

For 130 years, Mersen has been bringing progress to life.

Back to the future

A LOOK BACK OVER TECHNICAL AND SOCIAL INNOVATIONS THAT HAVE MOVED THE WORLD FORWARD

Inside Mersen A NEW MILESTONE REACHED



In the air

Mersen, a key link in the semiconductor value chain











- 6 Semiconductors powering societal transformation
- 8 SiC semiconductors: Mersen's unrivaled technical expertise
- 12 Interview Gregg Lowe, CEO of Wolfspeed
- **14** Soitec and Mersen, a winning team for the electric vehicle market

- **16** Mersen in the United States: a long history
- **18** Brushes: Once a leader... always a leader
- 20 Innovation: second nature to Mersen



- 24 Mersen exceeded €1 billion in sales in 2022 and started building its future
- **30** Mersen undergoes a digital revolution with BuzIT

ENERGY TO INNOVATE IS A MAGAZINE PUBLISHED BY MERSEN - Tour Trinity, 1 bis place de La Défense, 92400 Courbevoie - RCS Nanterre B572 060 333 -Tel.: 01 46 91 54 49 - www.mersen.com - Managing Editor: Luc Themelin - Chief Editor: Véronique Boca - Editorial Committee: Thomas Baumgartner, Laurence Lamy, Luc Themelin - Design and production: Avant d'aller dormir sous les étoiles - 119 rue de la Pompe, 75116 Paris - Writing: Le Prompteur -Graphic designer: Jean-Marie Lagnel - Photos: Florence Brochoire, Patrick Lazic, Soitec, Coll. Mersen, Istock, Unsplash - Publication: may 2023 - OTT Imprimeur, 67310 Wasselonne - France

Sustainable growth doesn't happen overnight



Mersen's sales exceeded the €1 billion mark in 2022 – capping off several strong years of supporting the development of manufacturers worldwide, despite a turbulent international environment. Far from resting on our laurels, we are already preparing our next steps. And our momentum, driven both by our innovation prowess and by current market demand, shows no sign of slowing down.

Sustainable growth markets

With the real-life consequences of global warming becoming more and more apparent in our everyday lives, "sustainable" markets now play a major role in driving our industrial growth. This is particularly true of

markets easing the energy transition from fossil fuels to electricity. Whether in electric vehicles or solar power, our expertise and product ranges are perfectly adapted to the stringent technical requirements of these sectors. Over the coming years, we will be investing heavily to increase our production capacity in Europe and the United States, as we commit to responsible

growth in the short, medium

and long term.

Unwavering confidence from the industry

Our growth objectives for the years ahead are not based on assumptions but on hard evidence. We have signed major contracts with several leading manufacturers to help them accelerate their expansion and meet the needs of today's market. Over the next seven years, for example, we will be supplying smart busbars to ACC, the joint venture between Stellantis,

TotalEnergies/Saft and Mercedes-Benz, for the "new-generation" batteries that will equip Europe's electric vehicles tomorrow. We also have a five-year agreement to supply Wolfspeed, the world leader in silicon carbide, with graphite components and other high-tech materials needed to manufacture their silicon carbide wafers, which are crucial for the development of electric vehicle power electronics. $\$



"With all our indicators in the green, we are now ideally positioned to secure further growth."

Our technology partnership with Soitec, meanwhile, will harness Mersen-powered innovation to fuel the rise of the electric vehicle market. Find out more about this alliance in our feature article.

CSR commitments taking shape

Today, we are faced with a complex balancing act as we try to grow our business while at the same time reducing its environmental impact. Our CSR results over the last few years have been particularly encouraging in this respect, with a 38% reduction in our greenhouse gas emissions intensity in 2022 compared to 2018. As we take the next steps in our development, we will have to be especially diligent to maintain this trajectory.

Reducing our environmental footprint while planning to massively increase our production capacity through several site expansions may seem like a challenge. But we will benefit from the invaluable experience we have gained in controlling and mitigating the impact of our operations in recent years. Armed with this expertise, we will intensify our efforts to limit our waste, increase our recycling rates and reduce our water and energy consumption. But the health and safety of our employees will remain, as ever, our top priority.

