GM stops Holden On

Survey of SAE-A members – the results are in

Holden No More: General Motors Puts the Lion to Sleep
You’re the Voice: SAE-A’s Member Survey; Your Thoughts For Our Direction
ESP: Extra Sensory Powers for Autonomous Vehicles
Technical Talk: A Study of Sliding Doors for MPVs

March 2020
Issue 23
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GOOSEBUMPS DON’T HAVE TIME TO REACT
THE ALL-NEW GR SUPRA

The All-New Toyota GR Supra is finally here. Created without compromise, the Supra boasts an exhilarating blend of power and agility. Offering the ultimate expression of driving pleasure. With accented lines and aerodynamic edges this car has been purposefully designed to connect you to your vehicle’s every move. It’s the result of our endless pursuit of engineering excellence. So, what are you waiting for?

AVAILABLE NOW. BOOK A TEST DRIVE TODAY.

OH WHAT A FEELING
SAE-A was founded in 1927 to address the need for further education for all facets surrounding Automotive Engineering, and now encompasses all mobility engineering industries in the Australasian region. The SAE-A is a non-profit organisation that works to serve the needs of its members and to promote the relevance of mobility related technologies to governments, industry and the community in general.
There is so much to talk about regarding SAE-A and our plans and challenges for this year, but before I expand on that, we must first acknowledge the impact COVID-19 is having on our world. It seems no country and no person is untouched by the impact this virus is having. Although Australia is as best placed as we can be to deal with it, it seems each day we have new developments to deal with, from stock market “adjustments” to event cancellations. Right now, no one can say for certain where this devastating phenomenon will finish but in the short-term, companies of all varieties will be affected from supply through to staffing arrangements. May I simply wish everyone all the best during this time, stay healthy and let’s hope we can all get through this as best we can.

Now, for 2020 and SAE-A, the most significant development is the survey results we received from our consultants, Kin8, whom we engaged to not only survey our members but to provide well researched recommendations that you our members saw as valuable, this we have named “The Voice of the Customer” and the SAE-A board is grateful for everyone who contributed.

The report is summarised later in this edition, but in short, we are committed to implementing the recommendations and in a timely manner, this is mandatory for us to remain viable and relevant. I will keep you informed of their progress over the next few months however, you will have already seen some initiatives including free access to FISITA Technical papers as well as an update on the Professional Engineers Act and its impact on our members. Much more is coming.

Planning is already well advanced for the 2021 APAC Conference, titled “Autonomous Vehicle Technology - harmonising the future on and off road” with more details to follow however, I suggest you save the date for the fourth quarter of 2021.

Another event of significance is the Annual General Meeting to be held on Thursday the 21 May at the Mulgrave Country Club in Mulgrave, Victoria, with the guest speaker Kristian Aquilina, Managing Director of General Motors Holden who will address the issue of the closure of that iconic brand in Australia. I have heard Kristian speak and he is an engaging speaker so I encourage anyone who is interested in our industry to come and hear him, you will learn so much about this historic issue as well as an opportunity to ask questions, this is a once in a lifetime opportunity so don’t miss it.

Wishing all our members all the best for 2020.

Adrian Feeney
Secretary, Chair and CEO
Society of Automotive Engineers – Australasia

Dear member, welcome to the first edition of VTE in 2020

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COVID-19 Update

SAE-A’s Member’s Voice of the Customer initiatives, particularly our increasing online accessibility options, have proved timely in addressing the impact of COVID-19.

With the pandemic evolving constantly, we aim to make all member services available within the growing constraints of social distancing and self-isolation.

An immediate focus is Formula SAE-A, as the tertiary education sector has been heavily impacted, and this is likely to limit the hands-on development of this year’s cars. We are already working with the universities to find the best way around this.

Similarly, we are adapting all our events to the reality that face-to-face interactions will become less prevalent as this medical crisis evolves.

At a time when co-location is becoming ever less of an option, we are continuing to ramp up the online options for many member services and staff activities.

We can advise of some decisions effective immediately. These include office staff working from home until further notice therefore, members are asked to not attend the office at the VACC House in person during this time.

Furthermore, board meetings will continue to be held but with the option of attending via online conferencing.

In this rapidly evolving situation, much will depend on personal responsibility. SAE-A will be guided by the Australian Department of Health and we encourage all members to do likewise.

We will continue to work with members in every way we can to help our entire automotive engineering community mitigate the pandemic’s impact on you and your work.

You will see listed on the pages of this magazine a number of events which were planned but given the changes that occur almost daily to our everyday routine some or all may be changed or cancelled. We will be communicating these changes to you, generally via email or in another electronic form as this is the quickest communication avenue available.

We urge you to please read all our correspondence in a timely manner to ensure that you are up to speed with any alterations to our events and activities.

For those who are not ‘tech savvy’ this may be a good time to become familiar with and to set-up alternative forms of computer/remote conferencing as this will no doubt assist your interactions not only with the SAE-A but also others during this difficult time.

While we are not working from our office in St Kilda Road we will be available on our mobile phones to answer any questions, or via email. Our contact details are listed on page 4 of this magazine.

Adrian Feeney
Chairman & CEO

GM-H Managing Director listed to speak at SAE-A Annual General Meeting

The 73rd Annual General Meeting of the Society of Automotive Engineers – Australasia is due to be held on Thursday 21 May 2020 followed by an Industry networking dinner.

It’s been a busy year, as SAE-A embarks on its journey within a rapidly changing industry, and with a reinvigorated board.

Nothing has demonstrated this rapid change more than the closing of GM-H and with this in mind the guest speaker for the event will be the current Managing Director of GM-H, Kristian Aquilina.

Mr Aquilina has been with GM-H for 22 years having started in the corporate affairs department, he was recently appointed interim chairman and managing director succeeding Dave Buttner.

Mr Aquilina was managing director of Holden New Zealand from 2015 to mid-2018 before returning to Australia to lead the carmaker’s marketing efforts locally. Following that appointment, he was promoted to the role of executive director of sales, marketing and aftersales.

Mr Aquilina is an excellent speaker with a deep knowledge of the company and its future plans. He will be taking questions and it will be an excellent opportunity for SAE-A members to gain an insight not generally accessible. Other discussions at the AGM will centre on the outcomes of 2019 and the 2020 activity to date, as well what is planned for the year ahead and beyond.

Formalities will be followed by an evening of networking and a three-course dinner with drinks included.

At this stage it is unknown whether the current restrictions on face-to-face meetings and crowd sizes will be relaxed by May. With this in mind please keep an eye out for correspondence from the SAE-A on whether this event will be held, and format that may take.

Also, keep up to date by regularly checking the SAE-A website www.sae-a.com.au

Standards Australia –

AS 3564.1-1998


This standard establishes a nomenclature for the repair and servicing of automatic transmissions in the automotive repair industry and aims at eliminating confusion in relation to terminology describing repairs to automotive automatic transmissions.

The revised standard was completed to a draft stage and was available for public comment, this process closed on 7 February 2020.

Currently all submissions are being considered and actioned as appropriate.

When the Standard has been revised and completed the SAE-A will advise members.

Classic Car winner tix

Under SAE staff member supervision and photographed as evidence of the ballot, the winner of the Phillip Island Classic Festival of Motorsport 2020 ticket giveaway was David Elliott. Mr Elliott has been a member since March 1994.

Due to the COVID-19 (Coronavirus) pandemic some events listed in our magazine may be cancelled or changed. The SAE-A will advise of those changes via email please ensure that you review your emails in a timely fashion to so that you remain up to date.
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5-day Introduction to Crash Investigation & Reconstruction

A course for anyone involved in motor vehicle collisions at the investigation, damage assessment, or litigation levels in Technical Crash Investigation and Collision Reconstruction.

It is assumed that the participants are familiar with basic maths and the use of a scientific calculator, and have some interest or experience investigating, assessing or litigating motor vehicle collisions.

Participants will learn how to effectively and efficiently examine, record and interpret the results of a collision and provide an opinion as to speed, direction of travel, vehicle and person movements and probable contributions of the human, vehicle and environment factors associated with the collision.

**DAY ONE: 9am – 5pm**
- Introduction to Collision Reconstruction
- Inspection of Scene
- Vehicle Condition & Inspection; Thrust Diagrams
- Lights & Glass
- Debris, Tyre Marks & Gouges
- Friction & Friction Measuring Devices
- Resulant Drag Factor – Effective Factor

**DAY TWO: 9am – 5pm**
- Measurements & Diagrams, Geodimeter Total
- Survey Station
- Photographs
- Speed from Skid, Yaw, Flips & Vaults
- Trucks, Articulated Vehicles, Tachographs & Trip Computers

**DAY THREE: 9am – 5pm**
- Pedestrian Collision Reconstruction – Vehicle
- Motorbike & Motorcycle Reconstruction
- Engine & Engine Parts
- Speed Estimate Formulae
- Motorcycle Reconstruction
- Dynamics, Time, Distance, Acceleration

**DAY FOUR: 9am – 5pm**
- Energy, Damage, Vehicle Stiffness
- Conservation of Momentum, Rear End, Head On, Intersection Collisions, Examination Review

**DAY FIVE: 9am – 3pm**
- Resultant Drag Factor – Effective Factor
- Friction & Friction Measuring Devices In-Service Inspection, Biomedical Engineering, Risk Engineering and Structural Engineering
- Conservation of Momentum, Rear
- Dynamics, Time, Distance, Acceleration
- Motorcycle Reconstruction
- Speed Estimate Formulae
- Pedestrian Collision Reconstruction – Vehicle
- Motorbike & Motorcycle Reconstruction
- Engine & Engine Parts

APAC comes to Australia next year

The SAE-A has been chosen to host the 2021 Asia Pacific Automotive Engineering Congress (APAC 21), the 21st event which exists to advance the development of automotive engineering and the automobile industry internationally.

