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THE MACHINIST

ULTIMATE GUIDE TO PROFITABLE MANUFACTURING

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SOARING TO A NEW STRATOSPHERE

With a passion for indigenization, innovation and excellence, MTAR has long been an important player in the Indian Aerospace and Defence sector, contributing to the success of many missions of the Indian Space Program. **Srinivas Reddy, Managing Director, MTAR Technologies Ltd takes us through this soaring trip**

ADDITIVE MANUFACTURING
AN END-USER TESTIMONIAL FROM GE ADDITIVE & TSUNAMI MEDICAL

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A COMPREHENSIVE REPORT FROM HEXAGON ON THE EV MARKET

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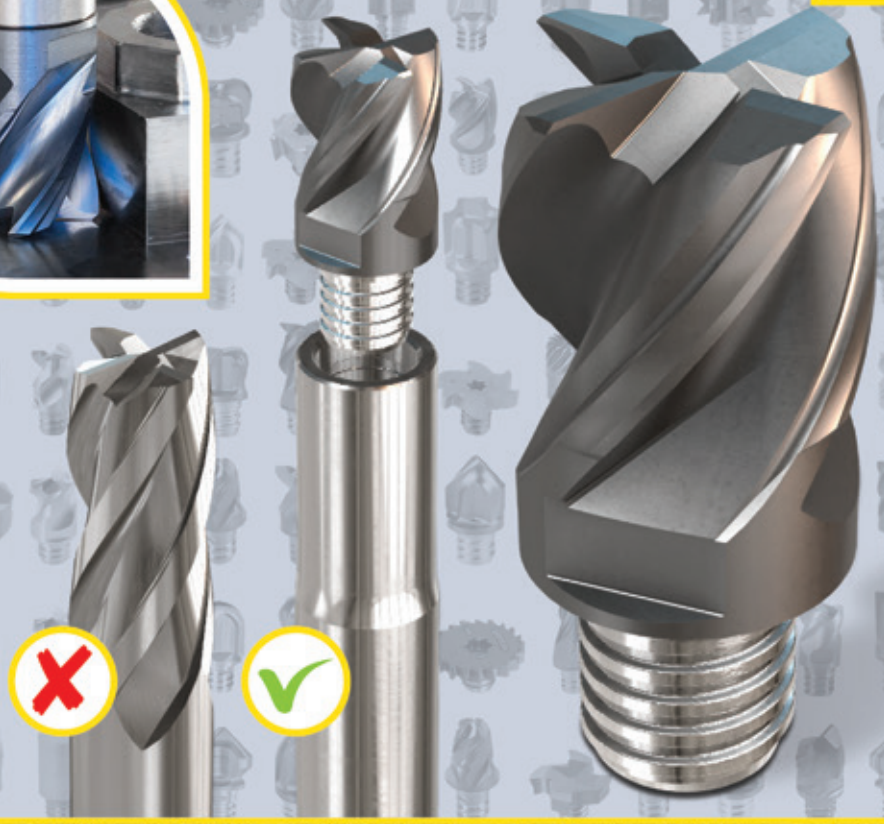

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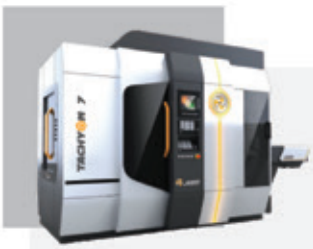

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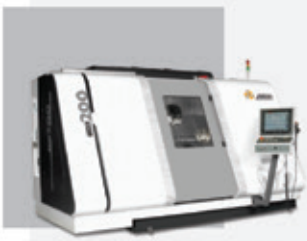

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MAKING FOR INDIA! BUT, HAVE WE MADE IT?

Ciao Readers!

It was a bright day in September 2014 – especially bright for Indian manufacturing- when Narendra Modi, Prime Minister for India, announced his call to domestic manufacturers – "Make in India!" Half a decade later, India stands proudly as one of the fastest-growing economies in the world.

"The country is working hard to enhance its capacities and capabilities at a fast pace. Focusing on our defence industry with a sense of purpose is at the heart of the 'Make in India' and 'Atmanirbhar' programmes," the Prime Minister asserted in a webinar earlier this year.

In certain aspects, things have changed or rather we say, improved. This could be evident from the fact that the inflow of Foreign Direct Investment (FDI) has increased, touching an all-time high of $64 billion in 2018-19. Our rank in the World Bank's ease of doing business jumped from 130 in 2016 to 63 in 2021; we also jumped several spots in the world competitiveness index, moving from 70 in 2016 to 43 in 2021.

But according to the PHD Chamber of Commerce report on the manufacturing industry, the performance of the sector has been far from satisfactory. Since 2014, the index of industrial production (IIP) has scarcely registered double-digit growth, contrary to the target of 12 - 14 per cent growth per annum. Data from the Centre for Monitoring Indian Economy shows a deceleration in the manufacturing sector that is even more pronounced than the economy. Taking the pandemic into account, the sector lost close to 40 per cent of its jobs (24 million) when compared to 2016.

And the share of manufacturing in the economy — which has never crossed 18 per cent historically — which stood at 14.9 per cent in 2018 - 19 (other years are affected by the pandemic), much lower than our neighbouring countries like China (29 per cent), Bangladesh (18 per cent), Vietnam (16 per cent), Thailand (27 per cent), Indonesia (19 per cent) and Philippines (19 per cent). So how far have we, as a country, MADE IT?

That said, in this month's cover story, we peek into the journey of MTAR Technologies Ltd – a company that not only makes in India but makes FOR India.

Electrification represents the biggest technological development in automotive power trains in decades, yet there is still significant uncertainty as to when actual, large-scale adoption of electric vehicles (EVs) will occur. There is currently a lack of the systematic, fact-based investigation of e-mobility-industry dynamics necessary to understand what is still holding back the mass-market adoption of EVs and what is required to finally get it off the ground. An in-depth report from Hexagon, covered in this issue, takes us through evolving automotive megatrends and how the last 16 months have seen the trajectory of electrification accelerating.

Additionally, we look at how one can optimise the lifecycle of a pump in a manufacturing facility, machining specialised alloys and much more.

I hope you enjoy this reading this edition as much as enjoyed putting it together. Do share with us your opinions, comments and thoughts at *Rahul.kamat@wwm.co.in*

Editor

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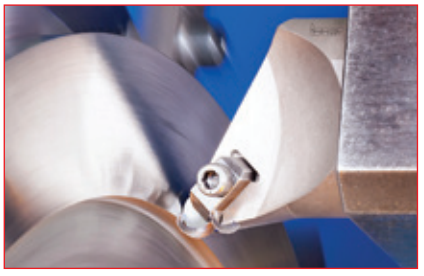

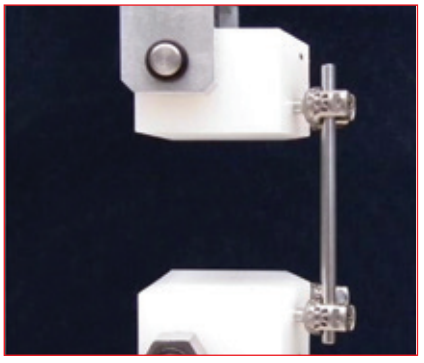

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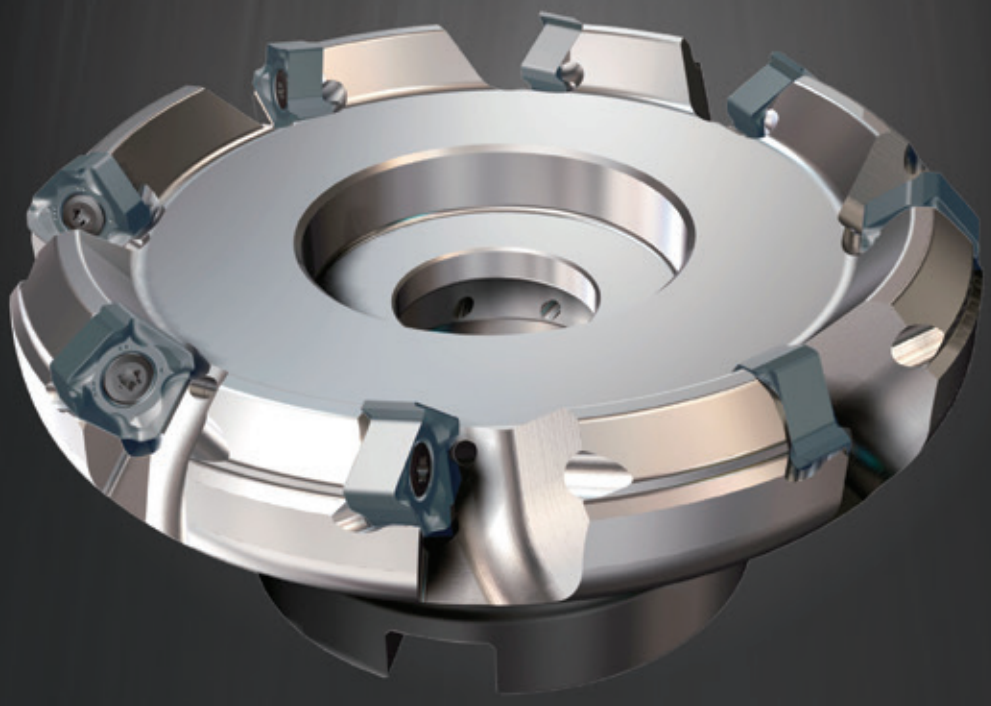

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YOUR GLOBAL CRAFTSMAN STUDIO

bp and Piaggio Group Join Up

bp AND PIAGGIO GROUP plan to work together to develop and roll out a comprehensive set of services for the rapidly growing number of two- and three-wheeled electric vehicles across Europe, India and Asia.

These vehicles – electric motorbikes, motor scooters and compact commercial vehicles – are today the most highly electrified vehicle class globally, with 44 per cent of sales and 25 per cent of the existing global fleet – or around 250 million vehicles – already electric. It has been estimated that by 2040 the proportion of sales of these vehicles that are electric may have risen to over 80 per cent and the number of electric two- and three-wheelers globally may have tripled to 750 million.

Bringing together Piaggio's extensive e-vehicle production operations and infrastructure management capabilities with bp's expertise and global reach, the companies aim to support the growing adoption of electric two- and three-wheelers globally to help address city congestion and reduce pollution in urban areas.

Richard Bartlett, bp's Senior Vice President, Future Mobility & Solutions, said: "The huge and fast-growing two- and three-wheeler market is already leading the way for electrification and we see great potential for continued growth across both Asia and Europe.

"Working together with bp will help us deliver our idea and offer of a mobility revolution" said **Michele Colaninno, Chief Of Strategy And Product Of The Piaggio Group.** "To achieve this goal, it is necessary to promote the widespread adoption of electric vehicles such as motorbikes, motor scooters and compact commercial vehicles equipped with battery swap technology or plug-in charging, thus encouraging a more sustainable life-cycle management of batteries and greater respect for the environment. Working with bp is an incredible starting point to enhance our strategy."

Under their memorandum of understanding, Piaggio Group and bp, along with affiliate Jio-bp in India, will explore opportunities to work together to offer charging and battery swap stations, as well as developing all-encompassing services such as 'Battery as a Service' (BaaS) - leasing, management and recycling of vehicle batteries - and 'Vehicle as a Service' (VaaS) - leasing, repair, maintenance and smart energy management of these vehicles. Initial efforts and focus will be on India, where Jio-bp and Piaggio are already engaged in developing electric vehicle solutions. The companies also intend to explore opportunities in broader Asia – in China, Indonesia, and Vietnam – and in Europe.

Convenience and mobility is a core part of bp's strategy. Working closely with innovative partners, bp seeks to develop new business models and services that will help deliver the future of mobility, energy and services for customers. Electrification is at the heart of bp's approach to mobility and it is growing its charging businesses around the world, aiming to have over 70,000 public charge points by 2030.

KOEL Reports A Strong Second Quarter Of FY 22

KIRLOSKAR OIL ENGINES LIMITED (KOEL) (BSE: 533293; NSE: KIRLOSENG), a leader in the manufacturing of diesel engines, agricultural equipment and generator sets with a sizable presence in international markets, announced today its financial results for the second quarter and first half of FY 22 ended 30th September 2021.

Commenting on the Q2 FY 22 results, **Mr. Sanjeev Nimkar, Managing Director, KOEL,** said "Kirloskar Oil Engines continued its progress in the strategic growth areas of Ultra High Horsepower, electric pumps, off highway and tractor engines, weeders in the domestic markets and Industrial & fire-fighting segments in the chosen export markets. We are witnessing good traction in healthcare segment, infra development and schemes like Jal Jeevan mission. BS IV transition has been executed smoothly. During Q2, we have launched new revolutionary product of Kirloskar 'i-land' and are expanding our foray into allied businesses in Water Management Solutions business, stabiliing our acquisitions in the space. Spiraling commodity prices are proving to be a challenge and are expected to put pressure on profitability in the short term, despite the mitigation measures put in place. Supply chain resilience is a key enabler in today's era and KOEL is well on course to turn the challenge into an opportunity."

Review of Q2 FY 22 Financial Performance (Standalone):

- Net Sales at INR 817.8 Cr for Q2 FY 22 vs INR 639.2 Cr for Q1 FY 22; 28% increase Q-o-Q
- EBITDA at INR 66.5 Cr for Q2 FY 22 vs INR 49.0 Cr for Q1 FY 22; 36% increase Q-o-Q
- EBITDA margin at 8.1% for Q2 FY 22 vs 7.6% for Q1 FY 22
- Net profit at INR 38.7 Cr for Q2 FY 22 vs INR 24.5 Cr for Q1 FY 22; 58% increase Q-o-Q
- Cash and cash equivalents* of INR 354.2 Cr, this demonstrates Company's strong liquidity position

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Godrej & Boyce Introduces E-Switch Technology

GODREJ & BOYCE, the flagship company of the Godrej Group announced that its business Godrej Lawkim Motors, today launched the electronic switch (E-Switch) technology for its range of general-purpose motors. This will replace the erstwhile centrifugal switch technology to enable a seamless switch over of start windings in its single-phase motors thereby significantly improving the motor's reliability

With new advancements in technology, there has been a rising trend of developed countries switching to electronic switch motors in the industry to create environmentally friendly and minimal maintenance motors with a compact design. Godrej Lawkim Motors is the first in India to introduce and shift to E-Switch technology that prevents sparking at the contact point and eliminates unwanted noise previously experienced with a centrifugal gear assembly.

The modern development of the E-Switch technology by Godrej Lawkim Motors promises a longer motor life – twice that of the centrifugal switch and uses no hazardous substances in its augmentation. The E-Switch technology eliminates moving parts for an electrical connection switch over. It is also easily replaceable, user friendly, and thereby, saves time and maintenance cost.

The E-Switch motor is intuitively designed to detect lock-rotor conditions and provide warnings in the event of an overload. **Xercsis K Marker, Executive Vice President & Business Head, Godrej Lawkim Motors** said, "There was a critical need to transition from the conventional Open Circuit Switch technology to make advancements in motor technology and thereby enhance the manufacturing process. After extensive field research and testing, Godrej Lawkim Motors is delighted to launch India's first E-Switch technology that will serve sustainably across all sectors including Agriculture, Food, Dairy, Domestic, and Construction. Currently, we are aiming to achieve 30 per cent of the market share for 100S frame motors. With the new E-Switch technology, we hope to offer an enriched experience and higher value benefits to our customers thus making their work safer and more efficient."