The first of many milestones

With all our indicators in the green, we are now ideally positioned to secure further growth and reach our target of €1.7 billion in sales by 2027. We are confident in our strengths and in our ability to continue supporting the profound transformation underway in our industries. And our upcoming investments will ensure that we are able to supply our customers with the quantities they need for their growth - while living up to our decades-long reputation for quality.

Against this backdrop, we were delighted to be included in the SBF 120 index at the beginning of the year, and it makes us optimistic for the future. Being named one of Euronext Paris' top 120 stocks is undeniable confirmation of our sound financial health and strength as a business. While we plan to change dimension over the coming years, we will remain true to the business model that has brought us so much success, as we continue along our path of carefully managed growth.



PROGRESS AND THE MERSEN SPIRIT GO TOGETHER WELL. SINCE ITS ORIGINS IN FRANCE IN 1889, THE GROUP HAS FACILITATED CHANGE IN SOCIETY. WHAT'S NEW TODAY AND FOR TOMORROW CLOSE-UP ON SEMICONDUCTORS, AND PARTICULARLY SIC SEMICONDUCTORS.

Semiconductors powering societal transformation **p.6** SiC semiconductors: Mersen's unrivaled technical expertise **p.8** Interview Gregg Lowe, CEO of Wolfspeed **p.12** Soitec and Mersen, a winning team for the electric vehicle market **p.14**

4 MERSEN ENERY TO INNOVATE-#3

Semiconductors powering societal transformation

From LEDs and photovoltaic cells to electric vehicles, computers and smartphones, semiconductors are all around us. For several decades now, they have been central to some of the most cutting-edge innovation - and there's much more to come.



Now such a crucial industrial component that they have sparked tensions between the United States, China and Europe, semiconductors have long underpinned growth in many markets that our society has come to rely on. "These materials – whose electrical conductivity is somewhere between metals and insulators - were first discovered in the 19th century, "says Philippe Meunier, Senior Manager, Strategic Marketing, at

Mersen. "People quickly realized that they could control their conductivity by doping them and then use them to make new electronic devices."

them into increasingly

the consumer electronics and

and rose to prominence at the

computer markets emerged

end of the 20th century.

A future shaped by

silicon carbide (SiC)

A quarter of a century later,

role in a large number of

renewable energies and

buoyant markets, including

semiconductors play a central

By forming junctions between semiconductors and achieving greater control over the direction and intensity of the electrical current over time, it has become possible to adapt power as required, increase the performance of components, and integrate

electric vehicles. And there is complex processes. It is largely no end in sight for this deepthanks to semiconductors that seated trend.

> "The challenge today goes far beyond simply controlling and increasing production capacity," savs Meunier.

"It's also a question of improving products and optimizing the performance and energy efficiency of components so that they can support the shift to a greener society."

"With higher performance and lower power consumption, SiC is becoming the standard for power semiconductor manufacturing."

Against this backdrop, silicon - currently the dominant material in the manufacture of semiconductors is increasingly being replaced by SiC for power applications. While SiC offers a number of advantages – including higher performance, lower energy consumption and less power loss - it also requires a high level of process expertise. Other semiconductors made of gallium nitride (GaN), gallium arsenide (GaAs)

and aluminum nitride (AlN) are also emerging for certain applications such as facial recognition in smartphones and autonomous vehicles. "There's a whole universe of innovation out there on semiconductor development,' says Meunier. "Now, we're going to see players like Mersen mobilizing all of their resources to make the promise of these technologies a reality."

SEMICONDUCTORS, A RAPIDLY EXPANDING MARKET



SiC* semiconductors: Mersen's unrivaled technical expertise

SiC has become hot property as it emerges as a key enabler for several markets. The new semiconductor is now used in all direct current (DC)/alternating current (AC) conversion devices found in electric vehicles as well as in energy storage, wind and solar systems.

"The main challenge for manufacturers today is how to best harness and control SiC semiconductor properties. That's where Mersen comes in."



Guaranteed production volumes

In a threefold promise to semiconductor suppliers and manufacturers - whose production capacity hinges on the reliability of their upstream partners – Mersen commits to deliverable volumes, component quality and lead times. Mersen has planned new investments in Europe and North America to support market growth by greatly increasing its production capacity.

A local presence across the globe

Mersen has a strong presence all around the world – particularly in America and Europe, where SiC semiconductors are enjoying huge success. Leveraging its fully local teams, the Group rounds out its unique technical expertise with a seamless understanding of each region's legislative, administrative and cultural specificities and challenges.

semiconductor market €110 million in sales for the semiconductor market in 2022. including €50 million for SiC solutions.