Held every two years, APAC provides excellent opportunities for automotive experts to present the latest product and development innovations and to exchange information in the field of mobility, connected cars and automotive technology as a global challenge for industry, users and society.

The inaugural APAC was held in Honolulu, Hawaii in 1981 as the International Pacific Conference on Automotive Engineering. It was initiated by four countries; the US, Indonesia, Australia and Japan. South Korea and China joined the following year, Thailand, Vietnam and Sri Lanka in the 1990s, India in 2004, and Iran in 2005, with a total of 11 countries now represented.

The name was changed to the Asia Pacific Automotive Engineering Congress in 2007.

The Conference has been initially themed “Autonomous Vehicle Technology - harmonising the future on and off-road”.

The Technical Committee for APAC 21 will:
- Target well known national and international speakers
- Determine a timetable for the call for papers, review, select and notify speakers
- Structure technical presentations – preliminary and break-out sessions
- Provide peer review of technical papers.

Due to the COVID-19 (Coronavirus) pandemic some events listed in our magazine may be cancelled or changed. The SAE-A will advise of those changes via email please ensure that you review your emails in a timely fashion to so that you remain up to date.
**Auto briefs**

**Jaguar Land Rover** is developing a pioneering shape-shifting system designed to improve customer wellbeing by tackling the health risks of sitting down for too long. The ‘morphable’ seat, being trialled by Jaguar Land Rover’s Body Interiors Research division, uses a series of actuators in the seat foam to create constant micro-adjustments that make your brain think you’re walking, and could be individually tailored to each driver and passenger. More than a quarter of people worldwide – 1.4 billion – are living increasingly sedentary lifestyles, which can shorten muscles in the legs, hips and gluteals causing back pain. The weakened muscles also mean you are more likely to injure yourself from falls or strains. By simulating the rhythm of walking, a movement known as pelvic oscillation, the technology can help mitigate against the health risks of sitting down for too long on extended journeys.

**InfiniGen** has been awarded a contract to supply Tesla fast-charging supercharger stations with energy as the company’s Lake Bonney Wind Farm and Battery nears full commercial operation, according to the South Australian Minister for Energy and Mining Dan van Holst Pellekaan. Located adjacent to the 278.5 MW Lake Bonney Wind Farm, InfiniGen’s 25 megawatt/52 megawatt hour lithium-ion battery system is a $38 million development, partly funded by the South Australian Government.

**The Consumer Electronics Show (CES)** held in the US is fast becoming today’s motor show with car makers and tech companies clambering for attention. Audi displayed its empathetic car which they say knows its user and their habits and uses intelligent functions and artificial intelligence to look after them. The BMW Group summed up its offering with the hashtag ChangeYourPerception. One of the highlights was the BMW Interaction EASE at the BMW Group stand, which was a concept car that had been given an abstract exterior to focus purely on the interior. Not only is the cabin meant to give the highlights was the BMW i Interaction EASE at the BMW Group stand, which was a concept car that had been given an abstract exterior to focus purely on the interior. Not only is the cabin meant to give the potential of intuitive, almost human-like interaction between passenger and vehicle.

**Plastic Fantastics awarded**

The Society of Plastics Engineers (SPE) annual Automotive Innovation Awards Competition is considered the “Oscars” for those developing polymer and composites-intensive components, systems and vehicles.

The nine categories, plus the Grand Award winner, were selected by a judging panel of industry experts. SAE International participated in the finalist judging.

A Vehicle Engineering Team Award (VETA) honoured the General Motors team that developed the composites-intensive 2020 Corvette Stingray.

The VETA award recognizes the technical achievements of entire teams comprised of automotive designers and engineers, tier integrators, materials suppliers, toolmakers, and others whose work in research, design, engineering, and/or manufacturing has led to significant integration of polymeric materials on a notable vehicle.

**BODY EXTERIOR** (also Grand Award winner) 2020 GMC Sierra LD FST – Composite Pickup bed Tier Supplier & Processor: Continental Structural Plastics

This is the industry’s first pickup bed in thermoplastic composite and carbon composite. It saved 28 kg, provided best-in-class impact resistance/durability, the unpainted UV-stable material eliminated the need for a bedliner saving another 18 kg. The box is fully recyclable.

**BODY INTERIOR** 2020 Ford Explorer & Lincoln Aviator and Corsair Integrated Button Carrier Modular Strategy Tier Supplier & Processor: Methode Electronics

To reduce overhead console complexity, a new design was developed that integrated mechanical, lighting, electrical and safety functions into a single modular button carrier, injection moulded from MIC PC/ABS. To date, two patents have been filed, one has been granted.

**ADDITIVE MANUFACTURING** 2020 Ford Explorer Sunglass Bin Tier Supplier & Processor: Methode Electronics

Additive manufacturing was used to produce a single tooling insert (lifter) that replaced two conventionally machined lifters for the sunglass stowage bin.

**CHASSIS/HARDWARE** 2020 Jeep Cherokee Rear Differential Front Bracket Tier Supplier & Processor: Boge Rubber & Plastics

A critical diecast and machined aluminium bracket was replaced by an injection-moulded bracket in 50% GR-PA 6/6 in this demanding rear differential module. The composite material was 30% lighter and saved US$1.00/ car direct costs provided 10x higher damping, improving NVH performance, and it fitted the current packaging space.

**PROCESS/ASSEMBLY/ENABLING TECHNOLOGIES** 2020 Corvette Stingray Rear Bumper Tier Supplier & Processor: Shape Corp.

The auto industry’s first pultruded curved bumper beam uses the unique radius-pultrusion process and equipment to achieve a hollow beam with central web in carbon fibre fabric-reinforced polyurethane/acylate resin. The beam meets low-speed crash requirements while cutting mass by 2.2 kg.

**MATERIALS** 2017 Hyundai Elantra Glass Wool Reinforced Composites for Improved Scratch Resistance Tier Supplier & Processor: Seyon E-Wha

To improve both long-term scratch resistance and dimensional stability in injection-moulded PP interior trim panels, glass wool (crushed glass + sand) was developed to reduce tack, whiskers, and fiberglass. A unique process was developed to incorporate glass wool into the resin compound.

**ENVIRONMENTAL** 2019 Ford Mustang 100% PCR Carbon Canister Housing Tier Supplier/Processor: Delphi Technologies PLC / MGS Mfg Group

The PP packing from PCR carpeting is given another use life by being recycled back into the injection-moulded carbon canister housing for passenger cars. It is being rolled out on more than 20 Ford programs globally.

**POWERTRAIN** 2017 Ford F-150 Transmission Gear Shroud Tier Supplier/Processor: Stackpole Int’l / MacLean-Fogg Co, Engineered Plastics Components

A new transmission gear shroud cover and base protect the drivetrain so it rotates freely without needing to push through transmission fluid, lowering effort, improving pump efficiency, and increasing vehicle mpg and the effective life of the transmission fluid. Very aggressive snap fits permanently join cover to base once the assembly is completed.

**AFTERMARKET & LIMITED-EDITION/SPECIALTY VEHICLES** 2020 Jaguar Land Rover Project 8 supercar Tier Supplier/Processor: HP / Jaguar Land Rover

Additive manufacturing proved the most efficient and cost-effective method for producing 19 parts on this high-performance sedan whose total build volume will be limited to 300 cars.
Early report shows transition from car manufacturing is okay

The Coalition Government’s support for car workers and local businesses impacted by industry transition has been backed by a new report titled Australian Automotive Industry – Transition following the end of Australian motor vehicle production. However, this report was released prior to Holden’s shutdown announced in February.

The report found that about 75 percent of former supply chain companies remain in business following the closure of the Ford, Holden and Toyota car manufacturing plants.

“This report shows locally owned businesses achieved the best results by drawing on existing skills to diversify and take advantage of new markets,” Minister Andrews said.

“Supply chain businesses have transitioned effectively by moving into new sectors such as truck and bus manufacturing, as well as agriculture and medical technologies.

“For future growth, electric vehicle markets offer significant opportunities for businesses to participate further in global supply chains.

“Our manufacturers also have strengths in emerging areas of lightweight components, battery recharging and cooling, and autonomous vehicle technologies.”

Hyundai and Kia work for a Canoo platform

Hyundai Motor Group announced that it has engaged Canoo to jointly develop an electric vehicle (EV) platform based on Canoo’s proprietary skateboard design for upcoming Hyundai and Kia models.

Canoo will provide engineering services to help develop a fully scalable, all-electric platform to meet Hyundai and Kia specifications. Hyundai expects the platform to facilitate its commitment to delivering cost-competitive electric vehicles.

Canoo is a Los Angeles based company creating EVs for subscription only, and offers a skateboard platform which houses the most critical components of the vehicle with a strong emphasis on functional integration, meaning all components fulfill as many functions as possible.

This reduces the skateboard size, weight and total number of parts, which ultimately provides more interior cabin space and a more cost-effective EV offering. In addition, the Canoo skateboard is a self-contained unit that can be paired with any cabin design.

Hyundai Motor Group expects an adaptable all-electric platform using Canoo’s scalable skateboard architecture to allow for a simplified and standardized development process for Hyundai and Kia electrified vehicles, which is expected to help reduce cost that can be passed along to consumers.

Hyundai Motor Group also expects to reduce complexity of its EV assembly line, allowing for rapid response to changing market demands and customer preferences.

Hyundai and Kia both recently announced plans to develop fully electric PBVs. Hyundai presented its first PBV concept as a key pillar of its smart mobility solution strategy at CES 2020 in January. At its CEO Investor Day on January 14, Kia announced its plan to develop PBVs tailored for shared service companies and logistics companies.

