

HORIBA MIRA: Shaping Journeys for 70 Years

HORIBA MIRA : 70年の“歴史”と“新たなあゆみ”

Geoff DAVIS

For over 70 years, HORIBA MIRA has supported many of the world's most prominent vehicle manufacturers and suppliers, by providing them with cutting-edge design, test and development capabilities. The company has remained at the forefront of vehicle development and has broken many records throughout its rich history, by providing customers with services tailored to their exact requirements, by investing in the latest technology, and by fostering a culture of teamwork and innovation amongst its dedicated workforce. HORIBA's successful acquisition of MIRA in 2015 marked a significant milestone in the history of the company. By combining two highly respected global brands to form HORIBA MIRA Ltd. and by establishing MIRA Technology Park as a centre of excellence in developing the latest transport technologies, the company is continuing to shape journeys of the future around the world by making vehicles safer, cleaner, more efficient and rewarding to drive.

HORIBA MIRA社は、最先端の設計・試験・開発技術を提供することで、世界の主要な自動車メーカーやサプライヤーを70年以上にわたって支援してきた。HORIBA MIRA社は、顧客の要件に応じてカスタマイズしたサービスを提供し、最新の技術に投資し、チームワークと革新の文化を育んできた。それにより、自動車開発の最前線に立ち続け、その過程で数々の業績を残してきた。2015年にMIRA社(当時)がHORIBAグループに加わったことは、HORIBA MIRA社の歴史における画期的な出来事のひとつである。高く評価される二つのグローバルブランドが結び付いてHORIBA MIRA社が誕生し、最新輸送技術の開発における中核研究拠点となるMIRA Technology Parkも開設された。そして、HORIBA MIRA社は、自動車を、より安全・クリーン・効率的で、運転する価値のあるものとすることで、未来への“新たなあゆみ”をグローバルに進めている。



Introduction

HORIBA MIRA (formerly known as MIRA) was founded in 1946 and has been based at the heart of the UK's automotive industry for over 70 years. From its early beginnings as the government funded, Motor Industry Research Association, HORIBA MIRA has grown to become a global provider of pioneering engineering, research and test services to the automotive, aerospace, rail and defence sectors and a centre of excellence for vehicle development. The company works in close collaboration with vehicle manufacturers and suppliers around the world, providing comprehensive support ranging from individual product tests to turnkey engineering design, development and build programmes.

The company has seven decades of experience in developing some of the world's most iconic vehicles, with HORIBA MIRA's engineers utilising the latest test facilities and simulation tools to make vehicles and journeys safer, cleaner, more efficient and rewarding.

With a suite of 37 major test facilities, 100 km of specialised proving ground and a wealth of engineering experience, combined with an expanding international presence, HORIBA MIRA is working hard to achieve its vision – that “By 2020 every journey in the world will be positively influenced by HORIBA MIRA.” In order to realise this ambitious vision, HORIBA MIRA is developing MIRA Technology Park, the 1.75 million sq ft (162,500 sqm) site where its headquarters are located. The development is set to create over 2000 new jobs at a variety of skill levels, from apprentices to leading technical experts, and will become Europe's largest transport centric technology park and the home of European R&D centres for some of the world's most prominent vehicle manufacturers and Tier 1 suppliers.

HORIBA MIRA's proven track record and on-going ability to operate at the forefront of vehicle technology development has led it to become a globally recognised brand for vehicle development. By applying its advanced engineering, test and validation capabilities to customers' challenging programmes, HORIBA MIRA is already shaping journeys of the future.

History

The Beginning (Figure 1, 2 and 3)

HORIBA MIRA's drive towards positively influencing every journey in the world began on 1st January 1946, when the UK motor industry established its own research association known as ‘MIRA’, the Motor Industry Research Association. Formed from the Automobile Research Committee (ARC) of the Institution of Automobile Engineers, MIRA was carefully constructed to



Figure 1 34° banking under construction

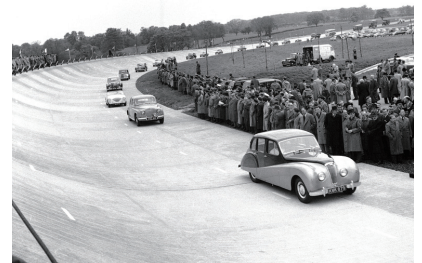


Figure 2 Opening of the High-speed Circuit



Figure 3 HORIBA MIRA's famous Belgian Pavé test facility

はじめに

HORIBA MIRA (旧 MIRA)社は1946年に設立された。英国政府が出資する自動車産業研究協会(Motor Industry Research Association)として出発し、自動車、航空宇宙、鉄道、および国防の各分野に先駆的なエンジニアリング、研究、および試験サービスを提供するグローバルプロバイダーへ、そして自動車開発の中核研究拠点へと成長した。HORIBA MIRA社は、37の主要試験施設群と100 kmの専用テストコース、そして豊富なエンジニアリングの経験を持ち、事業を国際的に展開している。

歴史とあゆみ

創業

英国の自動車産業の自前の研究団体として、MIRA (Motor Industry Research Association)が1946年1月1日に設立された。



Figure 4 The original Crash Laboratory



Figure 5 A climatic chamber



Figure 6 Crash testing on the High Energy Facility



Figure 7 An early Land Rover model being tested

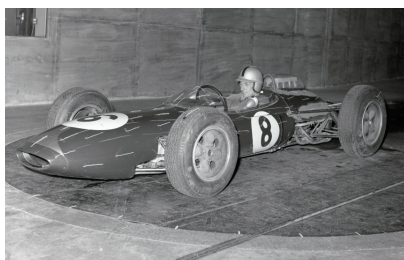


Figure 8 Aerodynamic testing of a Formula 1 car

serve the needs of the industry itself.