* SiC: Silicon Carbide.

A manufacturing process requiring exceptional prowess

It takes leading-edge expertise to supply the components needed to manufacture power semiconductors. The Group's isostatic graphite and insulators ensure complete control of the reaction at 2,400 °C, which is key to producing very high quality silicon carbide.





INTERVIEW

Mersen has committed to supplying nearly USD 400 million worth of graphite and other materials over the next five years to Wolfspeed, the global leader in silicon carbide (SiC) technology. Grega Lowe. CEO of Wolfspeed, discusses the challenges addressed by this contract.



Gregg Lowe, CEO

Wolfspeed has decided to significantly increase its production capacity by 2030. What is driving your growth?

The world's relationship with energy production and consumption is being seriously challenged today. Everyone agrees that we need to move toward more sustainable electrification and a more energy-efficient future. That means more affordable electric vehicles, widespread use of renewable energies and, more broadly speaking, the transformation of industrial systems. For all of these needs, Wolfspeed has developed particularly powerful solutions, including our silicon carbide wafers and transistors, which increase energy efficiency by 5 - 15%. We need to be ready to support the global transition already underway and to respond to the increase in demand on the horizon.

In particular, you have partnered with Mersen on a long-term contract. Why did you make this choice?

We need to increase our production capacity while maintaining our level of quality. That means strengthening our supply chain and therefore using specialists who know our processes and have fully mastered the specific characteristics of silicon carbide. Mersen is one such expert – perhaps even the best – and above all we have total confidence in its teams. We have been collaborating and manufacturing SiC semiconductor substrates together for almost 20 years.

Key points of the Wolfspeed contract for Mersen

- A five-year agreement to supply graphite and other high-tech materials for SiC semiconductors.
- Sales of approximately **USD 400 million** over five years.
- An investment of USD 120 million from 2023 to 2025 to increase production capacity.
- Creation of 200 new jobs, mainly in the United States.

How will this partnership work?

We will continue with our joint R&D efforts and contribute to Mersen's investments by way of advance payments to increase its production capacity. Mersen's presence in both Europe and the United States is a plus for us. We recently opened the world's largest 200mm SiC wafer fab in Mohawk Valley, and we plan to build new production facilities in the United States and Germany. Being able to rely on a partner on both sides of the Atlantic is a great asset.

"We need specialists like Mersen to support our development"



"Mersen is one such expert - perhaps even the best and above all we have total confidence in its teams."

GREGG LOWE, CEO

A winning team for the electric vehicle market

soitec mersen

Mersen is currently developing a new family of polycrystalline silicon carbide (p-SiC®) substrates with very low electrical resistivity for Soitec.

A key challenge facing the electric vehicle market in the coming years is how to increase battery life without loss of power. To solve this particularly complex technical problem, the world's leading producer of semiconductor materials, Soitec, joined forces with Mersen to develop a market first: a specific low-resistivity substrate that improves the conversion of direct current into alternating current for electric vehicle batteries.

From experimentation to mass production

"Our first contact dates back to 2019," says Alexandre Potier, Vice President, Research & Development, in Mersen's Advanced Materials segment. "For years, Soitec had specialized in a process called Smart Cut™, which involves transferring layers onto a silicon substrate, and wanted to apply this technology to SiC." Compared with conventional silicon semiconductors, SiC models have lower power loss and heat dissipation and are lighter and



less bulky, resulting in improved vehicle range. But a special SiC doped to have a lower resistivity is needed to reach the required level of performance. Such a material previously did not exist. *"We experimented with different processes for a year, trying to lower the substrate's resistivity by*

doping the material with nitrogen," says Potier. "With the first prototypes we presented, we earned Soitec's trust and got their green light to move from the experimental phase to the industrial phase. After spending 2022 developing a stable process, this unprecedented technical partnership will take shape in 2023 with the production of the first machines to manufacture substrates specifically for Soitec's "SmartSiCTM" components. On a European scale, the alliance is reflected in the close working relationship between Mersen's teams in Gennevilliers and Soitec's teams in Bernin and Grenoble.