Canoo’s proprietary skateboard architecture directly houses the batteries and electric drivetrain. Canoo reached Beta testing phase within 19 months, and the company recently opened the waitlist for its first vehicle.

Canoo’s first vehicle will launch in 2021.

Carbon Revolution on track with wheel manufacturing

Geelong based advanced manufacturer Carbon Revolution has announced that it is doing well since taking its first steps as a public company and it is on track to meet the forecasts it made when it raised $90m by listing on the ASX.

The company has been in a strong growth phase and expects to move into operating profit during the last quarter of the year and the company expects to reach production capacity of 32,000 wheels by mid 2020.

The production facility is an innovative manufacturer and designer of lightweight carbon fibre wheels and has been supplying Ferrari, Ford and Renault among other car companies. It is also making headway into the aviation sector starting with the development and production of lightweight wheels for Boeing’s Chinook helicopter. This follows a grant of $2.4m from the Federal Government.

“We are on track to deliver what we said we would do in FY20, and credit for this rests with our hard-working and dedicated team who together ensure we are constantly innovating and improving,” Carbon Revolution CEO Jake Dingle, said.

“We are on a strong trajectory for both production and sales, and our focus remains on delivering an exceptional product to meet our growing order pipeline.”

Mr Dingle said Carbon Revolution was commissioning additional manufacturing equipment in the second half of the year “Carbon Revolution seeks to innovate across three distinct layers,” Mr Dingle said.

“First, the product, and there is no doubt we have led the way in the design and production of single-piece carbon fibre wheels. Second, our unique manufacturing plant and processes, which we look to continually improve and industrialise.

“Our third and equally critical layer of innovation relates to how we do things differently and better when it comes to building our team. Our culture, the way we work together and our collaborative and inclusive approach are as unique as our technology.”
Adelaide Metro’s first delivery of Scania buses

The first of 340 new Adelaide Metro buses commissioned by the Marshall Government has rolled off the production line, supporting almost 100 local jobs.

The new buses are more fuel efficient and have lower exhaust emissions and will begin providing a better, cleaner and more comfortable bus service to passengers in February 2020.

Last year Scania Australia was awarded the contract to supply the buses over the next 10 years, with a minimum of 29 of the 34 buses each year to be constructed in South Australia by Precision Buses.

“The Marshall Government is continuing to build a better public transport network to provide better services and support local jobs,” said Minister for Transport, Infrastructure and Local Government Stephan Knoll.

According to Mr Knoll we are building a better public transport network to turnaround the fall in public transport patronage under the former government.

“We are building almost $1 billion of new public transport infrastructure, including electrifying the Gawler rail line, extending the Tonsley rail line and building more Park n Rides along the O-Bahn,” Mr Knoll said.

“We are also improving bus services and these approximately 340 buses over the next 10 years will provide passengers with a better, cleaner and more comfortable service.

“Importantly, the vast majority of these new buses will be manufactured right here in South Australia and create local jobs.

“These 340 new, clean Euro 6 buses will replace older buses and help reduce exhaust emissions making them cleaner and more environmentally friendly.

“By providing a cleaner and more comfortable service we are encouraging more people to leave the car at home and catch public transport.”

Precision Buses are also creating an Apprenticeship Academy and around 40 new jobs as a result of this bus supply contract.

Over the last six years, an average of 27 buses per year have been delivered. Under the new contract, an average of 34 buses per year are expected to be delivered.

More electric trials for electric Canter

**Fuso is working with the German municipality of Stuttgart and logistics company Hermes running five electric Canter E-Cell trucks in a 12-month trial.**

Two have been fitted with hydraulic tipper bodies and will be used for road construction and landscaping, while the other two run box bodies and will be used for waste bin transport and furniture delivery. Hermes will also carry out parcel delivery with one E-Cell test truck in Stuttgart.

Fuso already sells an advanced diesel-electric Canter Eco-Hybrid model in Australia, while also focussing on developing a fully electric E-Cell model. The eCanter was first on display at the Brisbane Truck Show last year and then stayed around to be fleet tested.

The powertrain has been removed and where the diesel engine usually sits is a cooling system and the components which control the power and distribute the electricity, plus two batteries.

Behind this, where the gearbox normally lives is an electric motor and a direct drive transmission. There are another four batteries on the side of the chassis, where you would normally find the fuel tanks.

This is a very simple driveline, electrical power from the batteries spins the electric motor and that power is transmitted to the rear wheels via the driveshaft. No gears.

Fuso gathered initial experience with fully electric Canters in Portugal in 2015. The Canter E-Cell proved a success in this fleet test involving eight vehicles. It was used not only by courier and freight-forwarding companies, but also by local authorities and urban horticultural businesses. The batteries took around seven hours to charge at a 230 volt/32 ampere power point, while the time dropped to just one hour when using a fast-charging system (390 V/100 A).

The results of this one-year practical trial show that the vehicles stood the test of daily use in short-distance delivery and urban transport.

With a range of over 100 kilometres, the Canter E-Cell vehicles exceeded the average distance that many trucks used in light-duty short-radius distribution cover each day. Based on the current cost of diesel and electricity in Portugal, the trial also produced savings in operating costs of up to 64 percent compared with a conventional diesel truck.

Renault electric trucks on the road in Switzerland

Renault Trucks has signed an agreement with the Carlsberg Group to deliver 20 electric trucks. These 100 percent electric 26-tonne trucks, which will be delivered in 2020, will be operated by the Feldschlösschen brewery, the Group’s Swiss subsidiary.

Renault Trucks believes that urban transport needs to move towards electric mobility quickly to improve quality of life in city centres and tackle global CO2 emissions.

Bruno Blin, president of Renault Trucks said: “It is the first order of this scale in Europe. It proves to our customers that the transport sector is undergoing a major transformation and reflects an industrial and commercial reality: our Renault Trucks, electric trucks, are rolling off the assembly line and will be on the roads of Europe.”

These Renault Trucks D Wide Z.E. 26t will make daily delivery rounds of between 100 and 200km to supply Feldschlösschen Swiss clients from the brewer’s 15 logistical sites in Switzerland.
Kenworth and Deakin Uni partner on hydrogen transition centre

A new Deakin University research centre in Warrnambool could make clean, quiet trucking a reality and position Warrnambool and the broader South-West region to tap into the world’s growing, multi-billion dollar hydrogen market.

Deakin Vice-Chancellor Professor Iain Martin said the new Hydrogen Transition Centre will be set-up at the Warrnambool campus, creating professional work for up to 12 locals, as the first step in establishing a $20 million HyceL@Warrnambool research and industry testing site.

“The centre will partner with industry to apply Deakin University’s world-leading capabilities to solve one of our toughest transport issues: how to fuel the world’s trucking industries in a low carbon future,” Professor Martin said.

“Freight trucking continues to grow here and overseas, and trucks are driving further, with heavier loads, all big challenges. The centre confirms Deakin’s commitment to the Warrnambool campus and the broader region, and when the HyceL@Warrnambool project is fully established it will create up to 200 full-time jobs.”

An Australian first, the Hydrogen Transition Centre is funded by $2 million in Federal Government research funding, announced at Deakin’s Warrnambool campus by the Minister for Education, The Hon Dan Tehan MP.

“The Federal Government investment will see our researchers partner with Australia’s leading truck manufacturer, Kenworth, as well as with industry leaders in hydrogen fuel-cells, electric vehicles and gas distribution,” Professor Martin said.

Hydrogen fuel-cells create electricity from hydrogen and oxygen producing only heat and water as a by-product.

The centre will test how fuel-cells can work together with electric vehicle technologies. It will mean an electric truck can create power while driving, avoiding the need for frequent stops and battery charging infrastructure.

“If successful, the enhanced technologies could be used by Kenworth trucks made here in Australia, as well as those made internationally by Kenworth’s parent company PACCAR.

“The technologies can also be applied to other heavy vehicles, such as buses, including those operated by Warrnambool Bus Lines,” Professor Martin said.

Building Warrnambool’s status as an emerging renewable energy hot spot and supporting the Warrnambool City Council’s ambitions of achieving carbon neutral status by 2040, a hydrogen future could burn bright for the city and the region.

The Hydrogen Transition Centre will put Victoria’s South-West at the heart of Australia’s work in hydrogen fuel-cell innovation and position the region to cash-in as new markets for hydrogen technologies emerge in the international push for cleaner transport. In less than 10 years, the global fuel-cell market is predicted to be worth more than US$49 billion.

In addition to truck tech, the centre will also test hydrogen safety and distribution, including how natural gas pipes can safely transport hydrogen in the future.

Long-term, the centre will also support the region to become a producer of so-called “green” hydrogen, an exportable commodity, made by using renewable electricity to split hydrogen and oxygen from water to create a new mode of energy storage.

Volvo puts its electric trucks on the road in the US

Volvo Trucks offered a first look at its North American Class 8 battery-electric project trucks. In Europe, Volvo Trucks recently started sales of electric trucks for urban transports and demonstrated electric concept trucks for construction operations and regional distribution.

By utilizing existing electromobility technology within the Volvo Group, Volvo Trucks in North America has been able to integrate those technologies into the existing North American VNR model.

The pilot demonstration was part of the Volvo Low Impact Green Heavy Transport Solutions (LIGHTS) project, a collaboration between 15 public and private partners to demonstrate the viability of all-electric freight hauling in high-density traffic and urban areas.

The Volvo VNR Electric project trucks will be put into real-world commercial operations with two of California’s leading freight companies; Dependable Supply Chain Services and NFI.

Volvo Trucks in North America will begin the first phase of serial production and commercial offering of the Volvo VNR Electric in late 2020.

www.saeia.com.au
Hyundai has very quietly brought to Australia its new Xcient prime mover and the small batch of trucks is traversing the country visiting Hyundai dealers. The company has been selling smaller trucks in Australia for around 10 years.

