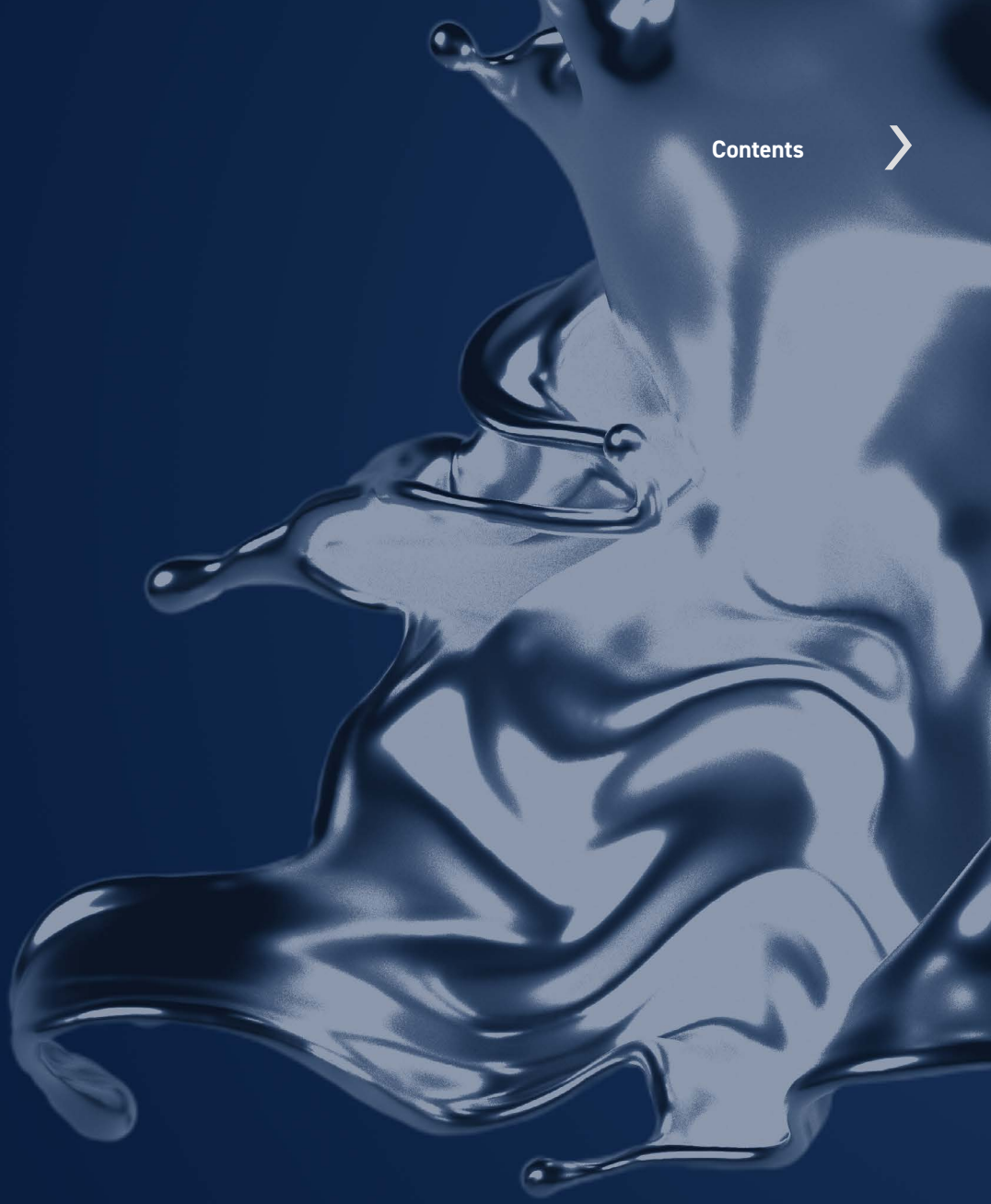
Chapter 2

TAKE CONTROL OF FUTURE VEHICLES

Contents

Take Control of Future Vehicles

Take Control of Future Vehicles is the second chapter in our eBook series.