From its beginning, MIRA has been instrumental in making engineering knowledge and experience available to the world's vehicle and component manufacturers. As its story has unfolded the company has survived the peaks and troughs of an industry which, since its birth, has been used by various governments as an economic regulator. It has survived national and world industrial recessions, emerging fitter, stronger and more focused than ever before.

1940s & 1950s (Figure 4 and 5)

Following an evaluation of over 40 potential sites including Donington Park and Silverstone, MIRA's Proving Ground was established at RAF Lindley, a former airbase near Nuneaton in 1948. The early site consisted of more than 650 acres of land with three concrete runways, perimeter tracks, dispersal and hard standings, a control tower and one hangar.

The first major development to the Proving Ground – which would later grow to become the centrepiece of MIRA Technology Park – was a half-mile section of the famous Belgian Pavé road, which was opened for use in early 1950. The MIRA laboratory facilities were also constructed during this time on a prominent 11 acre site along the historic A5 London to Wales, Roman trunk road known as Watling Street.

By 1952 construction was underway on one of the three super-elevated bends on the High-speed Circuit. This 34° banking is still used today, and allows a neutral-steer speed of 85mph, meaning constant 100mph laps can easily be achieved.

At the end of the 1950s an extensive investigation of wind tunnel testing was carried out using the 24 foot diameter aircraft wind tunnel at RAE Farnborough. The conclusion was that the automotive industry required a purpose-built wind tunnel, and that MIRA should set about designing and building the world's first full-scale wind tunnel. It was built inside the remaining aircraft hangar on the Proving Ground and was one of the first purpose built facilities at MIRA which started a series of developments that would continue throughout the 1960s.

1960s & 1970s (Figure 6, 7 and 8)

During the 1960s, MIRA rapidly built facilities to accommodate the newly emerging engineering disciplines of the time. Developments included a crash laboratory, NVH (Noise, Vibration and Harshness) chambers and an 'Atmospheric Pollution' Emissions Laboratory that was built in 1967. In 1968

1940年代と1950年代

1948年、ナニートン近郊のリンドリー英国空軍基地の跡地にMIRA社のテストコース(Proving Ground)が設置された。後にMIRA Technology Parkの中核施設となるテストコースである。全長1/2マイルのベルジャン路が完成し、1950年の初めから使用が開始された。

1952年には、高速周回路の建設が進められた。ニュートラルステア速度85 mphが可能な傾斜角34度のバンクは、現在でも使われている。1950年代末には、ファーンボロー王立航空研究所(RAE)にて風洞試験に関する大規模な調査を実施した。その結果、テスト

コースに残されていた航空機格納庫に風洞試験専用施設が造られた。

1960年代と1970年代

1960年代には、衝突実験施設、NVH(ノイズ、振動、ハーシュネス)室などが建設された。1967年には「大気汚染」エミッション実験施設が建てられ、1968年には衝突実験施設も開設された。

同時期にHyGe衝突スレッド実験施設が設置され、衝突試験装置が改良された。これらのプロジェクトは、より広範な衝突試験能力を提供し、乗員の安全確保装置の開発に理想的な施設群となった。

the Crash Laboratory was opened by Anthony Wedgwood Benn, who, at the time, was the UK Government's Minister of Technology. This laboratory was the most advanced crash facility in the world and helped MIRA lead the way in the science of safety development engineering.

Also during this time, plans for extending MIRA's safety facilities at Nuneaton intensified which resulted in the installation of a HyGe reverse impact sled facility, and improvements to the crash test rig. These projects provided a greater range of crash test possibilities and were ideal facilities for the development of passenger restraint systems. The HyGe Laboratory was formally opened by HRH Queen Elisabeth II's cousin, Prince Michael of Kent in March 1979. Following the opening, a variety of work was undertaken, including seat testing, seatbelt evaluation, and pedestrian impact testing using both adult and child dummies. During this time, MIRA was also involved in a large cooperative project concerning the restraint of children in cars using adult seat belts, and the creation of design parameters for booster cushions.

1980s and 1990s (Figure 9, 10, 11, 12 and 13)

The 1980s saw many additions to MIRA's facilities; with the opening of the Engine Test Laboratory by HRH Prince Michael of Kent and the creation of a Straight Line Wet Grip surface on the Proving Ground, which was opened on an extremely wet day in April 1986 by Mr Peter Bottomley, MP - Parliamentary Under-Secretary at the Ministry of Transport.

In 1987 MIRA's first Semi Anechoic Electromagnetic Compatibility (EMC) chamber was also opened by Sir John Egan, Chairman and Chief Executive of Jaguar Cars.