The Xcient is a real cabover prime mover in a European style with a 520hp engine mated with a ZF ASTronic automated manual transmission. It is intended for small or medium fleets but not for B-double work.

Isuzu has announced the creation of an Innovation business unit which will be responsible for Isuzu’s transformation in the face of the four fundamental shifts it sees as disrupting the transport sector; Connected, Autonomous, Shared and Electric trucks, referred to as ‘CASE’.

The announcement comes as Isuzu Motors Japan recently revealed new global initiatives with the establishment of a strategic alliance with Volvo Group and a technology sharing arrangement with Honda Research and Development to jointly undertake research on heavy trucks using FCEV (Fuel Cell Electric Vehicle) technology.

Isuzu Motors and Honda signed an agreement to undertake joint research on heavy-duty trucks utilizing fuel cells (FC) as the powertrain.

Isuzu has been researching and developing various powertrains including clean diesel engine, engines for natural gas vehicles (NGVs) and electric vehicle (EV) powertrains, which accommodate a broad range of customer needs and how vehicles are used.

Honda has been researching and developing fuel cell vehicles (FCVs) for more than 30 years. There are still some issues that need to be addressed to popularize the use of FC and hydrogen energy, including issues related to cost and infrastructure.

MAN has introduced a completely new truck line-up for the first time in 20 years, which is oriented towards the changing requirements of the transportation industry and according to the company sets new standards for – among other things – assistance systems, driver orientation and digital networking.

MAN says it has moved from vehicle manufacturer to a provider of intelligent and sustainable transport solutions. With fuel savings of up to eight percent, the new MAN Truck Generation achieves significant reductions in CO2.

The newly developed turn assist helps to prevent serious accidents in urban traffic – four years before the legally prescribed introduction. The lane change assistant also warns the driver of vehicles in the next lanes.

**Nikola TRE production by Italian IVECO in Germany**

IVECO and FPT Industrial, the commercial vehicle and powertrain brands of CNH Industrial and Nikola Motor Company will manufacture, through a European joint venture, the Nikola TRE in Ulm, Germany, at the IVECO manufacturing facility.

The site in Ulm is IVECO’s chassis engineering hub, in a region that has committed substantial investment to fund R&D projects.

In the first stage of the project, €40 million (approx A$73m) will be invested by the joint-venture company to upgrade the facility, which will focus on final assembly of the vehicle. Start of production is anticipated within the first quarter of 2021, with deliveries of the Nikola TRE beginning in that year.

“The Nikola TRE is proving to be the most advanced articulated truck in the world and will continue to set the standard for zero-emission vehicles today and in the future,” said Trevor Milton, Chief Executive Officer, Nikola Motor Company.

The first models to enter production will be the battery-electric 4x2 and 6x2 articulated trucks with modular and scalable batteries with a capacity of up to 720 kWh and an electric powertrain that delivers up to 480 kW of continuous power output.

The Ulm facility will receive module supplies from IVECO’s manufacturing locations in Valladolid and Madrid, Spain. Fuel-cell electric versions, built on the same platform, will be tested under the EU-funded H2Haul project during 2021 for an expected market launch in 2023.

This joint venture forms part of a wider partnership established with Nikola to accelerate industry transformation towards emission neutrality of Class 8 heavy-duty trucks in North America and Europe through the adoption of fuel-cell technology. The primary focus of the collaboration is to leverage each partners’ respective expertise to successfully deploy zero-emission heavy-duty trucks and to disrupt the industry with an entirely new business model.
RUAG upgrades for F-35 work

RUAG Australia has completed a major upgrade to its Hydraulic Actuator Centre of Excellence manufacturing facilities in Bayswater, Victoria. The upgrade is set to significantly improve productivity, reduce lead times and boost responsiveness.

The enhanced facility is well-positioned to process and deliver on larger order volumes satisfying aerospace customers’ increasing supply chain demands. RUAG is the sole global source supplier for the uplock actuator systems for F-35 Joint Strike Fighter program. The upgraded Bayswater facility now includes a 11 CNC machining centres, with the final investment stage bringing three additional new machines online.

RUAG Australia said. "We understand the customer’s need for quick turnaround, affordability, and reliability. This upgrade allows us to streamline our supply chain, meet the rapidly increasing demand to support industry diversification, and deepen our participation in aerospace programs, such as the F-35, Terry Miles, General Manager RUAG Australia said.

Space in Schools STEM challenge for future engineers

Registration has opened for the 2020 SPACE in schools STEM Challenge, that tasks school students to design and build a virtual Bio-Medical Space Hub proposed for construction on the surface of Mars.

The students’ task is to form a virtual design company which will make a bid for the design of this Bio-Medical Space Hub. They will have to build a 3D virtual model of the Space Hub and then present their design ideas to a team of industry judges.

The challenge is an exciting learning environment for students where they are encouraged to be creative and innovative and to explore different design options.

The program will expose students to 3D and Virtual Reality design software and provide design challenges that will provide opportunities for creativity. It will promote working and contributing to a team environment and introduce students to the use of virtual reality and gaming technologies as tools for developing solutions to human spatial and environmental problems.

SPACE in Schools will allow schools to participate in a sophisticated STEM program, at minimum cost and without the need for access to workshop facilities.

This project does not require teachers to have any unique or specialised skills. The project is about students thinking through a problem of human habitation, brainstorming a broad range of ideas and concepts and then selecting the best of these ideas into a solution that meets the design criteria.

For more information www.rea.org.au

Aero and defence briefs

Porsche and Boeing signed a Memorandum of Understanding to explore the premium urban air mobility market and the extension of urban traffic into airspace. With this partnership, both companies will leverage their unique market strengths and insights to study the future of premium urban air mobility vehicles.

So far Naval Group has subcontracted 137 Australian companies for the Attack Class Submarine fleet build according to the French shipbuilding company, and design of the Attack Class is intended to transition to Australia during the detailed design phase.

The preliminary design phase is progressing in France as well as with the Lockheed Martin Australia design team in Adelaide.

Boeing’s Australian team recently finished the major fuselage structural assembly for the first military aircraft to be developed in Australia for more than 50 years – the Loyal Wingman – as part of the Advanced Development Program in partnership with the RAAF. The 16-person team included BAE systems, FUAG Australia, Ferra Engineering and AME systems.

Deakin University has signed a Memorandum of Understanding (MoU) with Airbus paving the way for future research collaborations. These projects would include investigations in areas such as robotics, materials, motion simulators, artificial intelligence and batteries.

Titomic forges ahead in defence work

Local manufacturing company Titomic has entered into an agreement with Composite Technology, an Australian R&D and commercialisation division of a global defence product manufacturer.

This contract will generate $25.5 million in sales for Titomic from the provision of two Titomic Kinetic Fusion (“TKF”) Systems for industrial scale metal additive manufacturing.

The TKF manufacturing process will be certified to deliver defence products to the global defence market.

Composite Technology required two years of extensive research and prototyping by Titomic to guarantee the fulfilment of quality assurance requirements for the design, development and production capability of the TKF manufacturing system.

Earlier Titomic also signed an agreement with Thales to develop advanced additive manufacturing methods in Australia to support Thales’s development of next-generation soldier weapons systems for the Australian Defence Force.

www.saea.com.au
Best STEM students and teacher honoured

Our best and brightest STEM students and teachers were honoured at the BHP Foundation Science and Engineering Awards, and the Indigenous STEM Awards that highlight the importance of Science, Technology, Engineering and Mathematics (STEM) to Australia and celebrate the next generation of Australia’s STEM talent.

The awards featured an impressive line-up of Australia’s best STEM talent including teachers and the top school-aged researchers and innovators in the country, set to excel in their careers and become the leaders of tomorrow.

Six of the BHP Foundation Science & Engineering Award finalists will have the opportunity to showcase their research alongside students from 75 countries at the Intel International Science and Engineering Fair (ISEF) in the USA.

Space Agency opens in SA

Prime Minister Scott Morrison officially opened the Australian Space Agency’s new home in Adelaide.

“The Australian Space Agency is central to my Government’s vision to secure more jobs and a larger share of the growing space economy – forecast to be over $1 trillion in size around the globe by 2040,” Prime Minister Morrison said.

“Space captures the imagination and inspires us all. It develops new technologies that improve life on Earth and it offers huge economic and job opportunities.”

The offices, based at Lot Fourteen, are an important next step in the development of the Agency, who are working to triple the size of the Australian space industry and create 20,000 new jobs by 2030.

ANCA developing manufacturing platform for Tungsten cutting tools

ANCA Australia is developing a hybrid additive-subtractive manufacturing platform to manufacture Tungsten custom designed cutting tools.

It’s being developed alongside CSIRO and Sutton Tools, and is supported with funding from the Advanced Manufacturing Growth Centre (AMGC).

Successful completion of the project will allow ANCA to commercialise the new hybrid additive manufacturing machine platform.

Together, ANCA and CSIRO have demonstrated that the Tungsten-carbide tools could be made cheaper through improved production efficiencies compared with traditional Tungsten products.

In 2015, ANCA began exploring the potential for additive manufacturing to disrupt the Tungsten cutting tool market, which is worth an estimated $2.2 billion globally.

Skills in demand for Australia

Cloud engineers, credit assessors, social media and SEO digital marketing specialists have made the list of the top skill shortfalls for the first half of 2020, according to recruiting experts Hays. But the recruiter warns jobseekers that technical skills aren’t all that employers expect in job applicants this year.

In its latest Hays Jobs Report the company reveals the skills that are in greatest demand in 32 sectors and industries. According to Hays, employees are wanted in sectors including manufacturing, automotive, defence, rail, shipbuilding and industrial manufacturing.