MacDermid Alpha ELECTRONICS SOLUTIONS

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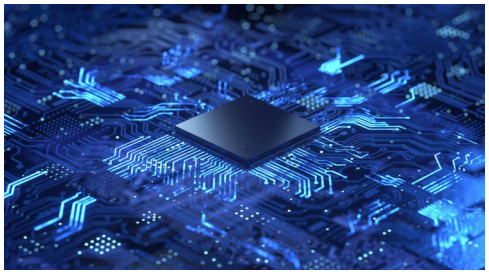
TAKE CONTROL OF FUTURE VEHICLES

Foreword

The automotive industry is standing at the edge of a precipice. The future age of mobility has brought a watershed moment for traditional supply chains. An entire sector is shifting gears. Global disruption, technological breakthroughs and rapidly changing consumer demands are forcing vehicle manufacturers to completely reimagine the way they build and sell vehicles.

The future demands revolution, not evolution – but where does this leave the traditional automotive OEM?

Introduction



The previous chapter in our eBook series looked at the importance of managing supply chain costs when it comes to selecting the right ADAS hardware materials. Of course, the other formula to consider is the reliability and efficiency of the materials. Balancing cost with quality is a delicate tightrope for any OEM or Tier 1, so how do you ensure you always make the right material choice?

A powerful combination of factors, namely rapid technological innovation and heightened concerns around the environment, is ushering in a new era for automotive. Today, the primacy of the engine is no longer a given, disrupting the balance of the entire supply chain. Amid this backdrop, established OEMs are today asking themselves "how do you exit a business that currently accounts for nearly 100% of your profits"?[1]

TAKE CONTROL OF YOUR COSTS

If you missed our first chapter 'Take Control of your Costs' you can download your copy now.

Download

[1] https://www.morganstanley.com/ideas/mary-barra-general-motors-exceptional-leaders-exceptional-ideas

TAKE CONTROL OF FUTURE VEHICLES

The combustion engine, the defining technology of the automotive industry until now, has been instrumental in the rise of the automotive OEM, providing them with an important bargaining chip. This has placed them in a position of power in setting the direction of travel for the automotive supply chain, which has had to adapt to accommodate their needs. This position of privilege has also influenced interactions with customers. Whether in terms of vehicle designs or financing models that have been a key contributor to growth within the industry, OEMs have remained firmly in control.

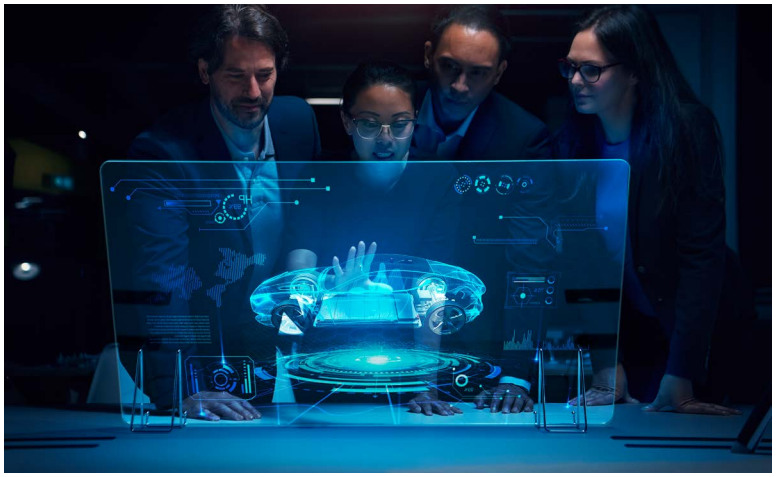
We are currently witnessing a major role reversal that could potentially have far-reaching consequences for the next stage of automotive history. Environmental concerns continue to feature more prominently in vehicle purchasing decisions. With fossil fuel-based engines expected to be phased out in the coming years due to changes in legislation, the transition towards electric vehicles is now a matter of adaptation and survival for OEMs, rather than a technology shift alone. This creates a range of exciting opportunities.