MIRA's propensity for record breaking began in the 1980s when Richard



Figure 9 Peter Taylor breaking the lap record on the High Speed Circuit in a McLaren F1



Figure 10 Chris Boardman's Olympic winning Lotus 108 in the Full-Scale Wind Tunnel

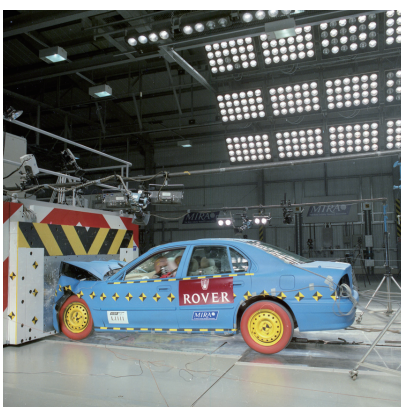


Figure 11 Crash Laboratory



Figure 12 Aerodynamic development of Thrust SSC

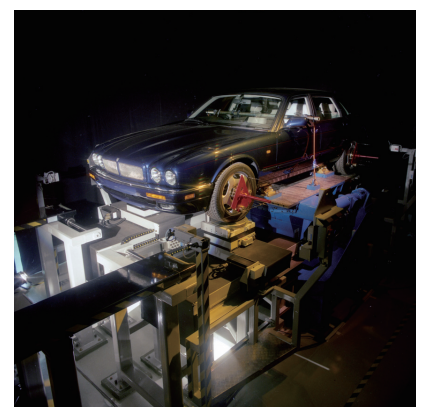


Figure 13 HORIBA MIRA's first Kinematics and Compliance Test Facility

1980年代と1990年代

1980年代には、エンジン試験施設が開設され、テストコースに直線ウェットグリップ試験路が作られた。1987年、MIRA社初の電磁両立性試験用半無響室も開設された。記録更新の挑戦は、1980年代に始まった。1985年9月、リチャード・クレーンは1時間の走行において、自転車の世界速度記録となる41.28 mphを達成した。

1996年には、欧州最先端の独立した運動学・コンプライアンス (Kinematics and Compliance : K&C) 施設を開設した。この新しい設備により、車両のサスペンションおよびステアリングシステムジオメトリーの運動学特性と、サスペンションスプリング、ア

ンチロールバー、エラストマーブッシュ、および部品変形のコンプライアンス特性を正確に実証できるようになった。

1990年代、MIRA社は、もうひとつの世界記録でも大きな役割を果たした。スラストSSCの独創的な後輪操舵システムの極秘試験と極めて重要なモデル風洞開発においてMIRA社がアドバイスしたことにより、スラストSSCのチームは、1997年10月15日に自動車ですべて初めて763.035 mph (マッハ1.007) の速度を達成し、音速を超えることができた。

速度に関する記録としては、1998年12月に、高速周回路での新たな

Crane set a new world record for human powered vehicles during one hour's running on the Proving Ground's Horizontal Straights in September 1985, achieving a speed of 41.28 mph. The existing record he broke was 37.5 mph, and the aerodynamic development of the vehicle; 'Bluebell' achieved a drag coefficient of 0.095, after being developed in MIRA's Full Scale Wind Tunnel.

The company's trend for record breaking continued into the 1990s. In preparation for the 1992 Barcelona Olympic Games, British racing cyclist Chris Boardman and Lotus Engineering took cycling to another level when they perfected the aerodynamics of both the Lotus 'super bike' and Chris's riding position. The revolutionary bike helped Chris to catch his opponent Jens Lehmann in the final of the 4km cycling pursuit and he went on to win the Olympic gold medal.

MIRA's vehicle dynamics capabilities significantly advanced in the 1990s when the company opened Europe's most advanced independent Kinematics and Compliance (K&C) Facility in 1996. This new rig enabled MIRA to accurately establish the kinematic characteristics of a vehicle's suspension and steering system geometries, and the compliance characteristics of the suspension springs, anti-roll bars, elastomeric bushes and component deformations. Knowledge of these characteristics is an essential aid for suspension engineers wishing to establish a thorough understanding of a vehicle's performance in terms of ride, impact isolation, steering and handling, and immediately became an essential engineering tool for vehicle and component manufacturers.

During this decade, MIRA also played a significant part in another world record. The company's input during secret tests on the unique rear-wheel steering system and vital model wind tunnel developments on Thrust SSC, meant the team were able to break the sound barrier with a car, achieving a speed of 763.035mph (Mach 1.007) on 15th October 1997.

Speed was also on the agenda on a cold, damp day in December 1998, when a new lap record for the High-Speed Circuit was set in a McLaren F1. It broke the record by averaging 168mph (270.36 km/h) around the circuit, and at one point reached speeds of 196.2 mph (315.75 km/h), beating the previous lap record of 161.655mph (260.15 km/h) which was achieved in a Jaguar XJ13 in April 1967.

The final major success for MIRA during the 1990s occurred in December, when the company won the top award for the best Teaching Company Scheme (TCS) programme.

な周回記録がマクラーレンF1により樹立された。この車は、平均周回速度168 mph (270.36 km/h)で記録を更新し、瞬間最高速度は196.2 mph (315.75 km/h)にも達した。それまでの周回記録は、ジャガーXJ13が1967年4月に達成した161.655 mph (260.15 km/h)であった。

MIRA社にとっての1990年代最後の大躍進は、最優秀企業教育 (Teaching Company Scheme : TCS) プログラムの最高賞の受賞である。

The 2000's (Figure 14, 15 and 16)

MIRA's ambitions for expansion were boosted at the start of the decade, when the company established a sister-site in Basildon, Essex. MIRA Quatro Park was opened on 27th June, 2000, by Dr Wilfried Janke, European Technical Director of Visteon. At the time it was built, this bespoke engineering test facility was the largest of its kind in the UK. Today it continues to offer independent validation testing on a variety of products for all engineering sectors.