These general-purpose motors are useful across sectors and find its application in areas such as monkey lifts, wood working machines, air compressors, betel cutting machines, milking, mixing of paints, agri-machinery etc.

Numaligarh Refinery Awards EPC Contract To thyssenkrupp

NUMALIGARH REFINERY LIMITED (NRL) has awarded an EPC Contract to thyssenkrupp Industrial Solutions India (tkIS India) in the range of approximately USD 155 Million to execute their 6.0 MMTPA Crude Distillation Unit and Vacuum Distillation Unit with Amine Treating Unit project on LSTK basis at their refinery located in Assam, India.

The scope of EPC work of this project includes Engineering, Project Management, Procurement, & Supply, Inspection & Expediting, Construction Management & Supervision, Mechanical Completion & Pre-commissioning of Plant, Commissioning, Start up, PGTR & hand over of plant.

Move Expert to Integrate Tachograph Data

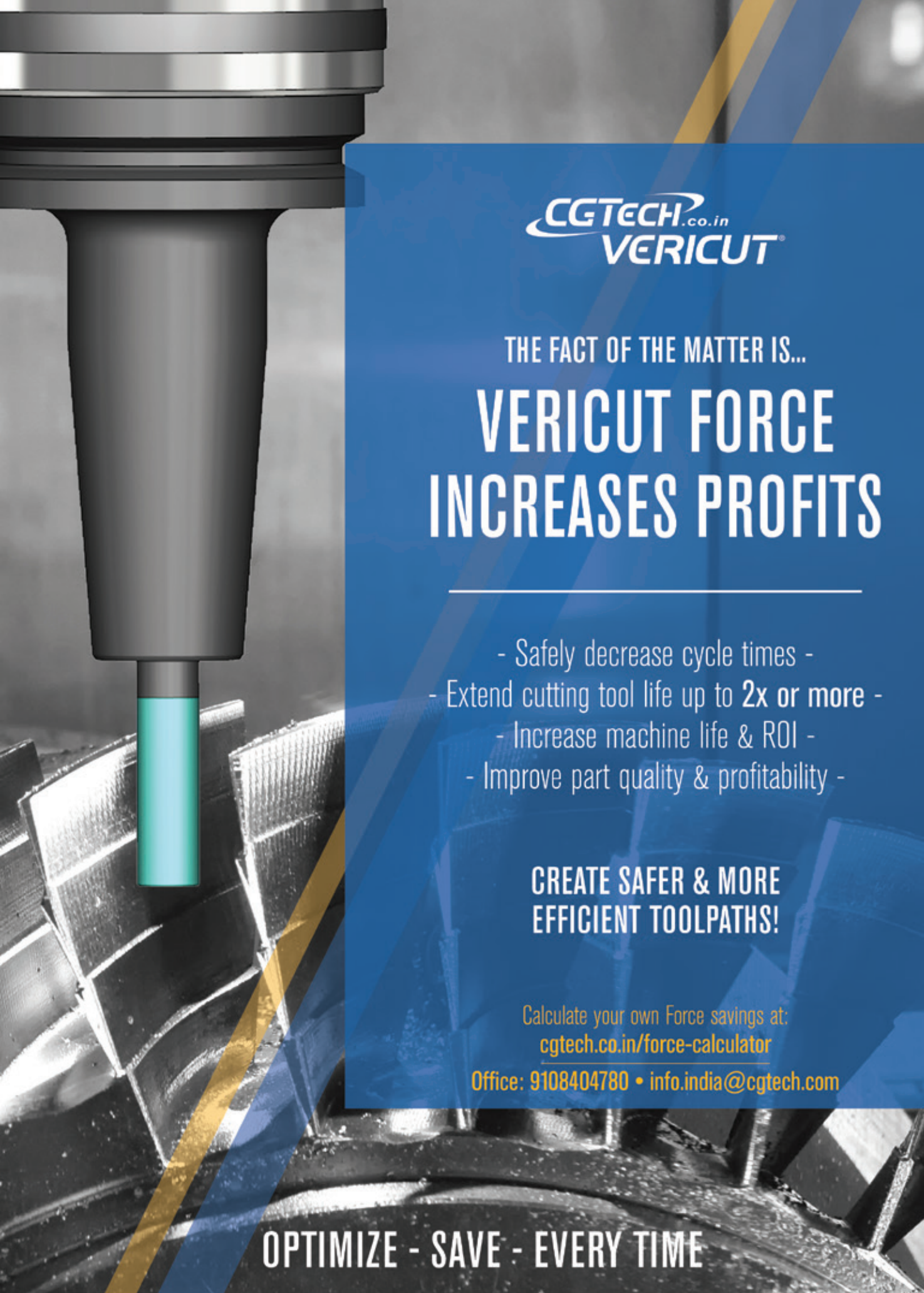
MOVE EXPERT, a leader in Europe for posting of drivers, and Continental, a pioneering developer of technologies and services, have signed a partnership for the integration of functionalities from Continental's TIS-Web fleet management software into the Move Expert e-solution. This will ensure full compliance with the legal requirements of the new EU Mobility Package from 2022 onwards. Move Expert will integrate VDO TIS-Web software functionalities and driver data into its new driver management platform, thus connecting two powerful e-solutions. The partnership will fulfill Move Expert's vision to develop a wide range of services for drivers in Europe, and Continental will benefit from a large eastern European coverage.

Mobility Package with new legal requirements

This strong partnership will create a unique e-solution for managing drivers' compliance with new requirements related to the Mobility Package. Planned for February 2022, the package will bring about an unprecedented change in the road transport market and impact the ability to organize transport activities in compliance with social legislation in 28 countries. Moreover, a harmonized European version of the national rating systems is also coming into force that will increase the need to monitor drivers and keep track of infringements by companies.

New e-solution for simple driver management

Integration of Continental VDO TIS-Web services into the Move Expert platform will give customers exclusive functions, allowing them to analyse driver and truck activities, manage posting of workers in 28 countries, obtain legal assistance and receive local qualified customer care in more than 15 countries and 25 languages. Companies from eastern Europe will especially benefit from the service. In addition to the upgraded interface of the Move Expert platform, thanks to VDO solutions for monitoring driver data remotely or in real time, customers will be enabled to proactively coordinate driver and truck activities and reduce risks of infringements.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Bridgestone India makes Pune Railway Station Disability Friendly

PUNE RAILWAY STATION will be friendlier to people with visual, audio and mobility disability. Bridgestone India installed station information in Braille as well as provided scan able sign language videos on information and provided ramps for easy access to wheelchair bound passengers to coaches.

The Station will now have Braille Maps in Metal that describes the entire Railway Station and all the facilities at the station. These are compact and easy for the person reading it as the entire map is the size of a normal A4 paper. Smart phone Scan able Audio and sign language video QR codes have been installed at various locations that give video-based information about the railway station both in Audio and sign. Portable Ramps that empower people using wheelchairs to board the trains with dignity have also been provided.

As part of this programme the company has installed Braille Platform Indicators, Braille General Signages for all the offices & facilities in the railway station. Braille Itinerary Booklets have been kept at the Railway Ticket & Information Counter. General signage with braille at toilets, waiting rooms amongst others will be of great help.

"Bridgestone prides itself as a mobility solution provider and this initiative is a solution enabling confidence and self-reliance in mobility for all. These efforts at the railway station hope to provide independent and seamless mobility enabling our differently enabled friends to travel independently. These features also reduce the risk of being misguided as well as the risk of accidents. This is the first of such initiatives and we will very shortly be completing a similar project at Indore railway station" said Parag Satpute, Managing Director, Bridgestone India.

We are delighted to share that in line with Govt's Accessible India Campaign, Pune Junction Station has been made more accessible for people with disabilities. We would like to express gratitude to Bridgestone India for taking up this initiative as part of their CSR." said SC Jain, Station Director, Pune, Central Railway.

Godrej Tooling Enhances R&D Investment in EV

GODREJ & BOYCE, the flagship company of the Godrej Group, has recently announced that its business Godrej Tooling has created a range of advanced automotive dies. This is in light of the Indian automotive industry opting for stricter fuel norms and increased electrification. With the industry rapidly shifting gears towards adoption of Electric Vehicles in India, it has necessitated the development of new engines, battery boxes and high precision sheet metal parts. In response to the same, Godrej Tooling increased its investment by 10% Y-o-Y on R &D towards their portfolio of tools and dies with a special focus on EV industry.

To meet the burgeoning demand for modification and replacement of automobile components in the modern Electrical Vehicle, Godrej Tooling has made a head start by developing advanced dies. They have further increased their budget on R&D initiatives to grow their portfolio in this sector and reduce the dependency on import parts. Godrej Tooling has also increased its capabilities with the addition of cutting edge technology in 3D printing and additive manufacturing to develop high precision dies for components with complex geometry in to meet higher functional standards. The business already has 1 patent and 1 copyright in overall dies.

Pankaj Abhyankar, Senior Vice President and Business Head, Godrej Tooling said, "The growing focus of the private and public sector on EVs have made it imperative for the automobile industry and particularly suppliers, to adapt to the ecosystem. As one of India's leading tool rooms, we have adopted a robust approach allowing us to be agile to take on electric mobility covering all bases in stimulation, design assembly and production. Godrej Tooling has a longstanding reputation of being future ready and the introduction of advanced automotive dies implies our readiness to remain ahead of curve."

Godrej Construction Implementing Circular Economy In Construction Materials

GODREJ & BOYCE, the flagship company of the Godrej Group, announced that its business Godrej Construction, a pioneer in adopting sustainable construction practices in India, is committed to minimize the impact of construction on the environment. To demonstrate the same, the business has recycled over 25,000 metric tonnes of concrete debris by implementing circular economy principles in their construction materials line of business, while their Ready-Mix Concrete (RMC) plant, Recycled Concrete Materials (RCM) plant and common areas of Godrej IT Park building in Mumbai are now powered by 100 per cent renewable energy. Godrej Construction is one of the first in the RMC industry to switch to green energy.

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DeburringEXPO Meets Expectations

RIGHT FROM THE VERY BEGINNING, a positive mood prevailed at DeburringEXPO, which was held as an on-site trade fair from the 12th through the 14th of October, 2021. Most of the roughly 1100 expert visitors came to the Karlsruhe Exhibition Centre with concrete tasks and a great need for information. This resulted in excellent contacts, valuable RFQs and interesting projects for almost all of the 105 exhibiting companies. Roughly 50 per cent of the expert visitors took advantage of the opportunity to gather information about current trends, the latest developments and best practice solutions in the fields of deburring and the production of precision finishes at the expert forum.

"For us there was no question that if DeburringEXPO would be staged as an on-site event, we would exhibit and present ourselves as a solutions provider for tasks in the field of deburring and precision finishing. And it was the right decision, because we were able to talk to existing customers about upcoming projects and their plans and generate interesting new leads. We're quite satisfied with the way things went at the trade fair," concluded **Maria Loula, managing director of Perfect Finish GmbH.**

Nearly all of the 105 exhibiting companies from twelve countries drew positive conclusions at the end of the three-day event. 94 per cent of the exhibitors expect very good to satisfactory post-fair business. Significant Contacts and RFQs This comes as no surprise, because the majority of the roughly 1100 expert visitors came to the trade fair with concrete tasks for which they're seeking solutions – frequently backed by sample parts or drawings they brought along.

"As expected, fewer visitors attended the trade fair this year than in previous years, but the quality is very good. Visitors are coming to our booth from widely differing industries with very specific tasks and projects," explained **Michael Striebe, sales manager for barrel finishing technology at Rösler Oberflächen GmbH.**

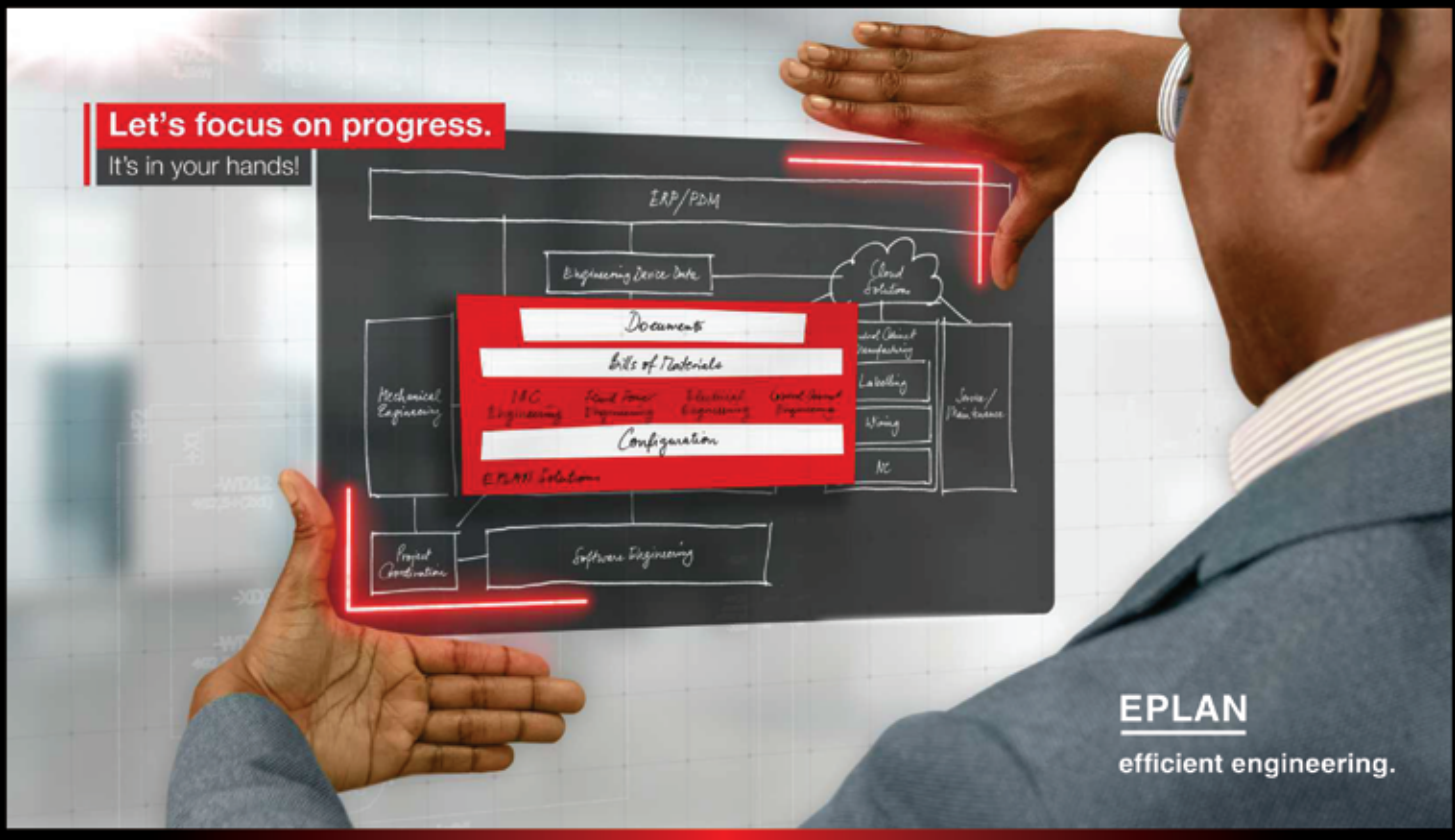
Greaves Electric Mobility Sells 5,000 Units

GREAVES ELECTRIC MOBILITY, the E-Mobility arm of Greaves Cotton Limited, and one of the leading players in the E-2W and E-3W segment, announced the rise in the sales numbers by 85 per cent while declaring their Q2FY22 financial performance. Riding strong on customer support and extensive product line, the company is anticipating a prosperous festive season. It has sold 5000 units in October (as on 25th October 2021).