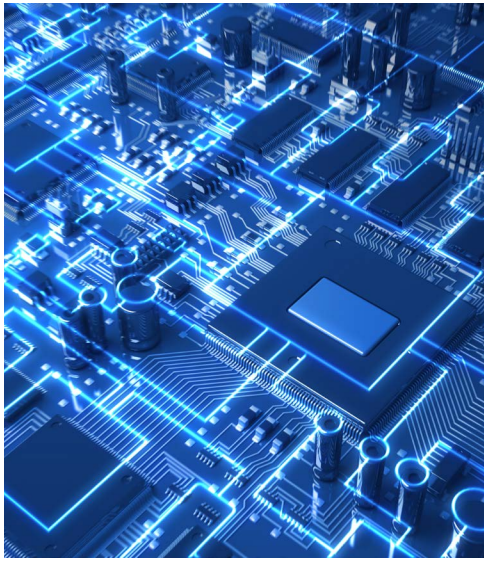
When we take stock of these developments, it is clear why the position of the OEM is changing. The very essence of vehicles is set to change, tipping the scales in favor of the supply chain, much to the joy of new entrants who are positioned to accommodate the new technological requirements of consumers an the wider market. To illustrate this point, LMC has predicted that two of the top 15 global car manufacturers this year will not feature in the top 15 list by 2028.

It is important that OEMs expand their focus to cover the new and critical areas that are emerging. Only once they have a firm grasp of this new supply chain will they be able to manage and take control of these costs.

By viewing the entire supply chain at a systems-level, it is possible to understand the intricate relationships between different materials and the cost implications of making material changes.

This opens the door to a whole series of benefits, including financial savings and reduced risk of material failure and reputational damage, thereby enhancing vehicle reliability and performance.





Brain vs heart – the changing anatomy of modern vehicles

This monumental shift away from internal combustion engines towards electronics, with all of the additional changes this will bring, is causing a major ripple effect throughout the supply chain. This will only intensify as we progress on our journey towards fully autonomous vehicles.

With the phasing out of internal combustion engines due to changing legislation, electric vehicles will soon take center stage. As carmakers approach Level 3 autonomy and beyond, such systems will take over an ever-growing portion of the vehicle's operational duties from the driver. When this scenario materializes, safety and reliability become more critical than ever before, placing a new emphasis on materials and systems which allow them to function reliably and effectively. Such materials will take on a whole new level of importance, and the increased attention they receive from OEMs will reflect this.

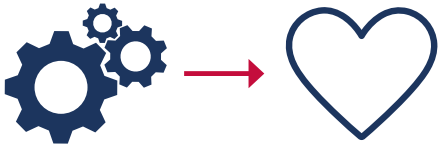
Find out about what MacDermid Alpha Electronics Solutions is doing to stay ahead of the curve and deliver materials that are ready for advanced levels of vehicle autonomy.

Find out more here

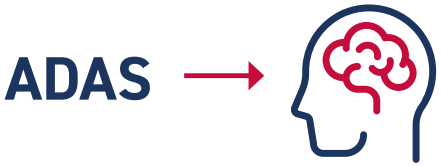
TAKE CONTROL OF FUTURE VEHICLES

To illustrate this point, let us draw on an analogy involving the head and the heart:

The engine represents the heart of a vehicle

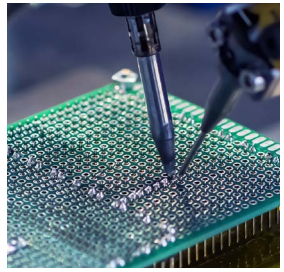


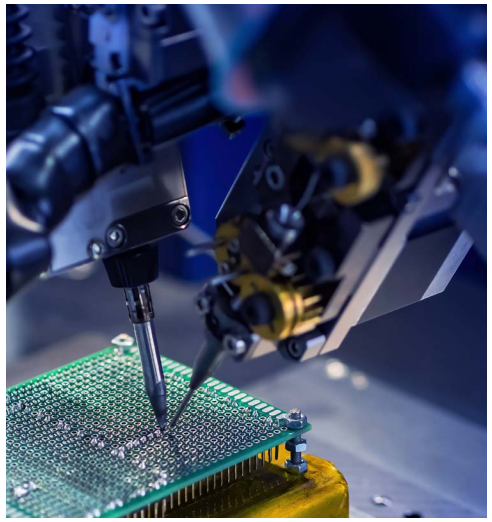
While ADAS represents the brain



What we are seeing is an unmistakable shift away from the heart in favor of the head. Vehicle electronics have historically been the brain of the vehicle, and their importance will only continue to increase as ADAS becomes more central to the performance, safety, and reliability of electric vehicles. And yet, expertise within the field of vehicle electronics and ADAS has typically sat within the supply chain, beyond the traditional scope of automotive OEMs. It is therefore clear that this is an area they can no longer afford to ignore or neglect.