The report, which is updated twice a year to reflect changing market conditions, also earmarks revit technicians, management accountants and civil engineers as core areas of demand until June 2020.

“We’re seeing vacancy activity across many sectors for skilled professionals, including finance, IT, marketing, HR, civil and commercial construction, healthcare, defence, office support and resources and mining,” Nick Deligiannis, Managing Director of Hays in Australia & New Zealand said.

“But there are wider macro issues at play that will dictate the success of a jobseeker this year. The key trends are for skilled professionals who, regardless of their role or industry, possess strong interpersonal and creative skills.

“Employers also want people who can make data-based decisions, adapt well to change and are continuous learners.”

For more information visit www.hays.com.au
Dayco to develop hybrid electric systems

Dayco is to develop hybrid electric systems for vehicle manufacturers across the globe in conjunction with Politecnico di Torino.

The objective of the agreement between Dayco and Politecnico is to research hybridisation systems and effectively develop the necessary technology innovations supporting vehicle manufacturers as they achieve the transition in an efficient, practical and sustainable way.

“We are enthusiastic to strengthen our relationship with the renowned scientists of the Politecnico di Torino. This new level of cooperation will provide leading hybrid system solutions to achieve a sustainable future of mobility for our customers globally,” said Joel Wiegert, CEO of Dayco.

The combination of research into the theoretical development of hybrid system solutions by the Politecnico with the specialised knowledge and technical abilities of Dayco, brings together the key elements to make these crucial technological advances a reality.

GM moves into electricals of the future

General Motors offered media a deeper look at the company’s all-new vehicle electrical architecture that was first confirmed in mid-2019, saying the vehicle-wide electrical system is associated with more than 100 new patents.

The advanced “digital vehicle platform,” known internally as Global B debuted with the 2020 Cadillac CT5 sedan. It serves as the electrical foundation for the 2020 Chevrolet Corvette Stingray and the 2021 Chevrolet Tahoe and Suburban, GM Yukon and Cadillac Escalade. The advanced architecture will provide for a wide spectrum of over-the-air (OTA) software-update functionality and enhanced driver-assistance and safety capabilities. Apparent dynamic aspects will include faster brake response, smoother and more accurate accelerations and decelerations while using adaptive cruise control and the increasingly sophisticated versions of GM’s Super Cruise SAE Level 2 driver-assistance system, while all onboard cameras now display high resolution images.

Europe’s largest auto R&D centre in UK

HRH The Prince of Wales officially opened one of Europe’s largest automotive research and development facilities, the National Automotive Innovation Centre (NAIC), at the University of Warwick, in Coventry.

Bringing together the brightest minds from industry and academia, the NAIC is a beacon for future mobility and sustainability research and development. It will create future vehicles and personal mobility solutions as well as deliver the skills required to keep the UK globally competitive.

Overseas news briefs

Amazon has put in an order for 100,000 Rivian electric delivery vans according to Diesel Magazine. The amazing thing is that these vans do not currently exist but obviously people are taking the company seriously as Ford also invested US$500 million in the company. Amazon’s order amounts to around US$700m. Rivian purchased a Mitsubishi plant in Illinois and already employs 750 people.

Jaguar Land Rover unveiled a new concept vehicle, Project Vector, as part of its Destination Zero journey, offering its vision of an autonomous, electric, connected future for urban mobility. The company’s focus is on achieving a future of zero emissions, zero accidents and zero congestion through its products, services and across its facilities. The compact, flexible vehicle concept measures four metres in length and is designed for the city, packaging all its battery and drivetrain components into a flat floor, to allow a variety of uses. The interior cabin space has seating configurations for private, or shared use and even the opportunity for commercial applications, such as last mile deliveries.

Jaguar Land Rover, Tata Motors and WMG are developing next generation future electrified and autonomous vehicles at the NAIC and so exhibited some of their latest projects including: Warwick’s Formula Student entry and the Warwick Moto concept which is led by WMG; Tata Motor’s latest affordable Nexon EV and autonomous Tata Hexa alongside Jaguar Land Rover’s latest prototype self-driving Jaguar I-PACE and ADAS Land Rover Discovery.

The 33,000m² centre is designed as an innovative, collaborative workspace for hundreds of academics, designers, researchers and engineers. It includes cutting-edge workshops, laboratories, virtual engineering suites and advanced powertrain facilities.
The Lion sleeps tonight

It seems there is in every Australian, a connection of sorts with Holden, for me it was my father a migrant whose first job was on the production line at Fisherman’s Bend. For others it was owning a Holden at some stage, or merely just barracking for the badge at Bathurst. That connection was severed abruptly by General Motors on 17 February 2020.

Until recently, countless SAE-A engineers of all types; mechanical, electrical, design ... have worked directly with Holden or for second or third tier suppliers and they have been a very strong part of the SAE-A. Our own president and CEO Adrian Feeney was one of those as was current board member Kate Cousins. It would be unthinkable for this magazine to not review what has been Holden and what is to come, some of the best engineers Australia has spawned built the brand and it is not on their shoulders that it fell. Shouldering that responsibility is General Motors but also a change in so many things: the ways in which vehicles are built, economies of scale, labour costs, polarisation of vehicle tastes, our small right-hand drive market, the list is long.

This is not the same as Nissan, Mitsubishi, Toyota or Ford ceasing production in Australia, they were always overseas brands. Holden was Australia’s brand and while production may have stopped on 20 October 2017 when the last existing vehicle plant in Elizabeth, South Australia closed the brand survived that albeit thanks to the General Motors moniker which it has had tacked onto its name since 1931.

By next year Holden’s Australia and New Zealand operations in engineering, design and financial services will close and the brand will be put to sleep. Holden staff will lose their jobs by the end of June 2020. Work at the Port Melbourne site will be wound down by the end of June 2020 and the Lang Lang facility will finish up in August.

However, SAE-A Chairman and CEO Adrian Feeney said the Holden engineering cuts were less than a quarter of the total number of engineers employed in Australia’s auto industry.

“Australian based car, truck and specialist vehicle companies employ thousands of world-class auto engineers, and Holden is only part of the story,” Mr Feeney said. “Several companies are capitalising on the special talents of Australia’s engineers, and one new start-up is already recruiting direct from Holden.”

Sales slips

Last year Holden announced it was axing the Commodore and Astra lines following slipping sales, and despite media speculation about possible heavy discounting of Holden’s in showrooms following the announcement, Commodore sales collapsed.

Only 132 units were sold in February 2020, which is a stark contrast to when Holden sold 10,028 Commodore VTs in March 1998. Sinking domestic sales meant demand for Holden vehicles was down by almost 29 percent to just 43,176 in 2019.

Dealers’ dilemma

Unlike ceasing production in Australia, this closure has hit Holden’s 216 dealer network (185 in Australia and 31 in New Zealand) and the thousands of staff employed in sales, parts, administration and servicing. GM has committed to providing compensation for its dealers and to allow them to transition to other brands or to close. They will also have the opportunity to continue as dedicated Holden service centres and to maintain a supply of spare parts for at least 10 years for the 1.6 million Holden cars on Australian roads.
According to the Australian Automotive Dealer Association (AADA) dealers and their employees will bear the brunt of General Motors’ decision.

“There has been a lot of talk about the 600 jobs that will be lost at Holden’s head office. These amount to very little compared to the people employed in Holden dealerships both in regional and metro Australia, a figure which could be as high as 6000,” said AADA CEO James Voortman.

“Dealers typically own millions of dollars’ worth of vehicle inventory, special tools and equipment, parts and bespoke facilities built to the exacting specification of the manufacturers,” he said.

“On top of that, dealers have often invested in long term leases, extending to a decade or more for these facilities. We know of dealers who are in the process of spending significant capital in upgrading or building showrooms, an investment demanded of them by Holden.”

We expect that these investments and commitments will be taken into consideration.

Government reaction

The federal government has criticised GM for making its decision without consultation with Prime Minister Scott Morrison saying he was disappointed and angry but not surprised.

“Australian taxpayers put millions into this multinational company and they let the brand just wither away on their watch,” Mr Morrison has said. In 2013, it was revealed that $2.17 billion was provided in subsidies over 12 years to help keep thousands of jobs.

A parliamentary inquiry has been announced to investigate GM’s decision, which is being led by Australian Labor Party Senator for Western Australia Louise Pratt, the Senate inquiry was passed unopposed when it was put to the vote in the upper house.

The inquiry will look at the impacts on local Holden workers, dealers and owners, as well as the fate of Holden’s extensive research and development assets. It will also look into the government’s proposed amendments to the franchise code, which will have an impact on policy settings in relation to dealerships.

A very brief history of Holden

1856 Holden begins as a South Australian saddlery business.
1917 Holden manufactures vehicle bodies.
1931 General Motors buys Holden Motor Body Builders.
1948 The FX, the first Australian-designed car, is released.
1951 Holden’s first ute goes on sale.
1958 South Australian manufacturing plant opens at Elizabeth, though it does not assemble its first full car until 1965.
1968 Kingswood and Monaro enter the market.
1969 Holden makes its first V8 engine.
1971 Holden launches the HQ model. Considered by some to be the best Holden ever.
1978 Commodore replaces Kingswood.
1990 Holden’s last Australian boss, John Bagshaw leaves the company.
2003 Holden opens $400m V6 engine plant at Port Melbourne, exports to Korea, China and Mexico begin. Toyota takes Holden’s position as top-selling car brand.
2009 Parent company, General Motors, files for bankruptcy in the US but survives.
2013 Prime minister Tony Abbott says the government will reduce support for automotive manufacturers despite appeals for help.
2013 Holden decides to end manufacturing in Australia by 2017. The Holden Commodore is to become a fully imported car.
2017 The company rolls its last car off the assembly line on October 20, ending more than 50 years of car production on the Elizabeth site.
2019 GM announces it will discontinue its Commodore and Astra models in 2020.
2020 General Motors announces the retirement of the Holden brand in Australia and New Zealand.
Bad news yes, disaster no

While it was once the backbone of Australian manufacturing, the car industry lost that title quite some time ago and if the public missed the bulletin then the manufacturing industry did not. It has been reinventing itself tirelessly.