Europe rallies for the semiconductor market through Transform

Launched in 2021, the European Transform consortium aims to develop a European SiC semiconductor manufacturing industry to serve the electric vehicle market. Mersen is contributing its expertise in the "materials and substrates" segment headed up by Soitec.



Mersen in the United States: a long history **p.16** Brushes: Once a leader... always a leader **p.18** Innovation: second nature to Mersen **p.20**





Brushes: Once a leader...

While the humble brush has undergone few obvious changes over the years, its performance has evolved continuously to meet new needs. A key component in electric motors, it is used in many industries for applications including railway traction (locomotives, subways, trams, etc.) and lifting (forklifts, cranes, elevators, etc.), as well as conveyors, reels, fans and pumps. Charles Street, an engineer at Le Carbone, first discovered the carbon graphitization process to make synthetic graphite in 1893. The company, which would go on to become Mersen, then revolutionized carbon brush manufacturing. Later, as demand for industrial motors grew and the automotive sector expanded, the Group's know-how and successive innovations found a wider market.



We make the contact.



10.062 . 15×34×17 . Marillar

10.073 - 35×20×12 - Market 10.074 - 35×20×17 - Market







... always a leader

Today, brushes are still essential to many industrial sectors where Mersen holds leadership positions, in particular wind generators. Mersen continues to improve its products, adapting the shapes, components and sizes to new applications, while always ensuring high quality manufacturing.



Innovation: second nature to Mersen

A LA VILLE, A LA CAMPAGNE UN ÉCLAIRAGE PORTATIF PARFAIT avec la Pile MAZD

BANQUE + PARIS

CIPEL: STRENGTH IN NUMBERS

In 1948, at the end of the Second World War, Mersen (then still called Le Carbone Lorraine) joined forces with Compagnie Française Thomson-Houston (CFTH) to create Compagnie Industrielle des Piles Électriques (CIPEL). Setting out to tackle the shortage of French-made batteries and stave off rising competition from major American manufacturers, the two specialists pooled their expertise to develop industrial batteries and pocket batteries under the Mazda brand.

CIPE

MAZD

COMPAGNIE INDUSTRIELLE DES PILES ÉLECTRIQUES

ĊĬĎĔĽ

R&D POTENTIAL Mersen strongly believes that innovation and product

quality improvements make

the difference. That is why

R&D at the center of its

de Recherche et

strategy and why, in 1948,

it founded Société d'Études,

the Group has always placed

SERAP: UNLEASHING

was designed to allow researchers to forget the constraints of manufacturing and be guided by their intuition. Over the years, the laboratory's innovations have served not only Mersen's growth, but also that of other markets, as discoveries were d'Applications (SERAP). This sold to other manufacturers for their own use. autonomous research business

FIG.4.





Chosen for their experience and strategic technical know-how as well as their ability to share their knowledge with others, the Open Experts embody Mersen's new approach to innovation, working toward an organization with greater efficiency and, above all, more Group-wide

collaboration. Since 2018, this network of experts has been working in three areas ("Apply", "Do" and "Sell"), helping teams around the world to develop their skills on a daily basis.

> Open Experts meeting in Italy.





2022 WAS A STELLAR YEAR FOR MERSEN, ONE IN WHICH THE GROUP EXCEED €1 BILLION IN SALES AND SAW ITS STRATEGIC VISION AND YEARS OF OPERATING EFFORTS CROWNED WITH SUCCESS.

Mersen exceeded €1 billion in sales in 2022 and started building its future **p.24** Mersen undergoes a digital revolution with BuzIT **p.30**



MORE THAN €1 BILLION IN SALES IN 2022 THANK YOU!



Mersen began building strong and sustainable momentum in 2022, exceeding its targets, confirming its expansion in buoyant markets



- from semiconductors and solar power to electric vehicles - and, above all else, combining growth and CSR. None of this would have been possible without the dedication of all its employees and the trust of its clients. 52 sites worldwide

emplovees

R&D centers

18



A player in a **changing** world

Mersen reached a highly symbolic milestone in 2022. But the Group already has its sights set on the next stages of its development. which will see it supporting the markets and manufacturers that will shape tomorrow's world.

Thomas Farkas, Group Vice President, Strategy and M&A

"We are pursuing a strategy of bolt-on acquisitions"

"Mersen's history is lined with acquisitions that have strengthened our expertise and increased our production capacities. Each time, we seek out companies that share our values and approach to business. and whose expertise complements our own. We plan to invest around €100 million in small companies, primarily in North America, where we have large contracts to fulfill.