An OEM's reputation and future success will depend on them acquiring a firm understanding of the workings of the brain. Decisive action is required on this point since this will have a major bearing on a manufacturer's ability to remain competitive. The automotive supply chain, meanwhile, can benefit significantly from observing how other industries integrate large quantities of electronics. Such insights can be applied as the automotive industry works to overcome space, weight, and design constraint to achieve performance goals.





Understanding the brain

In his book ‘The Power of Fifty Bits’, Bob Nease discusses how the human brain works when it comes to processing information. While it is capable of processing vast amounts of data at a given moment, only a minute proportion of this takes place within the conscious mind.

There is a clear evolutionary benefit to this; due to scarcity within our environment, the human body has adapted to become more efficient with limited resources. It does this by automating certain processes, freeing up bandwidth for problem-solving and other tasks which require higher-order thinking.

There are obvious parallels with advanced safety. Through a combination of applications including cameras, ultrasonics, radar, and lidar, advanced safety systems process enormous quantities of data in the background, while only a fraction of all this is directly channeled back to the driver via safety warnings. The processing requirements of these systems place hardware under significant strain, in the form of prolonged exposure to high operating temperatures and electrical currents. Operating conditions will almost certainly become even more challenging, and as autonomous vehicle technology continues to make strides, the brain of the car will need to work harder and smarter, processing exponentially larger quantities of data while withstanding these conditions. In this scenario, hardware material choice takes on a new degree of importance.

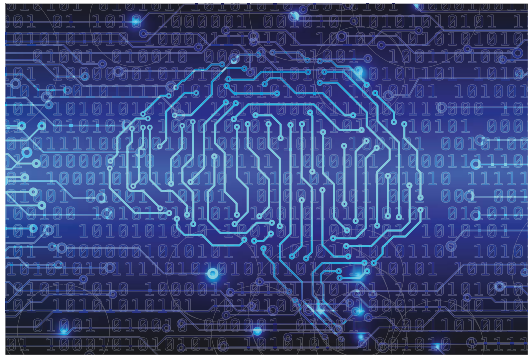
Just as a brain is made up of highly specialized areas that work together; so too are advanced safety systems. From the cortex to the brain stem, the basal ganglia to the cerebellum, there's a lot packed into a small area. The same is true of modern ADAS.

As the complexity of such systems and in-car applications increases, so too does the number of components required, which can compromise performance and efficiency, adding weight and consuming more power.

Smaller spacing between input and output joints in components has forced better designs and the miniaturization of the printed circuit board (PCB).

Ever-smaller electronics, specifically the circuits and their supporting advanced packages, are the bedrock of advanced safety systems innovation and play a decisive role in the overall safety of a vehicle and its occupants.

The joining materials used for connecting components to circuit boards used in safety systems are also critical to overall vehicle reliability and performance. They must be able to withstand the aggressive operating conditions to which they are continually subjected. The biggest issue in this regard is thermal fatigue. Alternate cycles of heating and cooling risk causing cracks and in the worst-case scenario, electrical failure. Increased processing power inevitably leads to higher temperatures and as components decrease in size, there is more pressure on joining materials than ever before.



Did you know one of the most common causes of electronic failures is solder joint fractures?

Use of a more reliable solder alloy can help save warranty costs for automotive OEMs. Click the link to watch our latest ADAS web tutorial, in which Lenora Clark explains how we achieved mass adoption at the Tier 1 level for our Innolot alloy, used to enable OEM performance specifications. She reveals more about the thermal cycle resistance of Innolot and why it is a preferred choice for many manufacturers.

Are you papering over the cracks?

Find out more about the benefits of using Innolot over conventional solder materials.