VTE in itself is testament to the morphing of what was once the car industry, underneath the glamour of car making there was and remains a vibrant truck and bus industry that has been plugging away for years out of the spotlight. There is a strong and high-tech workforce in defence and aerospace that are making huge inroads. Companies such as PACCAR, that builds Australia’s DAF and Kenworth trucks, and HSV, which builds right-hand-drive versions of American cars already employ hundreds of engineers.

“And then there is VinFast, the Vietnamese car maker which is recruiting its engineers from Europe and Australia and it already employs dozens of engineers in Melbourne,” SAE-A CEO Mr Feeney said.

Mr Feeney said that Holdens’ demise was low point in Australia’s automotive history, especially for the people who would lose their jobs, but it did have a potential silver lining.

“As a former Holden engineer myself, I feel for all these good people, many of whom have been my colleagues and friends, but they are too good not to rise again,” he said.

“You can be sure that a host of emerging electric and autonomous vehicle makers will join the likes of VinFast in looking to Australia for their best engineers.

“Now is the time for government, industry and the educational sector to strengthen their resolve and offer Australia’s engineering capabilities more than ever to global customers.”

VinFast already has a significant number of former GM employees in the ranks of its senior staff with CEO James DeLuca, director of design Dave Lyon, engineering vice-president Kevin Fisher and the most senior Australian employed, vice-president of manufacturing Shaun Calvert.

It has also been reported that VinFast has made some noises about an interest in acquiring Holden’s design and engineering facilities including the Lang Lang test centre.

The company already has an office in Port Melbourne where it hopes to add more Australian engineers to its staff numbers. VinFast Engineering Australia has 25-year Holden veteran Kevin Yardley, and chassis and powertrain integration engineer Joe Sawyer, a 23-year Holden veteran in its ranks.

Apparently, though there could be a contest to buy Holden’s test track at Lang Lang with reports that transport magnate Lindsay Fox has become interested in the proposition. His company already owns what was once the International Harvester test track at Anglesea which is used by many car brands and engineering companies.

Holden’s test track is on an 877-hectare site near the town of Lang Lang south-east of Melbourne with 44
kilometres of roads including a 4.7 kilometre four-lane high-speed oval, a 5.5 kilometre ride and handling course, a 1.8 kilometre noise testing area and a 100-metre diameter skid pan. The test track also has an obstacle course, an off-road test area and water crossings. In 2018 Holden spent $15.9 million updating the facility which also has an emissions lab.

Holden no longer a SuperCar

Now that the Holden badge is to be no more, the company has also refused to commit to remaining in the SuperCars championship which started out as a two-make series – it has had a smattering of other brands but it is essentially, or was, a Holden versus Ford affair.

Many teams have sought meetings with Holden, some have succeeded others not but there is no word on what will transpire. There is a lot of money tied up with the Holden teams.

But it’s not just motorsport that will feel the effects, Collingwood Football Club has been sponsored by Holden for years, its deal concludes at the end of this year. The NRL is already in talks with multiple brands in the search for a replacement sponsor for the State of Origin.

HSV – will it remain Holden Special Vehicles

Perhaps the only company that could uphold the Holden name may be Holden Special Vehicles. They are not reliant on GM for their existence, although there is a heavy-duty tie-up between them it may play out that HSV is forced to change its name to General Motors Specialised Vehicles thus the name Holden will be completely relegated to history.

HSV remanufactures Camaro muscle cars, and Silverado pick-ups from left to right-hand-drive in Melbourne. While parent company Walkinshaw Automotive Group converts the Ram 1500 and 2500 pick-ups in the same facility.

Defence is one opportunity

Minister for Defence Industry, Melissa Price, has indicated that Defence may be one answer to the problem of finding new work for Holden engineers and tradespeople after the Defence Department and National Naval Shipbuilding College officials held talks with General Motors about redeployment opportunities.

According to Minister Price, the 2017 Naval Shipbuilding Plan identified that the existing automotive workforce, especially engineers and trade workers to be potential sources of recruitment for defence industry work. Of course, there will be a need for re-skilling as the jobs are not identical, but the government is considering what may be possible for the future.

General Motors, the Naval Shipbuilding College and the Land Engineering Agency are expected to map out the skills and the experience of the Holden workforce to see whether there are synergies.

Those interested in the shipbuilding program can register on the Naval Shipbuilding College Workforce Register by getting in contact with the National Naval Shipbuilding Office in South Australia.

Holden’s icons

According to recent report head of Holden design, Mike Simcoe is personally conducting investigations into what can be done to preserve Holden’s iconic cars including its concept vehicles. Included in this is Holden’s collection of historical vehicles and its archive of information.

In the near future it is expected that a plan will be in place, it is hoped that these vehicles will remain in Australia.
The demise of Australia’s only car brand Holden is definitive proof that the Australian automotive landscape is prone to rapid and abrupt change for engineers, and as automotive companies one-by-one left manufacturing in this country it caused an upheaval that impacted greatly on the SAE-A.

These factors alongside a host of other elements shattered the SAE-A however, as proof of its value and standing, the SAE-A has remerged stronger, facing the challenges of the past and present. Now it must look forward and plan for its future and the future of the vehicle engineers it represents.

That’s one significant change; SAE-A now represents vehicle engineers not only automotive engineers but engineers of a range of mobility vehicles. Part of the landscape change internationally is that nowadays we talk of mobility vehicles due to the huge variations that have been introduced in that sector; there are hybrid vehicles, electric vehicles, self-driving vehicles, hydrogen powered vehicles – no doubt with more variations to come.

As automotive manufacturers closed their plants in Australia engineers either retired or moved on to other fields where their engineering expertise was needed, such as truck and bus engineering, aerospace and defence, and working in niche manufacturing such as Carbon Revolution which is mentioned elsewhere in this magazine. But this diversification was difficult to evaluate hence, the SAE-A saw an immediate need to uncover the truths behind its membership; where they were, what they did and how could the SAE-A serve them better.

Over a period of months in 2019 kin8 was commissioned to research and report on these and other issues. These are the results and also the broad base of what the SAE-A will focus on in the future.

Survey company kin8 conducted research with corporate members with an online survey as well as a 45-minute in-depth telephone interview, student members were each given a 10-minute in-depth interview and private members who participated were provided with the online survey and then a 45-minute telephone interview. Just over 85 members chose to be part of the survey and while reading this report on the outcomes, if it does not align with your views or if you have other input, the SAE-A welcomes your opinions and is eager to hear from you, please contact Rose D’Amicis on 0403 267 166.

This is what matters to members

Corporate memberships were largely renewed based on personal relationships and the SAE-A was not perceived by those members as being deeply engaged with industry, government or legislation.

“The core business of an association is to represent member groups to government and the public. SAE-A needs to address this. They used to be a peak industry body and need to rebuild that credibility.”

Student members were in the most part aligned with the SAE-A due to their experience with Formula SAE-A. Not surprisingly those who did well and gained good job prospects from the competition were likely to remain positive about the SAE-A. Those who were disappointed with
their experience in Formula SAE-A were harsh critics however, they were in the minority. Students who had a positive experience and received job prospects from Formula SAE-A rated high satisfaction with SAE-A.

“The organisation and speed of completion of Formula-SAE event at Winton raceway was exceptional, which I believe was due to SAE-A’s competent batch of staff... I also appreciated the networking opportunities provided to me by SAE-A during the industry event at FSAE-A.”

Private members, who were by far the largest cohort in the survey, perceived the SAE-A to be out of touch with the industry and felt underserved on issues such as technical information.

“I would value anything that gives truly behind-the-scenes information as opposed to the general information that is readily available through many other channels.”

Many considered the cost of membership as high particularly those who were not based in Victoria as they would generally have to travel to Victoria to participate in events. A large number of private members have been with the SAE-A for more than 20 years.

“It’s called SAE Australasia but it’s very Melbourne centric... I’m invited to Victoria events only, but it will cost me $800 for a return fare. That’s just to attend a syllabus evening, not including meals and accommodation.”

“The total cost of training courses and other events is often far too high for me and that is why I do not attend as many as I would like to. If I have to travel interstate to attend an event, I must close my business for the duration (no income) and also pay for travel and accommodation on top of the course or event costs.”

Unlocking value

For corporate members value can be unlocked by providing access to talented graduates as well as promotional opportunities for the corporate brand. Students who currently don’t perceive membership value beyond Formula SAE-A may be provided with opportunities to interact with corporate members, to network professionally and obtain employment. This would serve both the needs of the corporate members and students equally.

Corporate members consistently seek top talent, as well as the development of their employees, which SAE-A is well placed to facilitate. For corporate members the SAE-A can also provide advocacy services and a united voice to speak to the concerns of industry with state and federal government.

Formula SAE-A remains a key event of interest of corporate members for talent acquisition.

However, they said they did not receive opportunities to interface with SAE-A and potential recruits outside of the annual event.

“We attended Formula because it gave you access to engineers who had been through a good life experience, you got to see the good engineers.”

Many private members were introduced or encouraged to join SAE-A through their workplace; either via word of mouth from colleagues, employers or the company’s corporate membership. SAE-A can unlock value for those members by providing unique technical information and training that would otherwise be difficult to obtain.

Private members early in their career sought advantages to differentiate themselves through gaining access to the latest industry updates and being part of an industry recognised association. SAE-A is well placed to connect graduating student members with private members at events or through mentoring, to guide their SAE-A membership evolution.