Acknowledging the uptick in demand and riding on the festive season the company is aiming to bring to customers its range of products for both personal and commercial use. Considering the distress with increasing fuel prices, EVs are the sort after choice for daily computers now. On an average in Rs 112 a person can travel up to 50kms on a traditional petrol vehicle, whereas an EV can take you to 750kms. Understanding the scenario, Greaves also announced festive offers and easy financing solutions on various products to keep the momentum going.

Roy Kurian, COO, Ampere Electric, said, "We sold over 5000 units in October, with a sizeable demand emerging from non-metro regions. Buoyed by strong sales, robust finance and after sales support, we are committed to accelerate India's transition to EVs. The demand for EV is only going to multiply and as a leader in e-mobility, we recognize that building an ecosystem with the buyer at the center is important. We have witnessed significant growth in partners willing to join hands with us to expand our network."

Greaves Electric Mobility is consciously developing an ecosystem of choice, convenience and experience. The launch of India's first multi brand EV retail store- AutoEVMart, launching new variants and establishing strong financing and aftermarket support demonstrates that the brand is fulfilling the commitments towards its customers and the country. Greaves now has an unparalleled retail footprint of nearly 7000+ touchpoints, 12,000 mechanics on staff and a dedicated on-call support team to address the needs of EV buyers. Moreover, the company is striving to empower every individual with personal electric mobility solutions via Greaves Finance, its non-banking financial arm.



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By Kruti Bharadva

THE EVOLUTION TOWARDS SMARTER EV MANUFACTURING

Automotive megatrends continue to evolve, but the last 16 months has seen the trajectory of electrification accelerating. A survey conducted for Hexagon confirms the industry is on the threshold of change with the OEMs and supply chain trying to adapt to this change

The invention of the car, over 100 years ago, has had a profound impact on the history of modern design. From its earliest beginnings the car swiftly reshaped landscapes, cities, fashion, film and even whole economies. Today it is almost impossible to imagine a world without the car. However, as this paper will show, the car, and how its produced, is changing rapidly and the implications are that, since it is such a pivotal aspect of our lives, it will likely reshape life as we know it.

Recent events have forced questions and concerns to be raised about today's global car culture and the future of this predominant transport system. The pandemic has forcibly restructured work and social lives, challenged the assumptions about urbanisation, and the clearer blue skies have visibly shown the impact that less driving can have on climate change. Governments have increasingly begun to review the emissions limits and accelerated the timing of regulations for passenger and light vehicles. To date, more than 14 countries including parts of China and 20 cities globally, including Stuttgart, have proposed banning the sale of vehicles powered by fossil fuels. Most recently, the UK announced the phase out of sales of cars using only petrol or diesel by 2030 and a ban on the sale of vehicles with tailpipe emissions by 2035. In May 2021 the governors of 12 states, including New York and California, urged the US President to take "bold federal leadership" to ensure all new cars sold from 2035 are zero-emission.

According to March 2021 data, released by the International Energy Agency (IEA), global emissions plunged by almost 2 billion tonnes in 2020, the largest absolute decline in history. However, after hitting a low in April 2020, global emissions rebounded and were 2 per cent, or 60 million tonnes, higher in December 2020 versus the same month in 2019. What

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has become evident is the urgent need for systems of mobility that are radically more sustainable and efficient. Electrification is seen as the best option and is rapidly accelerating, driven by both legislation and popular sentiment.

As a result, the automotive industry has seen customer demand driving electric vehicle sales. While the global automotive market experienced a significant decline in sales of around 16 per cent in 2020, the EV market increased significantly. Sales of battery electric vehicles (BEVs) rose by 40 per cent and plug-in hybrid vehicles (PHEVs) by 74 per cent worldwide over the year. China is still the largest BEV market in absolute terms, but the growth driver has come from Europe. BEV sales in Europe more than doubled in 2020, while PHEV sales more than tripled.

According to PWC Strategy & Consulting, it's anticipated that EVs, including hybrid models, will increase 466 per cent by 2027. However, the challenge is profitability which is being squeezed by the required investments in electric and autonomous cars, and the impact of a shifting product mix with higher cost and lower margin EVs. Consequently, the sales and profitability at the world's biggest carmakers are expected to fall in 2020 because of the pandemic and ensuing economic shock. Meanwhile, the dazzle of all electric manufacturers continues with the market capitalisation of Tesla reaching new highs. Another way to look at the valuation of Tesla on April 30th, 2021 is to relate the market cap against the number of vehicles sold. When comparing Tesla against other EV manufacturers it can be seen there is an overall optimism about EV manufacturers which is not evident when compared to traditional OEMs.

Over the next three years, accelerating EV model introduction by all the major OEMs could change this picture but it will also put significant burdens on their organizations in terms of time-to-market as well as profitability. This will put constraints on the OEMs while there is a requirement to rethink design and manufacturing as part of a broader digital transformation.

INNOVATION AND BUSINESS MODEL

Accelerating digital transformation is an unanticipated consequence of the pandemic. In several surveys, the pace of change has been identified as significant. According to a McKinsey Global Survey of executives, companies have accelerated the digitisation of customer and supply-chain interactions by three to four years and the share of digital or digitally enabled products in their portfolios has accelerated by seven years. KPMG commissioned a survey of 780 digital transformation strategy leaders and 67 per cent said they have accelerated strategy and 63 per cent increased digital transformation budgets. American cloud communications platform-as-a-service (PaaS) company, Twilio, surveyed 2,569 enterprise decision-makers worldwide about digital transformation and found that Covid-19 had resulted in a six-year acceleration in digital transformation efforts across the board.

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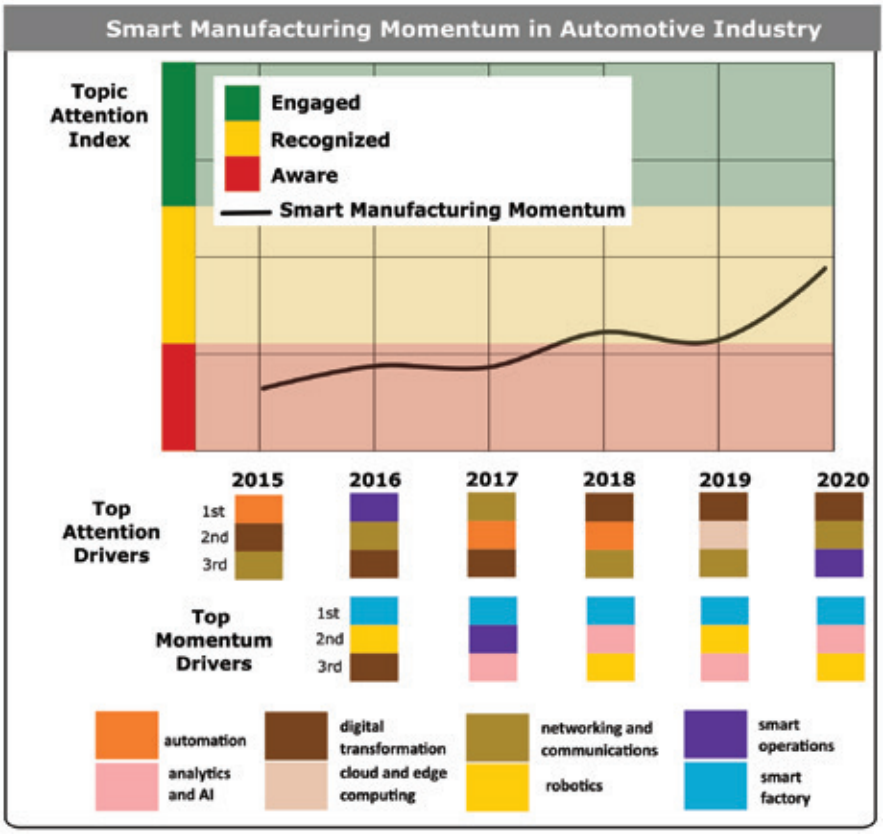

Against this backdrop, together with the megatrends impacting the automotive industry, Informa Tech Automotive Group (ITAG) and its partner, Tolaga Research, conducted research using digital content harvesting and natural language processing (NLP) techniques. The intent was to assess the accelerated adoption and impact of multiple technologies and their convergence with each other. The project set out to measure the attention and newsworthiness of key technologies and market factors that underpin the development and disruption of the automotive industry. The research focused on topics associated with Industry 4.0, smart manufacturing, and adaptive manufacturing. By looking at digital content going back to 2015 it was possible to create a topic attention index for the industry.

The analysis showed that networking, connectivity and digital transformation are consistently top attention drivers. Momentum drivers showcase technology rising stars measured by their growing semantic relevance across key industry topics. Analytics, AI, and robotics are consistently top momentum drivers. What the study concluded is that smart manufacturing attention is increasing but is still nascent (recognised but not engaged). Based on the analysis, it will likely take about two to three years for the industry to become fully engaged in smart automotive manufacturing. The continued convergence with each other of these additional technologies will act as an adoption accelerant.

This insight was confirmed in an early 2021 survey of EV development, from concept to manufactured product, conducted by Wards Intelligence for Hexagon's Manufacturing Intelligence division. The survey collected responses from 416 professionals, 64 per cent in the Americas, 21 per cent in Europe, 13 per cent in Asia and 2 per cent in the rest of the world. Of those surveyed, 25 per cent were OEMs, 42 per cent were from the traditional supply chain, 25 per cent were consulting/engineering and 3 per cent were auto tech companies.

Looking at the weighted average responses for smart digital transformation / manufacturing aspects of the survey, most results were in the range of 3 on a scale of 1 to 5, which indicates "I am aware of the technology shifts but not sure where it's going and how to exploit it". This is a very interesting situation, given it's becoming apparent from announcements that the industry intends to move very rapidly on EV development and different types of smart manufacturing over the next 18 months.

The industry has a rising awareness of the EV pivot challenge, even though the exponential reset and new operating realities are still emerging. The onset and

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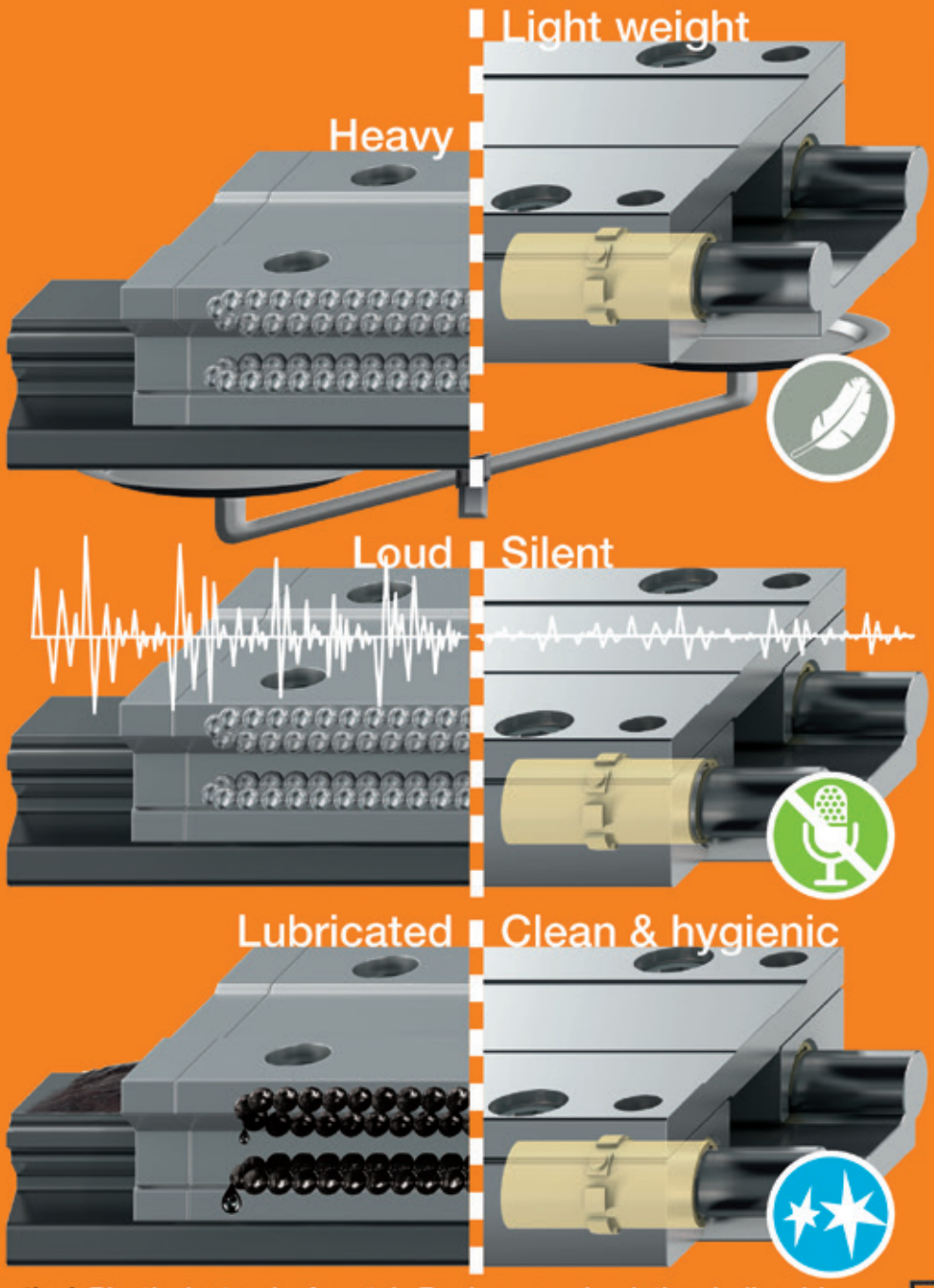

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impact of Covid-19 has forced the industry to rapidly reassess its traditional thinking around the supply chain. The business model for automotive, relative to electronics, has proven to be out of sync. There is a realisation of the need to realign the forecasting models of the "just in time" approach to the realities of the semiconductor industry, because the chip suppliers have other customers in different industries competing for the same chipsets and, consequently, there is a requirement to hold strategic inventory.

At the same time, the supply chain is being impacted by increasing partnerships and M&A that are driven by strategic intent and positioning, in both the EV and the ADAS/autonomous vehicle domains. New technology suppliers and vendors reflect the broadening automotive eco-system. Also, their role along the supply chain is shifting, with OEMs vertically integrating to consolidate power and competencies.