In order to meet customer requirements, improvements were made to a number of facilities at the site in Nuneaton between 2003 and 2006. A second Climatic Wind Tunnel (CWTtwo) was opened in 2003, and MIRA's comprehensive Electromagnetic Compatibility (EMC) capabilities were further enhanced in 2006 with the opening of the Heavy Vehicle Semi Anechoic Chamber (HVSAC).

In 2007 MIRA won Automotive Testing Technology International magazine's 'Crash Test Company of the Year' award. This was a major achievement for the company, and signalled the culmination of decades of hard earned experience gained in the field of vehicle safety development.

Throughout 2009, MIRA was involved in numerous high-profile projects, including the SAFERIDER programme which focused on Advanced Rider Assistance Systems and On-Bike Information Systems. This innovation provided speed alert, curve warning, frontal collision warning and lane change support functionality.

A cooperative system, WATCHOVER, was also designed in 2009. This prevented accidents involving vulnerable road users in urban and extra-urban areas where clear line of sight was unavailable.

FOOTLITE was another project MIRA worked on during this decade. It highlighted the close-coupled relationship between Intelligent Transport Systems (ITS) and low carbon technology via the delivery of driver information systems that educate and encourage safer, greener driving and longer term behavioural changes.

In 2009 the company's research activities within the rail sector became centred on passenger safety, when MIRA entered into a partnership with Motorail Logistics to perform the first full-scale rail crash test in over 20 years. Later that year MIRA collaborated with fifteen partners from European rail operators and manufacturers as part of the SAFE INTERIORS research programme, which addressed the complexities arising from standing and unrestrained passengers.



Figure 14 Climatic Wind Tunnel One



Figure 15 MIRA's Quatro Park



Figure 16 Crash test dummies used in full-scale rail crash testing

2000年代

2000年代に入ると、MIRA社はエセックス州バジルドンに姉妹施設を開設した。今日まで、あらゆる技術分野のさまざまな製品に関する独立した検証試験を提供している。

2003年、2番目の環境風洞(Climatic Wind Tunnel : CWTtwo)が開設され、2006年には、大型車両半無響室(Heavy Vehicle Semi Anechoic Chamber : HVSAC)が開設された。

2007年、MIRA社は、Automotive Testing Technology International誌の「Crash Test Company of the Year」を受賞した。

2009年のSAFERIDER プログラムは、先進ライダー支援システム(Advanced Rider Assistance Systems)とバイク車載情報システム(On-Bike Information Systems)に焦点を当て、速度警告、カーブ警告、前面衝突警告、車線変更支援機能などを提供した。

2000年代にMIRA社が取り組んだFOOTLITEは、もうひとつの重要なプロジェクトである。より安全で環境に優しい運転と長期的な行動の変化をドライバーに教えて促す情報システムを提供した。



Figure 17 Dr. George Gillespie welcoming Aston Martin to MIRA Technology Park



Figure 18 HRH Prince Harry training for a South Pole expedition in one of the Climatic Wind Tunnels



Figure 19 Transport Secretary Sajid Javid visiting HORIBA MIRA



Figure 20 The masterplan of MIRA Technology Park



Figure 21 An artist's impression of MIRA Technology Park in the future



Figure 22 Vince Cable with HORIBA MIRA's Connected Vehicle

The Dr Gillespie Era / HORIBA Acquisition (Figure 17, 18 and 19)

After taking charge of MIRA in January 2009, CEO, Dr George Gillespie formed a new Executive Team to lead the company, which drew upon a wide range of experience from across the engineering industry. Their vision was to bring the company together to form a cohesive commercial enterprise that was capable of expanding into international markets, while cultivating the very essence of the company that made it so unique and endearing to both its established customer base and its talented workforce. By strengthening its core capabilities within traditional vehicle engineering disciplines and investing heavily in emerging areas such as xEV systems and functional safety, the company quickly began to realise this vision.

MIRA's ambitious plans for establishing itself as a world leader in vehicle engineering first began to emerge with the announcement of MIRA Technology Park in 2010. MIRA Technology Park's vision was to build a state-of-the-art Engineering Centre and create the most advanced, independent transport Technology Park in Europe. This ambitious project, which is still ongoing, aims to generate more than 2,000 jobs by 2020.

During 2011 and 2012, The MIRA Technology Park plans attracted a lot of praise from the Government. In separate meetings with Nick Clegg (Deputy Prime Minister at the time), and Business Secretary Vince Cable, George Gillespie explained how a state-of-the-art Engineering Centre and Technology Park would help attract international companies looking for advanced engineering expertise and facilities.

Planning approval for MIRA's 1.75 million sq ft Technology Park development was endorsed by Secretary of State Eric Pickles in March 2012, and by November 2012 the first new building on the Technology Park, MIRA's new 43,000 sq ft Control Centre was opened by the Rt Hon Dr Vince Cable, Secretary of State for Business, Innovation and Skills.