Watch video

Perhaps the most effective way to demonstrate the value of selecting the right ADAS hardware materials is with an operational hypothesis: the event of ADAS materials quite literally cracking under pressure. Let's explore the challenges associated with this.

Have you ever suffered a hairline fracture? The longer you leave a small fracture, the worse it becomes. Ignoring a hairline fracture can lead to a more serious fracture or break occurring, which can significantly prolong recovery times and, in certain cases, lead to further health complications.

Such fractures are not uncommon in advanced safety systems.

When electronic components are continuously heated and cooled, they expand and contract. This places pressure on the solder joint, which can result in a crack that alters electronic performance.

Changing the resistance of the system may render it nonfunctioning. It will also shorten the lifespan of the component.

Research has long established that as the number of thermal cycles increases, it builds strain energy within the solder. This leads to progressive mechanical fatigue/degradation of the solder joint. In particular, creep strain is one of the most important time-dependent damage accumulative factors affecting solder joints. This scenario can lead to electronic failure. As well as safety, this can affect warranties, service costs and ultimately vehicle brand reputation.

People often underestimate the degree of harshness that prevails within the operating environments of modern vehicles. The processing requirements of ADAS cause these systems to generate a significant amount of heat. Such heat is a constant part of operation, therefore, being able to withstand temperature spikes is not enough; materials must demonstrate their suitability on a consistent basis. Should these materials fail to perform as required, this would severely jeopardize the performance of the vehicle, the safety of passengers and by extension, the financial and reputational position of the automaker.

When we consider that OEMs spent nearly

$44 billion

on warranty expenses in 2020,

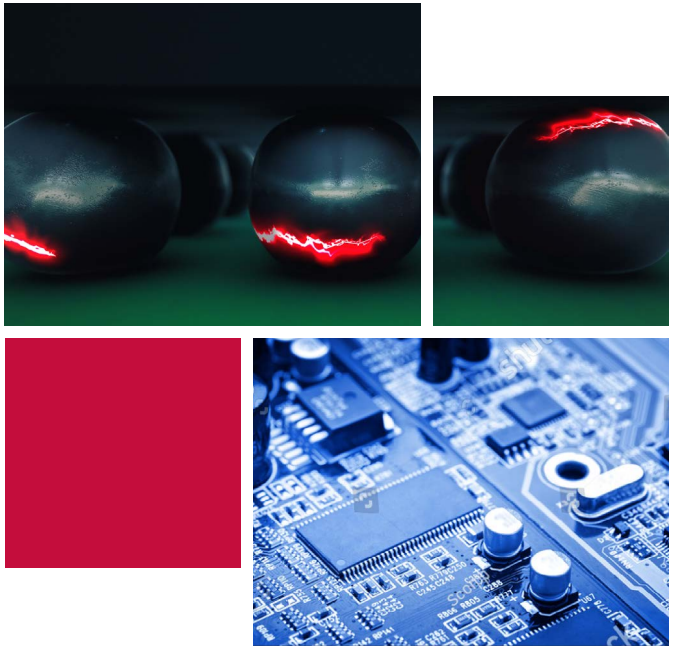
according to figures from Warranty Week, the full extent of the challenge becomes clear. As vehicles become more reliant on electronics, this figure could rise further still.

When the stakes are high, carmakers go to considerable lengths to insulate themselves from risk by satisfying stringent material reliability criteria, subjecting systems to prolonged testing, with materials expected to be able to withstand up to 3,000 thermal cycles to be considered fit for purpose.

Under such extreme conditions, traditional solder has been shown to fall short of the required level of durability, reinforcing the value of reliable alternatives such as Innolot which help reduce the risk of hardware failure. The indirect benefits of such materials in the form of reduced reputational risk and lower warranty payments must also be taken into account.

The ongoing trend of miniaturization adds yet another layer of complexity. As electronics become smaller, their tolerances become more critical, and small factors such as the space between features have an effect on the overall speed of electronic performance and ultimately occupant safety.