PIVOT CHALLENGES

Looking at the biggest risks for the automotive industry as it pivots from internal combustion engines (ICE) to EVs, 47 per cent of survey respondents indicated the biggest risk is failure to meet customer expectations, with 26 per cent believing it is not meeting the necessary price point. Pure play EV companies winning market share are considered less of a concern, but this could be short sighted since the barriers to entry are significantly lower.

"Other" comments from respondents fell into three distinct categories: the consumers' interest in and acceptance of EVs, the ability of the electric grid to support EVs and the resultant CO2 issues, and the industry's ability to be responsive and adjust its business models.

The survey also looked at the greatest inefficiencies in EV development and manufacturing processes. No single inefficiency was indicated by respondents, but four elements clustered as the leading inefficiencies. These are design complexity and over engineering, extent of collaboration with other OEMs, extent of platform sharing across range of vehicles and supply chain (33%).

Since 2011, the automotive industry R&D spending has outpaced sales growth in both Europe and North America. Given the challenges of 2020 and the pressing need to pivot to EV production, there is increased pressure to make R&D more efficient and avoid falling permanently behind their competitors. The four areas of inefficiencies are most likely related to established ICE R&D practices, and the pivot to EVs provides opportunity to break away from old habits.

There are some emerging technologies that could help OEMs address the costliest phases of a typical product creation process - the stages between the concept approval and the start of production. In a report by PWC Strategy&, it was estimated that 77 per cent of the cost and 65 percent of the time spent was in this area. The technologies that are being applied include AI, virtual, augmented and mixed reality (VR/AR/XR), digital twin (DT) and additive manufacturing (AM). The exponential impact of these technologies is not in their singular application but in combination with each other, as well as existing tools and technologies such as multi-disciplinary/cross-functional computer aided engineering (CAE) and manufacturing simulation. This should allow companies to overcome EV design challenges by joining up fragmented development processes along the supply chain and bring together previously siloed disciplines to unlock a speedier innovation process.

BARRIERS TO ENTRY

As noted, the survey identified that the industry did not see pure EV players as a threat. It's possible that the industry is about to get blindsided by third party players entering the market, outside of the traditional automotive supply chain.

The shift from internal combustion engines to electric vehicles means that the barriers to enter the industry are significantly lower, because of 3 things:

a. ICE technology, experience, best practice, tacit knowledge, and patents are not required. It could be said that the financial markets have already taken the write-down on this knowledge in the market cap valuations, even if the OEM balance sheets still reflect the assets.
b. The established supply chain, which is built to deliver ICE components at scale, is redundant for over 90 per cent of components in an EV world.
c. The current market volumes for EVs are small and so mass production facilities have less strategic cost advantage.

These business dynamics will test the industry structure because, without the burden of brown field ICE facilities that would need to be converted for EV production, new entrants have a greater variety of choice. They can focus on greenfield smart factories and they could partner with new auto tech entrants such as Foxconn and leverage their MIH skateboard platform with its ecosystem of 1400 suppliers. Or they could collaborate with experienced contract manufacturers, such as Magna Steyr, who are working with Fisker and have shown their adaptability in working with multiple new players in helping Sony produce their concept car.

SCALE

The Model T was a world-changing car when it was first manufactured in 1908. The fact that, by 1915, it

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was being manufactured in 28 factories around the US and in 14 factories and distribution points in Europe, Canada, Latin America and Australia, indicates that the car also heralded a transformation in mass production.

The next evolution in automotive manufacturing was the "just in time" mechanism that originated at Toyota in Japan. The system was so effective that, by the late 70's, the number of cars produced by Japanese workers was roughly double those manufactured in the U.S. More significantly, the quality was better.

Numerous automotive studies were conducted in the late 70's and early 80's about quality and productivity. The primary focus was on the inability of the US OEM's to catch up to Japan on quality processes. The excuses were multiple: they didn't have the right suppliers, facilities or processes, and that equipment was not equivalent; additionally, the mindset and training of the workers was different to that of Japanese workers. When Toyota built plants in the US and out-produced GM and Ford, it became obvious there was a mindset issue amongst US executives - they had a set way of thinking about things that set limits on their business.

In a May 2021 Wall Street Journal article, the headline was "Auto Makers Retreat From 50 Years of 'Just in Time' Manufacturing". The key point was that the historically hyper-efficient "just in time" single supplier system had proven fragile to the pandemic, sudden swings in demand, freak weather, and a series of accidents. The massive investments in the current mass assembly systems means that it is impossible to replace "just in time" entirely, because the savings are too great. However, the industry is focusing on areas of greatest vulnerability and stockpiling critical parts, such as semiconductors. Ford's CEO, Jim Farley, said that three decades in the car business hadn't prepared him for 2020.

The danger is that a similar mindset and lack of vision is now built around scale. The historically critical success factor of scale may not be the essence of the business model that will evolve and win in the near future. Change will happen faster, and, in today's interconnected world, the lessons learned will not remain in a single geography for long.

SMART MANUFACTURING TECHNOLOGIES

Many of the existing and future ICE and EV production challenges should be addressed and solved by smart manufacturing, including additive manufacturing techniques. Today this technology is still considered niche and bleeding edge, but it is rapidly evolving and being productised which should lead to greater autonomy and efficiency in plants, and throughout the evolving supply chain.

Smart manufacturing leverages digital technologies to deliver improvements in productivity, quality, flexibility, and service. There are three underlying digital technologies that, when combined, enable the smart factory. The first is connectivity which, combined with industrial IoT, enables the monitoring and control of equipment and sensors. When the network is linked to the second technology, intelligent automation including advanced robotics, machine vision, distributed control, and drones, an interconnected fabric of data is created. This can be processed and leveraged using the third technology cloud and edge compute, which allows pervasive data management and analytics at scale.

These digital technologies enable information technology (IT) and production facility operation technology (OT) convergence to support end-to-end digital continuity from design to operations, the areas referred to earlier as representing the most time and cost consuming aspects of product development.

AI is emerging as a catalyst technology for smart manufacturing and for linking the world of development with manufacturing. This is happening in several ways: one of the most significant is AI applied to cloud-based simulation software to allow global teams to reduce the efforts of OEMs during lab testing and on-road testing for new products and technologies, especially related to developments of EVs and autonomous vehicle development.

What will undoubtedly become the most profound application of AI is in combination with a digital twin of the vehicle. This provides the global engineering teams real-time access to a virtual representation of the constantly evolving product and allows the simulations and predictive analytic tools to be applied 24/7 throughout its lifecycle.

Another emerging area of application is the use of AI simulations with virtual and augmented reality, to allow non-engineering teams to be engaged early with design insights on product concepts. Where this has proved to be useful is in creating a digital twin of the proposed production process of the vehicle, and allowing plant workers, planners and designers to create and simulate the assembly layout and process

Automotive megatrends continue to evolve, but the last 16 months has seen the trajectory of electrification accelerating. The survey confirms the industry is on the threshold of change with the OEMs and supply chain trying to adapt to this change. The walk-away is that, even though OEMs and their supply chain are looking at new processes and tools, the ICE economies of scale mindset may limit thinking and inhibit adoption of successful EV approaches.

Source:
The Electric Vehicle Pivot by Hexagon

December 2021

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By Rahul Kamat

"JARVIS HELPS OUR CLIENTS TO AUTOMATE MONITORING TASKS"

In an interaction, **Atul Rai, Co-founder & CEO at Staqu Technologies** explains how Staqu, a Gurugram-based startup, is reducing monitoring costs by 35-40 per cent by automating the monitoring, setting up accountability, and bringing transparency

How is the global pandemic opening up industry opportunities, especially in the manufacturing sector and client bases to technology startups like Staqu?

In terms of IT adaptation, traditional manufacturing is a fairly conservative industry and is mostly the late adopter of software innovations. Our goal was to study the pain points a particular industry is facing in terms of security, safety, and operation-related monitoring, and provide a very simple plug-and-play solution with minimum Turnaround Time (TAT) with minimal cost for implementation.

Staqu offered its audio-video analytics and management solution JARVIS that revolutionised their entire monitoring task on existing CCTV cameras. They just require an internet connection on-site, and all the activities related to safety checks like fire, safety jacket, mask, hand gloves, intrusion, violence vehicle monitoring, etc., can be automated and reported to different stakeholders.

What kind of modifications that you have brought into your solutions like JARVIS to make them relevant to manufacturing sector clients?

Staqu is known for its solution in the homeland security domain. When we ventured into the manufacturing domain, one advantage we always had was that we already had the security monitoring feature - JARVIS, which is key for any kind of organisation. Every organisation installs CCTV cameras to firstly monitor the security infrastructure. Since we always had that, we further added other crucial features related to the safety of employees. For example, we included safety jackets, hard hat detection, fire and smoke detection, SOS detection, etc.

Similarly, we also added vehicle monitoring modules like numbers of vehicles coming in and going out, number plate recognition on normal cameras (generally companies purchase specialized cameras to do this activity which is not cost-efficient), etc. So far, we have added 85+ analytics on the JARVIS platform which is helping our clients to automate their monitoring tasks.

How is JARVIS different in terms of its functionalities and enablement from the normal CCTV and other video surveillance systems being used currently?

CCTV is always treated as an ordinary device having just ornamental values in any organization. However, we believe that CCTV/cameras are some of the most powerful sensors developed in humankind's history. It is the only sensor that produces brain interpretable data without any kind of language barrier.

For example, if I call you on your phone and tell you in Russian that violence has erupted in my area, it will not be easy to comprehend that audio data because you don't know the language (metadata). But if we can see the video data we can easily understand what's happening. Our motive with JARVIS - our audio-video analytics and management software, is to utilise the existing CCTV cameras to automate the monitoring tasks for which these manufacturing companies were investing money for buying new sensor hardware or hiring manpower.

Unlike any of our competitors, we don't require a data centre or capital investment locally; we are providing VMS (ONVIF compliance video management system) along with VA (Video Analytics), our solution can be integrated remotely just with the IP address of the camera. We are hardware agnostic whether you are collecting video from CCTV, mobile camera, or drone camera, all of them can be integrated with JARVIS.

Businesses generally deploy and adopt new technologies after analyzing the RoI. What is the investment involved and how does it justify in terms of RoI?

On average, we are helping our clients to reduce the monitoring cost by 35-40 per cent by automating the monitoring, setting up accountability, and bringing transparency. They just have to have an internet connection (broadband), and we are good to go. Previously, for the same kind of implementation, they were investing millions of rupees. Besides, the implementation time was longer, but in our case, it is just an hour.

Tell us about your collaboration with Microsoft? How it has helped the company to offer safety and compliance-centric analytics?

Microsoft was our first ISV partner. With them, we created a unique proposition for our end clients where clients can buy the cloud on Azure and we will deploy JARVIS on the respective account. This will prevent any capital investment. On the other hand, the customer will get scalable infrastructure for adding in any future requirement without repurchasing the overall offline infrastructure. Currently, we have partnered with AWS, Google, Intel, etc to extend our proposition.

At present, which are the projects Staqu has been working on and how many are in the pipeline? Do you have other solutions in the pipeline?

Staqu is currently working with 50+ organisations, and we are live on 10,000+ cameras. We are also in the process of adding 50 more organisations this financial year. We are also working on enhancing our product offerings and introducing some new solutions soon.

UPDATE

THE JAPANESE ADDITIVE MANUFACTURING MARKET

While metal additive technology is anticipated to grow significantly in the Japanese domestic market in coming years, it is still at an early growth stage.

Key to the domestic growth of metal additive manufacturing are specialist service bureaus who are guiding and educating Japanese manufacturers as they try to deploy the technology to overcome internal hurdles such as defining in-house design processes, select materials and plan for capital equipment investments.

Specialist service bureaus in Japan often act as the first step on the additive journey for manufacturers, allowing them to fully-visualise operations before they fully introducing an in-house system. One such bureau is Japan Additive Manufacturing & Processing Technology (JAMPT), based in Tagajō in Miyagi Prefecture. JAMPT was the country's first specialist metal 3D printing service bureau to provide technological services from metal powder development, prototyping all the way through to mass-production.

The company works closely with aerospace, defence, medical equipment and automotive sector manufacturers who are planning to deploy metal additive technology. It recently installed the latest GE Additive Concept Laser M2 and runs a total fleet of seven EBM and laser metal 3D printers.

As the use of metal additive manufacturing grows internationally, spurred on by successes with part consolidation and light weighting, **JAMPT's plant manager Shoichi Sato** believes that some industries in the country are still catching up.

"While aerospace companies in the US and other countries are installing metal additive components into aircraft engines, here in Japan, we are still often faced with his helping and educating companies how to identify the possible benefits of the technology," said Sato.

One of the many projects that JAMPT has been involved includes a recent project with JAXA - the Japanese national aerospace and space agency.

By Kruti Bharadva

SOARING TO A NEW STRATOSPHERE

With a passion for indigenization, innovation and excellence, **MTAR Technologies Ltd** has long been an important player in the Indian Aerospace and Defence sector, contributing to the success of many missions of the Indian Space Program. **Srinivas Reddy, Managing Director, MTAR Technologies Ltd** takes us through this soaring trip

Pick up any business magazine or tune in to any news broadcast from the past five years in India and it will all be about how this decade has been the golden era for the country's manufacturing. We had initiatives such as 'Make in India' and 'Atmanirbhar' being the guiding lights for industries and the government putting a firm control on defence imports by emphasising indigenization. But these are not new concepts. Well before 'Make in India' became the manufacturing mantra, one company – planted from the very seed of indigenization in the 1970's- thrived and bloomed into a perfect example of what India and Indian technology was and is, capable of.

MTAR Technologies is a leading precision engineering solutions company engaged in the manufacture of mission critical precision components with close tolerances (5-10 microns), and in critical assemblies, to serve projects of high national importance, through its precision machining, assembly, testing, quality control, and specialised fabrication competencies, several of which have been indigenously developed and manufactured. The Hyderabad based company primarily serves customers in the nuclear, space and defence and clean energy sectors, and has significantly contributed to the Indian civilian nuclear power programme, Indian space programme, Indian defence and aerospace sector, global defence and aerospace sector, as well as to the global clean energy sector.

"MTAR was born because of the need to Make in India – but in 1970!" Commented **Mr Srinivas Reddy, Managing Director, MTAR Technologies Ltd.**

The company's first project was the manufacture of coolant channel assemblies for nuclear reactor cores, as sought out by the Department of Atomic Energy at that time. The department had first approached state-owned HMT Ltd (then Hindustan Machine Tools

Limited) for the project, but it declined, saying there was too much complexity involved. Two friends and technocrats, **P Ravindra Reddy and the late K Satyanarayana Reddy,** took up the challenge with four machines at a small workshop in Hyderabad. And thus, MTAR was born.

"There wasn't much support back then, so MTAR's founders co-developed and supplied complex products such as fuelling machine heads, bridges and columns, drive mechanisms and grid plates for the core of nuclear reactors; liquid propulsion engines, cryogenic engine assembly, etc. for space launch vehicles; and base shroud assembly for the Agni programme in defence," shared Mr Reddy.

MTAR Technologies' product portfolio today includes 14 kinds of products in the nuclear sector, 6 kinds of products in the space and defence sectors, and 3 kinds of products in the clean energy sector and has a healthy mix of developmental and volume based production. The key strength of the company is its engineering capability which has consistently offered quality complex precision manufactured components and assemblies delivered within stipulated timelines and at a reasonable cost which has developed long-standing relationship with its customers.