You could call it a common-sense approach to external growth. Our goal is not to expand unreasonably, but rather to strengthen our local industrial network so that we can better serve our clients."



Éric Guajioty, Group Vice President, Advanced Materials

"Mersen is set to address the phenomenal demand for SiC semiconductors on the horizon"

industry will have to "Widespread adoption of electric contend with a surge in demand, vehicles in the years to come is a crucial while also improving the performance of goal for its components. As manufacturers, but also for society as Mersen's solutions we rise to the have a key role to play in ramping up challenge of decarbonization. To the technology succeed, the SiC behind these components, we will semiconductor

invest US\$120 million over the next few years to increase our production capacity and serve the industry leader, Wolfspeed. This is obviously a major challenge, but it is non-negotiable if we want to keep up with the leaders."

Strategy and M&A: Estelle Legrand, Group Vice President, Human Resources: Christophe Bommier, CTO: Luc Themelin, CEO.

Two appointments to the Executive Committee

At the beginning of April 2023, Sylvie Guiganti, Group Chief Information Officer, and Delphine Jacquemont, Legal Vice President and Secretary of the Board of Directors, joined the Executive Committee, which is now composed of 10 members. These appointments reflect the increasingly important role of Information Systems and Legal Affairs in Mersen's organization.

Gilles Boisseau, Group Vice President. **Electrical Power**

"We do not hesitate to invest if it allows us to support our clients' projects"

"Mersen's growth Company), a joint is being driven by venture between buovant markets Stellantis. such as electric TotalEnergies/Saft vehicles, wind and Mercedespower and solar Benz, is an power, but equally excellent illustration of this. by major manufacturers' We plan to invest between trust in our ability €15 million and to support them €20 million to - and invest accordingly if build special new necessary. automated lines The contract we at the Saint recently signed Bonnet-de-Mure site. These with ACC (Automotive Cells facilities will be

dedicated to the manufacture of smart laminated bus bars for a new generation of longer-lasting batteries for electric vehicles. We are targeting a specific segment of the market, and we are giving ourselves the means necessary to respond to manufacturers' needs."

Estelle Legrand, Group Vice President, Human Resources

"Growing while remaining faithful to our people-centric values"

"Between now and that makes us so 2027, the Group will change dimension. Such growth is an organizational challenge, of course, but especially a human one. Because it is not just about factories and production capacity. Above all else, it means bringing on board hundreds of people with whom we wish to share the Mersen culture

proud, and helping our current teams to train and find their place in this bigger organization. We have always allowed a great degree of leeway at the local level. We are counting on this proximity so that we can continue to grow while maintaining and even strenathenina team cohesion and the Mersen spirit."



Growth

Mersen is changing dimension

There is no sign of slowing down for Mersen. On the back of wins in its buoyant markets, the Group achieved most of the targets set in its 2025 roadmap **by the end of 2022** and has now set more ambitious targets for 2027.

The increasingly rapid adoption of electric vehicles is one of the main drivers of this momentum, with Mersen active both upstream of the market through the manufacture of silicon carbide semiconductors, and downstream with battery connection and protection. By 2027, the Group is targeting sales of €1.7 billion, with almost half of this amount to be generated in renewable energy, semiconductor and electric vehicle markets. These objectives will be supported by an ambitious investment plan.



€1.7 billion: sales target for 2027

Mersen holds its course, propelled by tailwinds

Far from resting on its laurels, Mersen fully intends to capitalize on its exceptional 2022 results to consolidate the foundations of its future growth. With its close local ties, innovation prowess and increasingly ambitious CSR program, the Group is poised to make steady progress in the years to come.



International

Investments all around the world

The United States and Europe are back in action on the semiconductor front, and the photovoltaic industry shows no sign of cooling in Asia. Thanks to **operations in 34 countries across all continents**, Mersen plans to put its production capacities to full use for the benefit of local manufacturers, and is strengthening its network year after year.

In South Korea, the over

23,000-square-meter Cheonan plant, inaugurated in late 2022, will enable Mersen to design and manufacture furnace equipment and complex ion implantation parts for the production of silicon-based semiconductors. In the **United States**, the Columbia site, acquired in 2019, is beginning to ramp up its three product lines - extruded graphite first, followed by insulating felts and isostatic graphite - to serve fast-growing markets.