Smaller designs must be able to withstand high degrees of pressure, be resistant to excess heat and vibration and offer a long lifespan for the vehicle. As vehicles become more dependent on electronics and high processing packages, the performance demands placed on materials increase considerably. These very high heat-generating packages create challenging operating conditions for hardware. Thermally conductive adhesives such as Atrox can be used to pull heat from the die within these packages. In addition to extending the package's life, this is critical to continuous system function. Therefore, the overall vehicle architecture needs to be a prime consideration for OEMs and Tier 1 suppliers, as it is a continually evolving system that must be adjusted to suit different electronic configurations.



Are you in control of your brand?

A period of uncertainty awaits the wider automotive industry, one that will force a great deal of adaptation within the supply chain. Automotive OEMs will need to acquire a more detailed understanding of electronic hardware, the value it brings and why it must be treated as key to future success. This starts with a fundamental reframing of where responsibility lies for advanced safety systems, with a more hands-on approach absolutely vital for OEMs.

Our next eBook chapter will consider the impact of advanced safety on OEM brand perception.

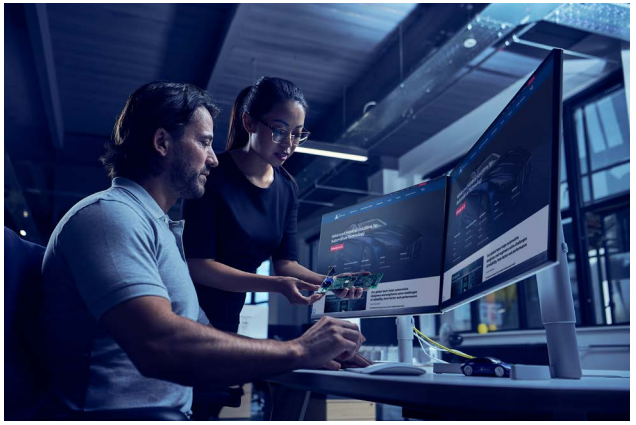
In an age of vehicle autonomy, meaningful differentiation will be harder to achieve than ever before, once again bringing the effectiveness of in-vehicle safety systems and vehicle reliability into sharp focus. These considerations will have major sway on purchasing decisions and must therefore be understood in greater detail.

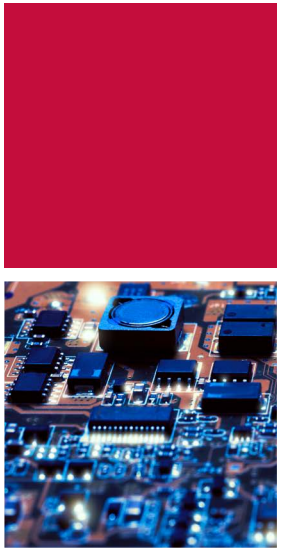
TAKE CONTROL OF FUTURE VEHICLES

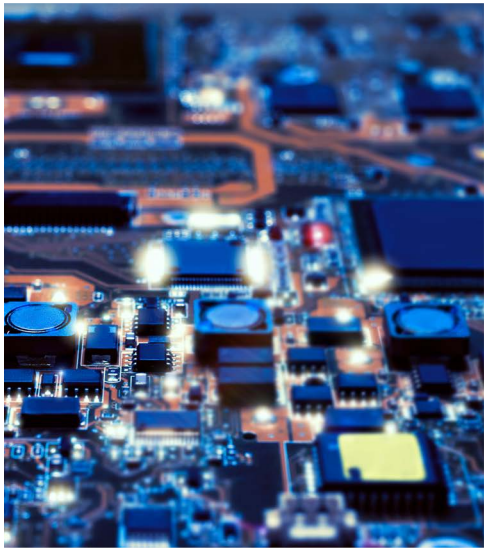
About MacDermid Alpha Electronics Solutions for Automotive

At MacDermid Alpha Electronics Solutions for Automotive, we help engineers and designers create future vehicles that are more efficient, interactive, reliable and safer for the new mobility age. We do this by fusing critical vehicle technologies with our advanced circuitry, joining materials and integrated electronics.

Harnessing the power of our family of brands, we view future vehicle designs at a systems-level. Our extensive knowledge of electronics and material technologies enables us to facilitate implementation of critical advanced safety systems, electric vehicle powertrains, and interiors which improve the user experience.







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