NATION BUILDING COLLABORATIONS

MTAR been serving customers in the civilian nuclear sector for over 35 years and has had a close relationship with the Nuclear Power Corporation of India Limited ("NPCIL") for over 16 years.

"We manufacture and supply specialised products such as fuel machining head, drive mechanisms, bridge and column and coolant channel assemblies, among others, not just for the new pressurised heavy water nuclear reactors, but also for refurbishment of the existing reactors," Mr Reddy commented.

The company is also a key supplier of mission critical components and assemblies to customers within the space and defence sectors for their programs of national importance.

"Through our long-standing relationships of over three decades and four decades with customers such as **the Indian Space Research Organisation ("ISRO") and the Defence Research and Development Organisation ("DRDO"),** we have been able to supply specialised products to the Indian space programme and the Indian missile programme, respectively. For instance, our offerings to ISRO comprised a wide variety of mission critical components and critical assemblies such as liquid propulsion engines, components and assemblies for cryogenic engines, specifically turbo pumps, booster pumps, gas generators and injector heads for such engines, and electro-pneumatic modules to serve its space launch vehicles," shared Mr Reddy

Within the defence sector, MTAR undertook complex assemblies for the DRDO, including the base shroud assembly (for Agni missiles) and the assembly of secondary injection thrust vector control ("SITVC") valves and hydraulic fin tip control ("HFTC") valves. The company also exports critical defence components to Rafael and Elbit.

"Our collaboration with ISRO began with small components and assemblies, and rolling out a rocket engine in 1989, which is still being used successfully! We are also getting more involved with the space programme," Mr Reddy added.

But of course, the success or failure of such mission critical components is dependent on the accuracy, precision, and quality of the components employed. For this reason, MTAR utilises the highest quality standards, advanced manufacturing technologies and techniques to ensure their components fully meet the needs of their esteemed customers.

"Quality is the key parameter here. The products require critical tolerances as they go into nuclear reactors and space launch vehicles, where failure is never an option. The quality norms are stringent, and we haven't faced a single blemish till date. Criticality and quality are the aspects our products stand for," Mr Reddy commented.

MTAR was also a key contributor to India's Moon mission, Chandrayaan-2 by manufacturing the spacecraft's crucial parts

KEY COMPETENCIES & CAPACITIES

MTAR has seven strategically based manufacturing units including an export-oriented unit based in Hyderabad, Telangana.

1970 The Inception by Establishing MTAR Unit 1 for BHEL Orders

1972 First Order from HMT was received to MTAR

1975 Started Montage (MTAR Unit 4) for Rough Machining Operations

1978 Established Heat Treatment & Surface Treatment Plant (MTAR Unit 5)

1980 Established MTAR Unit 3 for additional capacity for component manufacturing

1983 Started supplying components to ISRO

"We currently operate seven manufacturing units, of which three are supporting units and the other four profit centres. We are in the process of establishing an additional manufacturing facility at Adibatla in Hyderabad, which is expected to become operational in FY 2022. This will be a sheet metal facility, which shall allow us to undertake sheet metal jobs for Bloom Energy, ISRO and some other customers," said Mr Reddy.

"Our capability in measuring and maintaining quality and measurement records at each level of the process is a key enabler. In addition, our facilities are equipped with requisite equipment for dimensional and geometrical inspection to establish micron level adherence to specifications as set by our customers," he added

Most of MTAR's manufacturing facilities, including its EOU have accreditations such as the ISO 9001:2015 certification and AS9100D certification (technically equivalent to the EN 9100:2018 and JISQ 9100:2016 certifications) for quality management systems. The facilities at Unit 2 and EOU are certified for 14001:2015 Environmental Management System, ISO 27001:2013 Information Security Management System, and ISO 45001:2018 Occupational Health & Safety, which is a major milestone in its journey towards being a 100 per cent ESG compliant firm.

In September 2021, MTAR received the National Aerospace and Defence Contractors Accreditation Program (Nadcap) certification from Performance Review Institute (PRI) of US for its 100 per cent Export Oriented Unit (EOU) and Unit 5 at IDA Jeedimetla for a period of 12 months, which will be valid until November 2022. Nadcap is an industry-managed approach to conformity assessment of 'special processes' that brings together technical experts from prime contractors, suppliers, and representatives from government to work together and establish requirements for approval of suppliers using a standardised approach. Unlike traditional third-party programmes, Nadcap approval is granted based upon industry consensus.

OPERATIONAL HIGHLIGHTS

- Recorded highest production of Hot Boxes per month so far in June 2021 despite the devastating second wave of Covid-19
- Revenue from contracts with customers (sales) increased by 10.9 per cent in comparison with Q1 FY21
- Revenue from Exports increased by 52 per cent compared with Q1 FY21 amidst the supply chain disruptions caused by the second wave of Covid-19

Commenting on the results, Mr Reddy said, "Q1 FY22 was quite challenging as the nation was hit by the devastating second wave, which caused supply chain disruptions across the value chain especially for the firms operating in manufacturing sector due to labour shortages, intermittent lockdowns and delay in inspections. Despite the challenges, MTAR has clocked a revenue of Rs. 54.0 Crs with an YoY growth of 10.9 per cent. We have posted an EBITDA of Rs. 14.5 Crs with an YoY growth of 26.6 per cent and a net profit of Rs. 8.7 Crs with an YoY growth of 63.6 per cent."

"We anticipate a better growth in the coming quarters of FY22 as the pandemic subsides. The order inflows from civil nuclear power, clean energy, space and defence sectors are expected to be accelerated due to the huge national and global market potential available in these sectors," he added.

CLEAN ENERGY & SUSTAINABILITY

If the pandemic has taught us any vital lesson, it is the one of sustainability, of zero emissions and reduced carbon footprints. The most important aspect of clean energy are the environmental benefits as part of a global energy future. While clean, renewable resources also preserve the world's natural resources, they also reduce the risk of environmental disasters, such as fuel spills or the problems associated with natural gas leaks. With fuel diversification, through different power plants using different energy sources, it is possible to create reliable power supplies to enhance energy security, ensuring there is enough to meet our demand.

"Clean energy is one of our key customer sectors and we are, accordingly, involved in the manufacturing and specialised fabrication of critical assemblies

1986 MTAR enters Defence Manufacturing by making DRDO their Customer

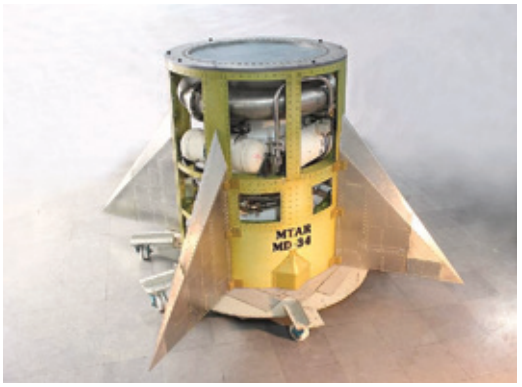
1988 HAL, GTRE, ADA also became MTAR customers and Defence sector grew

1989 Supplied the First Vikas Engine

1999 Manufacture of base shroud and Fin assembly and pneumatic components for use in Agni Programs.

2002 MTAR Unit 2 was established for additional capacity for Defence & Space

2008 Manufacture of grid plates for a 500 mega-watt Reactor



to customers such as Bloom Energy, Andritz, among others. We supply power units, specifically hot boxes to Bloom Energy USA with whom we have been associated with for over nine years, and currently, involved in the development and manufacture of hydrogen boxes and electrolysers," Mr Reddy commented

While hot boxes use methane to generate power, hydrogen boxes use methane to generate hydrogen which in-turn, are used to generate power.

"Whilst people are thinking of clean energy now, maybe accelerated due to the pandemic, we began investing in clean energy at least seven-eight years ago. As far as India goes, we need the right infrastructure in place, for example gas pipelines, to make clean energy a thing of today and not of the future," Mr Reddy added.

INDIGINIZATION IN INDIAN DEFENCE

An indigenous defence industry is a vital objective for India given its security environment and strategic objectives. India has a large and growing defence budget and a long history of defence industrial production. However, the country remains heavily reliant on defence imports, particularly for major platforms, while its own exports are extremely meagre.

There have been several partnerships, programmes and initiatives as part of India's efforts to create a capacity for the development of a domestic defence industry ecosystem. Reflecting the renewed interest in India as one of the world's top weapons markets, a total of 201 memorandums of understanding were inked for product launches and technology transfers during this year's Aero India, up from 50, two years ago. Joint ventures and Indian partners have already generated $600 million worth of exports and produced over $200 million in India industry revenues

"Indigenization has always been there in India- we built our own reactors and are now launching our own satellites. Capability wise, India is right up there with the best in the world. What is needed is that special thrust- which the government is giving now. Indigenization cannot happen overnight in every area, but if we follow the process, we will get there. The best thing the government did was to tell us -STOP IMPORTING, and thus compelling development of our domestic defence sector," opined Mr Reddy.

A PASSION TO INNOVATE

The road reaching here had its own share of potholes, according to Mr Reddy. The initial challenge was to set up the capabilities required for the development of a product in strategic sectors and the second was the development of products. To address the first challenge, the founders built many machines in-house, instead of importing similar ones from abroad, which resulted in a lot of savings for the company.

"We have built some of the most sophisticated, in-house special purpose machines (SPM) such as SPM-99 and Gantry SPM used for various special operations. Once our facilities were developed, the challenge was indigenising the technology and developing the end product. It was a roller coaster ride as our engineers spent several hours on the shop floor carrying out R&D to come up with certain products." Mr Reddy added.

"It took many years of efforts to develop the products that we supply today. We are maintaining the same pace to develop future technologies. We strategize three-four years ahead of time to develop a new technology. For instance, we have completed the development of electro-pneumatic modules this year, for which the developmental activity started in 2016," he shared further.

When asked about the future, Mr Reddy said they intended to increase wallet share in the sectors the company catered to by taking up volume production for developmental orders and at the same time enhance revenues from products that are already into volume production.

"We intend to maintain a healthy mix of developmental-volume production and take up the developmental activity of new technologies. We have the passion to innovate, and the rest is secondary," concluded Mr Reddy with a smile.

2010
Export Oriented Unit 100% EOU (MTAR Unit 7) was established

2011
Commencement of the manufacture of power units for Bloom Energy

2018
Commencement of defence exports by of our Company

2020
Commencement of developmental activity for roller screws that shall be an import substitut

By Kruti Bharadva

THE ART OF MACHINING SUPERALLOYS

Iscar takes us through the fine art of machining superalloys- a specialised field.

Superalloys - metal alloys, which reflect their complex alloyed structure, have become one of the main engineering materials for a long time. They feature extremely high elevated temperature strength, and therefore often are referred to as high-temperature superalloys (HTSA) or heat-resistant superalloys (HRSA). The history of superalloys started with the development of gas-turbine engines that required reliable materials for high operating temperature ranges. As a result of intensive research and progress in metallurgy, modern superalloys (SA) provide a long service life for working temperatures of more than 1000°C.

Understandably, the largest superalloy consumers today are aero- and marine engine producers (Fig. 1). Superalloys are also very common in the medical industry, which effectively use them for prosthetic implants in orthopaedic surgery. In addition, superalloys have become widespread in power generation and the oil and gas industries as crucial materials for essential parts of various devices.

Exceptional high-temperature strength and corrosion resistance are the undeniable advantages of superalloys. However, there are two sides to the coin: superalloys are not only highly priced, but their machinability is poor, which can pose challenges to manufacturing. The specific cutting force that characterises the resistance of the material to chip removal and defines the mechanical load on a cutting tool is high for superalloys. Although the main difficulty is heat, superalloys have poor thermal conductivity. Elemental and loose chips, which are generally generated when machining superalloys, do not provide adequate heat dissipation from the cutting zone. A tendency to work hardening makes the situation worse.

Fig. 1 – Superalloys are the key materials for turbojet and turboprop engines of modern aircrafts. Jet engine blisk machined with ISCAR's CUT-GRIP systems.

> "Exceptional high-temperature strength and corrosion resistance are the undeniable advantages of superalloys. However, there are two sides to the coin: superalloys are not only highly priced, but their machinability is poor, which can pose challenges to manufacturing

The manufacturer deals with various SA workpieces: cast, wrought, sintered, etc. The workpiece fabrication methods also have an impact on machinability. For example, abrasiveness of forged workpieces higher that cast ones substantially lower in comparison with sintered workpieces.

Consequently, a cutting tool is under significant thermal and mechanical load, which dramatically reduces tool life. Therefore, in machining superalloys, the cutting speed directly connected with the heat generation during chip removal is considerably lower when compared to other common engineering materials such as steel or cast iron. The direct result of the cutting speed limitation is poor productivity. Hence, overcoming machining difficulties and increasing productivity are the main challenges for the manufacturer of SA parts.

According to ISO 513 standard, superalloys together with titanium alloys relate to the ISO S group application. Depending on the prevailing element, superalloys are divided into three types: iron (Fe), nickel (Ni) and cobalt (Co) based alloys. Machinability drops

Fig. 2 – Machining a femoral knee implant component with a MULTI-MASTER endmill and exchangeable taper barrel head.

> The development of a carbide grade, in which strength and wear resistance will be mutually complemented is a tricky process that requires an appropriate carbide substrate, coating composition, and coating method

in the specified order; from the iron-based alloys, which can be compared with austenitic stainless steel, to cobalt-based alloys that represent the most hard-to-cut materials in the group.

Increasing efficiency of machining superalloys has become the focus of various scientific research and technological improvements. Their result was a significant advance in producing SA components. Manufacturing has effectively embraced new machining strategies and innovative methods of cutting coolant supply, such as high-pressure cooling (HPC), minimum quantity lubrication (MQL) and even cryogenic cooling has successfully been introduced. This has taken the productivity of machining superalloys to a new level. However, like in the case of titanium alloys, the key element for improving the productivity of SA machining is a cutting tool that directly removes material layers from a workpiece that produces chips. A cutting tool features the tool material and its geometry, which determines the tool's triumph or its failure.

Today, coated cemented carbides are the most common materials for cutting tools for machining superalloys. The development of a carbide grade, in which strength and wear resistance will be mutually complemented is a tricky process that requires an appropriate carbide substrate, coating composition, and coating method. To the amazement of those who believe that the breakthrough possibilities in this direction are almost exhausted, cutting tool producers continue to create new effective carbide grades. Additionally, in machining superalloys, ceramics - another tool material that enables substantially increased cutting speeds – are already in active use.

If tool materials are connected mostly with material sciences and metallurgy, cutting geometry is more in the tool design field. Ensuring high-performance geometry requires deep engineering knowledge and technology skills. On the one hand, to minimise heat generation and work hardening, a positive rake angle, a large enough clearance angle, and a sharp cutting edge are needed. On the other hand, such a shape weakens the cutting edge that should withstand a considerable mechanical load. Therefore, the correct designed cutting-edge condition becomes a critical success factor. Sintered carbide inserts have the advantage of enabling complex chip forming and chip breaking shapes for insert rake faces. Today, computer modelling of chip formation and pressing processes using finite element methods provide an effective tool to optimise the shapes that are already in the design stage. In solid endmills, a variable pitch design results in improved vibration strength. Cutting edges of these endmills are produced by grinding operations, and to eliminate flaking and edge defects, strict adherence to technological process requirements is highly important.