Large advances within MIRA's autonomous and connected capabilities have

2009年には、鉄道分野での研究活動の重点を乗客の安全性に置き、Motorail Logistics社と提携して20年ぶり以上となる鉄道突撃試験を実施した。

ギレスピー博士の時代／HORIBAによる買収

2009年1月より、CEOのジョージ・ギレスピー博士は、エンジニアリング産業での幅広い経験を生かす新たな経営陣を組織した。伝統的な自動車エンジニアリング分野の中核実証試験分野を強化し、xEVシステムや機能安全などの新たな分野に集中投資した。

2010年に公表されたMIRA Technology Park構想のビジョンは、

最新のエンジニアリングセンターを建設し、欧州に最先端の独立した自動車テクノロジーパークを作ることであった。今日でも進行中のこの野心的プロジェクトは、2020年までに2,000人以上の雇用創出を目指している。

2011年から2012年にかけて、MIRA Technology Parkの計画は、政府から多くの賞賛を得た。この計画は、先進的エンジニアリングの専門知識と施設を求める国際企業の誘致に貢献すると考えられた。

175万平方フィートのMIRA Technology Parkの開発計画は、

been fostered during George Gillespie's leadership. Central to this is the development of MIRA's Connected Vehicle, a highly automated car that integrates with MIRA's City Circuit – a facility which provides a safe, comprehensive and fully-controllable connected city environment dedicated to the testing, validation and demonstration of co-operative systems in an urban and sub-urban environment and allows synchronisation of intelligent infrastructure and other intelligent vehicles. This research, which is still on-going, is an enabler of enhanced test capability for the City Circuit and also the foundation for further proving ground automation.

A spin-off from the Connected Vehicle programme is the field of Cooperative Driving. While independent autonomous vehicles currently tend to be very cautious due to their situation awareness limitations, MIRA's work involving data sharing is helping to improve awareness and cooperative actions amongst connected vehicles and infrastructure that can optimise traffic flows. This activity builds on the Connected Vehicle's foundations and is seen by MIRA as an enabler of technologies for the wider deployment of future autonomous vehicles.

In September 2013 MIRA hosted another royal visitor. This time it was HRH Prince Harry and the UK team of the Walking With The Wounded Allied South Pole Challenge. During the 24 hour exercise, the team were subjected to temperatures as low as -35°C, snow blizzards, and winds of up to 200 km/h so they could prepare for the brutal environment of Antarctica. The event received international media coverage and generated a significant amount of interest in MIRA's environmental testing services.

2014 saw Bob Joyce, Jaguar Land Rover's Executive Director of Product Creation and Delivery, launch MIRA's newly expanded Kinematics and Compliance Facility featuring Europe's only independent Suspension Parameter Measurement Machine (SPMM) with moment of inertia capability.

As 2014 came to a close, Dr Gillespie was awarded an OBE in the Queen's New Year's Honours List. The award was presented to George for his services to international trade, following his continued commitment to building business overseas. On route to gaining this award, George accompanied Britain's Prime Minister, David Cameron, on a trade visit to China in December 2013, and visited Japan, India and China on several occasions during 2014 to build long-term business relationships between international markets and the UK.

The latest chapter in MIRA's history was written in 2015 when HORIBA increased its operation through the purchase of MIRA. The major investment, which was completed on 14th July 2015, saw HORIBA expand its portfolio



Figure 23 Bob Joyce and Dr. George Gillespie at the opening of the new Kinematics and Compliance Facility

2012年3月にエリック・ピクルス大臣により承認された。計画の中心は、MIRA社のCity Circuitに統合される高度に自動化されたコネクテッドビークルの開発であった。City Circuitは、インテリジェントなインフラと他のインテリジェント車両との同期を可能にする。今日も進行中のこの研究は、City Circuitの試験能力を強化するものであり、試験場のさらなる自動化の基礎となっている。

コネクテッドビークルプログラムから派生したものが、協調走行 (Cooperative Driving) の分野である。今日の個々の自動運転車両は、状況認識能力の限界から非常に慎重になる傾向がある。MIRAの協調走行に関する研究は、将来の自動運転車両のより幅広い展

開に必要な技術を実現するものである。

2013年9月、英国の南極探検チームがMIRAを訪問し、南極の厳しい環境への準備として、24時間の演習を実施し、マイナス35°Cの低温や吹雪、最大200 km/hの風に身をさらした。この模様は国際メディアでも報道され、MIRA社の環境試験サービスへの大きな関心が集まった。

2014年新たに拡張された運動学・コンプライアンス施設は、欧州で唯一の独立したサスペンションパラメータ計測装置 (Suspension Parameter Measurement Machine : SPMM) を備え、慣性モー



Figure 24 A. HORIBA and G. Gillespie



Figure 25 The Management Team at HORIBA MIRA Ltd.



Figure 26 HORIBA MIRA's Control Centre

with a move into vehicle engineering and testing consultancy. By combining two highly experienced and internationally recognised companies to form the HORIBA MIRA brand, significant gains can continue to be made towards making vehicles and journeys across the world safer, cleaner, more efficient and rewarding.

HORIBA MIRA's Current Capabilities

HORIBA MIRA has a unique combination of test facilities and complementary engineering capability, and also provides a location for organisations to locate their R&D activities.

HORIBA MIRA's headquarters, based in the UK, house 37 major test facilities and over 100kms of test tracks. Test facilities include comprehensive suites of crash and safety development facilities, climatic and aerodynamic wind tunnels, EMC test laboratories, emissions and powertrain test labs as well as a range of component and structure test facilities.

The HORIBA MIRA Proving Ground is very comprehensive and allows vehicle, component and tyre testing across a range of high and low speed, durability and low friction surfaces.