Beyond Formula SAE-A, many students did not see any benefits of staying an SAE-A member as they started their career. Here the SAE-A can unlock value for student members by demonstrating relevance as a source of technical expertise, upskilling, industry networking and professional development. The SAE-A is in the position to be the source of current and emerging technical industry information, it can provide professionals with unique knowledge, qualifications upgrades and employment opportunities and the society must leverage those advantages more fully in the future.

The overarching reason private members joined SAE-A was for access to technical industry information via events, seminars, site tours and research papers. Private members also sought to be part of an industry recognised member association, which offered professional development opportunities.

Another important reason for joining the SAE-A was also considered to be part of an industry recognised association and identified in the engineering community as an engineer. One of biggest opportunities that was apparent in the survey was the chance to offer access to members of technical standards and research papers, as well as highlighting industry trends, legislative ruling and advances in technology. Further to that, opportunities to attend industry events and seminars, site tours and networking were high on the agenda.

From L to R: SAE-A board members Kin Cheong, Adrian Feeney, Michael Waghorne, Greg Shoemark
SAE-A was seen to have positive potential for a role in relation to qualification authentication and upgrades.

“Qualification authentication would be good, especially in helping to recognise people without certification... trade schools don’t help enough with qualifications and a lot of trade qualified people would study part time to expand their skill set.”

Where to from here

For private members it appears from this survey that the vital area of urgent action is to provide more access to technical standards and research papers, updates on industry trends, legislative rulings and advances in technology.

In the longer term the SAE-A is to rebuild its reputation and credibility collaborating more with academics and corporate partners. To provide more opportunities for knowledge exchange and consider more online platforms for communication such as webinars.

Corporate members were particularly interested in representation to government on legislative impacts of proposed legislation. And developing the connections between graduates and companies.

“I spend a lot of money getting in front of ministers. We need more of this, SAE-A would be well placed but it’s hard, takes time and no one really wants to do it.”

Another prime area of importance to corporate members was that SAE-A should act as an industry connector not just with students but between corporate members identifying potential synergies via events and networking and providing access to technical research and conference papers that are typically difficult to access.

It was also suggested that the SAE-A annual awards might be reinstated to recognise industry innovation and reconnect with major industry players which could include government.

Corporate member companies could be better engaged through more frequent satellite events throughout the year. For example, this might be an educational workshop or a smaller scale physical or virtual competition. SAE-A should provide accessibility to these events nationally.

Corporate member companies could be given additional sponsorship opportunities, such as offering product or service discounts, insurance and other such offerings that would be exclusive to SAE-A members.

Where are we now?

There is no doubt that the past 10 years have been hard on SAE-A; from external sources such as the shutting down of large-scale automotive manufacturing in Australia and equally from internal issues that forced the association into voluntary administration.

“I would get back to SAE-A and be involved if I could see they had a specific direction. The society used to be stronger and more relevant, but it has allowed itself to slide in the last 10 years. It’s a hard place to come back from.”

After working for several years on re-establishing the operational base of the SAE-A, without which it would not have been possible to continue with any work, the board took the next step of surveying its members. This step was taken as a precursor, it was a weathervane to show the direction that members wanted to take for the future.

Now the SAE-A will begin to put into practice the recommendations that were put forward in this survey. As members please continue to provide feedback but also avail yourselves of the offers put forward, of the events organised and give of your knowledge and experience.

“I sincerely thank all those members who took time to contribute to this survey and provided such good feedback,” Adrian Feeney said.
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Simcentre portfolio has a new Star

Siemens Digital Industries Software has released Simcenter STAR-CCM+ software as part of the Simcentre portfolio of simulation and test solutions that helps optimize design and deliver innovations faster and with confidence.

The latest release of Simcenter STAR-CCM+ includes major enhancements to improve simulation time and accuracy as well as enhance collaboration, giving customers a comprehensive digital twin to help drive highly predictive simulations.

Siemens has included a completely new parallel polyhedral mesher for faster, more effective meshing, as well as the industry’s first model-driven adaptive mesh refinement (AMR) solution.

The latest release also includes automatic coupled solver control for reduced set up time while improving convergence speed and the industry’s first ever collaborative virtual reality (VR) feature in a CFD code for enhanced team collaboration on simulation results.

To keep up with the competition and achieve the next innovative breakthrough, faster and more reliable simulation results are critical. The latest release of Simcenter STAR-CCM+ offers a fully rewritten next generation parallel polyhedral mesher.

Using parallel performance, it meshes build up to 30 times faster than in serial, providing a consistent mesh regardless of the cores used and a more effective mesh distribution with the same accuracy and robustness.

New adaptive mesh refinement (AMR) technology is the industry’s first model-driven AMR, which intelligently refines the mesh based on the physics. This can lead to less user interaction as well as computational overhead and reduces overall mesh size.

Automatic solver controls dramatically improve the ease-of-use and robustness of the coupled solver. This delivers faster convergence to solution giving users additional speedup for all flow regimes straight out of the box.

Collaborative VR in Simcenter STAR-CCM+ allows teams across the globe to interact in the same immersive virtual environment in real time, enhancing communication and speeding up decision-making. Multiple VR clients can now be connected and synchronized to the same simulation, with avatars showing the location of other users and providing the ability to tether users to get the same experience.

Simcenter STAR-CCM+ is an integrated solution for computational fluid dynamics (CFD) and multiphysics simulation that brings automated design exploration and optimization within the grasp of all simulation engineers.

Mercury metrology measuring arm

A new European-made metrology arm for measuring the geometry of physical objects has been released by Leussink Engineering.

The new Tomelleri Mercury 1.8 metre 6-Axis Measurement Arm senses discrete points on the surface of the object with a probe.

The dimensions are immediately digitised and transferred to a CAD system, where surfaces are developed and drawings are finalised.

The new Mercury model features a counterbalance system that makes the arm ergonomic and easy to use. The counterbalance system also means that a user doesn’t need to affix the arm to a table surface just place it on a sturdy table top or solid interface like a steel or aluminium base with three support points and it is ready for use.

This makes it ideal for organisations that need to complete metrology projects on the go. No need to take your part into a metrology lab, with Tomelleri you can take the metrology lab to the part.

The Mercury is thermally compensated, meaning it is able to maintain its high degree of accuracy regardless of temperature change throughout the day.

Available in both 1.3 metre and 1.8-metre models, the Tomelleri Mercury Measurement Arm works with a number of leading software platforms, including Aberlink and the Geomagic suite.
Combining sensor powers for autonomous vehicles

A camera that registers a blank space on each image probably has a faulty design. If you compare the human eye with a camera, then the exact same thing happens when seeing. At the place where the optic nerve exits the retina, there are no receptors that record the light stimuli from which an image forms in the brain. This part of the eye is referred to as the blind spot. However, it does not disrupt anything because the information from the surrounding receptors on the retina and, especially, the visual impressions from the other eye, offset the missing image points.

At the same time, two eyes next to one another ensure that we can see spatial depth, a major requirement in estimating distances. Expressed in technological terms, the data from two sensors merge or fuse to become a more complete image with more information. Developers of automated driving functions also use this principle. Very different sensors are needed so that a driverless vehicle can also unequivocally comprehend every traffic situation even in unfavourable lighting and weather conditions.

Cameras, radar and lidar sensors each have their special advantages. If intelligently bundled, they allow for a sweeping and detailed 360-degree view.

Cameras are indispensable for object detection. They supply the vehicle with the necessary information by using artificial intelligence to detect objects, such as pedestrians or garbage bins, along the side of the road.

Furthermore, the camera’s greatest strength is that it can measure angles precisely. This allows the vehicle to recognize early on whether an approaching vehicle will turn. If city transport requires a wide angle of vision to record pedestrians and traffic, a long range of up to 300 meters and a narrow angle of vision are necessary on highways.

However, cameras not only monitor the exterior surroundings of the vehicle, they also keep an eye on the driver and passengers inside the vehicle. For example, they can recognize not only whether the driver is distracted or tired, but also which seating positions the passengers select. This knowledge represents a major safety plus because, in case an accident occurs, the seat belt and airbag functions adapt accordingly.

Unlike cameras that passively record image information, radar systems are an active technology. These sensors emit electromagnetic waves and receive the “echo” that is reflected back from the surrounding objects.

Radar sensors can therefore determine, especially, the distance and the relative speed of these objects with a high level of accuracy. That makes them ideal for maintaining distances, issuing collision warnings or for emergency brake assist systems.

Another decisive benefit of radar sensors compared with optical systems, is that they function regardless of weather, light or visibility conditions because they use radio waves. That makes them an important component in the sensor set.

Lidar sensors also apply the echo principle however, they use laser pulses instead of radio waves. That’s why they record distances and relative speeds equally as well as radar but recognize objects and angles with a much higher level of accuracy. This is also a reason why they oversee complex traffic situations in the dark very well.

Unlike cameras and radar sensors, the angle of view is not critical because lidar sensors record the 360-degree environment of the vehicle. High-resolution 3D solid state lidar sensors also display pedestrians and smaller objects three dimensionally. This is very important for automation as of level 4. The solid-state technology is considerably more robust than previous solutions due to the lack of moving components.

To merge the sensor information from the lidar, radar and camera systems to create one complete picture, a “brain” is also needed. Once vehicles are equipped with this artificial brain, drivers will soon be able to close their eyes or do something else and leave the driving up to their autonomous vehicles.
Hyung In Yun and Chung Sik Yim  
Hyundai Motor Company

The Study of Optimization of Sliding Door Effect

Introduction

The way we look at life is changing. Recently, the proportion of spending time for leisure with the family is expending. As a result of these changes, the automobile is not only transportation, but an important means of increasing the value of a customer’s life. As a result of these changes, demand for MPV vehicles for enjoying leisure activities of family units is increasing, and interest in sliding doors characteristic of MPV vehicles is naturally increasing.