Fig. 3 – Milling cutters with indexable round inserts from ceramics provide considerably increased cutting speeds for higher productivity.

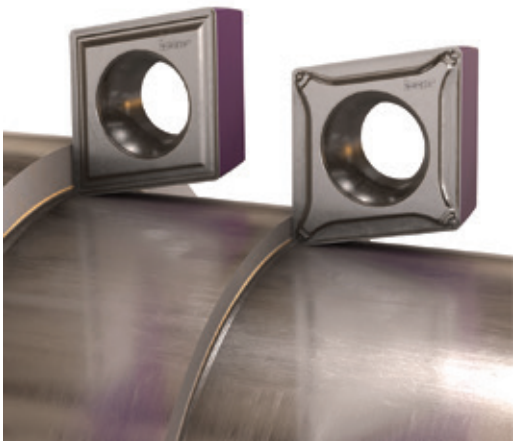


Fig. 4 –ISCAR's recently introduced M3M (left) and F3M (right) chip breakers for ISO standardised turning inserts designed specifically for ISO S and ISO M groups of application.

Cutting tool manufacturers pay a lot of attention to improving their product portfolios intended for machining superalloys.

Carbide grade IC806, which had was introduced over the last few years for face grooving superalloys and austenitic stainless steel, was successfully adopted by ISCAR's threading and deep drilling lines. This grade has a hard submicron substrate and PVD TiAlN/AlTiN coating with post-coating treatment according to ISCAR's SUMO TEC technology. IC806 provides notable resistance to flaking and chipping and maintains reliable and repeatable results.

In machining superalloys by solid carbide endmills and exchangeable heads, grade IC902, which combines ultra-fine grain substrate and nano-layer PVD TiAlN coating, ensures extremely high wear resistance and prolongs tool life. This grade has demonstrated very good results in producing devices for replacement knee and hip joints that are made from difficult-to-cut cobalt-chrome alloys (Fig. 2).

ISCAR has significantly extended the range of products for ISO S applications made from various cutting ceramics such as silicon nitride, SiAlON, and whisker-reinforced grades. The newly introduced ceramic items have replenished both indexable inserts and solid endmills (Fig. 3).

The latest rake face designs F3M and F3P for ISO standard turning inserts are intended specifically for hard-to-machine austenitic stainless steel and superalloys (Fig. 4). Their positive rake-angle geometry reduces the cutting force and ensures smooth cutting action, while the set of deflectors on the rake face improves chip control.

In ceramic double-sided inserts for turning and milling tools, ISCAR has added new chamfered and combined (chamfered and rounded) cutting-edge condition options for tough applications.

ISCAR has enriched the range of solutions intended for high-pressure cooling by new indexable cutter bodies and tool holders. For example, thermal shrink chucks with polygonal taper shanks, which have coolant jet channels along the central bore, have been replenished by the toolholder product line.

In conclusion, the need for increased productivity in machining HTSA is a continuous challenge for cutting tool manufacturers, and new effective tool developments are likely to come in the near future.

UPDATE

EICHER DELIVERS 315TH BSVI TRUCK TO KNR CONSTRUCTIONS

Eicher Trucks & Buses, part of VE Commercial Vehicles Limited, today completed the 315th vehicle delivery to KNR CONSTRUCTIONS LIMITED. The company bagged a massive order of 130 vehicles from the Hyderabad-based infrastructure major.

Recognising this momentous occasion, **Gagandeep Singh Gandhok, Senior Vice President – HD Trucks Business, VE Commercial Vehicles** said, "Our association with KNR Constructions Ltd began about 5 years ago, and in this short span of time we have jointly worked to deliver the 315th BSVI vehicle for their various infrastructure projects. Their faith and confidence on Eicher vehicles is a great delight for us at VE Commercial Vehicles."

"This order is a further testament to our strong product portfolio, especially tailor made for the niche infrastructural segment. For instance, our industry-leading Pro Series Tippers stand testament for our competitiveness, product strength and capabilities to deliver the highest levels of productivity."

On the partnership, **Shri K Narasimha Reddy, Founder & MD, KNRCL** said, "In our fleet of 1000+ tippers, Eicher constitute of good 33 per cent share i.e. 300+ vehicles. Eicher team supported us well in both the prestigious lift irrigation projects of Kaneswaran & Palamuru Rangareddy. Continuing this trust, we are happy to partner with VE Commercial Vehicles again and add 130+ Eicher tippers in our fleet for our new road construction projects in Tamilnadu, Karnataka & Kerala.

By Kruti Bharadva

A CONTINUOUS WAVE OF INNOVATION

In November 2020, **Stefano Caselli, founder and CEO of Tsunami Medical,** outlined his vision to drive spinal technology innovation forward using GE Additive's laser-based (DMLM) metal additive technology. The vision- investment in and early adoption of additive technology continues to bear fruit -which is driving business growth and global expansion

At the heart of Caselli's vision above sits the analogy of "a wave of innovation," and since the beginning of 2021, the Mirandola, Italy-based company has launched nine 3D-printed titanium spinal-fusion implants and a pedicle screw and rod system.

The ability to bring so many new products to market builds on the strong and trusted working relationship Caselli and his team have built with surgeons over many years and demonstrates the acceptance and use of 3D-printed titanium implants by the wider orthopaedic community. Indeed, that close collaboration with surgeons and clinical studies focusing on implant design that promote bone ingrowth are cornerstones of Tsunami Medical's R&D strategy.

"We spend a lot of time with surgeons listening to their needs, share creative ideas and experiences and assist in the operating room. It's well known that the orthopaedic sector has been a champion for metal 3D printing for many years, and over time, trust in additive manufacturing has grown," said Caselli.

> "We spend a lot of time with surgeons listening to their needs, share creative ideas and experiences and assist in the operating room. It's well known that the orthopaedic sector has been a champion for metal 3D printing for many years, and over time, trust in additive manufacturing has grown

"The deployment of metal additive manufacturing continues at pace in orthopaedics. Surgeons and healthcare professionals have become advanced expert users, thanks to their early adoption of the technology. Their comfort level, expertise and desire to innovate result in optimal conditions for accelerating product development and bringing them to market," he added.

MATERIALS AND MOBILITY MATTER

Tsunami Medical's second generation of implants incorporates many of the design and manufacturing advantages offered by metal additive technology to drive innovation in the orthopaedic sector even further.

The company's intervertebral (or interbody) bone ingrowth cages replace the vertebral disc to facilitate a bony fusion of the vertebral segment and retain or restore balance and stability of the vertebral column. There are several ways to approach the affected vertebral segment, so the company designed cages for each specific surgical approach, designing specific instru-

ments and tools and manufacturing them using additive manufacturing technology.

Today, spinal surgery is routine for both orthopaedic surgeons and neurosurgeons, delivering rehabilitative solutions for spine pathologies, which include but are not limited to, vertebral disc degeneration, vertebral fractures and scoliosis. Caselli and his team are continuously improving implant design and challenging conventional manufacturing techniques of the past.

Early interbody cages were made from machined titanium bars. Owing to the material's high biocompatibility and following a post-treatment that imparts the appropriate surface roughness, titanium does promote bone ingrowth.

However, titanium cages made by using conventional manufacturing, proved to be too rigid for the application, whereas a certain level of (micro)elasticity of the implant is required to initiate and accelerate bone growth. Also, these cages showed serious problems in radiological imaging by showing disturbing scattering. Both the implant stiffness and issues in radiological imaging have been resolved by cages manufactured of polyether ether ketone (PEEK) - a special highly resistant polymer, which became the industry's standard and preferred choice of surgeons.

PEEK features good biocompatibility, mechanical strength, as well as an elasticity like natural bone. Additionally, its radiolucency also allows a good post-operative evaluation. However, ultimately PEEK did prove not to be the most suitable material for these applications after all. Although it addressed the problems of conventional manufactured titanium cages, it has been proved no bone grows on the PEEK surface. It was therefore necessary to reconsider base material and manufacturing processes of interbody cages, and this is where 3D-printed titanium cages have come into play.

> "Tsunami Medical's unique net structure design is based on clinical experience and scientific research, which indicate that the ideal pore size for promoting bone ingrowth is between 500 and 700 microns. This is possible only using additive manufacturing

Using laser- and EBM-based additive technologies, it is possible to produce a trabecular surface, which is similar to the natural bone's structure and optimal for bone ingrowth. Tsunami Medical's unique net structure design is based on clinical experience and scientific research, which indicate that the ideal pore size for promoting bone ingrowth is between 500 and 700 microns. This is possible only using additive manufacturing.

This net structure, in combination with the geometrical design of Tsunami Medical's cage options, offers an elasticity of the implant at least equivalent to PEEK and very close to the micro-elasticity modulus of natural bone. This is the essential requirement for facilitating rapid ingrowth of bone tissue and building the required bone bridge between the vertebral bodies.

"This performance cannot be attained by simply converting an existing design made for PEEK into a 3D-printed one in titanium, which most manufacturers nowadays do; these designs are a lot stiffer than their PEEK alternatives. It is therefore essential to redesign the entire implant to achieve the desired elasticity. A stiff cage can be very risky for the patient, as it can become unseated and penetrate the vertebrae, causing loss of stability of the vertebral segment. Also, subsidence of the implant that causes deterioration of the bone tissue around the implant is an undesirable and high-risk consequence for the patient," added Caselli.

WAVE OF INNOVATION

Offering interbody fusion solutions with unique cages for each surgical approach during the last 10 years by itself can be considered a wave of innovation. However, focusing on innovation and differentiation, Caselli and team continuously look for needs in individual and broader international markets and investigate additive manufacturing solutions, for which the company may be considered a turn-key specialist. Recently, Tsunami received the regulatory approval (CE Mark) to bring next-generation interbody fusion cages and a screw and rod system to market, following the successfully proven first generation of additively manufactured surgical solutions for spinal fusion.

INTERBODY FUSION CAGES

This second generation of additively manufactured solutions builds on years of research and dedication by the team. The company's second generation of 3D-printed solutions is an addition to the first generation of fusion solutions: a line of interbody cages based on successfully proven Bone InGrowth Technology® with options for all surgical approaches.

"With four cages featuring built-in additional fixation features, four expandable ones and the first

3D-printed screw-and-rod system in the world, both for open and MIS procedures, we now are offering a full product portfolio for spinal fusion," said Caselli.

The cages with built-in fixation differentiate from alternatives by using fixation pins instead of screws. Using screws would require substantially more material to fix the screws, whereas by using pins, the elasticity of the implant doesn't need to be compromised. The expandable series of interbody cages comes fully assembled from the metal 3D printer. They can be extended three-dimensionally; individual adjustment of height and lordosis angle can be achieved with just one instrument. Below is an example of the direct lateral (which refers to the surgical approach) expandable cage called Giannutri.

PEDICLE SCREW-AND-ROD SYSTEM VENTOTENE

Tsunami has also extended its use of additive manufacturing to pedicle screws, now offering one of the world's first range of fully 3D-printed and CE marked solutions.

The characteristic threading built around a trabecular honeycomb structure is beyond the construction possibilities of conventional manufacturing, while the cannulated and perforated shape, achievable only with additive manufacturing, yields the necessary strength.

Tsunami's Ventotene system of pedicle screws and bars has recently been awarded the CE Mark. To obtain this certification, the systems must exhibit great strength and resistance over time. One of the most rigorous tests that pedicle screws must sustain requires that the screws, attached to nylon phantoms, be subjected to a 180 N strength for five million cycles. The Ventotene screws have been shown to withstand up to 10 million cycles.

Tsunami's Ventotene additively manufactured screws exhibit up to 20 per cent higher biocompatibility and mechanical properties when compared to conventionally machined products. Their trabecular structure provides a better bonding on the bone and allow, when necessary, the adding of cement from within the cannulated screw.

Since the screws are not made from solid material, they minimize the use of titanium and present a lower radiological footprint, improving the surgeon's visibility of the surrounding bone tissue.

The Ventotene screw system is currently undergoing ASTM testing for the U.S. market. The tests are like those required for CE marking in Europe. As for the cages, using titanium alloy in the additive process delivers appropriate levels of micro-elasticity needed to build a "bone bridge" to reinforce the vertebral structure.

GROWING GLOBALLY

Given most Tsunami Medical's customers are based outside of Italy, the work on international standards and certification is inextricably linked to the company's global growth trajectory. In addition to this work, the company is in the process of signing additional distribution agreements for specific geographical areas.

These efforts are being driven by industry veteran **Peter Witke, who joined the company as the company's chief commercial officer earlier this year,** bringing decades of experience in the medical devices sector.

"With our ever-growing portfolio of innovative, additive manufacturing-driven, differentiating surgical solutions – which meet all the trends that are currently recognized in the international spine markets – as well as the team's dedication to stellar customer support, we're confident in our ability to continue scaling globally over the coming years," said Wit.

Source: GE Additive

UPDATE

L&T TECHNOLOGY SERVICES PARTNERS WITH MICROSOFT

L&T Technology Services has announced that it has entered into an agreement with Microsoft to offer LTTS' Energy & Sustainability Manager Solution on Microsoft Azure to digitally transform and create sustainable factories of the future.

LTTS' Energy & Sustainability Manager is a comprehensive compliance and standard-driven solution that tracks energy losses across plants - the goal being to sustainably reduce wastage throughout a business and providing visibility into utilities and plant equipment. Deployed on Azure, the solution will be taken jointly to end-customers as IP-Cosell solution across a variety of industries.

Abhishek Sinha, Chief Operating Officer and Member of the Board, L&T Technology Services said, "Energy savings and sustainability have become key goals of all major digital transformation exercises. In such circumstances, it is paramount that manufacturing companies achieve environmental compliance and standards, while ensuring that environmental goals are observed across the organisation.

By Kruti Bharadva

OPTIMISING THE LIFE OF A PUMP

Everyone focuses first and foremost on purchase price when estimating pump life-cycle costs, but there are other optimisable costs that will help moderate pump-related expenses.

Facility managers who rely on industrial pumps for the various liquid-transfer duties in their manufacturing processes can be excused if they occasionally think that once the pump has been purchased, much of the heavy lifting has been completed. It is easy to see why this mindset might become prevalent. After all, identifying the right pump for the right process requires a lot of time and due diligence, from performance reviews to cost estimates, to even soliciting opinions from other manufacturers.

In reality, studies of different types of manufacturing operations have indicated that, when all is said and done, the purchase price of a pump will only be 10 per cent to 15 per cent of its total life-cycle cost, with "life-cycle cost" defined by The Hydraulic Institute as the "total lifetime cost to purchase, install, operate, maintain and dispose of the pump."

Based on that definition, the reality is that cutting a cheque for the purchase price of the pump is only the first of many potential expenses that will be incurred over the pump's operational lifetime, which – if the operator is fortunate – can be as long as 20 years or more. Hand in hand with that, pumps are said to account for between 20 per cent and 25 per cent of the energy usage in a manufacturing operation. Therefore, it is imperative that facility operators analyse their pre-buy research not only from an initial-cost perspective, but also from a total life-cycle cost viewpoint.