HORIBA MIRA has engineering expertise that relates to the test facilities that already exist. In addition, HORIBA MIRA engineering expertise has been traditionally focussed on vehicle systems with a long-standing tradition of using this expertise to develop vehicle attributes and DNA, typically, ride and handling, steering, braking, durability, NVH and passive safety.

Over the past 20 years, vehicles have evolved with conventional diesel and gasoline powertrain systems being replaced with hybridised and electrical architectures. In response to this HORIBA MIRA has evolved comprehensive capability in electrical powertrain architectures, battery systems and energy management, underpinned by HORIBA MIRA's core capabilities in electrical systems and EMC.

In more recent years HORIBA MIRA has taken a leading role, globally, in the areas of systems safety. As vehicles have become more complex and reliant on electrical systems or systems that are safety critical, the importance of the application of a systems engineering approach and ISO 26262 has become more important. In response to this, HORIBA MIRA has pioneered engineering consultancy capability in this area.

HORIBA MIRA has traditionally encouraged many of its valued customers to locate their R&D capability at HORIBA MIRA's traditional headquarters in

メントの計測が可能である。

2015年、MIRA社がHORIBA グループに加わったことで、その歴史に新たな章が書き加えられた。HORIBA Gr.は、車両エンジニアリングと試験のコンサルティングに乗りだし、自らのポートフォリオを拡張することになった。豊富な経験を持つ国際的に認められた2企業が結びついてHORIBA MIRAブランドを作り上げた。

HORIBA MIRA社の現在の能力

HORIBA MIRA社は、試験施設と補完的エンジニアリング能力を独自に併せ持ち、さらに各種機関に研究開発活動の拠点も提供し

ている。

HORIBA MIRA社のテストコースは極めて充実しており、車両、部品、タイヤなどを対象に、さまざまな速度での試験、耐久性試験、低ミュー路試験を行うことが可能である。また、HORIBA MIRA社は、既存の試験施設に関するエンジニアリングの専門知識を有している。

この20年、自動車は、従来のディーゼルとガソリンのパワートレインシステムをハイブリッドアーキテクチャや電動アーキテクチャに置き換えることで進化してきた。自動車がますます複雑に

the UK. These customers have benefited from easy access to test facilities and engineering capability and thus HORIBA MIRA has served as an attractive location looking to fast-track their R&D activity. Since 2010 HORIBA MIRA has built on this original principle, and has entered a period of on-going development as customised facilities are designed and built for a range of global customers looking to establish an R&D presence in Europe, and primarily the UK.

Current Areas of Research in Response to Industry

Following the arrival of the new Executive Team through 2009/10, and over the past 5 years, HORIBA MIRA has undertaken increasing levels of R&D. All R&D has been strictly focussed on developing capability and intellectual property in technical areas that have aligned with the overall strategy and business plan. Some key areas have included:

Battery pack design for vehicle applications, and development of battery management systems to ensure maximum life and performance

- HORIBA MIRA has designed and supplied bespoke battery packs for new Korean buses: a plug-in HEV and a pure EV with swappable packs. It was responsible for cell selection, hardware specification, BMS software, pack test and validation. The company worked in partnership with a Korean production supply chain and carried out cell characterisation and calibration using a unique process. The BMS was calibrated to cell characteristics and application for maximum performance of the pack and HEV system. In-house development and validation with advanced HIL and exercisers was also carried out.
- The finished pack had an integrated thermal system and platform and could be optimised for the local supply base. The pack's scalable architecture and BMS platform allowed pack development to be based off common systems and delivered in 9 months, while the BMS and pack design gave c.10% additional usable energy density compared to the industry standard.

Use of hydrogen for fuel cells application

- This is being conducted within a collaborative R&D project to develop a unique hydrogen generator using solid complex hydrides. HORIBA MIRA will develop a highly innovative continuous flow hot cell, producing 1 kW of hydrogen from a nano-structured ammonium borane composite. The project will develop a detailed understanding of the principles and material properties of the solid precursor material and

なり、電気システムや安全に関わる重要なシステムへの依存を強めているため、システムエンジニアリングアプローチとISO26262の適用がますます重要になっている。

HORIBA MIRA社は、研究開発活動を素早く進展させるための魅力的な拠点を顧客に提供している。欧州、特に英国に研究開発拠点を設けたいと考える世界中の顧客のために、カスタマイズした施設を設計・建設している。

業界に応える現在の研究分野

HORIBA MIRAの研究開発は、全体的戦略と事業計画に沿った技術分野における開発能力と知的財産に特化してきた。

バッテリーマネジメントシステム(BMS)の開発

- ・車両用バッテリーパックの設計と、最大限の寿命と性能を確保するバッテリーマネジメントシステム(BMS)の開発。

燃料電池への水素の利用

- ・固体錯体水素化物を用いた独自の水素発生装置の開発が、

thermal modelling, and simulation will be carried out to drive the design concepts. The project will also involve the development and build of a compact system incorporating thermal management, gas management, and movement of material and control electronics to generate hydrogen on-demand.

- The project is aimed at developing a patentable system for generating hydrogen from a solid fuel cartridge, and the system will mitigate the need for high barometric pressure and/or cryogenic hydrogen storage systems. The project is also aimed at drastically reducing the infrastructure and vehicle system costs.

Use of cryogenic fuels and liquid air as an alternative energy vector for fuel economy benefit

- HORIBA MIRA is actively researching technologies for the recovery of energy from liquid air through expansion, including how to integrate and control such cryogenic energy recovery systems in vehicles. A consortium of the Dearman Engine Company, HORIBA MIRA, Air Products and Loughborough University, with a grant from Innovate UK (the UK's innovation agency), have enabled the completion of the world's first demonstration of a liquid air engine in a commercial vehicle.