In this paper, we analyze the operating factors of the sliding doors and set up the optimal layout for the development of sliding doors that can be easily opened and closed by any family member including children, women or the elderly.

Subject

2.1. Sliding Door Mechanism

As shown in Fig. 1, the sliding door operating mechanism is Sliding the open/close operation of the sliding door using the outside handle is attached to the sliding door and the door is translated in the same time that a rotational motion along the rail. Door operating mechanism is; That is, depending on the layout of the three rails and three rollers a locus of the sliding doors is changed thus the force that is the operating force to open or close the sliding doors is changed.

2.2. Operating Force Factor Analysis

Parts that affect the sliding door operating force include door panel, outside handle, center roller, center rail, lower roller, and lower rail. The analysis of each component as a factor Table.1 and Fig. 3

A sliding door operating force major factor in Table.1 were classified into three types as below.

- Design factor
  - Center of gravity, handle hinge axis, handle point of action

- Properties associated factors
  - Bearing Stop/Motion Friction Coefficient, Spring Constant

- Design factor
  - Roller hinge shaft, rod/guide bearing point, Curve R, rail angle

Design properties and related factors were conducted to optimize the operating force by a factor because it is treated as a constant.
and fixed according to the design parameters as vehicle variables.

2.3 Sliding Door Trajectory Point Setting

In order to know the instantaneous operating force of the handle at any moment for operating the sliding door, the force acting on the handle which makes the sum of the force and moment generated by the frictional force, vertical drag, and gravity acting on the door to '0' should be obtained.

To do this, it is necessary to find the behavior including the position and the angle of the accurate instantaneous sliding door.

In order to calculate the position of the sliding door, it is necessary to set three points in the sliding door.

The point of the hinge axis of the roller whose absolute position with respect to the sliding door does not change according to the sliding door behavior (rotational motion + translational motion) is used. In other words, the behavior of the door is analyzed along three loci using two points on the center roller hinge axis and the lower roller hinge axis, and the operating force is calculated from the degree of freedom analysis at each position. (Fig. 4)

2.4 Sliding Door Operation Force

Operating force is the force required to move the door at a particular moment. Through KINEMATICS, TRACE (movement of 3 points when opening the sliding door) of the above-mentioned 3 points (1 point on the centre roller hinge axis, 2 points on the lower roller hinge axis) can be obtained through Catia.

Based on this, the frictional force acting on the rail and the direction of the vertical drag can be obtained. If these directions are fixed and only the magnitude of the force is set as a variable, the force to be obtained through the equation is;

1. Lower rail: Guide bearing normal force,
load bearing normal force
2. Centre rail: Guide bearing normal force, load bearing normal force
3. Upper rail: Guide bearing normal force
4. Handle force
(The frictional force is naturally obtained through the normal force).

There are a total of six unknowns. At this time, six equations of motion are obtained through six degrees of freedom constraint, and the magnitude of force in each situation can be obtained.

The direction of the frictional force in each rail is defined as the direction from the current point to the previous point, the direction of the guide bearing perpendicular to the xy plane at the current point, and the direction of the load bearing vertical force perpendicular to the rail on the zx plane at the current point. The variable definition is as follows.
1. \( N_{LG} \) = Lower roller guide bearing’s normal force
2. \( N_{LL} \) = Lower roller load bearing’s normal force
3. \( N_{CG} \) = Center roller guide bearings’ normal force
4. \( N_{CL} \) = Center roller load bearings’ normal force
5. \( N_{U} \) = Upper roller guide bearings’ normal force
6. \( H \) = Operation force of handle

The dependent variable, frictional force, is defined as follows.
1) \( f_{U} \) = Friction factor of upper roller bearing
2) \( f_{C} \) = Friction factor of center roller bearing
3) \( f_{L} \) = Friction factor of lower roller bearing

Let the above six variables (Separated by scalar value only) \( x_1 \sim x_6 \), \( N_{LG} \) be a direction vector with no magnitude. The equation of motion is as follows;
\[
\begin{align*}
I_{e} = & \left( 2f_{U}f_{L} + N_{LG} \right) x_1 + \left( f_{C}f_{L} + N_{LG} \right) x_2 \\
& + \left( 2f_{C}f_{C} + N_{CG} \right) x_3 + \left( f_{U}f_{C} + N_{CL} \right) x_4 \\
& + \left( \mu f_{L} + N_{UL} \right) x_5 + H x_6 \quad \text{(Equation 1)}
\end{align*}
\]

Define the front term of \( x_1 \) as \( a_{11} \), the front term of \( x_2 \) as \( a_{12} \), and the front term of \( x_1 \) of \( F_y \) as \( a_{21} \), the moment equation is as follows;
\[
\begin{align*}
M_{e} = & \left( P_{Ly} - \mathbf{P}_{Ly} \right) x_{1} + \left( \mathbf{P}_{Ly} - \mathbf{P}_{Ly} \right) x_{2} \\
& + \left( \mathbf{P}_{Ly} - \mathbf{P}_{Ly} \right) x_{3} + \left( \mathbf{P}_{Ly} - \mathbf{P}_{Ly} \right) x_{4} \\
& + \left( \mathbf{P}_{Ly} - \mathbf{P}_{Ly} \right) x_{5} + \left( \mathbf{P}_{Ly} - \mathbf{P}_{Ly} \right) x_{6} \quad \text{(Equation 1)}
\end{align*}
\]

\( P_{Ly} \) is the y value of the relative position of the lower rail point with respect to the center of gravity of the door. Likewise, we can obtain six momentary linear equations for \( x_1 \sim x_6 \) by obtaining moments in the y and z directions. Table 2 compares the actual values of the vehicle with the calculated values.

Put all the points obtained through TRACE in turn, you can obtain the operating force at all moments.

**TABLE 2:** Compare calculated and measured value

<table>
<thead>
<tr>
<th>Operation force</th>
<th>Calculated</th>
<th>Measured</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44N</td>
<td>41N</td>
<td>Full open condition</td>
</tr>
</tbody>
</table>

**FIGURE 5:** Diagram of the vehicle

**FIGURE 6:** The angle of center rail
Based on this, you can obtain the operating force diagram for the sliding door opening as shown in Fig. 5.

2.5 Study on Sliding Door Operating Force Optimization

By analyzing the impact of the design parameters associated with a sliding door operating force mentioned in Section 2.2, each tries to derive a sliding door operating force optimization.

2.5.1. Analysis of the Influence of Center Rail Angle

The angle of the center rail is typically set at certain degrees. If it is set under minimum degrees, there is a high risk of a section shrinkage problem. When the sliding door is opened at the initial opening of over widen angle, there is a problem of interference with the vehicle structure.

The operating force diagram obtained by changing only the center rail angle under the same conditions is shown if Fig. 7;

As shown in Fig. 7, the larger the angle of the center rail, the smaller the ratio of the maximum operating force to the initial operating force. That is, when the maximum operating force value is upper limit angle relative to lower angle, there is an operating force improvement of about 5%.

2.5.2. Analysis of the Influence of Lower Rail Angle

Change the lower rail angle under the same conditions and draw the operating force diagram as shown in Fig. 8.

As shown in Fig. 7, the larger the angle of the center rail, the smaller the ratio of the maximum operating force to the initial operating force. That is, when the maximum operating force value is upper limit angle relative to lower angle, there is an operating force improvement of about 5%.

2.5.3. Analysis of the Influence of Center Roller Arm Length

For the analysis of the influence between the center roller arm length and the operating force, the operating force curve was obtained by changing the arm length only under the same conditions.

As shown in Fig. 9, the longer the center roller arm length, the larger the initial operating force magnitude and the maximum operating force generation interval is changed to the initial value of the sliding door operation. That is, in order to improve the sliding door operating force, the arm length of the center roller must be set to a minimum. It is necessary to set the minimum length of the center roller arm having the gap on the locus of the sliding door since the gap between the center roller and the vehicle body cannot be secured when the length of the center roller is shorter.

2.5.4. Analysis of Influence of Distance from Lower Roller Guide Bearing to Hinge Axis

The operating force diagram was obtained by changing only the arm length under the same conditions for the analysis of the influence between the distance from the lower roller guide bearing to the hinge shaft and the sliding door operating force.

As shown in Fig. 10, the longer the distance from the lower roller guide bearing to the hinge axis, the larger the initial operating force magnitude, similar to the influence of the center roller arm length, and the maximum operating force generation interval is changed to the initial stage of sliding door operation. That is, to improve the
sliding door operating force, the length between the lower roller guide bearing and the hinge axis must be set to a minimum.

### 2.5.5. Analysis of Influence of Radial Value of Centre Rail

In order to analyze the influence between the centre rail radial value and the operating force, the operating force curve was obtained by changing only the radial value of the center rail under the same condition.

As shown in Fig. 11, the larger the radial value of the centre rail, the smaller the initial operating force of the centre roller. However, as the value of radial increases, it becomes more difficult to interfere with the vehicle body when the sliding door is opened.

### Conclusions

In this paper, sliding door layout and operating force improvement methodology is proposed by calculating the sliding door operating force as an equation, and the following conclusions are drawn.

1. Based on the sliding door layout, the operating force of the sliding door is calculated by using the KINEMATICS function of Catia. This makes it possible to predict the operating force of the sliding door at the design stage and to set the layout.
2. Layout setting conditions for optimizing the sliding door operating force can be set through analysis of design factors influencing each part related to the sliding door layout. This makes it possible to optimize the sliding door at the design stage before the production of the actual car.

### Reference

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*The driver is responsible for assessing off-road situations, determining if the terrain is passable and using appropriate off-road driving techniques.