To do that, there are five cost factors to consider when attempting to arrive at a trustworthy figure for what a pump's total life-cycle cost may be. Let's take a closer look at all five:

CAPITAL COST

As mentioned, capital expenditure – or Capex – in the amount of money paid to purchase the pump is the first and most obvious life-cycle cost. But identifying and optimising that Capex cost involves much more than comparing price tags.

The first consideration should be identifying the pumping technology that best suits the needs of your liquid-transfer processes. Usually, this comes down to a choice between positive displacement (PD) and centrifugal-style pumps, with the type of technology that is

ultimately chosen having huge implications regarding the total life-cycle cost of the pump.

In many instances, final pump selection can come down to an either/or choice:

- If a PD pump is chosen, will its operation require the use of a gear reducer or speed-reduction device? If it will, that is an added upfront cost that must be considered since centrifugal pumps do not need speed reducers.
- There have been several significant advances recently in the development of leak-free or seal-less pumps. These types of pumps, however, are generally more expensive than sealed pumps, but on the other hand, an inventory of replacement seals will not need to be purchased, stocked and tracked.
- Within the PD realm, air-operated double-diaphragm (AODD) pumps are a unique technology in that they do not need a traditional electric or fuel-powered motor to operate and have no couplings or seals that need to be maintained or replaced. The only daily operational cost is paying for a supply of air, but this means that the facility must be able to accommodate that capability. AODD pumps also do have several wear parts that will need to be monitored, including their diaphragms, balls and valve seats.

Specific to the chemical-manufacturing industry, over the years centrifugal pumps have become the default liquid-transfer technology in many of the world's chemical-processing systems. Because of this, many chemical processors will always choose a centrifugal pump because they know how they operate, are familiar with their benefits and are confident they will get the job done, no questions asked.

The problem with this mindset is that it means that many chemical-processing systems have been designed around the needs of the pump, rather than the needs of the system. For example, design engineers will design their systems so that raw materials can be blended or heated in a way that their viscosity is brought to a level that enables them to be handled by a centrifugal pump. In this case, they are reconditioning the material to fit the need of the pump, regardless of any potential life-cycle cost impact.

The operator, in addition to getting the viscosity to a centrifugal-friendly level, must also ensure that the pump continues to operate at its Best Efficiency Point (BEP), generally believed to be a window in which the pump operates at 80 per cent to 110 per cent efficiency levels. Any time spent operating outside the BEP can result in shaft deflection that will place higher loads on the pump's bearings and mechanical seal, which can damage the pump's casing, impeller and back plate. This domino effect will lead to higher maintenance and part-replacement costs that – teamed with the costs required to keep the pump operating at its BEP – will increase total life-cycle costs.

INSTALLATION COSTS

Determining installation costs and their eventual effect on total life-cycle expenses requires a total overview of the pumping operation. Some questions to consider include:

- Will any modification to the pumping system be needed when the new pump is introduced, or can it just be plugged into the existing infrastructure?
- Will new or modified connections to the process piping, electrical wiring and instrumentation, and auxiliary systems and utilities be needed?
- Are there any special weight considerations that could lead to the need for a special foundational platform, i.e. a baseplate?
- Will any boring into the existing foundation, or the pouring of a new foundation, be required?

This last question is the one that can have the biggest effect on total life-cycle costs. Some pump technologies are easy to install; for instance, AODD pumps that need only an air and discharge hose to be hooked to them before they are asked to do their jobs, even if that job demands that the pump operate underwater.

Vertical pumps, on the other hand, are typically less expensive than some other styles, but they sometimes need extensive foundation work that could require boring as much as 30 feet (10 meters) into the ground just to install the pump. Again, this can prompt the facility operator to employ some comparative if/then thinking: "If I want to use a more economical vertical pump, then it will cost quite a bit in installation costs." By taking that into consideration and reviewing all the possible alternatives, that if/then statement can be turned into: "If I use a more expensive multi-phase pump, then I will have lower installation costs."

Another area of consideration during pump installation is alignment. Simply put, pumps that are not aligned properly with the motor – and many often aren't – can lead to quicker part wear that can result in inefficient operation and pump failure. There are now some pump technologies that can be pre-aligned as they are manufactured through the use of an adapter, which eliminates the need to align the pump on-site, along with any costs associated with that alignment process.

A final expense within the installation-cost realm is commissioning costs. These are the fees that must be paid to have the installation reviewed to ensure that it satisfies all the parameters for proper installation and safe operation. Only after this review has been performed and sign-off received will the facility manager be able to flip the switch and begin operating the pump.

In the end, it all comes down to each individual facility's needs, wants and economic considerations, with all the spokes in the installation-cost wheel playing a part in determining total life-cycle costs.

OPERATING COSTS

The most obvious cost here is acquiring the energy – generally electricity, fuel or air – that is needed to power the pump. Here again, the style and operational capabilities of the pump technology play a notable role. For example, when contemplating a pump that operates via a motor that is 50 horsepower or lower, energy efficiency should not be a top-of-mind consideration for the operator. However, energy efficiency becomes a critical concern when the motor is 100 horsepower or larger, especially when those heavy-duty motors are featured on pumps that perform continuous-duty pumping operations.

Again, a comparison between PD and centrifugal-style pumps is in order:

- Typically, a PD pump motor is sized according to the bypass valve set point. This optimises the motor sizing so that it is close to the actual operating points and limits the energy consumed while still enabling it to achieve desired flow rates regardless of temperature, pressure or viscosity changes during the pumping process.
- Centrifugal pumps, on the other hand, are often not protected with bypass valves. Instead, centrifugal pump motors are sized according to the runout power. This essentially oversize the motor "just in case" the pump operates at runout. In reality, most centrifugal pumps don't operate at runout, meaning that the cost for a larger motor is often a needless expense.

Another cost to focus on when considering life-cycle operating expenses is the cost of any ancillary liquids needed to heat, cool or lubricate the pump during its operation. For instance, sealed pumps can require a water "quench," a process in which tap water is injected into the seal gland as a way to cool and clean the seal faces. This water is usually introduced into the pump at very low volumes, sometimes even lower than a dripping water faucet, but if 10 pumps require this treatment and they operate for 8,000 hours a year each, the costs for that water can quickly escalate. This expense is not needed with seal-less pumps.

Operating costs also contain a human element in the form of labour costs. These costs can fluctuate widely depending on the complexity of the pumping system itself. A system that regularly handles hazardous or explosive materials requires closer monitoring than one that only transfers benign materials. Though there has been growth in next-generation remote Cloud-based pump-monitoring systems and equipment in recent years, most manufacturing facilities still rely on first-hand on-site observation of the pumps to determine if they are meeting the parameters of any and all required performance indicators.

MAINTENANCE COSTS

Unanticipated downtime and lost production play a huge role in the pump's total life-cycle cost. In other words, a pump that is down for maintenance is not

moving liquid, which means the line is not producing product. While all maintenance is bound to take the pump out of service for some period, there are some pump technologies, such as sliding vane, that allow simple maintenance duties to be performed without having to remove the pump from the line. This will shorten the amount of time that the pump needs to be out of service. All these things make it imperative to understand a pump's anticipated maintenance needs before it is purchased.

The ultimate impact of maintenance costs is usually tied to the number of wear parts that the pump possesses. Pump technologies like centrifugal, sliding vane and AODD have relatively few wear parts – things like seals, vanes, O-rings and diaphragms – that are easy to replace at low cost. These part-replacement costs usually total less than 20 per cent of the cost of a new pump over its lifetime.

On the other hand, technologies like progressive cavity, screw and internal gear pumps can feature maintenance, repair and replacement costs that can approach or exceed 80 to 90 per cent of the pump's Capex cost. These types of pumps operate via highly precisioned machined metallic components that are expensive to produce. That's why these types of pumps are often called "throwaway" pumps; they are used until they break down and then replaced because replacement is more economical than repair.

Another component of maintenance cost is preventative maintenance. This is critical if the operator hopes to reduce or eliminate unanticipated downtime in any pumping processes. Because each pump application is unique, pumps can seem fickle at times. While the operator can determine a desired target life for the pump, the reality is that, if left unchecked, unexpected failures will cause costly pump downtime.

A preventative-maintenance plan can combat this – if the plan is properly considered and makes use of the past operational history of similar pumps used in similar applications. Making well-considered assumptions regarding pump maintenance based on history can go a long way in building a maintenance plan that can anticipate and mitigate any problems before they occur. This is another area where the recent advances in remote monitoring and data storage of a pump's operational history can help ease the burden on preventative maintenance. Some manufacturers are now offering phone apps to help track, monitor, operate and keep notes on the maintenance needs of their installed assets.

One final maintenance-related consideration for the operator is to determine whether or not it would be economically wise to purchase a spare pump that can be inserted into the pumping system on an as-needed basis. Determining the necessity of this, Capex expense will also play into the calculations for total life-cycle-costs.

DECOMMISSIONING COSTS

The final cost in a pump's lifetime is its decommissioning cost, or the cost to remove it from operation and dispose it. While these costs are typically not prohibitive, if the pump has been used in the handling of hazardous, toxic, radioactive or any other materials that require environmental sensitivity, the costs to decommission them will be higher. When disposing of pumps that have handled hazardous materials, the number and type of regulatory requirements that must be satisfied will also play a role in determining the decommissioning costs and their ultimate effect on total life-cycle costs.

KEY TAKE-AWAYS

When any type of list like this is created, an expected question might be: "So, which of these costs is most important if you want to optimise total life-cycle cost?" Let's look at them from least to most significant.

The one category that generally has a fixed cost that is least open to fluctuation or interpretation is decommissioning costs. Many operators may not even consider those costs as part of the total life-cycle cost package.

After that, we've found that Capex and operational costs (as they relate to energy usage and pump efficiency) are not seen as a make or break proposition for the pump user. While it's popular to market industrial operations as "green" or environmentally friendly, the truth is that no one makes a purchasing decision based on the pump's efficiency – and there really is no compelling reason to do so because the economics of operational efficiency don't really matter for pumps that have motors smaller than 100 horsepower, and that's where most industrial pumps operate.

Maintenance costs are important because pump reliability is a key component in ensuring that the pumping system meets the demands of the operation. However, the costs of maintenance are usually built into operating budgets through the purchase of spare inventory or the performance of prescheduled maintenance routines, making this a life-cycle expense that can usually be predicted reliably.

That leaves installation cost, which may be the least understood of all the categories. This also means that it offers the best opportunity for improvement. Most operators ignore or care little about installation costs, viewing them as nothing more than the "cost of doing business." However, this is an area that is ripe for improved optimisation, especially in new installations. Many operators can fall into the trap of relying too heavily on what has been done previously on-site or what has been done in other company facilities, without

truly realising how unique each individual installation really is. This can lead to a situation where it is hard to know what the true costs of the installation are and their ramifications regarding total life-cycle cost. These installation costs include not only foundation work, piping, etc., but also any auxiliary systems that will need to be made part of the pumping operation. These can include priming, liquid conditioning, heating, closed-cooling, filtration, vacuum and pigging systems, some of which can be exorbitantly expensive to install.

Conversely, rather than considering the need and cost of auxiliary systems, some operators will fall back on the mindset that all problems can be solved through the incorporation of a control valve or variable frequency drive (VFD). Control valves are useful to modulate the level of pressure that is needed to get the pump working properly – another example of building the system around the pump – but a more economical solution can be buying a pump that can inherently produce the application's required pumping pressure.

VFDs have become more affordable over the years, so some operators have begun to think that they can be a silver-bullet solution to everything that ails pump operation. While VFDs do offer a lot of functionality and flexibility and can make the system very nimble, they can wreak havoc on motors by introducing electronic pulses that will compromise the performance and reliability of the motor and other downstream pump components. Further, speed control itself is not a fix-all solution. A VFD will not help if a system's operating range is outside a pump's performance envelope.

WHAT COMES NEXT?

People in the process industries are knowledgeable, but because of the demands of their jobs they need a path of least resistance that accommodates the time, resource and production constraints that are placed on today's plant operators. The simple fact is that somehow, someway today's industry expects to achieve more output with less resources, which includes knowing all of the intricacies of an effectively functioning process system.

This has led more and more facility managers to turn to third-party Engineering, Procurement and Construction (EPC) contractors for assistance. EPCs are tasked with all design, procurement and construction tasks while ensuring that the entire project is completed on time and on budget. The use of EPCs has become more and more prevalent in recent years, to the point that hiring an EPC is now essentially considered an unavoidable first step when designing, outfitting and commissioning a manufacturing plant. And EPCs can be a valuable resource – if they have the knowledge and expertise to know the ins and outs of the operation they are building and are able to answer any questions their clients may have so they can truly meet their needs. However, some EPCs prioritise short-term guarantee periods and ignore long-term life-cycle costs. Additionally, EPCs don't pursue system optimisation. Instead, they are incentivised to design and construct systems that meet only the minimum requirements that are outlined in their contracts.

As mentioned earlier, the arrival of advanced remote pump-monitoring technologies promises to be a boon in optimising pump life-cycle costs. These new monitoring systems fill a niche in what has come to be known as the Industrial Internet of Things (IIOT). IIOT is defined as a network of physical devices, systems and platforms that use embedded communication technology to share the operational intelligence of industrial machines. It combines data technology and machine learning to bring together sensor data and machine-to-machine communication technologies. This enables the identification of operational inefficiencies sooner and more reliably, creating real-time operational transparency and significant cost savings for the operator.

The driver behind remote Cloud-based pump-monitoring systems is creating the ability to gather pump-performance data and store it for future use. These systems are nothing more than augmented ways to aggregate data. The challenge is finding the best ways to use this data to observe and predict pump performance, with the goal of optimising it as it pertains to total life-cycle cost.

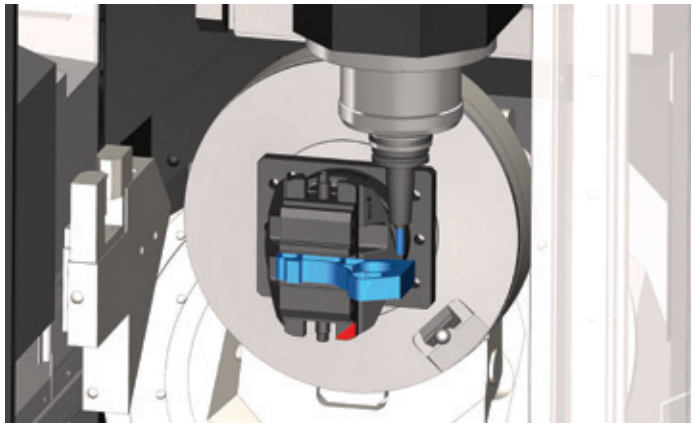
CONCLUSION

Many pump technologies are hundreds of years old and there really hasn't been a new, significant way in over a century to move 10 gallons of water, 10 feet in 10 seconds. But there are still exciting ways to improve the total life-cycle costs – if the operators of manufacturing facilities will, as they say, stop "kicking the can down the road." Granted, these time-strapped individuals do their best to create and operate manufacturing processes that meet the demands of strict and oftentimes unforgiving production schedules.

That being said, by working in harmony with pump manufacturers who are constantly looking to improve the effectiveness and reliability of their products – as evidenced by the new remote monitoring tools – they can identify and incorporate pump technologies with optimised life-cycle costs that will reflect positively on the manufacturing operation's ability to meet production demands and improve the bottom line.