Cybersecurity of vehicle systems

- The growing importance of cyber security and vehicle resilience is closely aligned to the dual trends of increasing automation in vehicles and increasing growth in the use of consumer devices in vehicles. These parallel developments mean that ensuring the resilience of these systems is now a top priority for the industry, and HORIBA MIRA is taking a lead in this.

Intelligent and connected vehicles

- The automotive sector is facing various global challenges, and the requirement for safe, secure and environmentally friendly transport has never been greater. By developing automated intelligent and connected vehicles, HORIBA MIRA will make journeys of the future safer, more efficient and convenient. OEMs, infrastructure providers and suppliers require support to design, develop, validate and test these new vehicle systems and HORIBA MIRA is able to support them with this, as it has experience in developing vehicles that interact with intelligent infrastructure using its City Circuit Facility (a dedicated ITS proving ground). The company has also created Network Guided Vehicle - a highly automated demonstration platform for testing driverless

共同研究開発プロジェクトの中で実施された。

- プロジェクトは、固体燃料カートリッジから水素を発生させるための特許性のあるシステムの開発を目指している。

代替エネルギー媒体としての低温燃料と液体空気の利用による燃料経済効果

- 液体空気から膨張によってエネルギーを回収する技術を研究している。

車両システムのサイバーセキュリティ

- サイバーセキュリティと車両故障からの復帰の重要性の高まりは、車両の自動化と消費者機器の利用拡大という2つの傾向と密接に結び付いている。

インテリジェントなコネクテッドビークル

- 自動車業界は、さまざまな地球規模の課題に直面しており、安全でセキュアで環境に優しい輸送の必要性が、かつてないほど高まっている。HORIBA MIRAは、自動化されたインテリジェントなコネクテッドビークルを開発することで、自動車をより安全で効率的で便利なものにしていく。

technologies, as well as a scaled-down testing environment (co-operative robots) which allow engineers to understand vehicle interactions and test algorithms/software.

- HORIBA MIRA has also developed a vehicle-in-the-loop system with its City Circuit to demonstrate cooperative vehicles with intelligent infrastructure, and had developed the intelligence and algorithms required for safe and highly efficient cooperative operation of autonomous vehicles. HORIBA MIRA's experts predict that up to a 25% improvement in efficiency can be achieved if vehicles and infrastructure cooperate effectively.

Lightweight commercial vehicle structures

- HORIBA MIRA worked on a project with a commercial vehicle OEM where it was responsible for the design, construction and testing of the hybrid technologies of a lightweight hybrid HGV. The aim of the project was to develop a hybrid HGV that was fuel efficient, quiet, highly manoeuvrable, had low emissions and an adaptable architecture. The OEM engineering team was based at MIRA Technology Park and HORIBA MIRA designed, integrated and validated the complete drivetrain. HORIBA MIRA was also involved in the sizing and design supply of the APU, battery pack and BMS, rear axle with integrated steering, traction motor and gearbox, thermal management system and hybrid control system.
- The finished vehicle featured a 25% payload increase, 4 wheel steer, zero emissions mode (EV), and achieved a reduction in CO₂ greater than 53%. There is a patent pending on body, rear axle and APU designs and HORIBA MIRA has secured a follow-on contract for the Urban Vehicle Range project, which will create low emission and fuel efficient refuse collection vehicles in the form of a CNG vehicle and a plugin-hybrid vehicle.

Unmanned ground vehicle technology

- HORIBA MIRA has experience of successfully designing and supplying an unmanned IED detection capability that was required in response to a UK MoD Urgent Operational Requirement. The vehicle needed to be safely controlled remotely and MIRA Autonomous Control Equipment (MACE) technology enabled the vehicle to be converted to feature unmanned capability. The MACE was integrated into a Land Rover Defender as part of a 12 month engineering development and delivery programme. A team of more than fifty HORIBA MIRA team members were involved in the project, and the company provided

・HORIBA MIRA社は、インテリジェントなインフラと協調型車両を実証するためにCity Circuitを用いたビークル・イン・ザ・ループ・システムも開発した。

軽量商用車の構造

・商用車OEMとのプロジェクトに取り組み、軽量大型トラックのハイブリッド技術の設計、構築、および試験を担当した。プロジェクトの目的は、低燃費・低排出ガスで静粛性と機動性に優れ、適応構造を備えたハイブリッド大型トラックを開発することであった。

・完成した車両は、積載量25%増加、四輪操舵、ゼロエミッションモード(EV)、53%以上のCO₂削減を特徴とした。ボディ、リアアクスル、APUの設計については特許を申請中である。

無人陸上車技術

・UK MoD Urgent Operational Requirementに基づく無人IED探知能力の設計と供給の経験がある。
・システムは2011年より英国陸軍に提供され、素早く安全な

full field support including all upgrades to the customer.

- The system has been in service with the British Army since 2011 and was used extensively for rapid and safe route proving. It has also been cited in UK MoD reports as “...a game-changing capability and the best system of IED detection currently deployed within the NATO group.”

