to the corner office, to enable digital transformation. Key technologies such as IoT, Edge Computing, Cloud, 5G and AI, will be critical to ensure the manufacturing sector continues to lead the smart normal era.

Lenovo ISG's strategy focuses on enabling the 'Data-Centered' - businesses and people who leverage data to better equip themselves to cater to their customer bases. Recognising their cost concerns, as well as data security fears in a remote work environment, we have been advising a more strategic and long-term approach.

With consumption-based models like TruScale, customers never take capital ownership of the hardware or other IT assets and only pay for what they use each month. As thought partners, our emphasis is on developing solutions that solve problems and create impact. We are optimistic that the future of manufacturing lies in automation, innovation, and smart technology adoption to increase productivity, performance, and profitability.