Sources
Geoff Van Leeuwen, Blackmer and PSG
PROCESS WORLDWIDE

IMPROVED PRODUCTIVITY AND TECHNICAL COMPETITIVENESS



Full support for factory digitisation (smart factory) from the government offices at both federal and state-level still seems insufficient for many companies to overcome resistance to sudden changes and risks that could accompany those changes. KP AERO INDUSTRIES CO LTD (herein KP Aero) is an exception. A small but well-equipped company with advanced technology in the Gyeongsang province of South Korea, KP Aero has successfully implemented the smart factory empowered by the corporate culture that conceives technological innovation as a natural task rather than burdensome.

KP Aero's successful global market debut after 30 years of self-gained technology proves it well. The company produces parts for A350, B737, B777, B787, and more. Korean Air, Korea Aerospace Industries and HANKUK FIBER are also important customers of KP Aero. In 2020 while the COVID19 significantly impacted the global aerospace industry, KP Aero successfully secured a deal with a major Japanese aircraft manufacturer.

THE ROLE OF VERICUT FORCE

KP Aero is already a user of the CNC simulation software and optimisation software VERICUT. However, when more need for precision machining was noted, and to improve the high-speed machines' productivity, the company made a call to test the optimisation module FORCE.

Force Optimisation CGTech's VERICUT Force is a physics-based NC program optimisation software module that analyses and optimises cutting conditions throughout NC program operations.

VERICUT Force makes the most effective NC program for the given material, cutting tool, and machining conditions. The result is significant time savings, and improved cutting tool and machine life.

"Aircraft manufacturers request lighter, more complicated, and precise parts. To meet these needs, which requires high-speed machining, we established a facility with machines that are capable of operating at an average speed of 30,000 rpm," said a spokesperson.

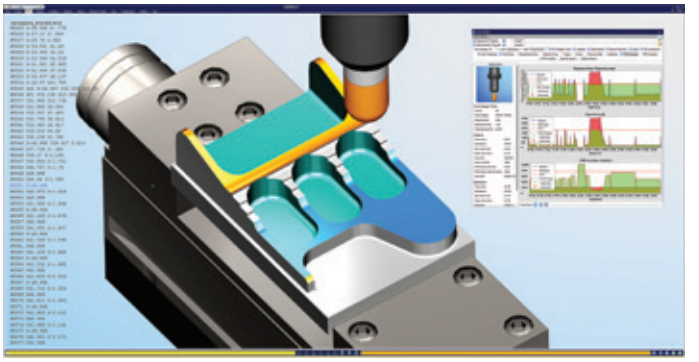
"VERICUT FORCE is a solution that is already highly accepted in the global aerospace industry. The fact that KP Aero using FORCE optimisation would give an extra boost to gain customer trust and strengthen the price competitiveness."

A Titanium (Ti-6Al-4V) part was machined using a 5-axis DMC-100U duoBLOCK to test the software. To machine a part faster and safer, FORCE cuts the NC code into small segments and applies the optimal feed rate for each segment, improving the efficiency of the toolpath and eliminate any risk due to overloads. After FORCE optimisation, KP Aero saved 25 per cent cutting time and eliminated tool breakage, which has been a problem while machining deep pocket corners and trims. Performance enhancement of the company is expected thanks to FORCE that can prevent overloads and tool breakage. FORCE also provides various easy and fast-to use analytic functions and charts.

FORCE and other VERICUT modules seamlessly connect to already established facilities. KP Aero is implementing FORCE software as a part of their smart factory processes and planning to optimise other parts' toolpaths soon.

ANALYSE

VERICUT Force allows programmers to quickly and easily visualise what is happening cut-by-cut in the



NC program as the tool contacts the material. With VERICUT Force you clearly see underutilised cutting conditions, excessive forces, metal removal rates, power, torque, and tool deflections.

A single click provides a review of the NC program and a visual analysis in the graphic review window. This analysis provides a view of the machining before running the NC program on the actual machine. VERICUT Force provides the user with a proactive analysis on NC programs, making them right the first time.

OPTIMISE

VERICUT Force makes optimising an NC program fast and easy. Force calculates the contact between the tool and material, cut-by-cut. Force also takes the cutting tool edge and the material into account to adjust the feed rates to be optimal and constant.

VERICUT Force's material catalogue is complete with ISO PMKNSH materials.

Benefits of Force

- Significant cycle time savings
- Charted cutting condition information for NC program analysis
- FAST analysis and iteration for testing various cutting scenarios
- Maximised and more consistent chip thickness throughout the machining process
- Cut-by-cut analysis of the interaction between the cutting tool edge and the material
- Improved cutting tool performance—utilise cutting tool technologies to their full potential
- Prevention of undesirable cutting conditions like excessive force, HP/Torque, and tool deflection

Source: CGTech

UPDATE

WANTED: UNIQUE PROJECTS WITH ENERGY SUPPLY SYSTEMS

The vector award for the best energy chain applications is entering its eighth round – and applications will be accepted until 11th February 2022

They rotate by 7,000 degrees, travel at speeds of up to ten metres per second and move three-dimensionally like snakes: energy chains made of high-performance plastics. Every two years, a panel of expert judges presents the vector award and up to 5,000 euros of prize money to the most fascinating projects and their developers.

Classical mechanical engineering is no longer the only place energy chains made of plastic are found. All over the world, they ensure that cables and hoses are guided safely – in space, at sea, and underground. In thousands of projects, energy supply systems and cables perform their tasks, overcoming great challenges – from strict particle-free requirements in cleanrooms, in the semiconductor industry to high chemical resistance in electroplating, to dirt resistance in mining to chips and sparks in woodworking. Then there is compact installation space, high speeds, and even acrobatic torsional movements. The vector award honours precisely these unique applications of energy supply solutions and e-chain systems with cables. "The competition is a great opportunity for us as a manufacturer to use our products in the finished machines and systems and learn even more exciting stories about the applications," said Michael Blass, e-chain systems CEO at igus GmbH and one of the judges. "Fittingly, we are celebrating the plastic energy chain's 50th anniversary with our customers."

The vector award comes with prize money of up to 5,000 euros. Last year alone, there were 266 entries from 32 countries. The winners will be selected by a panel of expert judges from the fields of science, industry, and specialist media and associations and will receive their awards at the 2022 Hannover Trade Show. Up until the 11th February 2022, developers can submit projects that they have already completed. In addition to the gold, silver, and bronze vector awards, there is also a green vector award. "Many industrial companies – like igus – are increasingly tackling the problem of sustainability. For example, customers can return their used energy chains to us. We sort the material by type and recycle it to produce granulate for new products. That's why it was important for us as the initiator of the vector award – together with the judges – to also honour sustainable projects with a special prize," says Michael Blass. The prize was spontaneously awarded to two projects at the last vector awards.

Compete for the vector award now at: *www.igus.eu/vector*

NEW LAUNCHES FROM LVD

LVD showcased the benefits of process efficiency at Blechexpo, demonstrating the Phoenix FL-3015 fibre laser cutting machine with new 20 kW power source, the new Ulti-Form robotic bending cell, and updated CADMAN® v8.7, a software suite designed to empower the smart factory.

The powerful 20 kW Phoenix FL-3015 provides the ultimate level of laser cutting productivity and processes efficiently a wide range of ferrous and non-ferrous materials and material thicknesses up to 40 mm.

The machine cuts up to 2.5 times faster than a 10-kW fibre laser. It pierces and cuts thick materials at rates faster than most plasma cutting systems with straighter kerfs and the ability to cut holes half the thickness of the sheet, all with the processing efficiency and accuracy of fibre laser cutting.

Acceleration and accuracy are further supported by the machine's rigid welded steel frame construction. An integrated control and drive system ensure the highest reproduction of programmed contours at fast processing speeds.

The 19" Touch-L control is user-friendly: operators of all skill levels can interact easily with the Phoenix. Phoenix FL offers a number of options to advance performance, including a 10-station automatic nozzle changer, CADMAN-L programming software, and MO-Vit modular automation from the Compact Tower to full tower and warehouse systems (TAS and WAS).

LVD's new Ulti-Form robotic bending cell keeps bending productivity at its peak, handling short and long production runs efficiently. The innovation was nominated for the Blechexpo Award 2021.

Ulti-Form offers a fast "art to part" process with LVD's powerful programming. CADMAN-B automatically calculates the optimal bend program and imports

all bending data into the robot software CADMAN-SIM, no robot teaching is required. SIM automatically calculates gripper positions, generating the fastest collision-free path for the robot and then feeds the information back to B, enabling the operator to work with just one program.

LVD's auto-adapting gripper accommodates several part geometries, automatically adjusting to the workpiece size. Its smart design saves investment in different grippers and gripper changeover time.

CADMAN v8.7 is able to integrate foreign operations such as tapping, deburring, and grinding, allowing to control, monitor and log an order from raw material to finished part. Foreign operations are now visible in the CADMAN-JOB overview screen and can be tracked and traced in the production process for real-time transparency.

The latest CADMAN software can also manage the complete sheet metal production process without the need for an ERP system. Work orders can be created within CADMAN-SDI for transfer to CADMAN-JOB. This functionality makes CADMAN a practical solution for sheet metalworking businesses of all sizes, including companies who don't have an ERP system.

SHIFTCONNECTOR GO MOBILE ROUNDS APP

Global software developer eschbach, the provider of Shiftconnector® digital manufacturing software for the pharmaceutical and chemical manufacturing sectors, has announced the launch of the Shiftconnector®Go Mobile Rounds application which seamlessly connects field workers with board operators via the Shiftconnector platform for routine actions and compliance management. The application is available for iOS, Android, and Windows, allowing workers to report activities directly from their mobile devices to a central location no matter where in the plant they are located.

"The Shiftconnector Go Mobile Rounds application offers a significant advantage to workers as they perform their daily inspection rounds about environment, safety and compliance activities in various locations throughout the plant," said Andreas Eschbach, the founder and CEO of eschbach. "It enhances the full workflow beginning with planning the inspection in the field, tracking and finally evaluation. With mobile capabilities, communication with central operations is enhanced and paper documentation is eliminated resulting in better management of day-to-day plant operations and simpler execution for all involved."

With its ability to function off-line, Shiftconnector Go Mobile Rounds also gives workers the opportunity to document actions when they might be in a location that does not have cellular access. The information is saved on the device and delivered when access is restored. For security requirements, if devices are shared between shifts, users have a specified PIN or password which must be applied to access the application.

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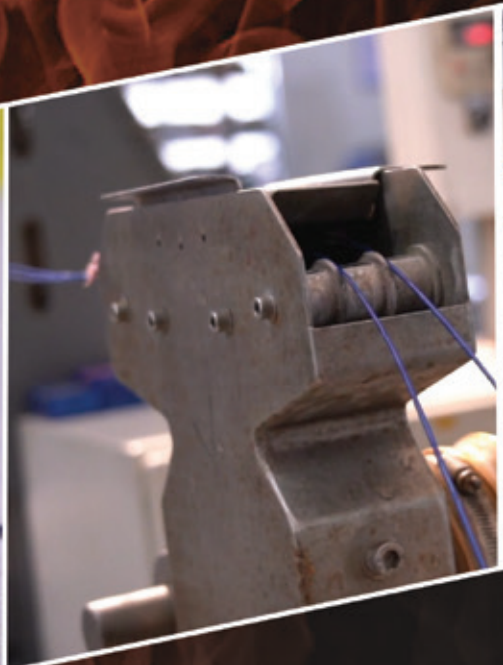

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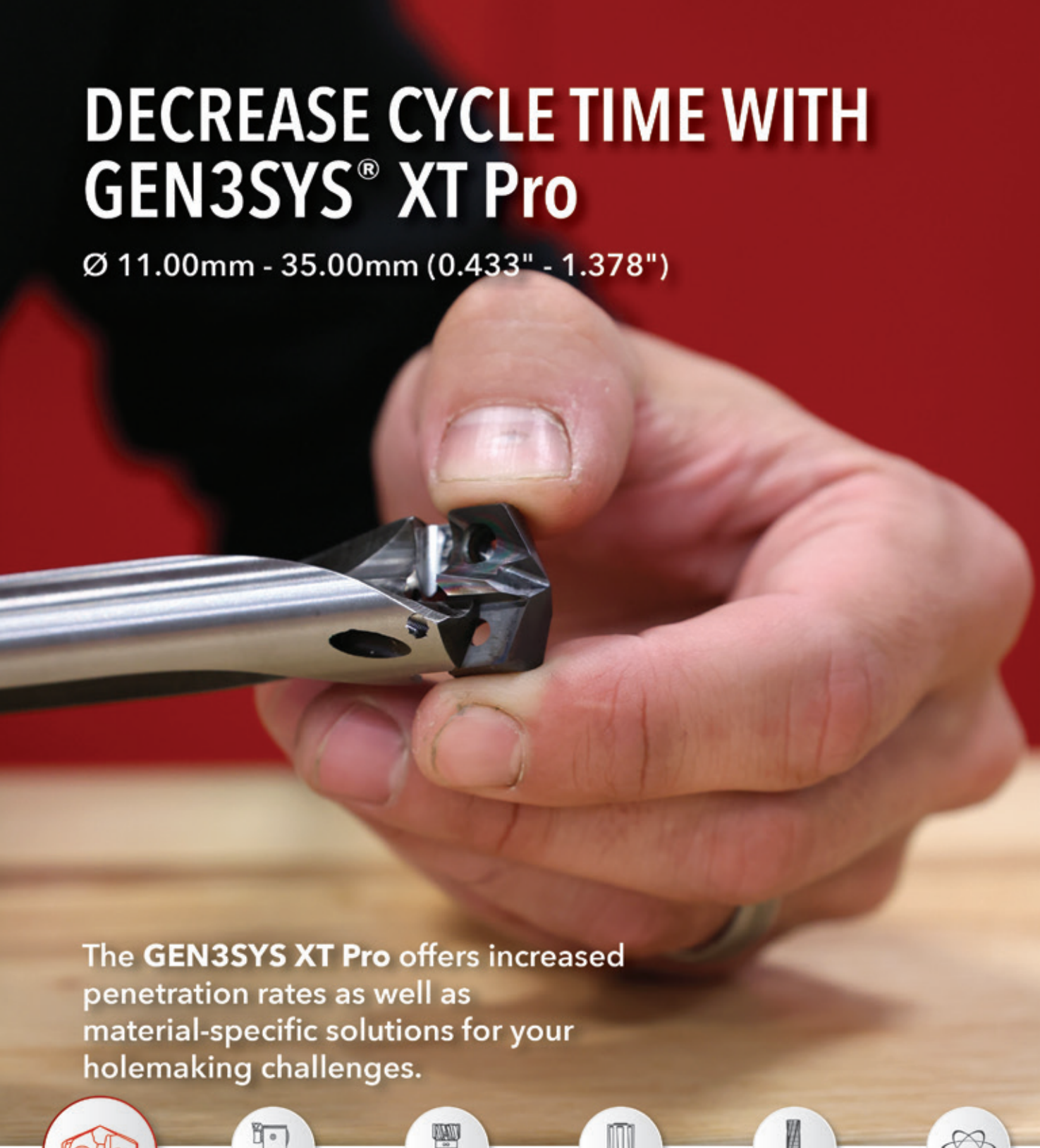

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