Future Strategy

HORIBA MIRA solves problems, driven by key megatrends that will shape the transport industry over the next 25 years. The company’s future strategy is based around four key themes which will guide its overall direction and growth, namely;

- Making vehicles CLEANER
- Making vehicles and journeys SAFER
- Making journeys more EFFICIENT
- Ensuring vehicles remain REWARDING to drive

These key themes underpin the company’s long term vision that “one day every journey in the world will be positively influenced by HORIBA MIRA”.

A major part of the business growth strategy will involve research and development of new capabilities and intellectual property across a range of emerging technology areas. To accelerate this development a new business unit, Strategic New Growth (SNG) has been formed to focus on this challenge. SNG will take the lead in identifying, developing and maturing the new capabilities needed to achieve growth plans. The priority strategic technology themes for SNG have already been identified, namely:

- Future energy vectors
- Intelligent and connected vehicle technology
- Vehicle resilience
- Advanced vehicle technologies including light weighting

HORIBA MIRA has already developed the seeds of new capabilities in these technology areas from recent investments in research. Its growth strategy is to scale these capabilities up by establishing the operational structure for SNG and investing in the skills and facilities needed for expansion of these four technology areas. For example, expansion of its capabilities in the area of vehicle resilience will require research into potential vehicle vulnerabilities and investment in facilities for the evaluation of real vehicles and systems in a secured quarantined environment using realistic infrastructure (e.g. cellular communications) without disrupting public services.

For the core Engineering and Testing business HORIBA MIRA ensures its

ルート検証に広く使われている。

今後の戦略

今後の戦略は、全体的な方向性と成長を導く以下の4つのテーマに基づく。

- ・車両を「よりクリーンに」する
- ・車両と移動を「より安全に」する
- ・移動を「より効率的に」する
- ・車両が運転する「価値のあるもの」であり続けるようにする

事業成長戦略の中では、新たに出現するさまざまな技術分野での新しい能力と知的財産の研究開発も重要な部分である。SNG (Strategic New Growth)の優先的な戦略的技術テーマは、以下のよう

- ・将来のエネルギー媒体
- ・インテリジェントなコネクテッドビークルテクノロジー
- ・車両の復帰性
- ・軽量化を含む先進的な車両技術

SNGの運営体制を確立し、上記の四つの技術分野の拡大に必要な技能と施設に投資する。

remaining facilities remain relevant to the current needs of the industry. Whilst this generally requires HORIBA MIRA to ensure its test facilities are kept up to date, it does also require it to enter new avenues and as demand requires.

Following the recent controversies concerning the measurement of vehicle tailpipe emissions and their reporting, the topic of Real World Emissions has become immensely topical and HORIBA MIRA has noticed a seismic shift in the emissions measurement requirements of the industry. As a result, HORIBA MIRA is developing leading test and measurement capability in this field and has begun to plan the installation of a new Advanced Emissions Test Centre at MIRA Technology Park. This new high-tech facility will see a number of teams from across the HORIBA Group coming together to deliver the project, including HOR (HORIBA Japan – Project Management), HF (HORIBA France – Climatic System), HTA (HORIBA Test Automation – Emissions Test Automation System), HE (HORIBA Europe – Chassis Dyno), HUK (HORIBA UK – Emissions Measurement & Analysis Equipment) and H-M (HORIBA MIRA – Project Management, building and integration).

This is just one example, but areas of technical development that include test facility development include vehicle connectivity, Advanced Driver Assistance Systems and Active Safety.

Amongst HORIBA MIRA core engineering teams it continue to enhance its existing capability by continuing to develop improved simulations techniques, engineering processes and technical disciplines.

With a heritage of 70 years in the automotive industry and a strong culture of innovation, HORIBA MIRA is well equipped to continue to develop and deliver core engineering and test services. Increasing vehicle automation and connectivity is creating a revolution in the automotive industry, bringing many new challenges for the industry. Wherever there are new challenges there are new opportunities for HORIBA MIRA, and with the combination of our innovation culture and our growth strategy, we are well placed to face the future.



Geoff DAVIS

Chief Strategy Officer
HORIBA MIRA Ltd.
Ph. D.

最近、自動車排出ガスの計測と報告が議論的となった。その後、実走行時の排出ガス (Real World Emissions) が大きな時事問題になり、自動車排出ガス計測要求の劇的な変化に改めて気付かされた。これを受けて、HORIBA MIRA社は、この分野をリードする試験・計測機能の開発を進めており、新しい先進排出ガス試験センターをMIRAテクノロジーパークに設置する計画にも着手した。この新しいハイテク施設では、プロジェクトを実現させるべくHORIBA Gr.全体から多くのチームが結集した。主なメンバーは、HORIBA Japan(プロジェクト管理担当)、HORIBA France(環境システム担当)、HORIBA Test Automation(排出ガス試験自動化システム担当)、HORIBA Europe(シャシダイナモメータ担当)、

HORIBA UK(排出ガス計測・分析装置担当)、HORIBA MIRA(プロジェクト管理、構築、組み込み担当)などである。

自動車産業における70年の伝統と強力なイノベーション文化を持つHORIBA MIRA社は、核心となるエンジニアリング・試験サービスの開発と供給を続けるのに十分な能力を備えている。車両の自動化と接続性の拡大は、自動車産業に革命を起こし、多くの新たな挑戦を産業界にもたらすだろう。しかし、どのような新しい挑戦であっても、HORIBA MIRA社にとっては好機であり、我々のイノベーション文化と成長戦略との融合によってその未来の新しい要求に応えていく。(抄訳 編集部)