Europe is not being left behind, with forthcoming investments to increase insulating felt production capacities in Holytown (Scotland) and the construction of a new workshop in Amiens (France). Supported by French environmental agency ADEME, this project, called NTT, for New Thermal Treatment, will replace current equipment with induction furnaces, which consume less fossil fuel, and will significantly reduce direct greenhouse gas emissions as well as energy and raw material consumption.

RSE

A roadmap to go the extra mile

Mersen continued to make headway on its CSR objectives in 2022, achieving a sharp 38% reduction in greenhouse gas emissions, further improving its waste recycling rate to 70%, and significantly increasing the proportion of women engineers among staff. This performance was praised by rating agencies including EcoVadis and MSCI. The Group now wants to go even further in managing the social and environmental impact of its business. To this end, it has set itself a roadmap through to 2025 based on an ambitious yet practical approach that takes into account its current and projected growth.











Mersen undergoes a digital revolution with BuzIT

Mersen kicked off a program to overhaul its IT system in late 2019. The aim was to standardize practices while adapting to site specificities and securing processes and tools.

Sylvie Guiganti, Mersen's Chief Information Officer, tells us more about the project.

How did the project to completely overhaul the IT system come about?

Mersen has been changing for years now, with business transformations, acquisitions, new sites and increasingly complex processes. Some of these changes were to meet regulatory requirements, but most were to cater to market demand. They all needed to be supported by a Group-wide, easily maintained IT system. The Group has big ambitions and we felt it was necessary to build a new IT system that could keep pace with our strategy over the long term.

What guided your thinking?

We wanted to return to the idea that an IT system should help rather than hinder business performance. This meant guaranteeing a high level of service by providing our teams with an application model that they could easily make their own, harmonizing our internal processes while leaving each site the latitude to tailor it to their day-to-day. And above all, we wanted a system that was fully secure and scalable.

What solutions did you choose?

We opted for a core model structured around an ERP system, then added various robust reporting applications to facilitate consolidation, purchase-to-pay automation and product lifecycle management. The core model is a common set of Group processes programmed into a centralized tool, based on shared management rules, data models and other reference systems that can be standardized. We needed a global solution that still offered enough flexibility to interface with local tools and integrate new functionalities over time – be it in response to changes in local laws or to specific customer requests.

So BuzIT spans all processes used by the Group's various segments?

Absolutely. It covers all areas – from purchasing, finance and accounting to sales, production monitoring and more generally any interaction with customers and suppliers – and supports them via the centralized infrastructure. The Manufacturing Execution System (MES), for example, will provide all sites with highly efficient planning and production management systems. It was a very important job.

BuzIT in 3 key words

Mersen opted for a system that

and a high level of process

mitigates the risk of cyberattacks.

thanks to robust market solutions

SECURITY

security.

"BuzIT is a collaborative project between IT and the businesses to develop a new IT system that drives team performance and Mersen's growth."

That's why we decided to outsource our infrastructure, with managed service hubs in Europe and the United States, so that we could focus on the process aspect.

How is rollout progressing?

ADAPTABILITY

BuzIT is a system for today

and tomorrow. It will enable

application interoperability.

standardized tools to be rolled out

with the flexibility to address new

needs over time and the scalability

to adapt to project and customer

requirements. BuzIT also supports

We are aiming to roll the system out at more than 60 sites, including 40 priority sites by the end of 2025, taking into account each site's needs, schedule and specific project management requirements. Our teams spend an average of six months on each site to ensure a smooth transition and, above all, adapt the system to the specific local context. Thanks to BuzIT, the IT systems and teams are once again driving the Group's growth.



LOCATION Each rollout is an opportunity for Mersen's IT teams to review all local processes and enrich the core model based on team needs, depending on projects and customers.



All over the world, Mersen is successfully growing. To get your fill of innovation, technology and pioneering spirit, check out our YouTube, Facebook and LinkedIn pages. You'll be able to learn about the Group's history, see presentations of innovative solutions, hear the views of managers and see what life is like for our teams in the 34 countries where the Group has operations. Immerse yourself in our processes, read about our news, our commitments, our actions and our job offers. **Stay tuned!**



